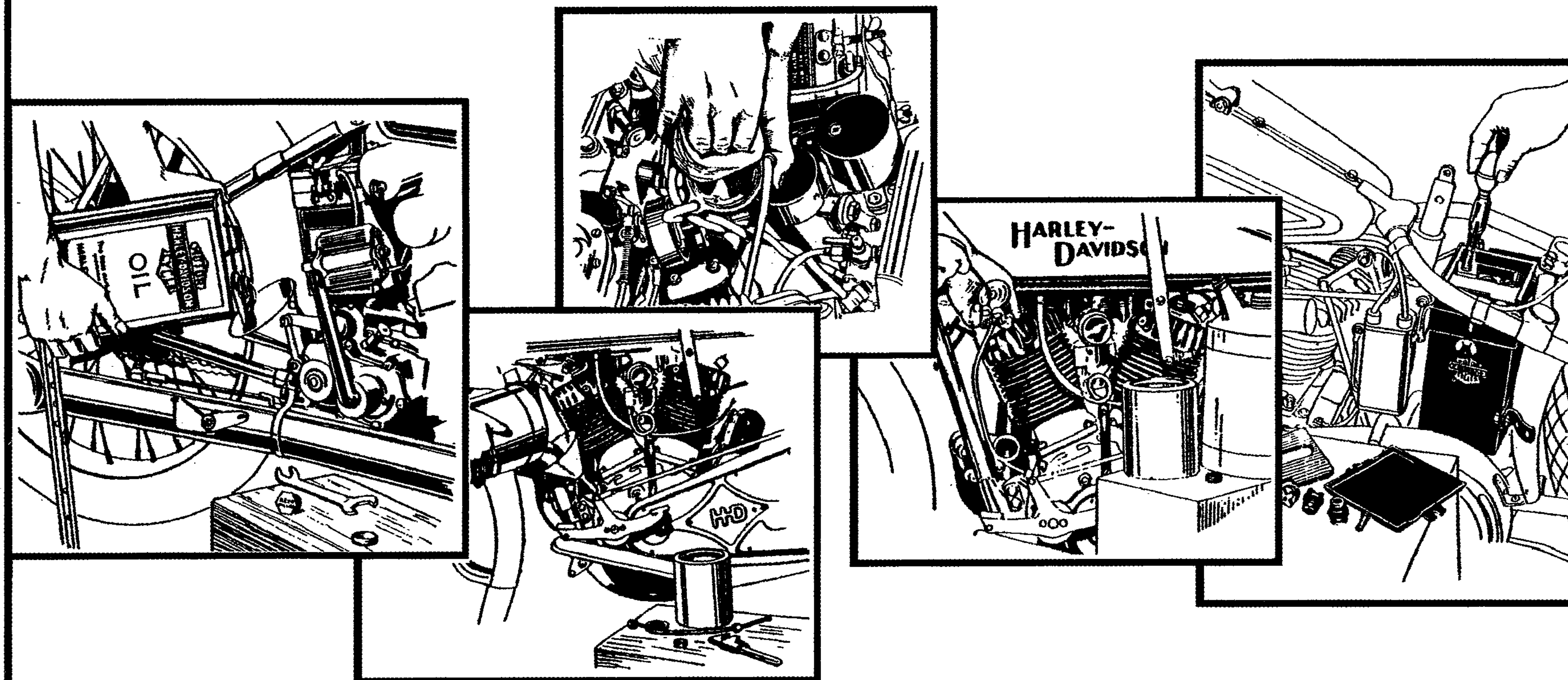
# SERVICE

## SHOP DOPE




# 1917 — thru — 1949

MOTOR
HARLEY-DAVIDSON
COMPANY®

99410-93

# PROLOGUE

This fifth book in our Antique Service Literature series covers the primary source of service information to our dealer network during the early years. This is the era when service manuals, as such, did not exist.

You will find the bulletins are not in numerical order, but are arranged according to date. Unfortunately, not every bulletin was available for reproduction.

We are pleased with the results and trust that this book will be beneficial to you in your restoration work.



CMI-250-12/95

# Service Dept. Bulletin

No. 44. Feb. 15, 1917 Harley-Davidson Motor Co., Milwaukee

## Sidecar Motor and Gear Number



## Why the Sidecar Motor is Logical for Sidecar Service

You want your riders to obtain the maximum in pleasure and service from their Harley-Davidsons. One excellent means to help this good cause is to provide them with motors adapted to their requirements. We refer here to the solo and sidecar motors. Each motor is designed for particular services.

It is clear that sidecar service requires different qualities in a motor than solo or single service. The big difference is the added weight of the sidecar equipped machine and the passenger or passengers, as the case may be. In sidecar service, power is of more importance than speed. The motor that will pull at an even pace for miles, or as long as necessary, without heating is better adapted to sidecar service than the motor that is somewhat faster at the outset but that is bound to heat up and lose power sooner or later. It is easy to see that a motor built especially for sidecar duty will give longer satisfaction and longer life than a motor built for the requirements of solo service.

We recommend the sidecar motor for sidecar and sidevan service. In this connection, please note that whenever reference is made to the sidecar, the sidevan is also included. The sidecar motor can also be used to advantage for solo or single service on rough roads, in deep sand, or in extremely hilly country. Provision is made on the machine order blank to specify the type motor wanted. Do not make the mistake to specify the solo motor on a machine that will be used for sidecar or sidevan service. These recommendations are based on our engineering department's tests as well as on three seasons' experience with both types of motors.

## The Difference in Construction Between the Sidecar and Solo Motor

It is well known that the only difference between the solo and sidecar motors is the set of 1/8″ steel plates, fitted between the cylinders and crank cases on the sidecar motor, to lower the compression. Both motors are fitted with the same type pistons and are identical in every respect. It is therefore compara-



tively easy to change a motor around at any time, but for the reasons explained hereinafter, it is always advisable to specify the proper type motor when ordering.

The difference in the compression of the two motors makes the sidecar motor ideal for double duty, whether with tandem, sidecar or van. This motor will naturally remain cooler under heavy pulling than the solo motor. The difference in the speed of the motors is slight, while the sidecar motor has this advantage that it will pull for miles without overheating and losing power. This motor is also longer lived than the solo motor in double duty service.

## What to Do When it is Desired to Change a Motor

If it is desired to change a solo motor to the sidecar type, a set of 1/8″ steel plates are to be fitted between the cylinders and crank cases. This change can be made at any time desired. Therefore, you need not hesitate to sell a sidecar to an owner of a solo machine, because his motor can be converted to the sidecar type at very small cost.

If a machine is fitted with a sidecar after it has seen a season's service or more, it is advisable to have the cylinders reground and fitted with oversized pistons and rings at our factory and then to fit the compression plates. It can be understood that a motor will not develop full efficiency with slightly worn cylinders, pistons and rings.

It is generally possible to specify the type motor desired when ordering the machine, if the importance of distinguishing between the solo and sidecar type motors is taken into consideration.

A sidecar type motor should not be changed to the solo type after one thousand miles, or more, service. The reason for this is apparent. In the first few hundred miles of service the cylinders and pistons "wear in," especially at the upper end of the piston travel. If the plates are removed, the pistons travel higher on the cylinder walls and the motor will knock.

If it is desired to change a sidecar motor to solo, after one thousand miles or more, the cylinders should be reground at our factory and the plates then removed. It is seldom necessary to make a change of this kind since the sidecar motor can be used successfully for solo service.

## How to Change a Solo Motor to the Sidecar Type

The accompanying illustrations make clear how to change a solo motor to the sidecar type and a sidecar motor to the solo type.

To change a standard or solo motor to the sidecar type, proceed as follows: Take the motor out of the frame, loosen the intake manifold packing nuts a few turns, then turn the manifold nipples out of the cylinders and remove the carburetor and manifold complete. Remove the cylinder stud nuts as well as the washers "B" and "C" and take off the cylinders. Take care to see that the pistons do not strike sharply against the connecting rods, or they may be put out of round, causing unnecessary friction in the cylinders after assembling. Be careful that the paper gaskets are not torn, or they will have to be replaced to make the motor oil tight.

Fit the 1/8″ steel plates, one below each cylinder. Then fit a set of paper gaskets between the plates and the cylinders. In other words, the original gaskets are not removed and another set is fitted. This

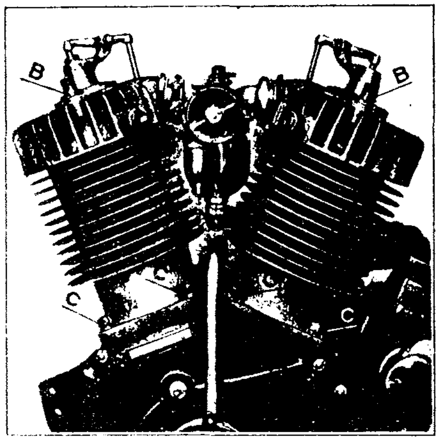



Figure One

is necessary to keep the motor oil tight. Replace the cylinders and fit the stud nuts securely, drawing them up evenly all around instead of tightening one nut all the way before beginning to draw up the others.

The exhaust lifter pins and intake push rods must be readjusted to take care of the difference in the position of the cylinders, as follows:

Raise the exhaust valve spring covers. Turn the motor until one of the exhaust valves is raised. Then adjust the other which in that position is closed. Allow .008″ to .010″ clearance between the exhaust lifter pin and valve stem. Before adjusting the second exhaust valve, turn the motor, bringing the valve to the closed position. Try the adjustment of both valves. Replace the spring covers.

Adjust the inlet push rods as follows: Remove the silencer spring covers. Adjust both push rods so that there is .004″ clearance between the inlet valve stem and inlet lever. The inlet valves must be closed while making the adjustment.

## How to Change a Sidecar Motor to the Solo Type

If a sidecar motor is changed to the solo type, the steel plates "A" are removed and the cylinder stud nut washers "C" and cylinder plug washers "B" fitted to take up the space occupied by the plates "A." The washers can be obtained from us at small cost. The above instructions on removing the motor, taking off the carburetor, etc., are to be followed carefully. The exhaust lifter pins and inlet push rods must also be readjusted, but instead of raising the lifter pins and lengthening the push rods, both are shortened until the proper adjustment is obtained.

It is important that the adjustment of the exhaust lifter pins and inlet push rods is absolutely accurate. Use one of our feeler gauges to measure the clearances.

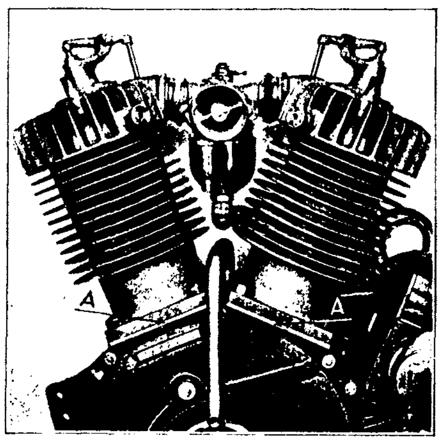



Figure Two



## Do Not Use the Standard Gear for Sidecar Service

Another essential for successful sidecar service is that of correct gearing. The standard solo gear is too high for sidecar use. We are glad to say that most dealers understand this and use the correct gear for sidecar service. Furthermore, every sidecar motor machine is geared for sidecar service when it leaves the factory.

## The Correct Sprocket Combination for Sidecar Service

Sometimes a machine is equipped with a sidecar after it has been in service, and it then becomes necessary to make the proper change. The standard solo gear ratio is 3.90 to 1 on high with the following sprockets: 15-tooth engine, 43-tooth clutch, 28-tooth countershaft and 40-tooth rear wheel.

The sidecar gear ratio is 4.50 to 1 on high with the following sprockets: 15-tooth engine, 43-tooth clutch, 28-tooth countershaft and 44-tooth rear wheel.

It will be noted that instead of using a smaller engine sprocket as heretofore, a larger rear wheel sprocket is employed, giving a slightly lower gear than was possible with a 14-tooth sprocket, making this sprocket combination particularly satisfactory for sidecar service.

Heretofore a 14-tooth engine sprocket with 40-tooth rear wheel sprocket have been used for sidecar service—gear ratio 4.39 to 1. When gearing a machine for sidecar service, this combination can be used, although it is not quite as well suited as the 15-tooth and 44-tooth combination.

It should seldom be necessary to use a lower than 4.50 to 1 gear ratio on high, for, with a gear reduction of 1½ on intermediate and 2¼ on low, this ratio is 6.75 to 1 on intermediate and 10.12 to 1 on low. However, if very heavy loads are carried, or if the roads are exceptionally rough, or the sand unusually deep, a 14-tooth engine sprocket with a 44-tooth rear wheel sprocket will afford a gear ratio of 4.83 to 1 on high.

## Why it is Important to Use the Proper Type Motor and Gear

The standard solo gear remains unchanged, viz., 15-tooth, 43-tooth, 28-tooth, 40-tooth. Never use a sidecar with the standard gear. The motor will not develop the power necessary for sidecar service. It will be necessary to shift to intermediate and low gears in places where the motor, if properly geared, would travel on high. The motor will overheat, lose power and serious trouble will be experienced.

It may be that in the past you have not considered the questions of proper motor equipment and gearing, depending on whether a machine is used for solo or sidecar service, with the above facts in mind. This bulletin has been prompted with the knowledge that solo motors are being used for sidecar service and in some cases with standard gearing. Such motors cannot give satisfaction.

For the good of the service, and to see that your riders obtain the maximum in pleasure and service, which we know is what every dealer is working for, see that your machines are geared for the service they are expected to render and equipped with the correct type motor.

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*Summary of Essential Facts.*

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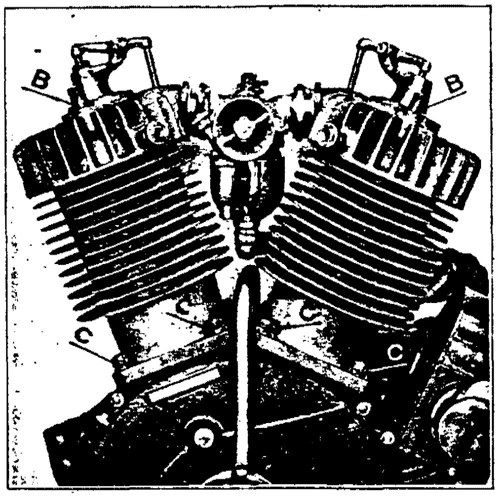


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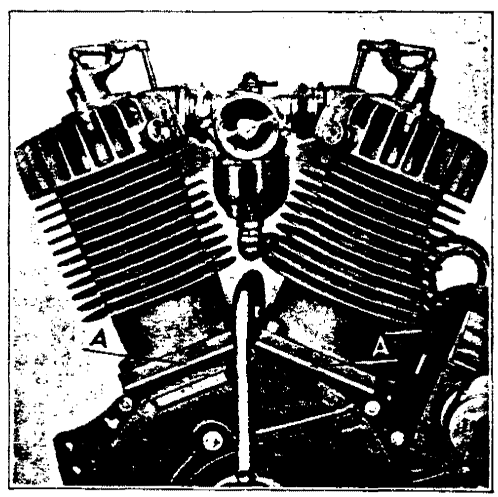


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It may be that in the past you have not considered the questions of proper motor equipment and gearing, depending on whether a machine is used for solo or sidecar service, with the above facts in mind. This bulletin has been prompted with the knowledge that solo motors are being used for sidecar service and in some cases with standard gearing. Such motors cannot give satisfaction.

For the good of the service, and to see that your riders obtain the maximum in pleasure and service, which we know is what every dealer is working for, see that your machines are geared for the service they are expected to render and equipped with the correct type motor.

# Summary of Essential Facts

Summarizing this bulletin briefly, the important facts are these:

When you order a new machine give the question of correct motor equipment careful thought and make your decision with the facts just covered in mind.

If the machine is to be used with a sidecar immediately or in the near future, specify the sidecar type motor. There can be no doubt in regard to this question.

Every sidecar motor equipped machine is geared for sidecar service at our factory, so you need make no change. This is another reason why you should specify the sidecar type motor for sidecar service. If a solo motor is ordered, the standard gear is of course furnished, unless otherwise specified. The sidecar combination of sprockets is 15-tooth, 43-tooth, 28-tooth and 44-tooth—high gear ratio 4.50 to 1.

Remember that whether the motor is sidecar or solo type, the sidecar gear ratio must be used if the machine is used with a sidecar.

When you order a machine for solo service, specify the solo motor, unless the machine will be used on very bad roads, in deep sand, or on steep hills, where power is of more importance than speed. In that case, the sidecar type motor should be specified. The same holds true if the purchaser is a likely sidecar prospect. You will be saved the time required to change over the motor and to lower the gear, when the sidecar is attached.

When you equip a machine that has been in service for some time with a sidecar, make sure that the gear ratio is correct. The standard solo combination of sprockets is 15-tooth, 43-tooth, 28-tooth, 40-tooth—high gear ratio 3.90 to 1.

To change to the sidecar gearing, you can either fit a 44-tooth rear wheel sprocket and use a 15-tooth engine sprocket, or a 14-tooth engine sprocket and 40-tooth rear wheel sprocket. The high gear ratio with a 15-tooth engine sprocket and 44-tooth rear wheel sprocket is 4.50 to 1, with a 14-tooth engine sprocket and 40-tooth rear wheel sprocket 4.39 to 1. Never use the standard gear on a sidecar equipped machine.

When you equip a machine that has been in service for some time, with a sidecar, change the motor to the sidecar type if possible, besides changing the gear. Change the motor to the sidecar type, either by merely fitting a set of compression plates between the cylinders and crank cases, if the motor has seen little service, or by having the cylinders reground at our factory and then fitting the compression plates.

Do not change a sidecar motor to the solo type after extended service, without first having the cylinders reground by us.

# Service Dept. Bulletin

No. 46. March 20, 1917 Harley-Davidson Motor Co., Milwaukee

## General Parts and Repair Number



## Sleeve for Muffler Inner Tube

If you notice that the exhaust of your early 1917 machines is not as quiet as that of the later machines, and you wish to quiet it, we will be glad to furnish you with a sleeve to fit over the muffler inner tube, free of charge. The object is, of course, to close some of the ports and this is accomplished without any back pressure. The factory number of the sleeve is FH-36, and we suggest including as many as you need with your next parts order. Machines shipped from the factory approximately after October 25th do not need the sleeve.

To fit the inner tube sleeve, the muffler must be removed. Take off the exhaust pipe connection which has a right thread. If necessary, soak the joints with kerosene and use a piece of pipe inserted in one of the openings to turn the connection. Remove the nuts on both ends of the muffler stud and the muffler shell can be taken apart. The sleeve is split and can be spread enough to slip over the muffler inner tube, without removing the cutout valve stem. Place the sleeve on the inner tube as far as possible and turn it to the left until the split is over the seam of the tube. If the sleeve is not turned, the ports are only partly closed.

## 1917 Inlet and Exhaust Roller Arms

When it becomes necessary to repair a set of 1917 exhaust or inlet roller arms, return them to us for exchange, instead of attempting to repair. This applies to all motors up to No. 17T-8927.

Beginning with this motor number on February 8th, a change has been made in the roller arms, enabling the fitting of new rollers and roller bushings when needed. This cannot be done practically on the



earlier roller arms. For this reason it is recommended that when roller arm repairs are needed, the whole fitting be exchanged for the later type. Any roller arms being carried in stock can be returned for exchange.

Rollers and roller bushings can be ordered for the new type roller arms. The roller turns on the bushing which fits stationary on the roller pin. The only fittings that can wear are the rollers and bushings.

## Renewal of Mechanical Oiler Parts—Always Ship Drive Case and Drive Case Cover to Factory When One or More New Parts are Needed

The mechanical oiler is practically trouble and fool proof and it is seldom that a part must be replaced. When an operating shaft, operating shaft bushing or chamber cap needs renewing, the oiler and drive case should be returned to us for the necessary repairs. Owing to the accuracy required in the fitting of the just listed parts, renewals are made only at our factory.

The good running of the motor depends to a great extent on the efficiency of the mechanical oiler. Parts such as the operating shaft or bushing, operating shaft and plunger chamber caps must be fitted with extreme accuracy; therefore, even though your repair facilities are of the best, refer mechanical oiler to us.

The reason why it is necessary to send in the mechanical oiler and the drive case assembly is that it is advisable to lap in the operating shaft with the mechanical oiler assembled on the drive case. The drive case cover is naturally distorted very slightly when assembled with the drive case and if the mechanical oiler is assembled and lapped in with its own drive case and then tested with its own worm gear, a perfect fit is insured.

If a new drive case cover is ordered, remove the drive case before fitting and assemble the cover with it to test the oiler by hand. Fit the intermediate worm gear and intermediate gear. Then turn the intermediate gear by hand. The operating shaft should turn freely. If there is a bind, or if the operating shaft turns with difficulty, send the drive case and cover to the factory to be "run in." Take no chance on causing the mechanical oiler to seize. The most practical plan is to send the drive case and cover to the factory when any mechanical oiler part needs renewing and we will lap in the oiler and return it ready for service.

## The 1917 Head Fittings Are Adapted to all Models

When it becomes necessary to fit new head fittings to an earlier than 1916 machine, the improved 1916 and 1917 construction can be taken advantage of. The 1916 and 1917 head fittings are of the two point bearing type and are better constructed than the earlier head fittings.

There is no difference in the price of the fittings and while it is necessary to fit both a new cup and cone, the small extra expense will be more than offset by the longer service the new parts will render.

When a head cup or cone must be renewed, inspect all head fittings and if any wear is found, replace the parts with the 1917 type. If the balls are O. K., fit two extra balls in each new cup, twenty balls being used in the 1917 cup, instead of eighteen as before 1916. The ball retainers are discarded, the bearings being assembled with good cup grease which serves as a retainer.

The parts needed to replace a complete set of 1909 to 1916 head fittings are as follows:

| | | | |
|---|---|---|---|
| 2 | EE-64 | Head cups, each... | $ .40 |
| 1 | EE-65 | Upper head cone... | .35 |
| 1 | EE-66 | Lower head cone... | .18 |
| 40 | BO-543 | Head cup balls, each | .01 |

Two extra balls are used in each 1917 head cup.

It is not necessary to replace both ball cups and cones to take advantage of the 1916 and 1917 construction. If one cup and cone are not worn, they need not be discarded while the worn parts can be replaced with the 1917 style. Most dealers are fitting the 1917 head fittings whenever a ball cup must be renewed on an earlier than 1916 model and find it well worth while to make the change, for the new fittings are exceptionally long lived.

## Fittings Required to Attach Different Sidecar Models to Various Model Machines

Inquiries are frequently received relative to parts needed to connect, say a 1917 sidecar to a 1914 or 1915 model, or a 1915 or 1916 sidecar to a 1917 model. To make the subject clear, we are herewith listing the parts needed for the various combinations. It will be noted that the sidecars are interchangeable on all models at small cost. When ordering a set of parts, specify the factory numbers.

To attach a 1917, 1916 or 1915 sidecar to a 1914 model, the following parts are required:

| | | | |
|---|---|---|---|
| 1 | DQ-60-A | Frame brace eye bolt. | $ .45 |
| 1 | EO-276-W | Spacer washer .... | .05 |
| 1 | DE-95 | Rt. stand stop..... | .08 |
| 1 | DE-43 | Rt. luggage carrier stud ......... | .06 |
| 2 | BO-683 | Stud nuts at 5c each | .10 |

To attach a 1917 or 1916 sidecar to 1915 models, the following parts are required:

| | | | |
|---|---|---|---|
| 1 | DQ-60 | Frame brace eye bolt. | $ .45 |
| 1 | EO-276-W | Spacer washer .... | .05 |

To attach a 1917 sidecar to a 1916 model, the following part is required:

| | | | |
|---|---|---|---|
| 1 | EQ-60 | Frame brace eye bolt. | $ .60 |

To attach a 1915 sidecar to 1916 models, the following parts are required:

| | | | |
|---|---|---|---|
| 1 | EQ-53 | Frame brace clevis.. | $ .60 |
| 1 | FO-536 | Frame brace clevis bolt .......... | .05 |
| 1 | EQ-60 | Frame brace eye bolt | .60 |

To attach a 1915 sidecar to 1917 models, the following parts are required:

| | | | |
|---|---|---|---|
| 1 | FQ-60 | Frame brace eye bolt. | $ .60 |
| 1 | EQ-53 | Frame brace clevis.. | .60 |
| 1 | FO-536 | Frame brace clevis bolt .......... | .05 |

To attach a 1916 sidecar to 1917 models, the following part is required:

| | | | |
|---|---|---|---|
| 1 | FQ-60 | Frame brace eye bolt. | $ .60 |

## 1915 Parts for 1914 Two Speed Hubs

Most of our dealers understand that when the original actuating worm cone or driving hub gear of a 1914 two speed hub needs renewing, we furnish a 1915 type cone and driving hub gear complete with roller bearings for $3.50 net, $4.25 retail, in exchange for the original parts. This exchange price has been in force since the fall of 1914.

To those dealers not familiar with



these facts, we wish to say that the 1915 parts are an advance in design, a double set of roller bearings being used in place of ball bearings and a thrust ball bearing being added to take up the end thrust of the drive gear. The regular retail price of the 1915 assembly of parts is $7.00.

Since a large number of the original 1914 cones and driving hub gears have already been exchanged, it is important when ordering a new 1915 actuating worm cone, driving hub gear, roller or thrust bearing or retainer to specify the correct part number.

You may overhaul a 1914 two speed hub that is fitted with the 1915 parts and find that the cone or driving hub gear is worn. If you order a new part from a 1914 parts list, we will send you a complete set of the 1915 parts, since we no longer furnish the original 1914 style parts. This will, of course, be wrong, since all you need is one new 1915 part. Therefore, when ordering an actuating worm cone, bearing, or driving hub gear, be sure to specify the 1915 parts number, if the part you are replacing is of the new type. If you repair a two speed hub that is still fitted with the original parts, return them to our factory, that is, the actuating worm cone and driving hub gear and we will exchange them for the 1915 assembly for $3.50 net. The factory number of this assembly is DG-170.

Follow these suggestions to obtain the benefit of the 1915 improvements when replacing an original 1914 cone or gear, and to avoid duplication and misunderstanding when ordering a new style part to replace one of the same type. You will find the 1915 parts listed on page 37 of the new 1910 to 1917 parts price list.

## Special Clamp for 1914 Sidecar

It is generally known that we furnish a special clamp for the 1914 sidecar. This clamp fits on the lower rear fork of the frame, replacing the original clamp. The special clamp measures 6 3-4 inches over all and distributes the sidecar strain. We furnish this fitting at actual cost, $1.25, because it should be fitted to every 1914 sidecar equipped machine. The number of this clamp is CK-774.

## The Repairing of Worn Carburetors—Charge Reasonable

When you overhaul motors you frequently find the carburetor worn at various points. The compensating air valve is in poor condition and generally the throttle shaft is loose in the carburetor body.

A carburetor in this condition cannot be adjusted accurately, for the wear at the throttle shaft spoils the mixture. Generally the carburetor cannot be adjusted to throttle down. The amount of wear at the throttle shaft can best be learned by raising the lift lever clear of the cam, taking hold of the shaft and moving it back and forth.

To take up wear at the throttle shaft requires reaming the carburetor body and fitting a bushing or an oversized shaft. Instead of attempting to do this, we recommend referring a carburetor in this condition to the Wheeler-Schebler Carburetor Co., Indianapolis, Indiana, for thorough overhauling. The average charge for a complete overhauling including the repairs necessitated by wear at the throttle shaft is $2.50 net, according to a recent quotation from the manufacturers. This does not include a new bowl or body. It is very seldom that either of these fittings needs renewing because of wear. Accident or abuse is generally responsible for serious damage to the body and bowl.

This price does not apply to every job, of course, any more than you or we can quote a flat price on all motor overhauling. However, in every case the charge is reasonable. The carburetor is placed in as good shape as new for all practical purposes, and since it is not a simple matter to repair a badly worn carburetor, we know that you will welcome the opportunity to get first class work at very reasonable cost.

The Wheeler-Schebler people are able to make prompt repairs and we urge every dealer to take advantage of this service. The rebuilding of badly worn carburetors can be compared with such work as regrinding cylinders and rebushing connecting rods—an operation that can be done best and cheapest by the manufacturers.

Heretofore, some dealers have referred worn carburetors to us for exchange. However, since we return all worn carburetors to the manufacturers, every dealer should refer his carburetors directly to the Wheeler-Schebler Carburetor Co. Always tag shipment plainly with your name and address and write a letter of instructions under separate cover at the time. Prepay transportation charges.

Parts such as the manifold, union, inlet nipples, packing bushings, gaskets, etc., are not manufactured by the carburetor people and therefore should not be included with carburetors that are to be repaired. If new parts are needed they should be ordered from us.

## Rebuilding Generator on 1915 Electric Model

If you have a 1915 electric model on which the generator has not been overhauled and fitted with the 1916 improvements, refer it to the Remy Electric Co., Anderson, Ind. The work will be done at a reasonable price. The 1916 and 1917 generators embody a number of improvements in addition to the manually operated switch that will be applied to the 1915 generator at a reasonable price.

## Remy Generator Drive Shaft and Gear Furnished Assembled

The drive gear and shaft for the Remy generator are furnished assembled, not separately. The gear is a .003-inch press fit on the shaft, besides being keyed. A perfect fit would be almost out of question if a new gear were fitted to an old shaft, or an old gear to a new shaft. The numbers of the parts are EX-1056, drive shaft and EX-1059 drive gear.

## When Ordering a Chain Guard for a 1913 Model

On every order for a 1913 chain guard, a 1914 guard is furnished. The 1914 chain guard is padded and quiets the action of the drive chain. It fits the 1913 models, the only difference in shape being a larger opening for the countershaft. Remember that we always furnish the 1914 chain guards on all orders for chain guards for 1913 machines.



## 44-Tooth Rear Wheel Sprocket for Sidecar Service

Bulletin No. 44 explains the change in the combination of sprockets for sidecar service; namely, the use of a 15-tooth engine sprocket and 44-tooth rear wheel sprocket in place of 14-tooth and 40-tooth sprockets. The number of the 44-tooth sprocket is DK-783. When ordering, do not make the mistake to specify the 44-tooth clutch sprocket used on the single geared machines, as has happened several times in the past. The new 44-tooth sprocket is not listed in the parts list, while the 44-tooth clutch sprocket is.

Attention is also called to the fact that bulletin No. 44 gave the standard three speed gear ratio as 3.90 to 1. This is incorrect. The gear ratio is 4.10 to 1. The 3.90 to 1 gear ratio is mentioned on pages 4 and 5 of the bulletin just referred to. Correct your copy.

## Use the 1917 Manual as a Reference Book—Its Value From a Selling Standpoint

You have already received your copy of the 1917 manual. We have tried to make the manual very complete and comprehensive. Keep your copy on hand for easy reference when you want information on a particular subject. A careful study of the manual is an education in itself, not only on repair work, but on the construction of the machine.

Every person connected with your organization should make it his business to read the manual carefully as a means to become more familiar with Harley-Davidson design and construction. You may not have regarded the manual from this viewpiont in the past. Its value as a means of improving your and your employees' knowledge of the machine and presenting such knowledge to the prospect as convincing sales argument, should not be overlooked.

## How the 1917 Manual is Placed in the Hands of the Rider

All riders who have registered 1917 machines to date will receive copy of the 1917 manual within the next few days. Prior to this season the manual has always been included with the machine. This year, this will not be done. Instead, the manual will be mailed the rider as soon as his registration card is received. This is an added inducement to the rider to register his machine immediately. Please remember that unless the machine is registered, the rider does not receive a manual. Therefore, the more promptly the registration card is mailed us, the sooner the manual will be in the hands of the rider. We want to see the manual in the hands of every 1917 owner because it covers information with which every rider must be acquainted to derive satisfactory service.

Another reason for forwarding the manual directly to the rider is this: We believe that the rider will appreciate the manual more if he receives it after he has taken delivery of the machine, and if instead of receiving it with the machine it is sent to him by mail. The manual is an expensive piece of workmanship and we wish to avoid all duplication and waste. Therefore, kindly read this carefully so you will know just how the manual will be distributed.

If you know that some of your 1917 riders have not registered their machines, please send us the registration cards or see that the riders forward them at once. If you will tell the rider that every registered owner receives a copy of the 1917 manual, we feel sure that there is not one that will not send us his registration card. Mention the same fact to every purchaser of a new machine. It is costing extra time and postage to place the manual directly in the hands of the rider by mail, but we are glad to absorb this expense because the results obtained make it worth while.

## Register Sales of Used Machines

Every sale of a used machine should be registered so that copy of the manual can be mailed the purchaser. It is just as important in its way to register used machines as to register new sales, for we are interested to keep in touch with the purchaser of a used machine. That rider in a year is generally an excellent prospect for a new machine. Furthermore, it is to your and our interest to keep every machine in good running order and we can help the rider by sending him the manual and other instructive literature, as well as the *Enthusiast*. Extra sets of registration cards will be furnished on request.

## Oil and Gasoline Tanks on New Machines Now Drained

Beginning February 1st all machines are shipped drained to conform with the ruling of the railroad companies. Heretofore you have been used to receiving machines with oil in the tanks and attention is therefore called to the new system so that there is no danger of running a new motor without filling the oil tank. Run the motor slowly the first time, so as to distribute the oil.

If the motor overoils, make the following adjustment: Remove the vent screw in the operating shaft chamber cap. If oil does not overflow readily, turn the motor slowly until it does. Replace the vent screw firmly. Then remove the vent screw in the cap over the plunger chamber until the oil overflows. Replace the screw firmly. This adjustment is fully covered on page 43 of the 1917 manual.

## A Plan to Spread Harley-Davidson Knowledge

A large number of dealers and dealers' repair men took advantage of the recent training course at our factory. Every one returned home with increased enthusiasm, a more intimate knowledge of the reasons for Harley-Davidson quality, acquired by study in various factory departments and last but not least, with greater ability to do first class repair work and render A-1 service.

Many dealers and repair men could not come to the factory, of course. In fact, to give every Harley-Davidson dealer and repair man a course of training at the factory would require several years. It is therefore our intention to make the 1917 service bulletins as helpful as possible. We will try to cover practically all of the work taken up in the repair course, so that every dealer and repair man has the opportunity to acquire a factory training.

Several bulletins have already been issued and others are in preparation with this in mind. One bulletin will cover the



subject of motor overhauling—How to place a motor in perfect running order, whether it needs no more than to have the carbon removed and the valves ground or whether it requires a thorough overhauling. Another bulletin will be devoted to the electrical system—Generator, battery, lamps, horn and wiring—How to test for short circuits, how to test the output of the generator; in other words, a clear and simple explanation with illustrations, of the care and repair of the electrical system.

For the dealers and repair men who have taken a course at our factory, the service bulletins will be an excellent check up and a constant reminder of the subjects covered by the course. There is nothing better than to see work actually done and to do it personally, but a certain amount of the work of the training course was necessarily covered by instructions and those who took the course, will find the bulletins a great help in their work.

This bulletin service is one of the biggest helps we have ever given our dealers. There isn't a dealer or repair man that is not eager to improve his knowledge. There are no "Know it Alls" or "I should Worrys" among Harley-Davidson dealers. We are therefore going ahead and will issue the bulletins at reasonable intervals. There is a great deal of ground to be covered and while a fine start has already been made, there is no time for lagging behind. You will receive every bulletin as quickly as it is issued. Place it in your loose leaf binder and it cannot get away from you. Study each bulletin carefully.

To make this plan a success, every dealer's co-operation is necessary. If you employ a repair man, see that he studies the bulletins. The man that does the work is directly interested. There is a difference between looking over a bulletin or reading and studying it. Some ground will be covered with which you and the repair man are already familiar; all the more reason why you should get the most out of the new material. Since the bulletins are now filed conveniently, they can be studied at leisure. One enterprising dealer says he intends to take the loose leaf binder along on his Sunday country trips and read and study under a shady tree.

It is going to take time and effort on the part of all concerned to carry out this bulletin service plan, but by working together, we are sure to accomplish big results. Service is the bridge to success in many lines today and nowhere does service count bigger or produce greater results than in the motorcycle business. Satisfied riders are real assets. They advertise you and your goods. The above plan is a means to give your riders efficient service, to keep your machines in first class running order and to be able to do good work at reasonable cost. The sale of a machine is but the beginning of relations between you and the rider.

All bulletins herein referred to are service bulletins. Various other departments will also issue bulletins that merit your best attention, but only service bulletins are referred to here. If you employ a repair man, see that he specializes on studying the service bulletins. In that case it isn't necessary that you devote as much personal attention to the study of the bulletins as if you do your own repair work.

If you have any subject in mind of general interest to you and your fellow dealers that has not been covered by a service bulletin, that is, a subject pertaining to the care and repair of the machines or some other phase of service, let us hear from you. You probably have ideas on service and are using methods in repair work that will interest other dealers. Do not forget that we always welcome suggestions. An interchange of ideas is always helpful to all concerned. Let us hear from you.

# Service Dept. Bulletin

No. 47. March 24, 1917 Harley-Davidson Motor Co., Milwaukee

## Factory Repair Work Number



Most dealers are familiar with the fact that certain operations in repair work can be done most satisfactorily at our factory and that our prices on this work are very reasonable to enable every dealer to take advantage of factory work where necessary for results.

## Prices on Regrinding Cylinders, Rebushing Connecting Rods and Relining Clutch Discs

The operations that come under this heading are regrinding of cylinders, rebushing of connecting rods and relining of clutch discs. Beginning Feb. 15, 1917, the following prices, including material and labor, are effective:

| | List | Net |
|---|---|---|
| Regrinding one cylinder and fitting piston, rings, piston pin and lock pin | $4.75 | $3.50 |
| Refinishing one cylinder, including sand blasting and nickelplating | 1.00 | .75 |
| Rebushing one set twin connecting rods at both ends | 3.00 | 2.25 |
| Rebushing one set twin connecting rods at lower end | 2.35 | 1.70 |
| Rebushing one single cylinder connecting rod at both ends, 1914, '15, '16 and '17 | 1.60 | 1.10 |
| Rebushing one single cylinder connecting rod at lower end, 1914, '15, '16 and '17 | 1.25 | .90 |

A cylinder need not be nickelplated, of course, when reground. However, if



a rider wants a first class job, both within and without, we will refinish the cylinder at the just quoted price. A cylinder should never be refinished with aluminum paint or other preparation, because of the danger of overheating and rusting.

The charges for relining clutch discs are as follows:

| | List | Net |
|---|---|---|
| Relining 1 set (2) clutch discs | $1.75 | $1.40 |
| Relining 1 set (2) clutch discs in lots of ten sets and over | | 1.25 |

Please note these prices carefully since they differ in some cases from the prices in effect prior to Feb. 15, 1917.

## Why and When Cylinder Regrinding is Recommended

If you have had cylinders reground at the factory before, this operation needs no recommendation. In some cases the impression still prevails that after a motor has seen several seasons' service, it can be thoroughly overhauled and placed in perfect running condition without regrinding the cylinders. The repair man will fit new bearings, piston pins and rings, but unless the cylinder walls are cut or burned will not think of having the cylinders reground.

Cylinder and piston wear is normally very gradual, but because of the accurate fit necessary for smooth, quiet running and full power development, regrinding is advisable when the cylinder and piston wear may *seem* very slight.

To measure the cylinder and piston fit, a set of 3 to 4 inch inside and outside micrometers are necessary. A perfect fit means a clearance not to exceed .003 (three thousandths) inch between the cylinders and pistons. This is no more than the thickness of a hair or of this paper. This does not mean that a motor will not run satisfactorily unless fitted perfectly, but rather that after covering many thousand miles and an overhauling is necessary, a first class job is impossible without regrinding.

Sometimes the repair man will make the mistake to figure that a new piston, standard or oversized, will take up the wear and make a perfect fit. This is erroneous, for the cylinder wears taper, that is, more at the upper than at the lower end of the piston travel and the wear cannot be taken up by fitting a new piston either standard or oversized. Naturally a slight shoulder is worn at the upper end of the piston travel, against which a new piston will strike, making the motor noisy. The same condition applies to fitting wider than standard piston rings, when the ring slots in the piston are worn. The top ring will strike the shoulder which the orginal ring had worn in the cylinder and the rider will wonder why his motor is noisy. The oversized rings will moreover not fit perfectly in the piston grooves.

When speaking here of a shoulder, we do not necessarily mean a great deal of wear. The shoulder may be so slight as to be barely felt by the sense of touch, but if the accuracy necessary for smooth, quiet running is considered and the speed of the piston travel, it can be appreciated that if a piston or ring that has "worn in" is replaced with an oversized part, the motor is likely to be made noisier rather than quieted. There is also the danger of breaking the new piston by striking the shoulder constantly.

Cases have come to our attention where several pistons broke in one motor and the dealer was at a loss to understand the cause. The fact is that the cylinder was worn and that the pistons were broken by striking the shoulder at the end of the piston travel. If such a cylinder is reground and fitted with the correct size piston, all further trouble is obviated.

A new piston should never be fitted to a motor without regrinding the cylinder. This statement applies to practically every case, and if the repairman is guided accordingly, he will be able to turn out first class motor work and make satisfied riders. A motor that is overhauled and reground will run smoother and more quietly, the compression will be better and the power and speed greater, than if it is attempted to make a job without regrinding. A cylinder should be reground when it is worn, if it is scored or cut from lack of oil, as well as when the walls have been damaged by the piston pin. Do not think that a good fit can be made by lapping in a new piston.

Our charge for regrinding is reasonable, so that the question of cost need not stand between the rider and a first class job. We are also able to give prompt service on regrinding cylinders, so that a motor overhauling is not unnecessarily delayed because the cylinders are reground.

It has been the experience of many repair men to overhaul a motor without being able to eliminate a knock or pound, although new bearings were fitted and all fits seemed to be O. K. Maybe even new pistons and rings were fitted and the repair man was at a loss to know what to do. In all probability, the piston fit was not accurate as above explained and if the cylinders had been reground, the motor would have run as sweet and smooth as a new job.

## How to Measure Cylinders and Pistons

The correct way to determine the piston fit is to measure the piston at the bottom, the cylinder 1/4 inch from the upper end of the stroke. The piston is largest at the bottom, the cylinder at the top after considerable wear. Therefore, they are to be measured as just suggested.

A set of inside and outside micrometers are necessary to do accurate work and since accuracy is necessary for good results, every first class repair shop should have a set of micrometers. First class instruments can be bought at a well stocked hardware or tool supply house.

A new motor or a reground cylinder is fitted with not more than .003 inch clearance. When a motor is taken apart for overhauling, measure the cylinders and pistons as just explained and if the clearance is found to exceed .008 inch, have the cylinders reground if a first class job is specified.

When a set of micrometers is not at hand for measuring, try the piston fit in the cylinder. If there is more than three paper thicknesses of play between the cylinder and piston walls, the cylinder should be reground. The motor will retain its power, speed and quiet running, if cylinders are reground about every two seasons.

## Why Cylinders Should be Reground at our Factory

Most dealers are in a position to do first class repair work and we urge that you do your own motor work, unless a rider specifies a factory job. However, when it comes to regrinding cylinders and similar operations, as explained hereinafter, be satisfied only with the best and send your work to our factory.

Our facilities for regrinding cylinders are the very best. Two special grinders have been installed in our repair department in the service building. These grinders are equipped with special fixtures for counterbalancing the valve chamber of the cylinder. Without this fixture a true grinding job is impossible because the cylinder will wobble and the result will be an out of round grinding job. Each grinder represents an investment of better than $1,000.00.

Do not be satisfied to have your cylinders reground elsewhere, for absolute accuracy is necessary or the work is worse than useless. Our cylinders are ground taper and unless the exact limits are known, the operator cannot make a perfect fit. Generally when cylinders are ground outside of our factory, they are ground straight and, of course, results are far from what they should be.

Then there is the job of turning up oversized pistons if you do not have your cylinders reground at our factory. This means ordering the piston castings and turning them up or ordering finished oversized pistons and rings and taking a big chance on getting an accurate fit.

Our price for regrinding is, we believe, the lowest ever offered and all work is handled promptly, so that there is every incentive to having your cylinders reground by us. If a cylinder has been cut by a loose piston pin, it can generally be reground. Do not attempt to have the cut filled and to use the same piston.

## Pack Cylinders Carefully to Avoid Breakage

Pack cylinders carefully for shipment. Remember that all merchandise is subjected to rough handling in transit and that cylinder flanges are easily broken. If you pack a set of cylinders in one box or package, place excelsior, paper or burlap between them so that they cannot strike. If a cylinder is shipped in a wooden box, make the latter as near the dimensions of the cylinder as possible, so that the cylinder cannot be thrown around. Protect with excelsior or paper.

Address every factory shipment very plainly—Service Department. The reason for this is explained in bulletin No 42.

## Regrinding Does Not Weaken Cylinders

Sometimes we are asked whether regrinding weakens a cylinder. The answer is NO. A cylinder can generally be reground a number of times and with the exception of cases where a piston pin had cut the cylinder walls, we do not know of an instance where a cylinder had to be replaced because it had been reground.

We never remove more stock than necessary. On the first regrinding, the cylinder is generally not enlarged more than .010 inch. At that rate, the cylinder can be reground a number of times. This is based on the assumption that good oil is used and that the motor is kept free from carbon, dust and grit by frequent flushing. Hard carbon, dust, sand and other foreign matter will cause unnecessary wear if the motor is not kept clean.

## Regrinding Increases Power

Sometimes a rider wishes to increase the horsepower of his motor by cylinder regrinding. This is not recommended because if the cylinders were ground out to the limit, the walls would, of course, be weakened. If a motor is enlarged .010 inch or .020 inch, the cubic displacement is increased very slightly. The displacement of a twin motor is 60.34 cu. in. If the cylinders are ground .010 inch oversized, the displacement is increased to only 60.69 cu. in.

Naturally, regrinding and the fitting of oversized pistons increases the power of a motor, because a perfect fit is made and lost compression restored. Therefore, a rider who wants to increase his power can do so by having his cylinders reground, even though the horsepower of his motor is not increased.

When it is desired that the pistons be lapped in after regrinding, which is the same as running them in, we will do so at an additional charge of 50 cents per cylinder. If the pistons are to be lapped in, specify in your letter of instructions.

## Oversized Piston Pins Fitted if Specified

If on taking a motor apart, it is found that the piston pin bushings are slightly worn, a perfect fit can generally be made by fitting slightly oversized pins. Therefore, when specified, we will be glad to fit .002, .003 or .004 inch oversized piston pins, when furnishing new pins on a regrinding job. Of course, if a bushing is worn considerably, it is best to renew it, for it is not advisable to fit a considerably oversized pin to a new piston.

## How to Distinguish and Order Rings for a Reground Cylinder

Cylinders are always reground to certain standard sizes. No more stock is removed than necessary. All reground cylinders are therefore .010, .020, .030 inches, etc., oversized. This simplifies carrying oversized rings in stock. Odd sizes need not be carried.

The bore of a reground cylinder is distinguished by a number stamped on the cylinder base, sprocket side, near the forward edge. A cylinder measuring 3.320 inches is marked R-2, R indicating that it has been reground, the number 2 being the second number of the decimal. Therefore R-2 really means .010 inch oversize, the standard cylinder measurement being 3.309 to 3.310 inches. A cylinder measuring 3.330 inches, or .020 inches oversized is marked R-3, 3.340 inches R-4, et cetera. Therefore, when ordering new rings for a reground cylinder, it is only necessary to specify the number on the cylinder base. If the motor is one that you have not seen before, inspection will show whether it has been reground at our factory. This method of marking has been in effect for about 16 months. Of course, standard rings are not to be fitted to an oversized piston.

## Sidecar Motor Should be Fitted with Compression Plates

A motor used in sidecar service should be fitted with ⅛ inch compression plates between the cylinders and pistons, the same as the 1917 sidecar motor. Therefore, when having such a motor reground, specify three ring pistons and compression plates. The latter sell at 20 cents retail each. See service bulletin No. 44 for further particulars.

All reground cylinders are fitted with 1917 pistons. These pistons have larger bearing surfaces than the pistons of some of the earlier seasons. When an earlier than 1912 single cylinder is reground, a new connecting rod is also furnished at a reasonable price to enable using the 1917 piston.

Twin cylinders should be reground in sets whenever possible, although this is not necessary. When one cylinder of a 1916 sidecar motor is reground, a two ring piston should be specified, since this was standard in our 1916 sidecar motor construction. If the cylinders are reground in sets, three ring pistons with ⅛ inch compression plates, as already referred to, will be fitted.



## Some Dealers Carry Exchange Cylinders

Some dealers carry one or two sets of reground cylinders in stock, so that when a motor is brought in for overhauling, the rider can be given immediate service by exchanging cylinders. As already stated, our service on regrinding cylinders is very prompt, but it pays when you do considerable motor overhauling to carry one or two extra sets of cylinders, so that you can give the rider who does not want to lay up his machine more than 24 hours, as good a job as the rider whose cylinders you can refer to the factory.

We have a number of sets of reground cylinders fitted with pistons, rings and pins, on hand, for all practical purposes as good as new, that we will dispose of at reasonable prices to such dealers as wish to carry an extra set or two. You may have a set or two of old cylinders on hand that if reground, would be made serviceable and could be used for exchanges. When exchanging cylinders, the rider's cylinders must be examined carefully to see that he does not get a better set than his. If the cylinders are about alike, they can be exchanged at the price of regrinding plus express charges.

## Why Connecting Rods Should be Rebushed at our Factory

The fitting of steel connecting rod bushings is as specialized as cylinder regrinding and should only be done at our factory. The bushings are ground on a special grinder after they are fitted, since they naturally distort when pressed in the rods and a perfect fit is impossible without grinding after fitting. For this reason, the steel connecting rod bushings are not furnished on parts orders. It pays to carry an extra set of connecting rods, so that when a motor is brought in for overhauling, rods can be exchanged and the worn bushings replaced at the factory. The bushings should be replaced when the connecting rods have up and down play. When the bushings are worn badly, they are grooved or ringed. Generally when the bushings need renewing, the roller bearings and crank pin should also be replaced. Oversized rollers are furnished in sizes from .0001 (one ten thousandth) inch up.

## Accuracy is Necessary in Assembling Motor

In assembling cylinders, pistons and connecting rods with the motor after regrinding and rebushing, great care must be taken. Instances have come to our attention where pistons were put out of round and never were trued and rounded up, so that they would not travel true and the advantages of regrinding were therefore lost. The same holds true if a connecting rod is sprung very slightly.

In a service bulletin to be issued in the near future, every operation pertaining to motor overhauling will be covered thoroughly. Most Harley-Davidson repairmen appreciate the importance of absolute accuracy in motor work and a careful reading of the motor overhauling bulletin is recommended. It would be unfortunate to lose the benefits of a regrinding job by some slight carelessness in overhauling or in assembling. The use of the factory piston squaring plate is strongly recommended for accurate work in lining up pistons and connecting rods. The use of this plate will be described in the bulletin just referred to.

## Never Use a Piston Pin Lock Pin Twice

It will be noted that a new piston pin lock pin is furnished with every reground cylinder. The reason for this is that a lock pin should never be used twice. As soon as you take a motor apart, throw the lock pins away. From spreading and closing, the lock pins are naturally weakened and it does not pay to take a chance on a piston pin working loose and cutting the cylinder walls because as inexpensive a part as a piston pin lock pin was not renewed.

## Clutch Discs Should be Relined at Our Factory

Relining clutch discs is another operation that can be done best at our factory. Smooth clutch action is essential to good clutch service. Every clutch disc that we reline passes through one of our giant presses, "bumped" as we call it, giving it the perfect, even friction surface, so necessary for smooth clutch action. When a set of discs need relining, return them or exchange for a set from your stock, then return to the factory for relining, or hold them until you have accumulated a sufficient number to get the benefit of the quantity price.

Clutch linings and rivets can be obtained from us, if a dealer prefers to do his own relining, but it is cheaper to send the discs to the factory. In addition to this, a perfect job is made. Most dealers are referring their clutch discs to the factory and we know that everyone will, once the advantages of factory relining are understood. Excellent service is given on this work, for all discs received at the factory are exchanged for discs already relined, so that there is no delay. The subject of fitting clutch discs and adjusting the clutch bearings will be covered in a near future bulletin and reference to these instructions is recommended in this connection.

# Service Dept. Bulletin

No. 51. April 25, 1917 Harley-Davidson Motor Co., Milwaukee



## Mention the Motor Number

Whenever you write us regarding a machine, mention the number of the motor. This information is frequently necessary to answer a letter promptly and intelligently. With the different models in service it is not sufficient to refer to a machine as a 1917 or 1916 model.

This may seem to be a small point but is in fact very important. It has happened more than once that important information has been delayed, or inaccurate information given, because the motor number was not mentioned.

Sometimes a dealer will refer to a machine as "my demonstrator" or "the machine I sold Mr. so and so." If the machine is registered as the dealer's demonstrator or if the rider has registered it, it is of course a simple matter for us to look up the motor number; otherwise, there may be a delay or inaccurate information may be rendered. The sure way is to mention the motor number.

## Using Old Models for Their Parts

Sometimes a machine taken in trade is worth more if stripped for its parts than if resold. Generally such a machine must be repaired to place it in good running order and the dealer in some cases finds it difficult to break even. If such a machine is stripped for its parts it is very likely that the dealer will more than break even on his investment. That this plan is practical is best attested by the fact that it is being used by a number of dealers.

Generally, a considerable amount of material of a machine that has seen several seasons' service is found in serviceable condition or can be placed in such condition at small expense. This material can be used in repairing other machines. Cylinders can be reground, connecting rods rebushed and be used advantageously for exchange service, especially if a dealer does considerable overhauling.

The carburetor can generally be overhauled at considerably less than the cost of a new one. The makers will do this work at reasonable cost as explained in service bulletin number 46. The magneto as a rule is O. K., or can be placed in serviceable condition at reasonable price. We could go on this way through the whole machine.

Of course good judgment must be used in sizing up a machine. There may be little call for parts of a certain model because there aren't many machines of that model in the dealer's territory. You can, however, appraise a machine for its parts value after careful examination. It may happen that it will cost more to place a machine in first class mechanical condition than it can be sold for. In that case the machine should by all means be used for its parts.



## A Suggestion Regarding Service to Commercial Users

It has been suggested that we furnish public service corporations and others who use Harley-Davidsons in large numbers and maintain their own service departments, with such service bulletins as will be of direct interest to the men responsible for the good running of the machines.

Large corporations such as telephone, electric and gas companies generally maintain a repair department to look after their machines. If you number one or more of such concerns among your users we will be glad to have you give us your ideas of this plan. We would not furnish all the service bulletins but only such as would be of direct interest and would help the cause of good service.

The above suggestion was made by a dealer after reading the recent bulletin on Service to Commercial Users. This dealer believes that since the people that he has in mind do their own service and repair work, it will pay to give them the benefit of such service bulletins as will be of direct help. Let us hear from you.

## To Increase Confidence in the Dealer

Your attention is called to the article in the current issue of *The Enthusiast* headed: Do You Know What is Being Done to Give You Service? This article tells the rider why he should go to his dealer when his machine needs attention. There are still some riders who have their machines overhauled at some other shop than their dealer's, because some one else offers to do the work cheaper.

This article explains that the dealer's facilities are the very best, that every dealer is furnished with factory tools and wrenches at reasonable cost, that a large number of dealers and repairmen took a course of training at our factory last winter and that by means of our bulletin service each dealer is kept in touch with the most efficient means of keeping all of his machines in good working order.

The effect of this message is sure to be felt, for *The Enthusiast* reaches every registered Harley-Davidson rider and is read with interest and attention. This was brought home by the avalanche of returns received from the mailing card enclosed with the last number of *The Enthusiast*, asking the riders whether they wanted their names continued on the mailing list. Everything done to bring the dealer and rider together to cement their relations is sure to help business.

## Regarding Timer Lever Screw DX-1012

Do not use the wrong length screw in fitting the timer lever on the Remy generator. It has happened several times that a longer than the regular screw was used. This screw protruded through the cover so that the nut on the end of the circuit breaker shaft would strike it. As a result the circuit breaker was thrown out of adjustment, the points did not break with an equal gap and the motor did not run satisfactorily.

This is a small item but just because it seems unimportant may easily cause the repairman a lot of worry. Always use the regular screw DX-1012.

## Oiling the Inlet Valve Stems

Wear of the inlet valves and housings can be reduced to practically nothing if the following suggestions are applied.

Applying a little oil to the inlet valve stems will lengthen the life of the valves and the valve guides. Apply a few drops of light oil—regular motorcycle oil—to the inlet valve stems every week during the first four or five weeks of service and every two or three weeks thereafter. The oil will tend to glaze the valve stem and guide, thereby reducing wear.

# Service Dept. Bulletin

No. 52. May 10, 1917 Harley-Davidson Motor Co., Milwaukee



## Make Your Instructions on Every Repair Job Complete

Parts that are returned to us for re-enameling nearly always need repairing of some kind before the job can be completed in first class shape. Frames and forks are frequently found bent, tanks and mud guards dented, and very often other parts arrive in a damaged condition.

It has been our experience that if a rider goes to the expense of shipping his machine or certain parts to the factory for re-enameling, he expects a first class job and does not want us to re-enamel his frame and forks without straightening and lining, if such work is necessary. It is out of question to write for specific instructions on every re-enameling job that needs additional attention. To do so would mean considerable delay and extra detail work. On the other hand, when you quote a rider on a re-enameling job, you naturally must know about how much the factory work will cost you. To avoid misunderstanding the following plan will be put into effect at once with your help.

When you ship to us a job for re-enameling, whether it consists of one part or a complete machine, word your instructions according to the following, depending on what you want done:

1. Re-enamel only. Make absolutely no repairs.
2. Re-enamel and make all necessary repairs.
3. Re-enamel and make the following repairs. (Then specify what work you want done.)
4. Re-enamel and make necessary small repairs. If considerable work is needed, submit estimate.

Taking your own experience in repair work into consideration, you will agree with us that a definite system of giving complete instructions on re-enameling and, in fact on all repair work, is necessary in order to avoid misunderstanding and enable us to give you prompt service.

It has already happened that the repair work on a re-enameling job exceeded the cost of the enameling itself. If the dealer has no previous understanding with the rider and the factory, a misunderstanding is apt to result. When you quote a rider an approximate price on re-enameling or when you ship to us parts of machines from your used stock, always take the foregoing into consideration. As we receive parts for re-enameling from dealers all over the country, you can understand how important it is to give us definite instructions and to estimate the job carefully for the rider.

Our current prices on re-enameling parts and complete machines do not include any labor for taking apart, reassembling and making repairs. The labor necessary to tag each part before referring the job to our enameling department, for collecting the parts for shipment after re-enameling, and doing other incidental work, is charged for extra. It is not included in the charge for re-enameling. Since this labor varies on practically every job it is impossible to give a definite quotation excepting on the actual re-enameling. Bear in mind that there is other labor besides re-enameling connected with every job. For instance, in order to prevent confusion, we must distinguish each



part with a metal tag, stamped with the repair order number, as there may be one hundred or more jobs en route through our enameling department at the same time.

Whenever possible, do your own stripping and ship to us only the parts that are to be refinished. This means to take apart forks and transmissions, remove frame and tank fittings, etc. Wheels need not be stripped if the hub shells and spokes are to be re-enameled, as is now done very frequently. However, the hub, brake and clutch parts must be removed from the hub shells.

In stripping parts for re-enameling we often find fittings worn or damaged beyond repair. Head fittings, front hub cones or rocker plate bushings are found worn, fork springs broken, sprockets worn and so on. Frequently it is out of the question to assemble the job with such parts. There is also a natural disinclination on our part to assemble a machine or parts with damaged parts. If the rider afterwards finds such parts he would feel that the factory did not make a first class job. Therefore, when parts are found beyond service, new parts are fitted and charged for. If, in such cases the dealer and rider figured on the actual re-enameling only, the charge would be larger than expected.

For these reasons we prefer that on a straight re-enameling job you ship to us only the parts that are to be refinished and make your instructions clear. Also bear in mind that any quotations on re-enameling do not include the labor for tagging the parts and other incidental operations. This labor will not exceed a few hours on most jobs.

While the above instructions apply especially to re-enameling, they hold true of all repair work. Make your instructions on each job complete. Leave nothing in doubt.

When you return a set of forks to be repaired, instruct us whether or not to re-enamel them. Do not take it for granted that because a set of forks are scratched we will re-enamel them. We must have your instruction to that effect. When you ship to us a cylinder for regrinding and want the valves ground in or refaced, instruct us accordingly. If you return a number of parts for re-enameling and certain nickelplated fittings are included, tell us whether or not to renickel them. If you want to leave a job to our best judgment or want an estimate, instruct us accordingly.

It is necessary to have a definite working plan, as outlined, on each repair job; first, to save time and make good service possible; second, to be able to turn out every job exactly as you and the rider expect it.

## Instructions for Attaching Sidecar Top

When a sidecar is ordered equipped with top, the latter is attached without extra charge. When a sidecar top is ordered separately, it is furnished complete with fittings and if the following instructions are carried out carefully it will be a simple matter to make a first class job of attaching it.

Be careful not to damage the upholstering while removing it to fit the top irons to the body. Loosen just enough upholstering to be able to fit the irons. This will amount to about 10 inches for the forward top irons or props, figuring from the front end of the upholstering, and about 4 inches to both sides of the corners on the rear of the body for the rear rod.

Fit the rear rod first. It will be necessary to twist the rod back and forth in order to pass it along under the upholstering. Be sure to have the rod rest on the sides of the body and draw it backward against the rear of the seat. After the rod has been passed through properly, cut a small hole in each side of the upholstering just large enough to pass the rod through. Center the rod properly on the wooden strips of the body by using the holes in the rod as a guide. Then with a 3/8-inch drill or auger put the clamp bolt holes into the wood strip. Make the rod secure by passing the 3/8-inch bolts through the wood strip from the bottom and then through the rod and drawing the nuts tight. Replace the upholstering as carefully as possible to make a neat appearing job.

To fit the front irons, loosen the top of the upholstering from the front end as already explained. Measure forward 19 1/2 inches from the outside rear end of the body, being sure to have the ruler or scale in line with the rear rod. Mark the wood strip at this place. This mark is to be the center point of the front iron or prop when it is fitted. Be sure to get this measurement accurate or the top will not fit properly.

Hold the iron against the side of the wood strip with the stud in line with the mark and drill two 1/4-inch holes. It is advisable to drill these holes so that they will line up with the upper holes in the side iron. Cut holes into the upholstering the same as was done for the rear top rod. Fit the bolts with the heads on the outside and draw the nuts secure. Then fit the two wood screws and replace the upholstering carefully.

Place the bow rests on the bow rod and adjust them properly after the top has been fitted.

The threaded glove fastener or clasp with the hexagon head is to be fitted on top of the cowl about 1 inch from the edge exactly in the center. Drill a hole at this point with a No. 28 drill. The fastener is firmly held with a clamp nut placed under the cowl.

Measure 4 1/2 inches to both sides from the center of this fastener and about 2 3/4 inches from the edge of the cowl. Drill two holes with a No. 28 drill at these points. Fasten both front strap loops with one bolt and nut. Line the loops up with the edge of the cowl away from the center glove fastener. Drill the other holes and fit the screws and nuts.

Place the bushings or collars on the front top irons, fit the sidecar top, the spring nut locks or lock washers and the nuts. Bend part of the nut lock or lock washer against the shank of the nut, thereby locking it secure.

Spread the top, cross the front straps and pass them through the loops on the cowl. Adjust the straps so that the distance from the highest part of the cowl to the bottom of the top is 19 1/2 inches.

Fit the fasteners or clasps for the rear top straps on the rear of the body immediately below the padding and about 3 inches from the outer edge so that the straps hang perfectly straight. Firmly press the rear strap eyelets over the fastener screws.

To fit the rear curtain fasteners draw the curtains reasonably tight so as to get all wrinkles and looseness out of them. Note carefully where the eyelets are and fit the curtain fasteners.

Attach the front curtain to the top and to the fastener on the cowl. Then note where the eyelets are and mark the position for the two curtain fasteners. The proper place will be about 7 1/2 inches from the outer edge of the strap loops. Do not draw the front curtain too tight over the cowl and use the same No. 28 drill for drilling the rivet holes into the cowl. The rivets which clamp the curtain fasteners are split and can easily be spread with a screw driver.

Attach the left side curtain to the top and fit the fastener to line up with the eyelet in the side curtain. The remaining curtain fastener is to be placed on the right side of the sidecar body so that it lines up with the eyelets in the right side curtains.



# How to Apply Harley-Davidson Transfers

This is a subject with which most dealers and repairmen are familiar but for the benefit of those who have not applied transfers before, or who have not been successful in every case, we offer the following instructions:

After the final coat of enamel has dried thoroughly, rub lightly with mineral wool or fine sand paper. Then dust carefully and make sure that the surface to which the transfer is to be applied is perfectly clean.

Apply a thin coat of quick drying varnish or gold sizing to the face side of the transfer and allow to dry until it becomes tacky, that is, so that it will not stick to the fingers when rubbed lightly, but will stick if pressed firmly. Then place the transfer on the enameled surface being careful that the transfer is not wrinkled. Press the transfer firmly in place.

The transfer is made up of two thicknesses of paper, the top layer of which can be removed at once without wetting, by loosening the edge and slowly pulling it off. This leaves a thin layer of paper over the transfer. Moisten with water until saturated. Then remove the paper carefully.

Have a piece of cheese cloth that has been dipped in gasoline ready and rub lightly over the transfer and surrounding surface. This will take off all surplus varnish or sizing. Dry off the gasoline with a clean piece of cheese cloth and the enameled surface is ready for the varnish.

If these instructions are followed carefully, a first class job will result. Transfers for the tanks, frame head and tool box are furnished free of charge.

## IMPORTANT NOTICE

The design of the 1917 motor requires that from .008 inch to .010 inch clearance be allowed between the exhaust valves and lifter pins. On the 1916 and earlier models a closer adjustment was recommended. The 1917 push rods are adjusted with .004 inch clearance, the same as heretofore.

It has frequently happened that in checking over the exhaust valves of a 1917 motor dealers and riders have readjusted them with the clearance recommended for the 1916 and earlier motors. This is wrong and we recommend that you see that the exhaust and inlet valves on your 1917 motors are adjusted correctly. If the adjustment is too close by only .001 or .002 inch, the valves are likely to be held open after expansion and exposed to the direct heat of the charge. Furthermore, the timing of the motor is changed. This will result in unsatisfactory motor service.

Several cases have come to our attention in which it was believed that carburetor trouble was being experienced but investigation showed that the trouble was due to too close adjustment of the exhaust and inlet valves. The inlet push rods should be adjusted to allow .004 inch clearance between the valve stems and inlet levers. This adjustment is the same as in previous seasons.

If you have a 1917 motor that spits and misses at high speed, regardless of changes in the carburetor adjustment, check over the inlet and exhaust adjustments and you will most likely find that they are not correct. The exhaust and inlet valves must be adjusted and the clearance measured when the motor is cold.

# Service Dept. Bulletin

No. 53. May 21, 1917 Harley-Davidson Motor Co., Milwaukee



## The Harley-Davidson Two-Speed Hub

This bulletin covers the care and adjustments of the Harley-Davidson two-speed hub as well as instructions for stripping, repairing and assembling.

While the two-speed model is no longer manufactured, there are many thousand two-speed machines in service. The two-speed hub naturally needs attention from time to time and while its care was outlined in the 1914 manual, frequent inquiries from dealers and riders show that there is need of a clear explanation of how to take apart, repair and re-assemble the two-speed mechanism. This bulletin is written with that in mind.

Never make any unnecessary adjustments, nor force the shifter lever into high or low speed, nor lubricate the two-speed hub at other intervals than recommended. Never try to force the shifter lever into high or low speed when the machine is standing still and the motor is not running. The dogs may not be in line and to force the lever may bend the shift mechanism. If the clutch is engaged to the point where it has the slightest trace of a drag, the dogs will line up readily and allow easy shifting. The time to make adjustments is generally after the position of the rear wheel has been changed in adjusting the chains. Then do not change the position of the shifter lever "43" on the shifter pinion washer "42" but adjust the short shifter rod "38" as explained hereafter.

## Lubricate the Two-Speed Hub Every 1,500 Miles

The two-speed hub should be lubricated with Harley-Davidson non-fluid lubricant or a good grade of medium heavy cup grease every 1,500 miles. To lubricate the hub remove the axle end screw "25." Load a grease gun, such as is listed in our accessory catalog, about one-fifth full, place the nozzle in the end of the axle and discharge the contents into the hub. In cool weather when the lubricant is thick and hard, thin it by heating. Let the lubricant cool before using the machine. Never put in more grease than just specified and do not use a thin lubricant, because the lublicant will have a tendency to work out of the hub and into the brake, preventing the brake from holding. After adding the lubricant replace the axle end screw firmly. To insure easy shifting put a drop of oil on the various bearings of the shifting rods daily, or at least once each week.



## Importance of Correct Shifter Rod Adjustment

Very often little thought is given to the shifter rod adjustment. As long as the shifter handle on the tanks will not jump to neutral automatically while riding along in either high or low speed, the average rider is inclined to take it for granted that everything is in proper adjustment. This, however, is not necessarily true, because it is very important to have the dogs of the clutch collar "20," right cone "21" and of the inner hub shell "2" engage fully. If only the edges of the dogs engage there is great danger of chipping off the corners and if this practice is continued long enough, these parts of the two-speed mechanism will be ruined.

To make sure that the adjustment is O. K. apply the following: When the two-speed mechanism is in neutral position the shifter handle on the tanks must be in a perpendicular position, the shifter lever "43" must be in line with the rear axle "24" and the shifter rod lever "26" must be at equal angles with both shifter rods. This adjustment will allow the dogs to engage entirely, insure easy shifting, reduce wear and allow the clutch collar pin "9" to enter the lock holes "H" in the clutch gear cone "13." If the clutch collar pin cannot enter these holes, if the pin and cone are worn, or if the clutch collar spring screw (not shown in illustration) is loose, it will be impossible to get the shifter handle to stay in either high or low speed.

## To Adjust the Shifter Rods

It will be understood from the above that generally when the two-speed does not shift readily, or when the speeds do not engage properly, the shifter rods are out of adjustment. Re-adjust the long rod first. This rod has right threads and should be adjusted so that the shifter handle on top of the tanks is perpendicular in the neutral position and at the same time the shifter rod lever should be at equal angles with both shifter rods.

Disconnect the shifter rod end "45" from the shifter lever "43" so that the shifter lever can be properly adjusted on the shifter pinion washer. The shifter lever must be in line with the axle when the mechanism is in neutral position. To find the neutral position, move the shifter lever forward and backward. If the lever will not line up, loosen the shifter pinion nut on the shifter pinion sufficiently to allow moving the shifter lever as may be found necessary. After the long shifter rod and the shifter lever have been adjusted place both in neutral position and adjust the short shifter rod so that the end will just fit over the stud of the shifter lever.

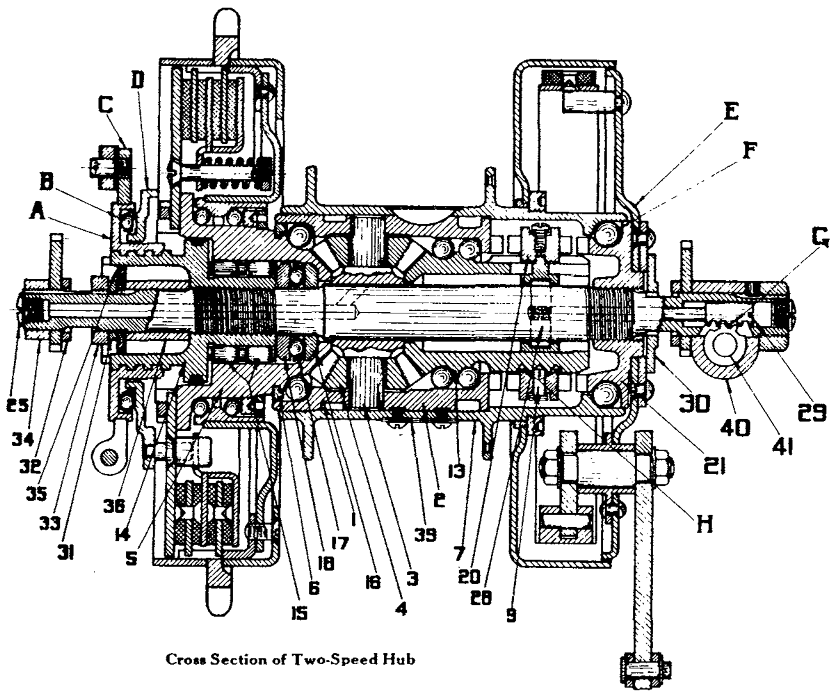
After the proper rod adjustment has been obtained note whether the lugs or stops on the shifter bracket "22" are preventing the shifter arm "23" from fully engaging in either high or low speed. If the arm strikes these stops before low and high speed are fully engaged, file off the stops on the shifter bracket as may be required.

## How to Strip the Two-Speed Hub

If for some reason the two-speed hub must be taken apart, as for fitting a new axle, the following method of stripping used at the factory is recommended. Taking for granted that the rear wheel has been removed from the machine, proceed by removing both axle clamp nuts "34," left side spacer washer "32" and rear axle adjusting clip. Remove the actuating nut "A" and collar "C" by turning this assembly to the right, then take off the actuating ball retainer with balls "B" and the actuating plate "D."

found to stick tight, lightly tap the spoke side of the clutch hub shell with a rod or hammer handle. Push the axle toward the right to release the nineteen steel balls at "F," taking care not to lose any.

Remove the right cone "21," take off the two screws clamping the hub shell




**Cross Section of Two-Speed Hub**

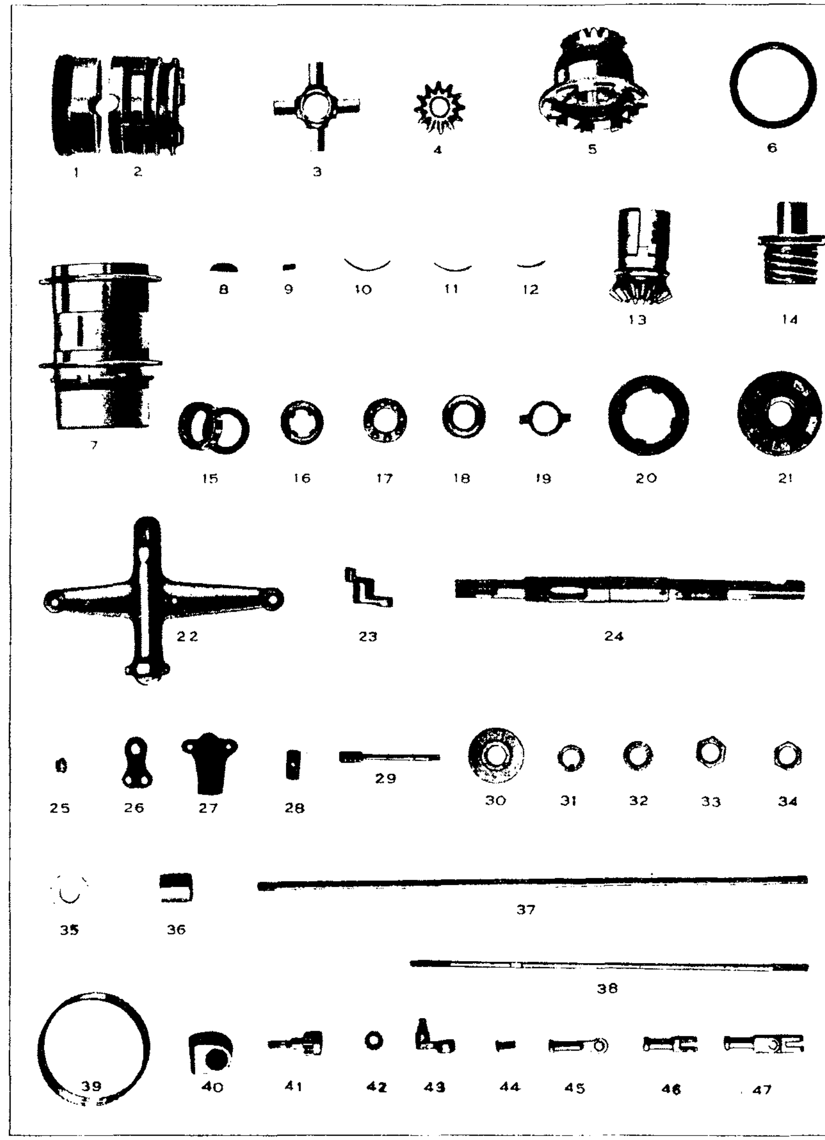
Remove the hexagon 1/4″ x 24 nut clamping the shifter lever and take off the lock washer, lever "43" and shifter pinion washer "42." The shifter pinion "41" can be removed from the shifter body "40" by lightly forcing it downward. Withdraw the shifter body from the axle and remove the adjusting clip (not shown in illustration), washer "30" and brake side cover assembly "E."

Remove the left cone lock nut "33," bushing "36" and the actuating worm cone "14." The entire clutch assembly with the driving hub gear "5" can then be removed from the rear hub. If it is

band "39" and then the band. With a dull chisel remove the six woodruff keys "8" which lock the inner and outer hub shells "1," "2" and "7." To remove the keys take a dull drift or chisel. Place the drift or chisel against the left edge of the keys, strike the chisel with a hammer and the keys can be rocked out of the key ways.

With factory wrench CK-6 furnished especially for the purpose, remove the inner hub shell assembly from the outer hub shell by turning to the right. The wrench fits the dogs of the clutch collar which is locked by dogs to the inner hub






**Component Parts of Two-Speed Hub**

# Service Dept. Bulletin

No. 53. May 21, 1917 Harley-Davidson Motor Co., Milwaukee



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To make sure that the adjustment is O. K. apply the following: When the two-speed mechanism is in neutral position the shifter handle on the tanks must be in a perpendicular position, the shifter lever "43" must be in line with the rear axle "24" and the shifter rod lever "26" must be at equal angles with both shifter rods. This adjustment will allow the dogs to engage entirely, insure easy shifting, reduce wear and allow the clutch collar pin "9" to enter the lock holes "H" in the clutch gear cone "13." If the clutch collar pin cannot enter these holes, if the pin and cone are worn, or if the clutch collar spring screw (not shown in illustration) is loose, it will be impossible to get the shifter handle to stay in either high or low speed.

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Disconnect the shifter rod end "45" from the shifter lever "43" so that the shifter lever can be properly adjusted on the shifter pinion washer. The shifter lever must be in line with the axle when the mechanism is in neutral position. To find the neutral position, move the shifter lever forward and backward. If the lever will not line up, loosen the shifter pinion nut on the shifter pinion sufficiently to allow moving the shifter lever as may be found necessary. After the long shifter rod and the shifter lever have been adjusted place both in neutral position and adjust the short shifter rod so that the end will just fit over the stud of the shifter lever.

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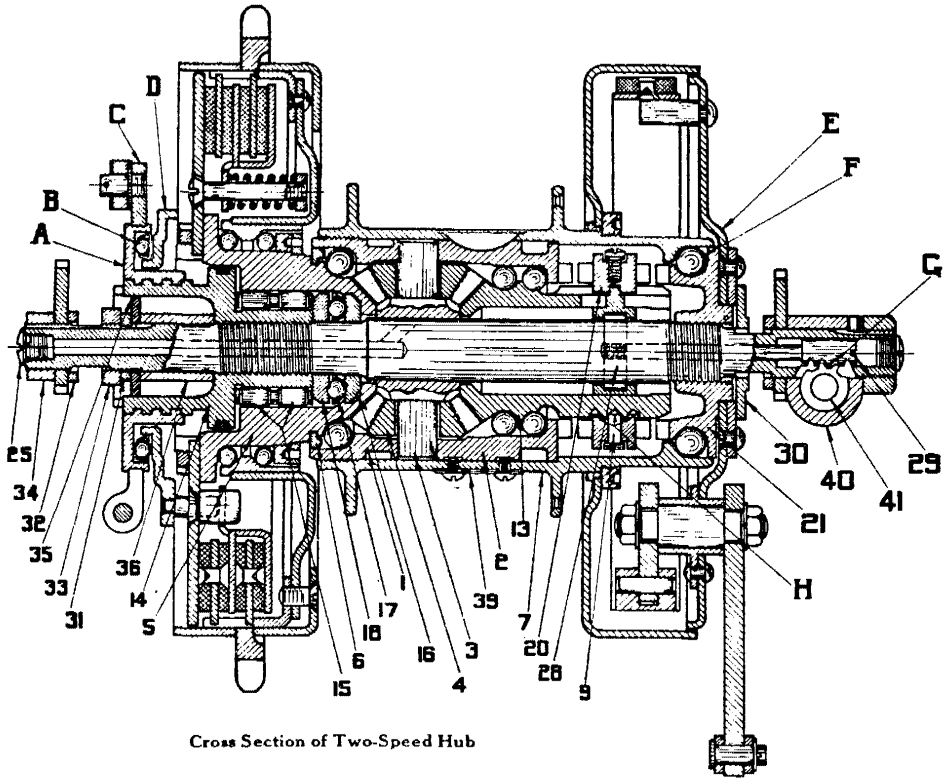
found to stick tight, lightly tap the spoke side of the clutch hub shell with a rod or hammer handle. Push the axle toward the right to release the nineteen steel balls at "F," taking care not to lose any.

Remove the right cone "21," take off the two screws clamping the hub shell




Cross Section of Two-Speed Hub

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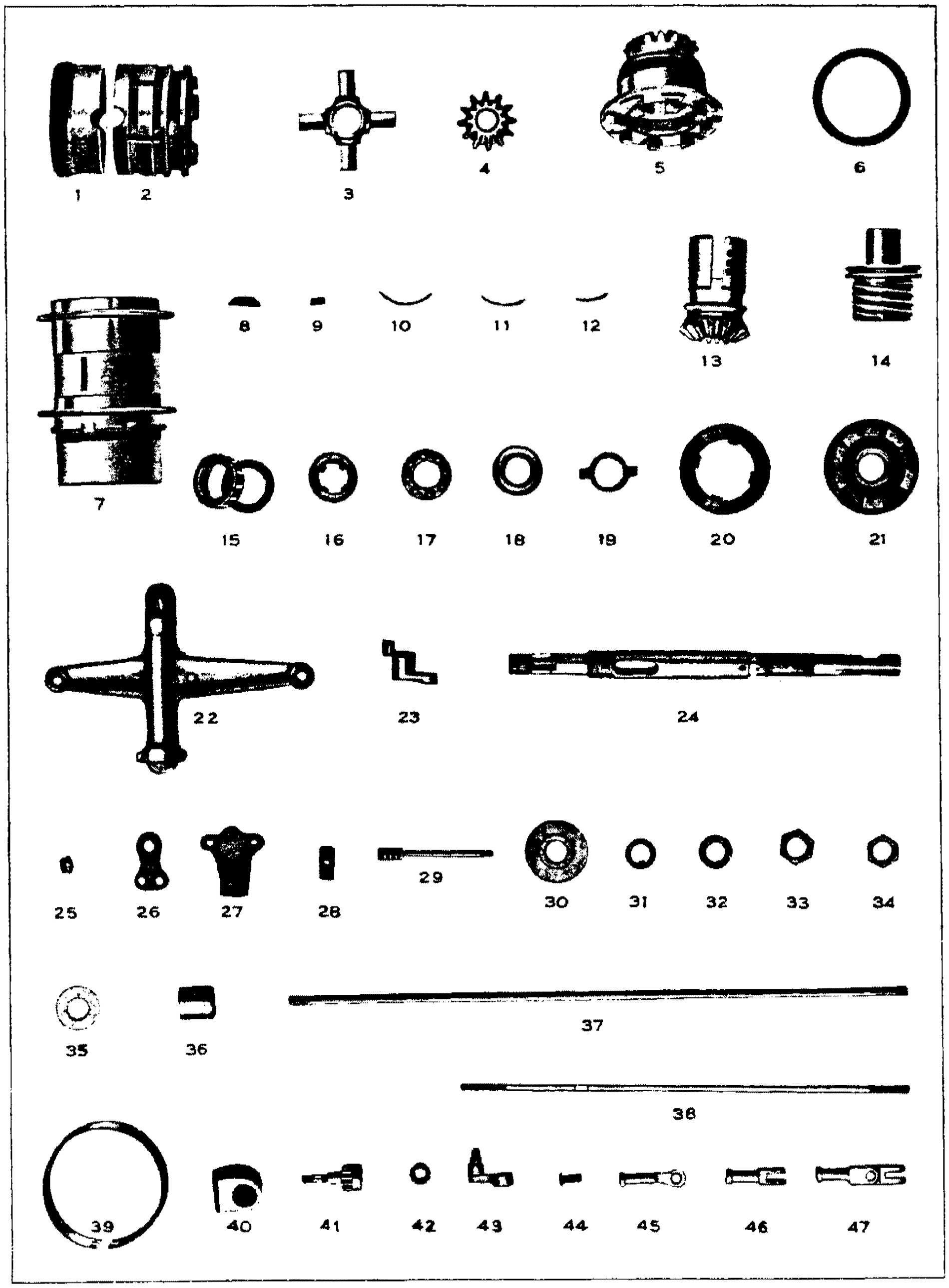



Component Parts of Two-Speed Hub

When ordering two-speed parts always specify the Factory Number, and not the Photo Number.

| | | |
|---|---|---|
| 1 | BG207 | Inner hub shell (left half) |
| 2 | BG207 | Inner hub shell (right half) |
| 3 | DG218 | Bevel pinion shaft |
| 4 | BG217 | Bevel pinion |
| 5 | DG215 | Driving hub gear |
| 6 | BG213 | Driving packing ring |
| 7 | BG200a | Outer hub shell |
| 8 | BG202 | Hub shell keys |
| 9 | BG224 | Clutch collar pin |
| 10 | BG223 | Clutch collar spring (lower) |
| 11 | BG222 | Clutch collar spring (center) |
| 12 | BG221 | Clutch collar spring (upper) |
| 13 | BG225 | Clutch gear cone (1914) |
| | DG225 | Clutch gear cone (1915) |
| 14 | DG210 | Actuating worm cone |
| 15 | DG177 | Roller bearings |
| 16 | DG175b | Ball race inside |
| 17 | DG176 | Ball retainer and balls |
| 18 | DG175a | Ball race outside |
| 19 | BG264 | Clutch shifter collar |
| 20 | BG219 | Clutch collar |
| 21 | BG220a | Right cone |
| 22 | BG273a | Two-speed shifter bracket |
| 23 | BG278a | Shifter arm |
| 24 | DG262 | Rear axle (1915) |
| | CG262 | Rear axle (1914) |
| 25 | BO153 | Axle end screw( right) |
| | BO151 | Axle end screw (left) |
| 26 | BG286 | Shifter rod lever |
| 27 | BG297 | Shifter lever bracket |
| 28 | BG208 | Clutch shifter bar |
| 29 | BG209b | Clutch shifter plunger |
| 30 | BO328 | Axle washer (inside frame) |
| 31 | CG265 | Axle lock washer |
| 32 | BO315 | Axle washer (outside frame) |
| 33 | BO696 | Left cone lock nut |
| 34 | BO693 | Rear axle nut |
| 35 | CG253 | Axle support washer |
| 36 | DG248 | Axle bushing |
| 37 | CG190 | Long shifter rod (10C) |
| | CG289 | Long shifter rod (10F) |
| | DG190 | Long shifter rod (11C) |
| 38 | CG288a | Short shifter rod |
| 39 | BG201 | Hub shell band |
| 40 | CG189 | Shifter body |
| 41 | BG199a | Shifter pinion |
| 42 | BG193 | Shifter pinion washer |
| 43 | BG258a | Shifter lever |
| 44 | BG299 | Shifter rod clevis pin |
| 45 | CG284 | Shifter rod end |
| 46 | CG296 | Shifter rod clevis |
| 47 | CG294 | Shifter rod link complete |

shell. The entire hub shell assembly is removed from the left side of the outer hub and can very easily be taken apart. Without the special wrench it is not easy to remove the inner hub shell. Its use is therefore recommended. The price of the wrench is $1.25. If the axle is to be changed for some reason the clutch shifter bar "28" can easily be withdrawn after the shifter plunger "29" has been screwed out.

## Inspection of Parts

If the two-speed wheel has seen considerable service, the parts should be carefully inspected for wear. To enable careful inspection, the parts must be washed thoroughly. After washing, inspect all the bearing surfaces of the various parts. Pitted or worn balls, cups and cones should be replaced with new parts, likewise any other part showing considerable wear.

If it was difficult to move the shifter handle on the tank while shifting speeds and all the bearings along the control rods were free and well lubricated, the trouble may be due to a bent axle. Examine the axle where the shifter plunger is fitted. The axle may be binding on the plunger.

## Fit Roller Bearing Cone and Driving Hub Gear

The original style driving hub gear and actuating worm cone should in every case be replaced. These parts were fitted with ball bearings which have since been replaced with the well known Harley-Davidson roller bearing. This style bearing is trouble-proof as well as very long lived and should for that reason replace the earlier type. The original ball bearing cone and driving hub gear can be exchanged for the new parts at a charge of $4.25 provided the old style parts are sent to us. The regular price of the new assembly is $7.00. The new assembly goes under part No. DG-170.

## How to Remove the Driving Hub Gear

To fit the new style driving hub gear to the clutch will of course require taking the clutch apart. After the clutch assembly with the driving hub gear has been removed as has been explained previously, mark the driving disc and the outer edge of the clutch hub shell with a scratch awl or pencil because it is of great importance to have the discs fit the same feather keys of the hub shell when again assembled.

Lay the clutch on the bench and hold it secure by driving three spikes into the bench equally spaced around the sprocket and as close to the clutch sprocket as possible. This will make it easy to hold the clutch assembly while unscrewing the driving hub lock nut and the driving hub nut. With special factory wrench CK-800 remove the driving hub lock nut and the driving hub nut. Lift the hub shell and sprocket assembly from the friction disc assembly, being careful not to lose any of the 68 1/4-inch balls.

Clamp the teeth of the gear in vise jaws covered with sheet copper to protect the teeth and with factory wrench No. CK-17 remove the driving disc lock nut. If the friction assembly sticks slightly on the driving hub gear, tap the gear lightly. Inspect all bearing surfaces for wear and pits, including the steel balls, and replace all that are not in good condition.

# How to Fit the Roller Bearing Driving Hub Gear

When assembling the driving hub gear and clutch assembly it is advisable to fit the clutch hub shell on the driving hub gear before the friction assembly. This will allow an accurate bearing adjustment and is recommended for that reason.

Pack the hub shell cone with a good grade of thick cup grease and place the 1/4-inch balls in two rows of 34 each, using the grease as a retainer. Place the driving hub gear into this assembly in the same way the other gear was fitted. Screw the driving hub nut down tight on to the driving hub gear, then back it off about 1/4 turn and firmly tighten the driving hub lock nut. Try the bearing adjustment by turning the hub shell on the driving hub gear. This must run perfectly free with just the slightest trace of a shake. If the bearing adjustment is not just right, tighten or loosen the driving hub nuts as may be found necessary.

Place this assembly in a vise, clamping the gear and fit the friction assembly in such a manner that the marks placed on the driving disc and hub shell before the clutch was taken apart, line up. Lightly tap the driving disc to force it over the spline fittings of the driving hub gear and draw the driving disc clamp nut down tight.

# How to Assemble the Two-Speed Hub

Pack the clutch gear cone "13" bearing grooves with grease which will lubricate and act as a retainer to hold the balls while assembling. This bearing consists of a double row of 5/16-inch balls of 18 balls each. Place the clutch gear cone with balls into the right half of the inner hub "2." Since this bearing is only a free running fit and no play is allowed, the balls will not enter the inner hub shell easily and it generally will be found necessary to press firmly with the hands to get the parts together.

Lubricate the bevel pinion shaft "3" with regular motor oil and place the four pinions "4" on the shaft. Place this assembly in position on the right half of the inner hub "2" and fit the left half "1" of the inner hub against the right half so that the marks on the inner hubs line up. The marks are either center punch marks, numbers or letters. It is very important to match up the inner hub shells because these parts are machined in pairs to insure a perfect fit over the bevel pinion shaft. For this reason it is necessary to renew both halves when one-half must be renewed.

Fit the shifter collar "19" over the axle. Place the clutch shifter bar "28" through the shifter collar and the provided slot in the axle. Screw the clutch shifter plunger "29" into the shifter bar. When this is done care should be taken to get the teeth of the plunger to line up evenly and properly with the slot in the axle so that the shifter pinion can move the shifter bar the full travel of the slot. Refer to "G," illustration No. 1.

Place the clutch collar "20" over the right end of the axle in such a position that the lock pin is to the left of the feather key of the clutch collar and that the high side of the lugs or dogs of this collar is to the right. Place the axle assembly into the inner hub shell assembly and with a screw driver press in the clutch collar pin "9" so that the clutch collar can be placed over the clutch gear cone. Be sure that clutch collar pin is in line with the three lock holes at "H" in the clutch gear cone.

Engage the dogs of the clutch collar and the right side of the inner hub. Lubricate the entire assembly with a little cylinder oil, hold it together carefully and place it into the outer hub "7" from the left side. With wrench CK-6 placed over the clutch collar, the inner hub shell assembly is screwed into the outer hub by turning to the left. It is very important to turn the inner hub very tight into the outer hub. If it is impossible to line up the key ways after the inner hub is turned in tight by hand, do not back the inner hub outward slightly but force it tight with a hammer.

After the inner hub has been properly tightened and the key ways line up, fit the six woodruff keys "8." These keys fit tight and it will be found necessary to use a hammer to drive them way down. Be sure to drive them way down and see that no dirt remains in the key ways or it will be impossible to fit the hub shell band "39."

Place the hub shell band over the rear hub and fit the two hub shell band screws. If trouble is experienced in fitting the screws use a soft thin punch or nail. Place this through two holes one on each end in the band and into one of the outer hub holes, then pull the band in place, hold it and fit one of the screws.

Pack the right cone bearing "21" with thick cup grease and fit the nineteen 3/8-inch balls. Lubricate the inner hub mechanism with a few drops of thin oil and screw the cone on the axle. Screw the right cone 1/16-inch beyond the rear axle clip grooves and line up the square shank of the cone with the grooves in the axle. If this is done the brake arm will line up properly with the brake arm clamp and then there will be no danger of spoiling the bearing adjustment when fitting the wheel in the frame. Push the axle inward toward the left by hand.

Pack the left side of the two-speed mechanism with thick cup grease. Force this grease in well between the pinion gears. Allow sufficient room for the driving hub gear or an over-supply of grease will be put into the hub causing it to work out on the brake side. Fit the driving packing ring "6" into the driving hub gear recess with the square edge toward the clutch. Pack the driving hub gear bearing with thick cup grease and fit the eighteen 3/8-inch balls. Place the clutch assembly over the axle and onto the rear hub.

Pack the ball thrust bearing "16," "17" and "18," and roller bearing parts "15" with grease and fit them into the driving hub gear in the following manner: First fit the beveled race "16," then the ball retainer with the balls "17," the outer race "18" and the roller bearings with retainers "15."

Be sure that the felt washer in the recess of the actuating worm cone "14" is in good condition and will retain the lubricant and prevent dirt from entering this bearing. Then screw the actuating worm cone in place. First screw this down tight, then back it off possibly 1/4 turn or just enough to allow the wheel to turn perfectly free and make sure that the bearing is not being cramped.

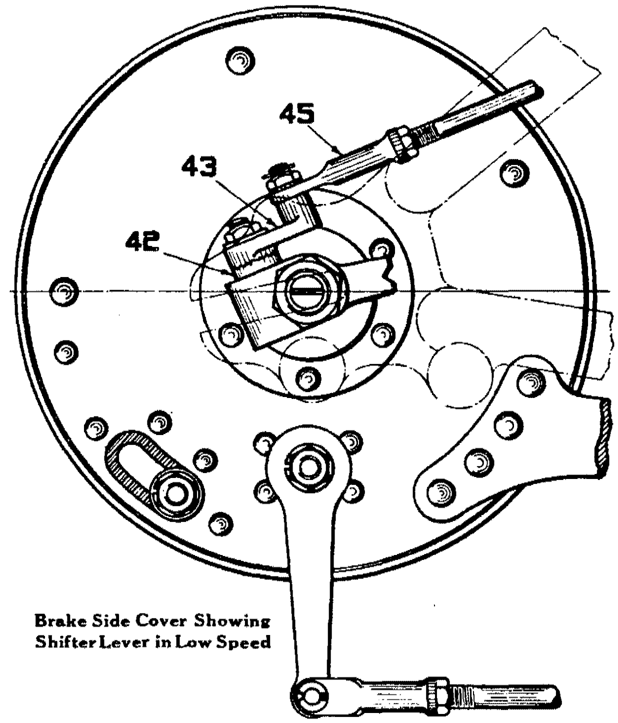
Fit the bushing "36" over the left axle end with the large diameter toward the actuating worm cone. Then place the axle support washer "35" over the axle against the bushing. This washer was not used on two-speed hubs manufactured before June 1st, 1914, but should be fitted to these two-speeds also, because it greatly adds to the strength of the axle. Next to the axle support washer fit the keyed lock washer "31," then fit the lock nut "33" and draw this very tight.

*Again try the wheel to see that it turns freely and that the bearings are not cramped. Fit the brake side cover so that the brake arm is in line with the brake arm clamp. Remember that this is very important because if the brake end cover were either forced up or down in lining up the brake arm with the clamp, the bearing adjustment of the rear wheel would be changed and there would be great danger of ruining the actuating worm cone, driving hub gear and the complete bearing in a very few miles of driving.*

If the brake shell has been removed, inspect it for wear before replacing. To fit the brake shell force it over the feather keyways of the rear hub by tapping and hold it securely by drawing the brake shell nut down tight.

After the brake side cover has been properly fitted, place the large plain washer "30" which fits on the inside of the frame over the axle with the large flat bearing surface toward the brake. Then fit the axle washer and clip which go on the outside of the frame. Place the shifter body "40" over the axle with the lock Do not draw the clamp nut tight because the shifter lever will have to be adjusted properly when the wheel is set into the frame. This has already been fully explained under *Importance of Correct Shifter Rod Adjustment.* Replace the axle clamp nuts and the axle end screws.

When clamping the wheel in the frame by tightening the clamp nuts, be careful not to allow the shifter pinion to come in contact with the axle. To overcome this danger, turn the shifter body forward and backward to find the central position,




**Brake Side Cover Showing Shifter Lever in Low Speed**

pin toward the outside. Grease the shifter pinion "41" with thick grease and place it into the shifter body.

Replace the remaining parts in the following rotation on the shifter pinion: Shifter pinion washer "42" with knurled side up, shifter lever "43" with knurled side down, lock washer and clamp nut.

then tighten the right clamp nut while holding the shifter body.

If too much play develops at the rear wheel or clutch, adjust the left cone only and be sure that the bearings are not cramped after adjusting. A very little shake and a free running wheel indicate proper adjustment.

# Service Dept. Bulletin

No. 62. November 1, 1917 Harley-Davidson Motor Co., Milwaukee

## Care of the Commutator—Electrically Equipped Model

*Causes of Quick Wear*
*Hard Carbon Brushes*
*To Fit and Adjust new Carbon Brushes*
*Proper Pressure of Brushes against Commutator*
*To Adjust the Tension of the Brush Springs*
*To Repair a Grooved Commutator*
*Poorly Fitting Circuit Breaker Cover*

A commutator which is grooved, showing that the brushes are gradually cutting into it, should not be neglected. Inspection of the commutator is recommended whenever the circuit breaker or distributor points are inspected and adjusted. Neglect will in time render the commutator and armature useless. A careful periodic inspection for wear and the application of the proper remedy when wear is found, will make renewal of the commutator unnecessary during the life of the machine.

## Causes of Quick Wear

Quick commutator wear can generally be traced to one or more of the following three causes: Hard carbon brushes, brushes bearing with too much pressure against the commutator, or failure to clean the commutator if the machine is used in very sandy or dusty country, especially if sand and dust can get under the circuit breaker cover.

## Hard Carbon Brushes

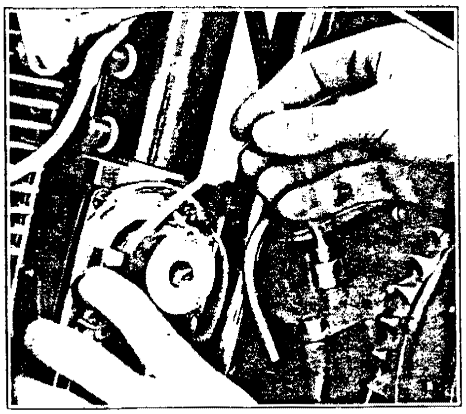
If a commutator is found grooved and inspection of the brush tension, as described hereinafter, proves that the springs are properly adjusted and the mechanism on the inside of the circuit breaker cover is clean, hard brushes are the cause of the commutator wear.

The reference to hard brushes does not mean that the brushes are as hard as a piece of steel, but rather that the composition of the material in the brush lacks graphite. The amount of graphite in a brush cannot be seen with the eye. Therefore, when a faulty brush is suspected, all three brushes and brush holders should be replaced.

Never replace a brush without replacing the holder because it is very important to have a perfect circuit between the two, and to obtain this circuit very careful soldering and tinning are required. The cost of a brush holder is less than the cost of the labor required to solder and tin a new brush to an old holder.

## To Fit and Adjust New Carbon Brushes

Trim the new brushes to conform with the radius of the commutator. Place the brush holders on the studs. Cut some "00" sandpaper (never use emery) into strips 3-8 inch wide. Place this sandpaper between the commutator and brush with the coarse side toward the brush.



After the sandpaper has been properly placed, bear down lightly on the brush holders and pull out the sandpaper. Be careful when pulling out the sandpaper not to damage the near edge of the brush. Follow the radius of the commutator with the sandpaper as much as possible. Refer to illustration. To obtain a good bearing of the brush against the commutator may require pulling the strip of sandpaper through several times, but the operation should be repeated only as often as is necessary.

When trimming the forward brush, be sure to pass the sandpaper between the lower bearing housing support and the commutator if the strip is long enough, and pull upward and backward so that the edges of the brush will not be trimmed off. When trimming the two rear brushes pass the strip of sandpaper under the upper housing support, then under the upper and lower brushes, and draw the sandpaper toward the front.

After the brushes have been properly seated, remove all traces of grit by wiping the commutator with a gasoline soaked rag and then drawing plain writing paper between the brushes and commutator. For instructions on adjusting the brush springs refer to instructions under "Proper Pressure of Brushes against Commutator" and "To Adjust Tension of Brush Springs."

## Proper Pressure of Brushes Against Commutator

The proper brush pressure against the commutator is six ounces. Determine the proper pressure with a small spring scale or hook the end of the brush holder with a piece of wire to a scale graduated to ounces. Then pull the generator away, the exact brush pressure is determined at the point when the brush is just leaving the commutator and the scale is balancing. Never let a brush bear with greater pressure, nor have it considerably less. Too much pressure will cause quick wear of both the commutator and brushes, while too little pressure will affect the conductivity of the brush and interfere with the current output of the generator.

## To Adjust the Tension of the Brush Springs

When inspection proves that the brush springs are improperly adjusted, the following instructions should be applied: The cotter pins holding the brushes on their studs should be withdrawn, so that the brushes and springs can be removed from the studs far enough to release the springs from the slots in the studs. A piston pin lock pin, or something similar to it, should then be placed through the outside opening of the brush holder and over the straight end of the spring. Wind up the spring to the proper tension by turning the piston pin lock pin. Push the brush holder back over the stud. When this is done, the spring will have to follow and no trouble will be experienced if the slot of the lock pin lines up with the slot in the brush holder stud.

Again test the tension of the brush against the commutator. If the brush seems to be bearing with too much pressure, release the coil spring one-half turn, or if the pressure is too little, give the coil spring another half turn.

If it is impossible to obtain the proper pressure by turning the spring one-half turn, one way or the other, proceed as follows: Release the spring entirely by withdrawing the brush holder part way from the stud. Then replace the brush holder and spring on the stud without having any pressure on the brush. With a pair of narrow-jawed pliers take hold of the end of the spring which bears against, or is hooked on to the brush holder. Pull this end of the spring out until the proper tension has been obtained and cut off the spring, leaving just enough of the spring to overcome all danger of it slipping off the brush holder. Be sure to try the pressure of the brush from time to time while pulling out the spring so that no more is pulled out than is necessary. After the spring has been properly adjusted, replace the cotter pin.

## To Repair a Grooved Commutator

A grooved commutator can be repaired if the groove is not more than 1/16 inch deep. Place the complete armature in a lathe, holding it between centers, and turn down the face of the commutator. When turning the commutator down, be sure to take off light cuts at a time, and under no circumstances turn off any of the shoulder of the commutator which is toward the armature end of the commutator and is about 1/8 inch wide.

After the commutator has been turned down, remove all copper chips from between the segments and re-assemble the instrument. Careful inspection will show that the brushes have only a little bearing on the commutator, necessitating retrimming of the brushes as already explained. If a commutator is cut too deep to be refaced, the generator should be referred to the Remy Electric Co., or to their nearest branch or service station, for repairs.

## Poorly Fitting Circuit Breaker Cover

If grit and dirt are found on the circuit breaker and distributor mechanism whenever the circuit breaker cover is removed, examine the felt washers and note whether the cover is bent. The cover must fit well enough against the generator to prevent the entrance of dirt or grit. If dirt can enter, it will wear the brushes and commutator unnecessarily and may get on the breaker and distributor mechanism, causing irregular running of the motor.

Make sure that the felt washer is securely shellaced to the generator and that it fits properly between the cover and the generator. If the cover is bent, even only slightly, be sure to straighten it carefully. If the small, round felt washer between the spider and the cover has been lost, replace it. Otherwise considerable dirt will enter at this point the same as at a poorly fitting cover.

Our experience proves that periodic inspection of the commutator and brushes according to these instructions is necessary. Natural wear, dust and dirt, improperly adjusted spring tension and the fact that the manufacturers are unable to govern absolutely the composition of the brushes, makes inspection important. This inspection can conveniently be made at this time of the year when many machines are overhauled and the others can be spared easier than in the summer riding season. We advise inspecting the commutator and brushes whenever the circuit breaker cover is removed.

Inspect the screws in the right bearing plate from time to time to make sure that they are drawn up tight. It is extremely important that these screws be kept tight. This insures proper alignment of the armature and pole pieces and will prevent injury to the armature. A loose fitting right end plate will cause the motor to misfire, due to variation in the gap between the breaker and distributor points. If the screws work loose, clean the screw holes, see that the lock washers and lock plate are fitted and shellac the screws and screw holes.

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# Service Dept. Bulletin

No. 63. December 5, 1917 Harley-Davidson Motor Co., Milwaukee

## A Practical Means of Doing Your Own Battery Charging When D. C. Current is Not Available



For some time there has been a demand for a reliable battery charging apparatus. The increasing popularity of the electrically equipped model brings with it the question of battery charging and in many cases the dealer wishes to make provisions to do this work himself. For the dealer who has direct or D. C. current available, the problem of charging batteries is a simple one as explained later in this bulletin. It is the dealer who can only get alternating or A. C. current, who must have a means of converting this current to direct current. This is the field of the rectifier, an instrument to change A. C. current to D. C.

The motorcycle battery is almost in a class by itself. Its charging rate is so low that it cannot be charged on the same line with automobile batteries without being damaged. The life of a battery is shortened very materially by charging at a too high rate, as many dealers and riders have learned to their regret. We have examined numbers of batteries that were ruined by this cause. Many garages and even battery charging stations, through ignorance or carelessness, charge small batteries at high rates.

Because these conditions exist and knowing that many dealers wish to do their own battery charging, we are furnishing a rectifier that is ideal for the charging of small batteries. With the rectifier is furnished a rheostat, or resistance, with which the current can be regulated to charge from one to eight batteries.

The rectifier can be used by every dealer who does his own battery charging and cannot get direct current. Various apparatuses were tested by our engineering department and the rectifier that was best suited to our needs was adopted. Quality, efficiency, life and cost of installation were considered.

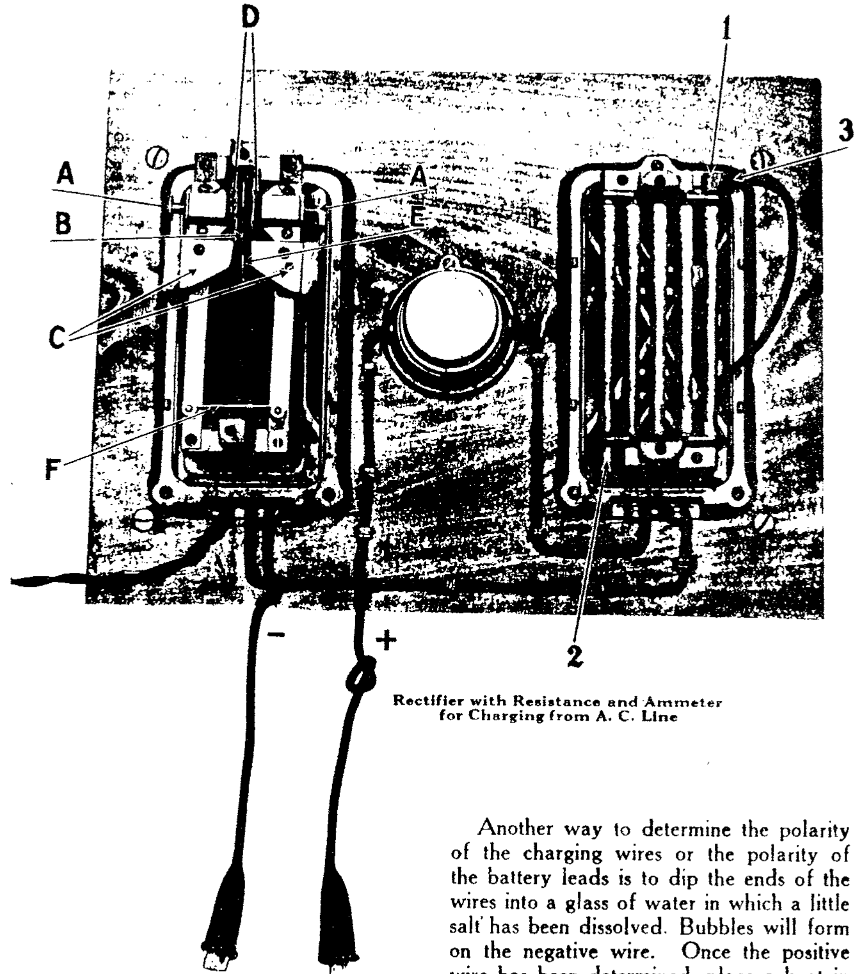
The rectifier is designed for use with 110 volt alternating current 60 cycle frequency. This is the type current commonly used, but before ordering a rectifier we suggest making sure that your voltage and cycle frequency are 110 and 60, respectively. The instrument is furnished mounted ready for service. The panel can be attached to a wall, the charging wire fitted into a socket and the leads are ready to be connected to the battery.

**The price of the rectifier complete with resistance and ammeter is as follows: Type 1636, F-F Magnetic Rectifier, mounted on panel, with rheostat, ammeter and wiring as shown in illustration, $28.00, list, (west of the Rockies $30.00, list), f. o. b. Cleveland. Shipping weight about 20 pounds. Write for discount.**



## To Charge Batteries with the F-F Rectifier

When you receive a rectifier you will note that the instruments are arranged differently than in the accompanying illustration and that the wiring is concealed. paint the positive binding post red or distinguish it from the negative post in some simple manner to avoid any chance for confusion.




**Rectifier with Resistance and Ammeter for Charging from A. C. Line**

The letters "P" and "N" are stamped on the mounting panel above the positive and negative binding posts, respectively, and the positive binding post is also indicated with a tag. We suggest that you

Another way to determine the polarity of the charging wires or the polarity of the battery leads is to dip the ends of the wires into a glass of water in which a little salt has been dissolved. Bubbles will form on the negative wire. Once the positive wire has been determined, place a knot in it, according to common practice, and paint the "POS" (+) and "NEG" (—) marks on the panel to simplify distinguishing the charging wires for all the time.

# Regulating Charging Rate

When charging a battery make sure that the positive wire of the rectifier is connected to the positive pole of the battery, marked "POS," (+) or indicated in red. Connect the negative wire of the rectifier to the negative pole of the battery marked "Neg" (—). After the battery has been connected properly, insert the plug into a lamp socket and note the charging rate on the ammeter.

The charging rate is regulated by moving the clip "3" between the points "2" and "1" on the resistance unit, as shown in illustration. With the clip at point "1" the entire resistance is cut in or the charging rate is at a minimum. At point "2" the entire output of the rectifier enters the battery. The resistance allows for a wide range of battery charging rates. From one to eight or even ten batteries can be charged at one time. No fixed position for the resistance clip can be given to charge a certain number of batteries. By connecting the clip in various positions on the carbon bars, varying charging rates will be obtained and can readily be noted on the ammeter.

It has always been recommended to charge the motorcycle battery at a one ampere rate. However, with the France rectifier the charge can be started at two or three amperes. In fact when a rider is in need of his battery, a higher than one ampere charging rate is recommended. The battery begins to warm up and charge sooner. There is no danger of overcharging because as the battery becomes charged, its resistance cuts down the charging rate until, when the battery is fully charged, the current automatically tapers off to a fraction of an ampere, as will be indicated on the ammeter.

Do not charge one battery at a higher rate than three amperes and as soon as the battery begins to bubble or gas, reduce the charging rate to one ampere. If a battery is not in healthy condition, that is, if it is internally damaged, its resistance will not cut down the charging rate. Therefore when the temperature of the solution rises above 110° F., or the battery begins to bubble or gas, reduce the charging rate.

# To Charge More than One Battery

When more than one battery is to be charged, connect the batteries in parallel as shown in illustration below. All positive wires of the batteries must be interconnected to the positive lead of the rectifier. The negative battery wires must be connected in like manner with the negative lead of the rectifier.

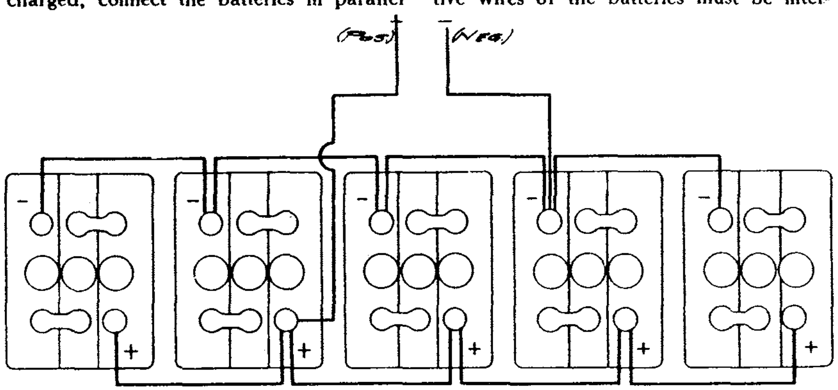


Diagram of Batteries Connected in Parallel



If the rectifier is being used to charge one battery and another battery is connected, connect the batteries in parallel and change the position of the resistance clip so that a greater charging rate will flow through the ammeter. Adjust the flow of current with the resistance whenever another battery has been added to, or removed from, the charging line.

When one battery is to be charged allow two amperes of current to flow through the battery and cut out more resistance by moving the resistance clip from "1" to "2," for each battery that is added to the charging line. Since one battery can be started off at two amperes, two batteries can be started at a four ampere charge, three batteries at six amperes, bearing in mind always that the charging rate must be reduced when the battery begins to gas and the temperature of the solution rises above 110° F.

# To Adjust the Rectifier

To adjust the rectifier the knurled screws "A" should first be turned outward or away from the armature. Then screw them inward. By proceeding in this way pressure will be applied to both carbon brushes which will prevent them from backing up and getting out of adjustment automatically. Be sure to have the armature "B" central between the pole pieces "C" of the magnets.

There should be a small gap at "D" between both of the carbon and copper electrodes when the rectifier is not in use. This prevents any back flow of current from the battery when idle and will allow the armature to vibrate freely when in use. It is very important to have the carbon brushes seat squarely against the copper electrodes. The cover for the rectifier should always be kept in place.

# To Adjust the Charging Rate

The charging rate is regulated by sliding the small brass weight "E" on the armature spring, up and down. This weight, however, is set by the factory for best results and should not be moved unless conditions warrant.

# Fuse Protection

The rectifier is provided with a fuse "F" per illustration. The fuse is of 20 ampere capacity and protects the instrument should the load be excessive, that is, over 20 amperes. If with the resistance clip "3" on contact with carbon rod at "2" end, a battery were connected in reverse with the charging wires, that is "POS" (+) to "NEG" (—) and "NEG" (—) to "POS" (+), the fuse will also blow. This of course does not apply to a dead battery because such a battery has no opposing current. If a fuse burns out do not replace with a fuse of more than 20 ampere capacity. Should the vibrator be working and the ammeter not show any deflection or there is no current at the charging wires, it is possible that the binding posts which hold the fuse are loose, or that the fuse is blown.

**The dealer who can rely on a battery depot for careful and prompt service does not need a rectifier, but there are times when the ability to give immediate service on battery charging will prove an asset to every dealer's service department. The dealer who is not convenient to a battery service station, or who knows from experience that his service station cannot be relied on to do careful work, is directly concerned in a means of doing his own battery charging.**

**Battery charging with the F-F Rectifier can be done at a profit. Battery charging is not an item of free service. The rider is willing to pay for the work and will in addition appreciate that the dealer can do his battery charging promptly, instead of having to refer the work to a service station.**

## Read Carefully Both Bulletins No. 63 and 64

The thought may occur that because you use D. C. current, the bulletin on charging with alternating current does not interest you, or you may be interested in charging from an A. C. line and feel that you are not concerned with the bulletin on charging from a D. C. line. Both bulletins contain important information on battery charging and every dealer and mechanic will find it to his interest to read both bulletins carefully.

## Battery Manual for Dealers and Mechanics

The Electric Storage Battery Co. publish an excellent volume on the subject of battery repairing. We have secured a supply of these books and will furnish copy to every dealer who is interested in improving his knowledge of battery construction, or who is doing or intends to do battery charging and repairing.

## Of Interest to All Harley-Davidson Dealers

We wish to obtain complete information as to the number of Harley-Davidson dealers that are already doing battery charging and repairing, or that are contemplating doing such work. A considerable number of dealers are already charging and repairing batteries, while many will do their own charging with the F-F rectifier as well as their battery repair work. If you are in the class of the dealers who are charging and repairing batteries, or if you decide to do your own charging and repairing in the future, please notify us.

# Oil Bulletin

January 2, 1918 Harley-Davidson Motor Co., Milwaukee, Wis.

## Oil in Cans

| | | List | Net |
|---|---|---|---|
| 1 Gallon Size | 1 | $1.25 | $ .87½ |
| | Crate of 10 | 12.00 | 8.40 |
| | 2 Crates of 10 | | 16.00 |
| | 5 Crates of 10 | | 37.80 |
| 5 Gallon Size | 1 | 5.25 | 3.67½ |
| | 6 | | 3.50 |
| | 12 | | 3.30 |
| | 10 Gallon Case (2-5) | 10.25 | 7.15 |

## Oil in Barrels

| | | | |
|---|---|---|---|
| One-Half Barrel | (28 to 32 Gal.) | per gal. | .59 |
| Full Barrel | (48 to 54 Gal.) | per gal. | .56 |

The above prices are for both medium and heavy oil.

## Special Racing Oil

| | | | |
|---|---|---|---|
| 1 Gallon | | $1.40 | $1.05 |
| 5 Gallon | | 5.75 | 4.52½ |
| 10 Gallon | | 11.00 | 8.15 |
| One-Half Barrel | (28 to 32 Gal.) | per gal. | .78½ |
| Full Barrel | (48 to 54 Gal.) | per gal. | .73½ |

# Service Dept. Bulletin

No. 68. February 20, 1918 Harley-Davidson Motor Co., Milwaukee

## When and How to Overhaul Crank Pin Bearings



### To Test the Wear

When a motor is overhauled, the fit of the crank pin bearing is seldom overlooked. In many cases the mechanic will fit a larger size set of rollers to overcome a little play at the crank pin bearing, which he believes may cause a knock. Nothing can be further from the actual fact, because there must be considerable play at this bearing to cause a knock. If the upper end of the rods can be moved sideways, as much as 3-16 inch, the crank pin bearing is not too loose a fit and need not be overhauled.

To test the clearance or fit of the crank pin bearing, wash out all oil and try the rod for up and down play. Have the upper end of the rod in line with the crank pin and fly wheel shafts, when the rods are near their upper dead center. The bearing should be overhauled only when the clearance is sufficient to be felt or to make a thumping noise. Therefore, do not overhaul a crank pin bearing just because the upper ends of the rods can be moved sideways slightly.

### To Take Apart and Inspect Bearings

If according to the foregoing tests the bearing is found too loose, place the fly wheels in a vise, clamping the sprocket shaft and remove the lock washer and clamp nut on the gear side. To remove the gear side fly wheel from the tapered crank pin, strike the rim of the wheel with a hammer about 90° from the crank pin, or strike the crank pin squarely, being careful not to damage the threads during the latter operation.

Before removing the rods from the rollers place a lower exhaust valve spring cover over the crank pin and on the roller retainers. With one hand bear down on the cover while removing the rods with the other hand to prevent dropping and possibly losing the rollers when removing the rods.

Remove the retainers with the rollers from the crank pin. Inspect the rollers, retainers, crank pin and the hardened steel bushings in the rods for wear. Pay special attention to the grooves that may be worn into the crank pin by the rollers. If the pin is grooved, do not try to overcome the play by fitting larger rollers, because the crank pin never wears equally all the way around. Generally, renewal of the crank pin is found necessary. The same holds true of the bushings in the connecting rods. The wear is not evenly distributed over the entire area of the bushings. When the bushings are worn, the rods should be sent to the factory for rebushing and regrinding. If the closed end of the retainers is worn by the rollers, the retainers should be replaced with new ones.



### Why Connecting Rods Should be Re-Bushed at the Factory

Special fixtures are required to remove the worn steel bushings and to press in new ones to prevent bending or damaging the rods. In addition to this it is very important to grind the bushings to size after they have beeen pressed in, because the bushings are distorted during the operation and must be trued up accurately, otherwise they will be no better than the worn bushings. This grinding operation also requires special machines. Therefore it is important to have the factory do this work.

It is recommended to have the factory fit the rebushed connecting rods to a new set of rollers, retainers and crank pin, because various sizes of rollers may have to be tried to obtain a good fit. Sometimes even with the rollers varying in size as little as .0001 (one ten thousandth) inch, a perfect fit cannot be obtained and careful lapping will be required. Some dealers have their connecting rods only rebushed at the factory and do their own fitting of roller bearings and crank pin. This is satisfactory, provided the dealer has the proper equipment.

> The rollers used in the connecting rods are made in twenty assorted sizes varying from .001 inch oversize, to .001 inch undersize, each size varying .0001 inch in diameter. Unless ordered otherwise, standard size rollers are furnished on parts orders.

### To Repair a Slightly Worn Bearing

If inspection of the Bushings finds them worn only very slightly, they can be placed in good condition by lapping them with the special connecting rod lapping arbor, described and illustrated herein. If the shop equipment includes one of these laps, the work can be taken care of by the dealer's mechanics as well as at the factory. The worn crank pin and rollers with retainers should of course, be replaced with new ones.

### How to Obtain a Good Roller Bearing Fit

When renewing the whole bearing, or only fitting a new set of rollers with retainers and crank pin and lapping the connecting rod bushings, the bearing fit should of course be made so that the rods have no shake and can be turned perfectly free.

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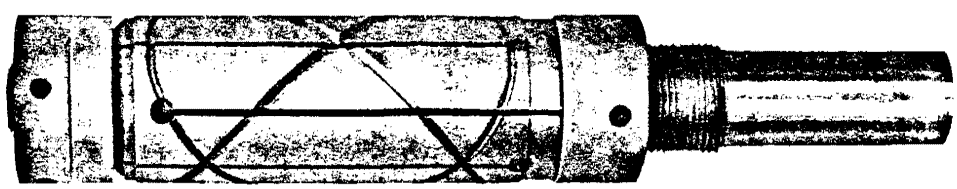
When the bushings have been lapped but not replaced by a new set, although a new crank pin is being used, do not try a standard size set of rollers and expect a good fit. Try a set of rollers that are about .0003 inch oversize. If the rods have any play, try the next larger size of rollers, .0004 inch oversize. Be sure to place the .0003 inch oversize rollers in their original containers to avoid dropping or mixing them with some other size rollers.

If the next size larger rollers, in this case, .0004 inch oversize, eliminate all shake but prevent the connecting rods from spinning freely, or cause the rods to climb, the bearing fit is too tight. In this case, the roller retainers should be reversed. To reverse the roller retainers, remove the connecting rods and roller retainers. Replace the latter so that the retainer which was at the top is at the bottom. Then try the bearing fit. If reversing the roller retainers will not allow a loose enough fit, the connecting rod bushings should be lapped with the lapping arbor furnished by us until they fit the .0004 inch oversize rollers.

## How to Lap the Connecting Rod Bushings

To lap the bushings, clamp the arbor in the chuck of the lathe, place the lap over the arbor and by means of the two adjusting nuts on the arbor, adjust the diameter of the lap to fit the bushings.

Run the lathe at a speed of about 200 to 300 r.p.m., place some emery compound such as is used in grinding valves, on the lap, put the rods over the lap for a few seconds and enough stock should be removed from the bushings to make a good fit on the rollers. The bushings are of course to be cleaned before trying them on the rollers.



Never attempt to lap connecting rod bushings with any other kind of a lap than is illustrated here, because it is very important to lap both sides of the bushings and both bushings to the same diameter.

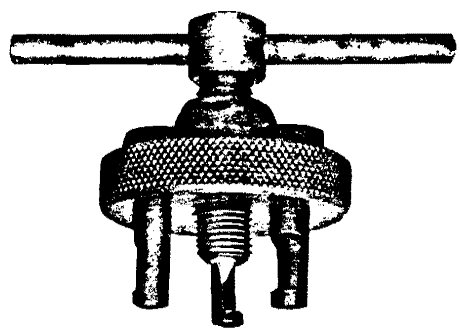
If no lathe is available the connecting rod bushings can be lapped by clamping the lapping arbor in a vise and turning the rods in a true arc by hand. Another method would be to drill a 3-8 inch hole centrally through the end of the arbor and to fit a 3-8 inch rod about 16 inches long to serve as a handle. The connecting rod could then be clamped in a vise and the arbor could be turned by means of the handle. Exercise great care while lapping a connecting rod bushing. Very little lapping makes a decided difference in the inside diameter of the bushings. The bearing fit is good when the rods can be spun perfectly free with possibly the very slightest trace of a side shake noticeable at the upper end of the rods.

# Description of Connecting Rod Lapping Arbor

The connecting rod lapping arbor is made up in two sizes; one to fit all crank pin bushings prior to 1915, and the other to fit the 1915 and later model bushings. Each lapping arbor consists of a taper shank arbor, two adjusting nuts, one adjusting collar and an iron lap. In Service Bulletin No. 55 the lapping arbor is described as though it included two sizes of laps. It was later decided, however, to furnish separate arbors and laps for the two sizes of bushings. The price of the lapping arbor complete is $7.50 list.

# Magneto Gear Puller

This illustrates the new magneto or generator gear puller. The puller will facilitate removing the magneto gear from 1916, 1917 and 1918 motors. It is also adaptable to the drive gear used on the model 250 generator with the exception of the gear used on the 1915 motor.



Price of the puller is $2.25 list. Order by number FK-831.

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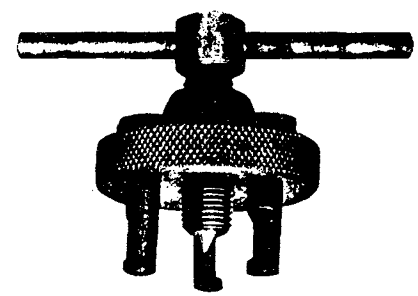


facilitate removing the magneto gear from 1916, 1917 and 1918 motors. It is also adaptable to the drive gear used on the model 250 generator with the exception of the gear used on the 1915 motor. Price of the puller is $2.25 list. Order by number FK-831.

# Service Dept. Bulletin

No. 71. March 5, 1918 Harley-Davidson Motor Co., Milwaukee



## The Advantages of the Solo Motor and the Sidecar Motor

The sidecar or parcelcar owner requires a motor that has abundant power at low motor speed, and that will pull a heavy load as long as necessary, without overheating. The sidecar type motor is especially built for this purpose. Its combustion chambers are larger and its compression therefore lower than that of the solo type motor. It will continue to pull and maintain an even speed under conditions that would overtax the solo motor.

Both motors are furnished as standard equipment and are identical excepting that the sidecar motor is fitted with a set of 1-8 inch compression plates between the cylinders and crankcase, which make the difference in the size of the combustion chambers. Therefore, to convert a solo motor to the sidecar type is simply a matter of fitting a set of compression plates between the crank cases and cylinders, while to change from sidecar to solo type, requires nothing more than the removal of the compression plates.

It should be understood that in some cases after a motor has been run for a year, its efficiency cannot be increased by lowering the compression because of wear. Therefore, when it is desired to remodel a motor, the cylinders should be reground and fitted with oversize pistons and rings. The valves may also have to be reground or refaced. After the cylinders have been placed in first class shape the compression plates are fitted.

For the same reason the plates should not be taken from a sidecar motor after it has seen a thousand miles or more service, because the cylinders and pistons have worn in by that time, especially at the upper end of the piston travel. If the plates are removed, the pistons travel higher on the cylinder walls and the motor will knock because the pistons will strike the shoulder in the cylinders. Therefore, before such a change is made the cylinders should be reground.

When placing a machine order specify the type motor needed, (specification blanks are provided on the machine order form), and you and the rider will be saved the trouble of making a change later. The sidecar motor can be used for solo service and should be given the preference for severe solo service, especially if the machine is placed in the hands of a new rider. When the motorcycle is not used constantly with a side attachment or when it is intended to use a sidecar at a later date, the sidecar motor should be specified.



## Correct Gear Ratios for Sidecar and Solo Service

While it is important that the proper type motor be used according to the service expected, it is of still greater importance that the proper sprocket combination or gear ratio be used. Sidecar service requires the use of a lower gear than solo service. A machine fitted with a sidecar motor at our factory is geared for sidecar service, another reason for specifying the type motor needed when placing the machine order. Unless a machine is ordered with a sidecar motor, or the sidecar gear is specified, the gear must be lowered if a side attachment is used. The machine used with a sidecar but geared for solo service will not develop the power of a machine properly geared. It will overheat and serious injury to the motor will be the result.

We are giving herewith a table of proper gear ratios for 1915 to 1918 three speed models, according to the service expected. The use of the now standard 48 tooth rear wheel sprocket is recommended because it enables using a larger engine sprocket than the smaller sprockets, which naturally means longer chain and sprocket life. The 44 and 40 tooth sprockets can, however, be furnished on parts orders.

## Sprocket Combinations for Sidecar Service

| Number of Teeth Motor Sprocket | Number of Teeth Clutch Sprocket | Number of Teeth Countershaft Sprocket | Number of Teeth Rear Wheel Sprocket | | High Gear Ratio |
|---|---|---|---|---|---|
| 15 | 43 | 28 | 48 | standard 1918 sidecar gear | 1 to 4.91 |
| 14 | 43 | 28 | 44 | | 1 to 4.83 |
| 14 | 43 | 28 | 40 | | 1 to 4.39 |
| 13 | 43 | 28 | 44 | | 1 to 5.20 |
| 13 | 43 | 28 | 40 | | 1 to 4.73 |

## Sprocket Combinations for Solo Service

| | | | | | |
|---|---|---|---|---|---|
| 17 | 43 | 28 | 48 | standard 1918 solo gear | 1 to 4.34 |
| 16 | 43 | 28 | 44 | | 1 to 4.22 |
| 15 | 43 | 28 | 40 | | 1 to 4.09 |

## Delays in Transit

Freight and express are moving very slowly especially from Eastern points. Express is frequently enroute twice or three times the length of time required ordinarily.

This fact should be taken into consideration when acknowledgment of material shipped us for repairs is not received as promptly as expected.

If these instructions are noted carefully together with the accompanying illustrations, it will be found comparatively easy to make any necessary repairs. If it is only necessary to adjust the shifter rods, there is no need to take the hub apart. It will generally be found that difficult shifting and poor meshing are due to poorly adjusted shifter rods.

If this bulletin does not answer all of your two-speed questions, write us briefly.

# Inspecting and Overhauling the Clutch

In connection with overhauling the two-speed hub, the proper method of inspecting and overhauling the clutch can also well be covered, especially since the fitting of the roller bearing driving hub gear requires stripping the clutch partly. Inspecting the clutch while the two-speed hub is apart may save having to remove it at some future date.

The clutch is to be taken apart as already explained under *How to Remove the Driving Hub Gear.* The driving and friction disc assembly can be held very conveniently in a vise. Before removing the screws, note how far they extend through the clutch spring nut sectors. If the clutch has been holding well and these screws are found to just extend through the sectors, all discs and springs are in good condition and the assembly should not be taken apart.

If the adjusting screws extend quite a way through the sectors and the clutch slips with a properly adjusted lever, it is not necessarily true that the discs are worn. The six springs may have contracted due to overheating the clutch from considerable slipping. Again the slipping may be due to grease or oil having gotten onto the discs.

If the six clutch screws must be removed, it is advisable to mark all discs in line with the driving disc because it is very important to have the friction discs fit the same spline fittings of the key ring in the hub shell when the clutch is again assembled. If the position of the discs is changed, they may stick in the key ring and the clutch will take hold jerkily with a tendency to stall the motor.

Remove and measure the springs to see whether they have contracted. When new the 1915 springs are 1 inch long and the 1914 springs 11/16 inch. If measuring the springs shows that they have contracted more than 1/16 inch, or if they appear to be weak, replace them.

If the friction disc linings are covered with oil or grease they should be thoroughly cleaned. To clean the discs, first wash them in gasoline. Then soak them with gasoline and lay them on a gas plate to burn out the remaining traces of lubricant. The discs may require several soakings in gasoline and burnings before all grease will be removed. If the disc linings are less than 1/16 inch thick, the discs should be sent to us to be relined or a new set should be fitted.

## To Fit New or Relined Friction Discs

Before assembling the clutch with a new or relined set of discs, be sure to fit the discs in the key ring of the hub shell and mark them when a good fit has been obtained so that there will be no danger of the discs sticking after the clutch has been assembled. If the discs stick when they are fitted in the key ring, they should be turned so that the same spline fittings do not line up. Find the position where the best fit is obtained and if the discs stick only slightly they can be worked in to be a good fit by forcing them way in and out several times. Do not grind off any stock from the disc feather keys unless absolutely necessary and then be sure to grind off only enough to allow the discs to work in and out freely without any forward and backward play.

## Mark the Discs and Key Ring

After a good fit has been obtained, mark the discs and key ring with chalk marks so that these marks can be referred to when assembling. If the position of the releasing friction disc has been changed on the releasing disc, find the position where it does not stick and mark both discs. If the releasing disc, hub friction discs and releasing friction disc have been removed, proceed as follows:

Fit and chalkmark the hub friction discs in the clutch hub shell, fit and mark the releasing friction disc on the releasing disc, fit and mark the releasing disc on the studs of the driving disc. The friction assembly now being fitted, the clutch is ready for assembling.

## How to Assemble the Clutch

Place the lower hub friction disc on the releasing disc, fit the releasing friction disc so that the marks on this disc and on the releasing disc line up, then fit the other hub friction disc so that the marks line up with the first hub friction disc.

Carefully place these parts in a vise and clamp them together. Put the six clutch screws through the driving disc and the releasing disc. Place the six coil springs on the screws and turn the screws into the clutch spring nut sectors. If trouble is experienced in starting the screws in the sectors, the springs can be compressed sufficiently by hand. The screws must be tightened an equal number of turns to obtain equal pressure over all friction surface. If one adjusting screw is screwed into a sector further than the others, the clutch will not release as it should and give poor service.

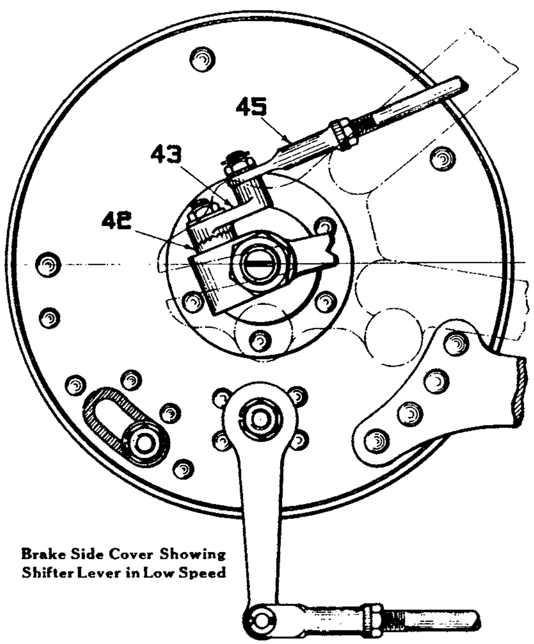
To make sure that the assembly will work freely, lay it on a surface plate with the driving disc down and strike the releasing disc lightly but squarely all the way around with a hammer. The assembly is now ready to be fitted into the clutch hub shell but since an accurate bearing adjustment is necessary, it is advisable to fit the clutch hub shell on the driving hub gear as is explained under *How to Fit the Roller Bearing Driving Hub Gear.* If new discs were fitted, be careful not to assemble the friction disc and hub shell assemblies according to the marks placed on these parts before they were taken apart. Assemble according to the marks placed on the parts after the proper fit had been obtained.

If the brake shell has been removed, inspect it for wear before replacing. To fit the brake shell force it over the feather keyways of the rear hub by tapping and hold it securely by drawing the brake shell nut down tight.

After the brake side cover has been properly fitted, place the large plain washer "30" which fits on the inside of the frame over the axle with the large flat bearing surface toward the brake. Then fit the axle washer and clip which go on the outside of the frame. Place the shifter body "40" over the axle with the lock

Do not draw the clamp nut tight because the shifter lever will have to be adjusted properly when the wheel is set into the frame. This has already been fully explained under *Importance of Correct Shifter Rod Adjustment.* Replace the axle clamp nuts and the axle end screws.

When clamping the wheel in the frame by tightening the clamp nuts, be careful not to allow the shifter pinion to come in contact with the axle. To overcome this danger, turn the shifter body forward and backward to find the central position,




**Brake Side Cover Showing Shifter Lever in Low Speed**

pin toward the outside. Grease the shifter pinion "41" with thick grease and place it into the shifter body.

Replace the remaining parts in the following rotation on the shifter pinion: Shifter pinion washer "42" with knurled side up, shifter lever "43" with knurled side down, lock washer and clamp nut.

then tighten the right clamp nut while holding the shifter body.

If too much play develops at the rear wheel or clutch, adjust the left cone only and be sure that the bearings are not cramped after adjusting. A very little shake and a free running wheel indicate proper adjustment.



If these instructions are noted carefully together with the accompanying illustrations, it will be found comparatively easy to make any necessary repairs. If it is only necessary to adjust the shifter rods, there is no need to take the hub apart. It will generally be found that difficult shifting and poor meshing are due to poorly adjusted shifter rods.

If this bulletin does not answer all of your two-speed questions, write us briefly.

# Inspecting and Overhauling the Clutch

In connection with overhauling the two-speed hub, the proper method of inspecting and overhauling the clutch can also well be covered, especially since the fitting of the roller bearing driving hub gear requires stripping the clutch partly. Inspecting the clutch while the two-speed hub is apart may save having to remove it at some future date.

The clutch is to be taken apart as already explained under *How to Remove the Driving Hub Gear.* The driving and friction disc assembly can be held very conveniently in a vise. Before removing the screws, note how far they extend through the clutch spring nut sectors. If the clutch has been holding well and these screws are found to just extend through the sectors, all discs and springs are in good condition and the assembly should not be taken apart.

If the adjusting screws extend quite a way through the sectors and the clutch slips with a properly adjusted lever, it is not necessarily true that the discs are worn. The six springs may have contracted due to overheating the clutch from considerable slipping. Again the slipping may be due to grease or oil having gotten onto the discs.

If the six clutch screws must be removed, it is advisable to mark all discs in line with the driving disc because it is very important to have the friction discs fit the same spline fittings of the key ring in the hub shell when the clutch is again assembled. If the position of the discs is changed, they may stick in the key ring and the clutch will take hold jerkily with a tendency to stall the motor.

Remove and measure the springs to see whether they have contracted. When new the 1915 springs are 1 inch long and the 1914 springs 11/16 inch. If measuring the springs shows that they have contracted more than 1/16 inch, or if they appear to be weak, replace them.

If the friction disc linings are covered with oil or grease they should be thoroughly cleaned. To clean the discs, first wash them in gasoline. Then soak them with gasoline and lay them on a gas plate to burn out the remaining traces of lubricant. The discs may require several soakings in gasoline and burnings before all grease will be removed. If the disc linings are less than 1/16 inch thick, the discs should be sent to us to be relined or a new set should be fitted.

## To Fit New or Relined Friction Discs

Before assembling the clutch with a new or relined set of discs, be sure to fit the discs in the key ring of the hub shell and mark them when a good fit has been obtained so that there will be no danger of the discs sticking after the clutch has been assembled. If the discs stick when they are fitted in the key ring, they should be turned so that the same spline fittings do not line up. Find the position where the best fit is obtained and if the discs stick only slightly they can be worked in to be a good fit by forcing them way in and out several times. Do not grind off any stock from the disc feather keys unless absolutely necessary and then be sure to grind off only enough to allow the discs to work in and out freely without any forward and backward play.

## Mark the Discs and Key Ring

After a good fit has been obtained, mark the discs and key ring with chalk marks so that these marks can be referred to when assembling. If the position of the releasing friction disc has been changed on the releasing disc, find the position where it does not stick and mark both discs. If the releasing disc, hub friction discs and releasing friction disc have been removed, proceed as follows:

Fit and chalkmark the hub friction discs in the clutch hub shell, fit and mark the releasing friction disc on the releasing disc, fit and mark the releasing disc on the studs of the driving disc. The friction assembly now being fitted, the clutch is ready for assembling.

## How to Assemble the Clutch

Place the lower hub friction disc on the releasing disc, fit the releasing friction disc so that the marks on this disc and on the releasing disc line up, then fit the other hub friction disc so that the marks line up with the first hub friction disc.

Carefully place these parts in a vise and clamp them together. Put the six clutch screws through the driving disc and the releasing disc. Place the six coil springs on the screws and turn the screws into the clutch spring nut sectors. If trouble is experienced in starting the screws in the sectors, the springs can be compressed sufficiently by hand. The screws must be tightened an equal number of turns to obtain equal pressure over all friction surface. If one adjusting screw is screwed into a sector further than the others, the clutch will not release as it should and give poor service.

To make sure that the assembly will work freely, lay it on a surface plate with the driving disc down and strike the releasing disc lightly but squarely all the way around with a hammer. The assembly is now ready to be fitted into the clutch hub shell but since an accurate bearing adjustment is necessary, it is advisable to fit the clutch hub shell on the driving hub gear as is explained under *How to Fit the Roller Bearing Driving Hub Gear.* If new discs were fitted, be careful not to assemble the friction disc and hub shell assemblies according to the marks placed on these parts before they were taken apart. Assemble according to the marks placed on the parts after the proper fit had been obtained.

When ordering two-speed parts always specify the Factory Number, and not the Photo Number.

| | | |
|---|---|---|
| 1 | BG207 | Inner hub shell (left half) |
| 2 | BG207 | Inner hub shell (right half) |
| 3 | DG218 | Bevel pinion shaft |
| 4 | BG217 | Bevel pinion |
| 5 | DG215 | Driving hub gear |
| 6 | BG213 | Driving packing ring |
| 7 | BG200a | Outer hub shell |
| 8 | BG202 | Hub shell keys |
| 9 | BG224 | Clutch collar pin |
| 10 | BG223 | Clutch collar spring (lower) |
| 11 | BG222 | Clutch collar spring (center) |
| 12 | BG221 | Clutch collar spring (upper) |
| 13 | BG225 | Clutch gear cone (1914) |
| | DG225 | Clutch gear cone (1915) |
| 14 | DG210 | Actuating worm cone |
| 15 | DG177 | Roller bearings |
| 16 | DG175b | Ball race inside |
| 17 | DG176 | Ball retainer and balls |
| 18 | DG175a | Ball race outside |
| 19 | BG264 | Clutch shifter collar |
| 20 | BG219 | Clutch collar |
| 21 | BG220a | Right cone |
| 22 | BG273a | Two-speed shifter bracket |
| 23 | BG278a | Shifter arm |
| 24 | DG262 | Rear axle (1915) |
| | CG262 | Rear axle (1914) |
| 25 | BO153 | Axle end screw( right) |
| | BO151 | Axle end screw (left) |
| 26 | BG286 | Shifter rod lever |
| 27 | BG297 | Shifter lever bracket |
| 28 | BG208 | Clutch shifter bar |
| 29 | BG209b | Clutch shifter plunger |
| 30 | BO328 | Axle washer (inside frame) |
| 31 | CG265 | Axle lock washer |
| 32 | BO315 | Axle washer (outside frame) |
| 33 | BO696 | Left cone lock nut |
| 34 | BO693 | Rear axle nut |
| 35 | CG253 | Axle support washer |
| 36 | DG248 | Axle bushing |
| 37 | CG190 | Long shifter rod (10C) |
| | CG289 | Long shifter rod (10F) |
| | DG190 | Long shifter rod (11C) |
| 38 | CG288a | Short shifter rod |
| 39 | BG201 | Hub shell band |
| 40 | CG189 | Shifter body |
| 41 | BG199a | Shifter pinion |
| 42 | BG193 | Shifter pinion washer |
| 43 | BG258a | Shifter lever |
| 44 | BG299 | Shifter rod clevis pin |
| 45 | CG284 | Shifter rod end |
| 46 | CG296 | Shifter rod clevis |
| 47 | CG294 | Shifter rod link complete |



shell. The entire hub shell assembly is removed from the left side of the outer hub and can very easily be taken apart. Without the special wrench it is not easy to remove the inner hub shell. Its use is therefore recommended. The price of the wrench is $1.25. If the axle is to be changed for some reason the clutch shifter bar "28" can easily be withdrawn after the shifter plunger "29" has been screwed out.

## Inspection of Parts

If the two-speed wheel has seen considerable service, the parts should be carefully inspected for wear. To enable careful inspection, the parts must be washed thoroughly. After washing, inspect all the bearing surfaces of the various parts. Pitted or worn balls, cups and cones should be replaced with new parts, likewise any other part showing considerable wear.

If it was difficult to move the shifter handle on the tank while shifting speeds and all the bearings along the control rods were free and well lubricated, the trouble may be due to a bent axle. Examine the axle where the shifter plunger is fitted. The axle may be binding on the plunger.

## Fit Roller Bearing Cone and Driving Hub Gear

The original style driving hub gear and actuating worm cone should in every case be replaced. These parts were fitted with ball bearings which have since been replaced with the well known Harley-Davidson roller bearing. This style bearing is trouble-proof as well as very long lived and should for that reason replace the earlier type. The original ball bearing cone and driving hub gear can be exchanged for the new parts at a charge of $4.25 provided the old style parts are sent to us. The regular price of the new assembly is $7.00. The new assembly goes under part No. DG-170.

## How to Remove the Driving Hub Gear

To fit the new style driving hub gear to the clutch will of course require taking the clutch apart. After the clutch assembly with the driving hub gear has been removed as has been explained previously, mark the driving disc and the outer edge of the clutch hub shell with a scratch awl or pencil because it is of great importance to have the discs fit the same feather keys of the hub shell when again assembled.

Lay the clutch on the bench and hold it secure by driving three spikes into the bench equally spaced around the sprocket and as close to the clutch sprocket as possible. This will make it easy to hold the clutch assembly while unscrewing the driving hub lock nut and the driving hub nut. With special factory wrench CK-800 remove the driving hub lock nut and the driving hub nut. Lift the hub shell and sprocket assembly from the friction disc assembly, being careful not to lose any of the 68 1/4-inch balls.

Clamp the teeth of the gear in vise jaws covered with sheet copper to protect the teeth and with factory wrench No. CK-17 remove the driving disc lock nut. If the friction assembly sticks slightly on the driving hub gear, tap the gear lightly. Inspect all bearing surfaces for wear and pits, including the steel balls, and replace all that are not in good condition.

# How to Fit the Roller Bearing Driving Hub Gear

When assembling the driving hub gear and clutch assembly it is advisable to fit the clutch hub shell on the driving hub gear before the friction assembly. This will allow an accurate bearing adjustment and is recommended for that reason.

Pack the hub shell cone with a good grade of thick cup grease and place the 1/4-inch balls in two rows of 34 each, using the grease as a retainer. Place the driving hub gear into this assembly in the same way the other gear was fitted. Screw the driving hub nut down tight on to the driving hub gear, then back it off about 1/4 turn and firmly tighten the driving hub lock nut. Try the bearing adjustment by turning the hub shell on the driving hub gear. This must run perfectly free with just the slightest trace of a shake. If the bearing adjustment is not just right, tighten or loosen the driving hub nuts as may be found necessary.

Place this assembly in a vise, clamping the gear and fit the friction assembly in such a manner that the marks placed on the driving disc and hub shell before the clutch was taken apart, line up. Lightly tap the driving disc to force it over the spline fittings of the driving hub gear and draw the driving disc clamp nut down tight.

# How to Assemble the Two-Speed Hub

Pack the clutch gear cone "13" bearing grooves with grease which will lubricate and act as a retainer to hold the balls while assembling. This bearing consists of a double row of 5/16-inch balls of 18 balls each. Place the clutch gear cone with balls into the right half of the inner hub "2." Since this bearing is only a free running fit and no play is allowed, the balls will not enter the inner hub shell easily and it generally will be found necessary to press firmly with the hands to get the parts together.

Lubricate the bevel pinion shaft "3" with regular motor oil and place the four pinions "4" on the shaft. Place this assembly in position on the right half of the inner hub "2" and fit the left half "1" of the inner hub against the right half so that the marks on the inner hubs line up. The marks are either center punch marks, numbers or letters. It is very important to match up the inner hub shells because these parts are machined in pairs to insure a perfect fit over the bevel pinion shaft. For this reason it is necessary to renew both halves when one-half must be renewed.

Fit the shifter collar "19" over the axle. Place the clutch shifter bar "28" through the shifter collar and the provided slot in the axle. Screw the clutch shifter plunger "29" into the shifter bar. When this is done care should be taken to get the teeth of the plunger to line up evenly and properly with the slot in the axle so that the shifter pinion can move the shifter bar the full travel of the slot. Refer to "G," illustration No. 1.

Place the clutch collar "20" over the right end of the axle in such a position that the lock pin is to the left of the feather key of the clutch collar and that the high side of the lugs or dogs of this collar is to the right. Place the axle assembly into the inner hub shell assembly and with a screw driver press in the clutch collar pin "9" so that the clutch collar can be placed over the clutch gear cone. Be sure that clutch collar pin is in line with the three lock holes at "H" in the clutch gear cone.

Engage the dogs of the clutch collar and the right side of the inner hub. Lubricate the entire assembly with a little cylinder oil, hold it together carefully and place it into the outer hub "7" from the left side. With wrench CK-6 placed over the clutch collar, the inner hub shell assembly is screwed into the outer hub by turning to the left. It is very important to turn the inner hub very tight into the outer hub. If it is impossible to line up the key ways after the inner hub is turned in tight by hand, do not back the inner hub outward slightly but force it tight with a hammer.

After the inner hub has been properly tightened and the key ways line up, fit the six woodruff keys "8." These keys fit tight and it will be found necessary to use a hammer to drive them way down. Be sure to drive them way down and see that no dirt remains in the key ways or it will be impossible to fit the hub shell band "39."

Place the hub shell band over the rear hub and fit the two hub shell band screws. If trouble is experienced in fitting the screws use a soft thin punch or nail. Place this through two holes one on each end in the band and into one of the outer hub holes, then pull the band in place, hold it and fit one of the screws.

Pack the right cone bearing "21" with thick cup grease and fit the nineteen 3/8-inch balls. Lubricate the inner hub mechanism with a few drops of thin oil and screw the cone on the axle. Screw the right cone 1/16-inch beyond the rear axle clip grooves and line up the square shank of the cone with the grooves in the axle. If this is done the brake arm will line up properly with the brake arm clamp and then there will be no danger of spoiling the bearing adjustment when fitting the wheel in the frame. Push the axle inward toward the left by hand.

Pack the left side of the two-speed mechanism with thick cup grease. Force this grease in well between the pinion gears. Allow sufficient room for the driving hub gear or an over-supply of grease will be put into the hub causing it to work out on the brake side. Fit the driving packing ring "6" into the driving hub gear recess with the square edge toward the clutch. Pack the driving hub gear bearing with thick cup grease and fit the eighteen 3/8-inch balls. Place the clutch assembly over the axle and onto the rear hub.

Pack the ball thrust bearing "16," "17" and "18," and roller bearing parts "15" with grease and fit them into the driving hub gear in the following manner: First fit the beveled race "16," then the ball retainer with the balls "17," the outer race "18" and the roller bearings with retainers "15."

Be sure that the felt washer in the recess of the actuating worm cone "14" is in good condition and will retain the lubricant and prevent dirt from entering this bearing. Then screw the actuating worm cone in place. First screw this down tight, then back it off possibly 1/4 turn or just enough to allow the wheel to turn perfectly free and make sure that the bearing is not being cramped.

Fit the bushing "36" over the left axle end with the large diameter toward the actuating worm cone. Then place the axle support washer "35" over the axle against the bushing. This washer was not used on two-speed hubs manufactured before June 1st, 1914, but should be fitted to these two-speeds also, because it greatly adds to the strength of the axle. Next to the axle support washer fit the keyed lock washer "31," then fit the lock nut "33" and draw this very tight.

*Again try the wheel to see that it turns freely and that the bearings are not cramped. Fit the brake side cover so that the brake arm is in line with the brake arm clamp. Remember that this is very important because if the brake end cover were either forced up or down in lining up the brake arm with the clamp, the bearing adjustment of the rear wheel would be changed and there would be great danger of ruining the actuating worm cone, driving hub gear and the complete bearing in a very few miles of driving.*

No. 53 Service Department Bulletin

## To Adjust the Circuit Breaker Points

The fibre block on the circuit breaker arm is subjected to a certain amount of wear in service, and after several thousand miles it will be necessary to readjust the contact points to make up for this wear. As a matter of precaution, an inspection and adjustment if necessary, should be made, say, every 1,500 miles. If the high side of one of the steel cams is not in contact with the fibre block, it will be necessary to turn over the generator slowly by means of the rear wheel (transmission must be in high gear and the clutch engaged), until the steel cam hits the fibre block and separates the contact points as far as they will go. The lock nut "11" should then be loosened with the generator wrench, and the adjusting screw "10" should be turned out or in by turning the hexagon head until it is just possible to insert the flat steel gauge on the wrench between the points at "9." After the points are correctly adjusted, carefully tighten the lock nut and measure the clearance again to be sure that the adjustment is correct.

## To Reseat Brushes and Clean Commutator

Inspect the commutator and brushes every month or every 1,500 miles. If the commutator is found blackened, not dark brown, it should be cleaned by burnishing with No. 00 sandpaper. *Never use emery paper.* Normally the commutator requires no attention. To clean the commutator, cut a strip of No. 00 sandpaper into strips about 3/8" wide. Run the motor slowly and hold the sandpaper with the coarse side against the commutator until the latter is bright and clean. Be careful not to get a finger caught in the drive chain during this operation. See that the brushes have a good and clean bearing surface against the commutator. If they have not, insert a strip of the same sand paper between the commutator and the brush, with the coarse side towards the brush. Be sure to pass the strip of sandpaper around the commutator as far as possible and when drawing it out follow the radius of the commutator to prevent trimming off the edges of the brushes. It is extremely important to have the entire surface of the brush bear against the commutator, to receive full efficiency from the generator. Bear down lightly on the brush holder and withdraw the sandpaper. After cleaning the brushes and the commutator, remove any particles of sand with a gasoline moistened cloth. This is important, for sand will cut the commutator. Do not take for granted from the above instructions that it is necessary to clean the commutator and reseat the brushes every 1,500 miles. Clean these parts only when conditions warrant. If the commutator is found cut or worn by the brushes, even though the damage seems to be only slight, refer your machine to the dealer immediately.

## Lubricating the Generator

Never use thin oil on any part of the generator. Once a year put a little vaseline about half the size of a pea on the top of the fibre block of the interrupter lever and keep the cup on the right side of the generator filled with good vaseline if the cup is provided with a wick. This cup will require filling about every 1,000 miles. If the generator has a regular grease cup here instead of a vaseline cup, give this one-half turn every 500 miles and keep it filled with a good grade of cup grease.

# Service Dept. Bulletin

No. 76 August 10, 1918 Harley-Davidson Motor Co., Milwaukee

## To Repair Inlet Housings and Valves

In a recent letter it was suggested that inlet housings and valves with worn guides and stems, respectively, be referred to the factory for repairs.

If a dealer has a lathe or can have reliable work done at a local machine shop, he can buy the inlet housing bushings from us and save sending the valves and housings to the factory. The repair operations are described below.

Housings and valves of all models later than 1912, but exclusive of 1915, can be repaired.

The list prices of the bushings are as follows:

| | | | List Price |
|---|---|---|---|
| DA 834 | 1913-1914 | Inlet Housing Bushing | $ .20 |
| DA 834R | 1916 | Inlet Housing Bushing (Standard Size) | .30 |
| DA 834RA | 1916 | Inlet Housing Bushing (Undersize) | .30 |
| HA 834 | 1917-1918 | Inlet Housing Bushing (Standard Size) | .30 |
| GA 834 | 1917-1918 | Inlet Housing Bushing (Undersize) | .30 |

### To Repair Worn 1916 and Later Inlet Housings

Center the inlet housing in the chuck of a lathe and bore it out 33/64″. This will remove the entire guide. Lay a straight edge or a depth gauge across the bottom of the housing, and turn the lower end of the guide boss off until the distance between the straight edge and boss is 11/16″.

Tap this hole with a 9/16″x24 V tap, entering the tap from the bottom. This tap, GX743, retails for $1.95. If a new valve is to be used, place a little white lead on the threads and screw in a guide or bushing with a standard hole. If the valve stem is worn only slightly and is to be faced down, screw in an undersize guide. Be sure to screw in the guide from the bottom of the housing and to place a little white lead on the threads before turning it in tight; otherwise there will be a leak, and the result will be nearly the same as with a worn guide and stem.

After a new guide has been turned in place, the valve seat in the housing should be trued up if it is worn. To have this seat true with the guide hole is very important, and will therefore require placing the housing on a mandrel. Before turning the housing seat down, be sure to obtain the proper taper (30° or 45°, depending upon the model); then set the compound head accordingly, and turn the seat down just as much as may be necessary.

After the housing seat has been trued up, the extreme lower end may have to be turned off slightly so as not to reduce the valve opening. Never turn this lower flange off so that it is less than 3/16″ deep, and turn off only enough to have the lower taper edge of the valve come flush with the bottom of the housing. If these limits cannot be followed, the housing is worn too much and should be scrapped.



### To Repair 1916 and Later Inlet Valves

Before an inlet valve stem can be centered and trued up, the key end of it must be annealed, because the stem is hardened for a distance of 1/2 inch.

After machining, harden the stem again by heating the end in molten lead and quenching in oil.

Center the valve stem and valve head accurately. The valve head is already centered, while the valve stem can be held in a bell center, or a fixture can be made with which the valve stem can be accurately clamped to facilitate turning the stem down. Whichever method is adopted, make sure to clamp the valve centrally so that the valve stem will be at equal centers to the valve head.

Turn the stem down to about .264″ diameter. Polish it with No. 00 emery cloth and try the fit of the stem in the housing guide. The fit is right when the stem is perfectly free with just a slight trace of shake noticeable.

After truing up the stem, reface the valve seat again, making sure that the valve stem is absolutely central. Valves which are worn so that the taper face runs flush with the top, or within 1/32″ from the top, should be scrapped.

### To Repair a 1913 or 1914 Inlet Housing

Worn 1913 and 1914 housings are also repaired by boring out the guide and fitting a bushing, but because of the design of the housing, a different style bushing is used.

The housing guide is bored out to .378″ and is not threaded. The bushing is then pressed into the housing from the inside, flush with the top of the guide, and held by a .002″ press fit. If the bushing is too long, the inside end of it is faced off so as to give sufficient clearance between the guide and the valve head.

If the valve is replaced with a new one, center the housing accurately, and ream out the guide with a 9/32″ reamer. The valve seat of the housing is then faced off square with the guide by supporting it on a mandrel.

### To Repair a 1913 or 1914 Inlet Valve

If the valve stem is only slightly worn, it can be made serviceable by facing off the stem to true it up and then boring the bushing to give the stem about .001″ clearance.

Before attempting any machine work, anneal the valve stem, and after machining, harden it as explained under, To Repair 1916 and Later Inlet Valves.

These inlet valve stems are not faced off as easily as the later than 1916 inlet valve, because the heads of them are not centered. For this reason, extreme care must be taken in chucking the valve head, so that the stem is trued up square with the seat.

It is understood that inlet housings and valves can continue to be referred to the factory for repairs, if preferred.

## To Adjust a Faulty Manual Ignition Switch

If previous tests and inspections prove that the centrifugal switch, horn, battery, wiring and connections are O. K. and the horn cannot be sounded when the motor is cranked, the motor will be hard starting because the manual ignition switch is faulty.

Since the manual ignition switch is integral with the lighting switch, refer to instructions covering the removal of this switch on pages 4 and 5, under "To Inspect and Correct a Faulty Lighting Switch." Remove the three screws holding the fibre base and spider cover assembly together, and bend the end of the contact blade. This will be only very slightly, as may be found necessary. Be careful not to bend the contact blade too much because it will then be impossible to lock the ignition when the key is removed. This same blade grounds or short circuits the generator when the key is removed from the switch.

## When Motor Keeps on Running with Ignition Key Removed

This trouble can be traced to two causes which are:

1. Failure of entire switch assembly to make a connection or ground to the frame.
2. Contact blade failing to make contact or ground against the lug of the spider assembly cover when key is removed.

To determine whether entire assembly is grounded, start the motor and touch a screw driver to the switch and the frame work after removing the enamel at the points of contact. If a spark occurs, it will be necessary to remove the enamel so that switch clamp can make contact with the frame.

If no spark occurs, it will be necessary to remove cover and bend contact blade until it makes contact with the lug of the spider assembly cover. If the temper should be burned out of this blade, it should be replaced.

## To Test Whether the Generator is Charging the Battery

If the storage battery is exhausted and it is suspected that the generator is not charging, have the battery recharged and start the motor in the regular way. Then disconnect the ground connection. If the motor continues to run, the generator is furnishing current. If the motor stops, the generator is faulty and the matter should be referred to your dealer. During this test the motor must not be run at a speed exceeding 15 miles per hour.

If the above tests prove that the generator is charging, that the circuit between the generator and battery is closed, that there is no short circuit, and that the battery is not at fault, the output of the generator most likely is not normal due to a dirty commutator and brushes. In that case, clean the commutator and reseat the brushes as explained under that heading.

## Hard Starting

Hard starting of the motor can generally be traced to a discharged storage battery or failure of the ignition switches to make a good connection between the generator and battery. In the case of a discharged battery, refer to instructions "To Run With A Discharged Battery." If the switches are suspected refer to instructions under "To Test for and Repair a Faulty Ignition Switch."

## The Warning Signal

One feature much appreciated by Harley-Davidson owners of electric models, is the fact that the warning signal or horn can only be sounded when the motor is running. If the horn can be sounded constantly when the motor is idle, prevent complete discharging of the battery by removing the ignition key from the switch or by disconnecting the battery ground wire.

Examine the fuse in the horn circuit. Of course with a burned out or a loosely held fuse the horn could not be sounded. The cause of the short circuit must be found and remedied before the fuse is replaced.

If the horn sounds continually without pressing the horn button while the motor is running, there is a short circuit either in the horn switch on the handle bar, in the wire from the horn switch to the horn, or in the horn itself. If the horn cannot be sounded while the motor is running, remove the horn cover and make sure that the vibrator contacts are not pitted or stuck together. The points should break at least a 1/64" when the armature is bearing against the diaphragm stem. If the points are not at fault, see that the wiring from the switch box to the horn, and from the horn switch to the horn is not damaged or loose. If these instructions do not cover the trouble refer to service bulletin No. 61.

## To Run With a Discharged Storage Battery

The motorcycle can be run with a discharged or disabled battery, but it is very important to have the battery recharged or repaired immediately, because if the battery is left in a discharged or disabled condition for any length of time it will be ruined. If the battery is disabled or partly discharged, turn the lights off when starting motor.

Switch on the ignition, put the gear shifting lever in either low or second gear, engage the clutch, raise the exhaust valves and push the machine at a good pace by running alongside, drop the valves, and jump on or quickly disengage the clutch as soon as the motor starts. If the machine will not start, disconnect the battery ground wire on the outside of the battery box and repeat the above instructions. After starting the motor, be sure to reconnect the battery ground wire at once or the generator may be ruined. Always see that the battery ground wire is connected while the motor is running, because the battery acts as a safety valve and protects the generator. It is possible to ruin the generator if the motor is driven at a speed greater than 15 miles per hour unless the storage battery remains connected.

Before disconnecting any of the wires other than the spark plug wires to make a repair, disconnect the battery ground wire from the battery box cover to prevent burning out of fuse or short circuiting the battery.

## If Battery Discharges Without Apparent Cause

Should the top of the battery become dirty and saturated with electrolyte, a slow discharge will be the result. Likewise, the battery box and the terminals will be eaten and destroyed. Keep the battery clean.

Test for a short circuit between the generator and battery as follows: Have the lighting switch turned to the OFF position and the motor idle, being sure that the horn cannot be sounded. Then disconnect the ground wire on the outside of the battery box and rub it against some metallic part of the machine. If sparking occurs, there is a short circuit. To find out where the short circuit is, remove the ignition key from the manual ignition switch and repeat the above test. If sparking occurs the same as before, the short circuit is between the battery and the manual ignition switch. No sparking during this test would indicate that the short circuit is in the wiring, or connections leading from the manual ignition switch to the centrifugal switch.

## How to Test a Suspected Battery

If this test and the above explained conditions do not apply, the battery itself may be at fault. Take the battery out of the box and have it charged. After charging tape the ends of the wires. Take a hydrometer reading and make note of the specific gravity of each cell. Set the battery in a cool, clean and dry place for twenty-four hours. Then take a second hydrometer reading of each cell. If the battery is O. K., the readings will practically be the same. If there is a decided difference in the reading the battery is at fault and should be referred to the nearest Exide Battery Service Station.

## To Clean Circuit Breaker Points

To clean the circuit breaker points, it is necessary to remove the bakelite cap of the distributor. If the circuit breaker points at "9" are slightly pitted or burned, they should be cleaned with No. 00 sandpaper. *Never use emery paper.*

## Ignition Mechanism of the Harley-Davidson Remy Generator

1. Distributor cap locating lug, or stop, should interlock with the slot at "6" whenever the distributor cap "3" is replaced. Failure to fit the distributor cap properly may mean a damaged generator; 2. High tension terminals which alternately collect the ignition current from segment "5" and carry it to the spark plug wires. These high tension terminals clear the segment by about 1/64" and should never be adjusted; 3. Distributor cap; 4. Distributor segment contact spring which carries the ignition current from carbon contact "14" to segment "5"; 5. Distributor segment distributes the ignition current from the distributor segment contact spring "4" to the high tension terminals at "2"; 6. Slot in timer head casting lines up with lug "1" when the distributor cap "3" is properly fitted; 7. Circuit breaker lever; 8. Circuit breaker cam; 9. Circuit breaker points; 10. Adjusting screw with which the gap at the circuit breaker points "9" are adjusted; 11. Adjusting screw lock nut, prevents adjusting screw "10" from turning automatically. The lock nut must be loosened before an adjustment is made, and must be securely tightened after adjusting; 12. Primary wire connects primary winding of coil "16" to ground through circuit breaker points at "9"; 13. Distributor cap spring (2 used) securely holds the distributor cap "3" in position; 14. High tension carbon contact insert which carries the ignition current from wire "15" to distributor segment contact spring "4"; 15. High tension wire which carries the ignition current from the secondary winding of the coil to the carbon contact insert "14" in the distributor cap; 16. Coil only one used.

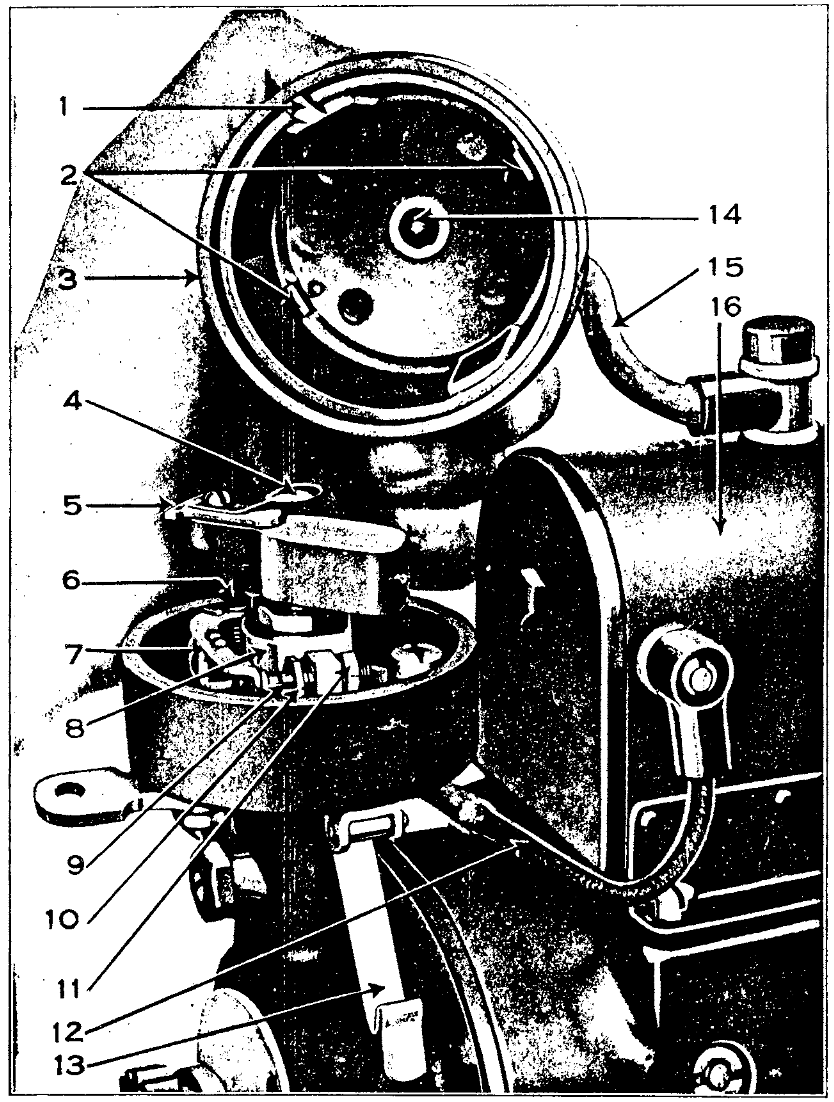



**Illustration of Ignition Mechanism**

The trouble lamp or sidecar lamp connection hole is offset to the right of the switch. Refer to illustration which plainly shows where to plug in. In order to light either the trouble or the sidecar lamp, the lighting switch must be turned on because this connection is in circuit with the tail lamp.

## When Lights Do Not Burn When Motor is Idle

Failure of the lamps to burn while the motor is not running, generally indicates that the battery is discharged, or that the lighting fuse is burned out due to a short in the lamp circuit. In the latter case locate and remedy the short circuit before replacing the fuse. Two fuses are mounted in the switch box for the horn and lighting circuits to prevent discharge and possible injury to the battery should a short circuit occur in the lamp or horn wiring. See that the fuses are held firmly in the holders. In case a fuse burns out do not use a piece of wire as a substitute. Locate and remedy the cause of the trouble and replace the fuse with a new Harley-Davidson fuse. By using a piece of wire, the short circuit that was responsible for the fuse burning out, may cause serious injury to the switch or wiring, and discharge the battery. In an emergency, if the fuse in the lighting switch is burned out and the short circuit has been remedied, the horn fuse can be safely used in the lighting circuit. If tinfoil can be obtained a temporary repair of a burned out fuse can be effected by wrapping a double thickness of tinfoil around it.

To ascertain whether the battery is discharged, test it as explained under the battery instructions. If the fuse and battery are found to be in good condition, the trouble lies in the lamps or in the wiring. Inspect the bulbs and examine the wiring for a break. Also look over the lamp connections to see if any are loose or broken. If the battery is discharged have it recharged immediately. If the trouble was due to a loose or broken connection, or a short circuit in the wiring, repair accordingly. Investigation shows that most discharged batteries are caused from excessive or careless use of the lights.

## If One Lamp Fails to Burn

If all the lamps but one burn, the fault lies in that particular lamp, or in the wiring thereto. It may be that the contact spider for that particular lamp is making a poor circuit with the insert contact in the switch. In this case, see switch instructions pages 4 and 5. The failure of a lamp to burn may be due to a burned out bulb, and the test of inserting a good bulb in place of the suspected one immediately suggests itself. If the good bulb fails to burn, the wiring and the connections to the lamps should be carefully examined.

## If Neither Headlight Will Burn

If neither head lamp bulb lights, but the tail lamp bulb does, the trouble must lie either in the headlight bulbs, wiring, lighting switch or the double connector in the headlight. Sometimes trouble with the small headlight is caused by failure of the reflector to make a good connection or ground to the lamp body, especially if the entire interior of the lamp is covered with enamel. If the enamel is the cause of the trouble, scrape the lamp at the point of contact with the reflector, with a scraper or screw driver. If it is necessary to remove the reflector, use the greatest care not to touch the reflecting surface. To open the lamp for replacing a bulb, loosen the screw in the bottom of the front flange about 1/4". Remove the glass retainer, glass and packing washer. To replace a bulb in a new type headlamp it is necessary to remove one hinge pin and swing door outward.

## Fluctuating Lights

If the lamps burn bright when the motor is running at moderate speed, but vary and flicker when the motor is running slowly, the cause is a discharged battery or a poor circuit between the battery, generator and lights, at one or more of the following points.

Carefully inspect the ground wire which is clamped under the cover clamp screw of the battery box, and leads to the negative pole of the battery. In like manner examine the positive wire leading from the battery to the terminal block on the battery box to the lighting switch. See that the upper fuse is O. K., that it is held securely and that the wire connections on the switch clamp screws are clamped firmly. Examine the contact spider of the lighting switch as explained under "To Inspect and Correct a Faulty Lighting Switch." Examine the wiring leading to the lamps and the connections on the inside of the lamps.

## To Inspect and Correct a Faulty Lighting Switch

Remove the two hexagon nuts which clamp the entire switch box assembly to the studs of the switch base. Take hold of the black switch box cover and remove the entire assembly from the switch base. If the cover sticks it can easily be forced off by placing a screw driver against the edge of the cover from the left side of the machine and then striking the screw driver with the fist or palm of the hand. Remove the two round head screws which clamp the black switch box cover to the switch assembly and remove the cover. If an inspection proves that the wires are connected firmly and properly as per illustration showing switch wiring diagram, the fibre switch base to which the wires are attached should be removed from the cover and spider assembly. These two assemblies can be taken apart after the three screws which pass through the side of the spider cover have been removed. Inspect the four spider contacts inside of this cover. Make sure that they bear against the contact inserts in the fibre base with sufficient pressure to insure a closed circuit, and that they cannot slide beyond the insert contacts. To see whether the spider contacts slide beyond the insert contacts, turn them to the various positions and with a pencil, mark the exact location of the contacts on the metal cover of this assembly. Then put the fibre switch base assembly into the switch cover assembly and note whether each mark lines up with its respective clamp screw. If they do not line up properly, bend the spider contacts as may be found necessary.

## To Test for and Repair a Faulty Ignition Switch

The following symptoms can be traced to the ignition switches of which there are two: The centrifugal switch which is entirely automatic and built into the generator; and the manual switch which is integral with the lighting switch and operated with a key.

The Centrifugal Switch is Out of Order When:—

1. The horn can be sounded when the motor is idle.

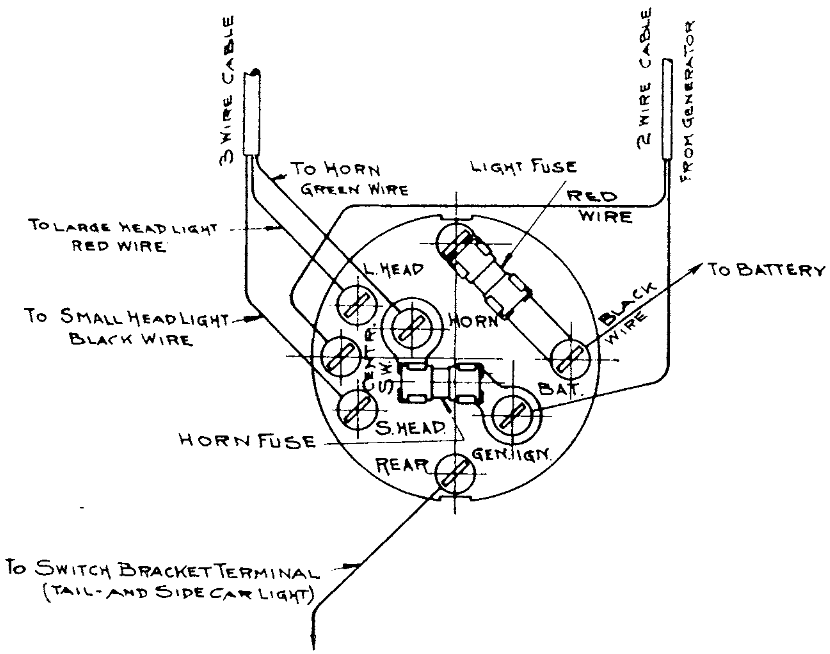
2. The horn can be sounded for a period of a few seconds after the motor stops.

3. The horn cannot be sounded when cranking the motor vigorously. (See that fuse is O. K.)

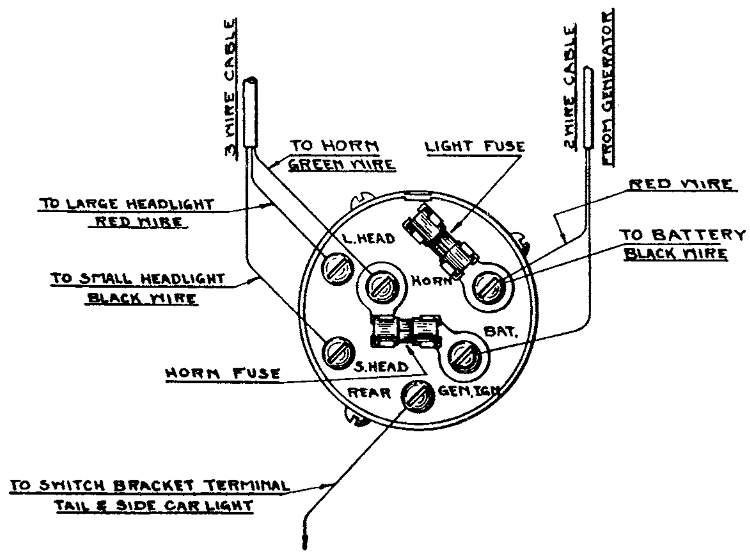
The Manual Switch is Out of Order When:—

4. The motor does not stop when the ignition key is removed.

5. The horn cannot be sounded when the motor is cranked and the centrifugal switch is in good working order.



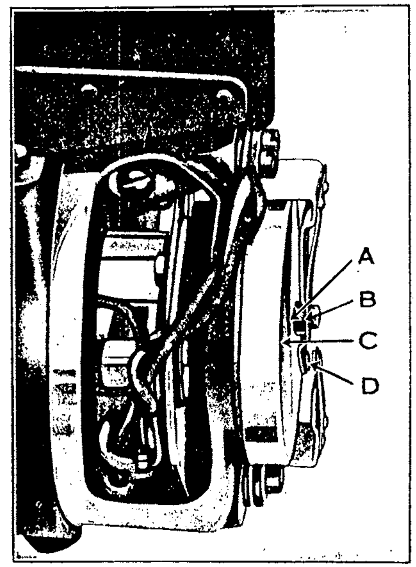

Switch Wiring Diagram of Model 18-J
Equipped with Model 235 Generator




Switch Wiring Diagram of Model 19-J
No Ignition Key being used

# To Adjust the Centrifugal Switch

To gain access to the centrifugal switch it will, of course, be necessary to remove the left foot board, short chain guard and chain. Under the cover at the lower left end of the generator is a set screw. With a screw driver loosen this about one turn. This cover which is held by a bayonet type connection, is then removed by turning it to the left as far as it will go and pulling it from the gen-




erator. Be sure that the clearance "A" between thrust button "B" and cover "C" of the centrifugal switch does not amount to more than a few thousandths of an inch. If there is too much clearance at this point, ball action will be lost which will prevent a good contact if any, at the points "D." If the blades require adjusting, disconnect the ground wire from the battery box cover screw to prevent a short circuit, which if only for an instant would remove the temper in the switch blades making them useless. Never bend the switch blades as they are finely tempered and "set" on the switch blade support. Always bend the switch blade support when changing position of blade. Adjust the long blade support first.

When bending the long blade support, care must be taken to bend it so that the steel insert in the thrust button is in line with the thrust ball in the switch housing. This is very important, because, if the ball comes in contact with the bakelite of the button, it will wear a pit into the button in a short time. After the large blade is in the proper position, obtain the clearance at the contact points by bending the lower or short blade support. A definite clearance for these points cannot be given because of the variation in the stiffness in some of the blades. However, it is safe to assume, that 1/32" clearance is about right. Bend this blade support accordingly, being careful that the points line up, and make a good square contact.

The switch should now be tested to see whether or not the adjustment is correct. Replace the short chain and battery ground wire, raise the valves, press firmly on the handle bar horn button and give the starter crank a vigorous stroke. If the centrifugal switch blades are properly adjusted, and the circuit between the generator and battery, and the battery itself is O. K., the horn will sound for just a fraction of a second.

Watch the action of the centrifugal switch blades. See if they make contact. Then if the horn does not sound while pressing the horn button, check for the following possible troubles:—

1. Battery is discharged. 2. Faulty manual switch. 3. Loose wire connections. 4. Faulty horn or the wire itself is broken at one or more places.

It is well to get into the habit of attempting to sound the horn after stopping the motor, to determine whether the centrifugal switch is functioning properly.

# Service Dept. Bulletin

No. 48A. July 10, 1918 Harley-Davidson Motor Co., Milwaukee

(Revised Edition of Service Bulletin No. 48)

## Inspection and Lubrication of Clutch Bearings

Clutch Bearings of 1917 and earlier style clutches should be repacked with good cup grease every 3000 miles for average service and oftener if the machine is subjected to exceptionally severe service. We recommend that the dealer lubricate this style clutch bearing rather than the rider, because special wrenches are required to handle the driving hub nut and lock nut, and also because perfect adjustments are necessary to get good results.

The following instructions apply especially to the 1915 to 1917 three-speed model clutch, although in a general way they apply to the clutches on direct geared models as well.

The 1918 three-speed clutch is lubricated with a few drops of oil through the actuating plate every 1000 miles, as explained in the 1918 manual.

### How to Take the Clutch Apart

In order to lubricate the driving hub bearings of other than 1918 three-speed clutches it is necessary to remove the clutch complete from the machine and then to strip it. Do this as follows:

On three-speed models remove the cotter pin and both nuts from the clutch pull rod, then the actuating plate and spring. With the special clutch wrench DK806 remove the left threaded lock nut and the clamp nut which hold the clutch on the main shaft. If the clutch sticks tight on the main shaft, strike one side of it with a rawhide hammer or block of wood. Remove the driving hub lock nut with wrench CK17. Take off the lock washer if one is fitted, and with wrench CK800 turn off the driving hub nut. With a scratch awl mark the driving disc and clutch shell, because it is essential that the spline fittings or keyways of the discs and the key ring of the hub shell are assembled as taken apart. Remove the disc assembly from the driving hub assembly, being careful not to lose any of the 64 1/4 inch balls.

### How to Lubricate the Bearings

Carefully clean and inspect the bearing surfaces of the driving hub and hub shell cone. If a part is found pitted or worn badly, it should be replaced. If a new hub shell cone is required, send the clutch hub shell assembly to the factory to have a new cone fitted. A ring showing the travel of the balls does not indicate wear. Repack the bearings with Harley-Davidson non-fluid lubricant or a good grade of cup grease. The lubricant also acts as a retainer while assembling the clutch bearing in two rows of 32 balls each.



### How to Adjust the Bearings by Means of the Driving Hub Nut

Fit the left threaded driving hub nut after seeing that it is a perfect fit. Draw the nut tight and then back it off the distance between three rivets on the sprocket hub shell. This distance can easily be determined with the wrench. If the driving hub nut is drawn up as tight as possible, the bearings will be damaged or the driving hub nut may be backed off automatically, even though a lock washer is fitted between it and the lock nut. The driving hub nut acts as a cone to adjust the bearings. The bearing must be free without any perceptible shake.

### How to Fit the Driving Hub Lock Washer and Lock Nut

After fitting the driving hub nut, fit the lock washer. The washer is made with a key that fits in a keyway in the driving hub; then with wrench CK17 fit the right threaded driving hub lock nut. Draw this nut up as tight as possible.

### How to Test the Adjustment of the Bearings

Test the adjustment of the bearings before locking the lock washer or fitting the clutch to the machine. Lay the clutch on the driving hub lock nut, fit the actuating plate and with some suitable leverage, bear squarely down on the actuating plate. When the plate is forced downward, the friction discs are released. While holding the actuating plate in this position, it should be an easy matter to turn the clutch sprocket with the fingers. If the clutch sprocket turns hard, loosen the driving hub adjustment slightly. If this does not remedy the trouble, the six clutch adjusting screws may be screwed in too far.

After the proper bearing adjustment has been obtained, lock the lock nut by forcing a punch or chisel between the clutch shell and lock washer opposite one or two of the milled grooves in the lock nut. This will force a part of the lock washer into the milled slots or grooves in the lock nut and prevent this nut turning automatically.

### Driving Hub, Nuts and Lock Washer Furnished Assembled

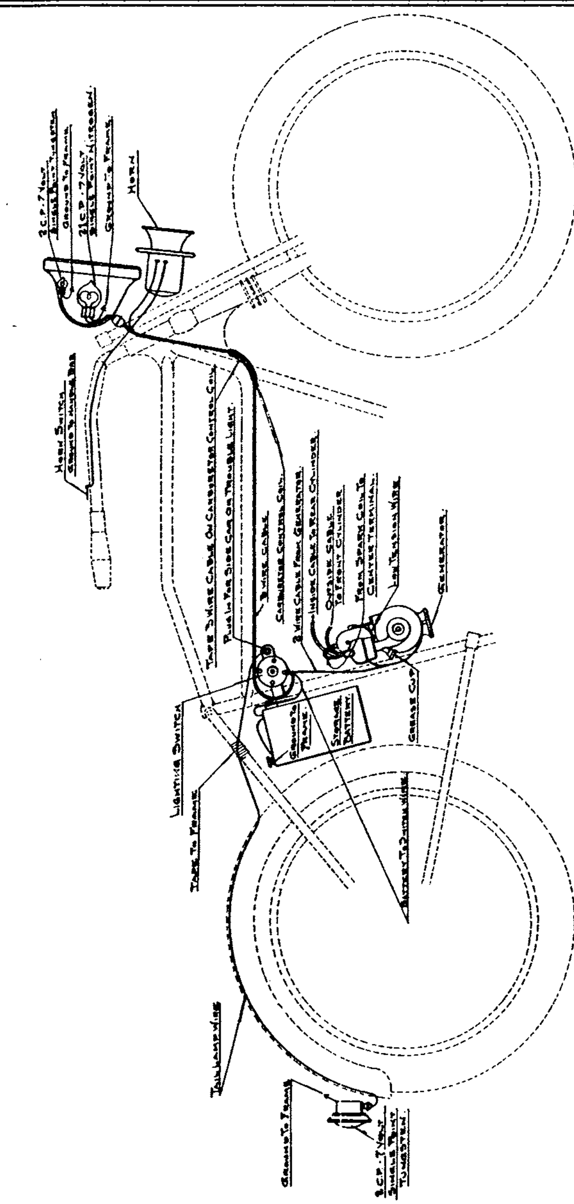
When a driving hub must be replaced, we include a nut, lock nut, and lock washer with the new driving hub. This is done to insure a perfect fit. The lock washer on the driving hub has been used since May, 1916, and since to use it, a keyway must be provided in the driving hub, the lock washer cannot be fitted to the earlier driving hubs. If difficulty is experienced with the lock nut and nut of an earlier type driving hub working loose, a new style driving hub with which will be included a nut, lock washer and lock nut should be fitted. Order by part DG534.

### How to Fit the Clutch

Before fitting the clutch on the shaft, make sure that the shaft, keyways, and driving hub are clean. Fit the key properly; that is, see that it fits snugly in both keyways but that it is not too high and prevents the driving hub from resting properly on the shaft; then firmly tighten both clutch clamp nuts with wrench DK806. Adjust the clutch pull rod nuts so that there is about one-half inch free motion at the top of the hand lever when it is in the extreme forward position. This is important to get the proper clutch adjustment.

# Service Dept. Bulletin

No. 67. Revised. Harley-Davidson Motor Co., Milwaukee



Wiring Diagram of Model 18-J
Equipped with Model 235 Generator

# The Harley-Davidson Remy Electric Lighting and Ignition System

This remarkably efficient system consists of a compact direct current generator, storage battery, headlight with two bulbs, tail light, signal and switch. The generator furnishes low tension 6-8 volt direct current for lights, signal system, and for charging the battery. This current is "stepped up" or transformed into high tension current for ignition by the coil on top of the generator.

It should be understood that the battery is not provided as an independent system for lighting and ignition, although the storage battery will provide ignition and lighting current for a short time when the generator itself is not generating.

## Care of the Harley-Davidson Remy Generator

The electrically equipped model requires reasonable attention. It is advisable to have your dealer make any necessary inspections, tests and adjustments because extreme accuracy is, of course, essential. For the rider who cannot conveniently refer his machine to a dealer we are covering the care of this model herewith. If the instructions are followed closely and care is exercised any necessary adjustments can be made successfully.

## Do Not Overload the System

Never overload the electrical system by equipping with accessories not approved by the Harley-Davidson Engineering Department. The generator is designed to give just so much current; the storage battery capacity is limited; therefore, care must be exercised when adding electrical equipment.

## Why the Battery Must Always Be Kept in Circuit

The battery acts as an accumulator and governor holding the voltage down to 8 volts. The current produced by the generator at 30 miles per hour, with the battery out of circuit, is above 30 volts. This high voltage produces a serious overload on the generator and will burn and pit the breaker points in a short time. Other serious damage may result to the armature, spark coil, or condenser. Bulbs will burn out at any voltage higher than 6-8 volts. Therefore, even though the storage battery should be exhausted and not capable of giving off current, it must be left in its place, connected up.

## The Lighting System

The headlight contains two bulbs—the larger bulb is twenty-one candle power and nitrogen filled. The dimmer and tail light bulbs are each two candle power and have tungsten filaments. The lighting switch has three positions; all OFF, bright headlight and tail light, and dim headlight and tail light.

Never leave the machine standing with the bright headlight turned on as the battery will be discharged in a short time.

If any of the lamp bulbs need renewal, replace with lamps of the same candle power and voltage. This is extremely important; 6-8 volt bulbs should be used. In ordering, specify single point bulbs.

# The Importance of Proper Push Rod and Exhaust Lifter Pin Adjustment

Some mechanics give little thought to the importance of readjusting the pushrods and lifter pins to the one-thousandth part of an inch after grinding the valves. This oversight is extremely dangerous because the lift mechanism and cylinders do not expand evenly when the motor gets hot.

# The Exhaust Valves Expand More Than the Cylinders

There is a tendency for the exhaust valve stems to expand more than the cylinders after the motor has warmed up. Therefore, if sufficient clearance is not allowed between the lifter pins and valve stems when the motor is cold, the exhaust valves will be held open after the motor has warmed up. If the one fact that the exhaust valve stems expand more than the cylinders is taken into consideration, the importance of adjusting the lifter pins accurately will be appreciated.

# The Cylinders Expand More Than the Push Rods

Trouble will also be experienced with the inlet mechanism if the adjustment is not accurate. However, instead of the push rods expanding more than the cylinders and getting tight against the inlet valves, they will loosen up gradually as the motor gets hot, because the cylinders expand more than the push rods. Therefore, if the inlet push rods are adjusted while the motor is hot, the inlet valves will be held open when the motor cools down, because the cylinders will contract more than the push rods. For these reasons it is very important to adjust the exhaust lifter pins and inlet push rods with great accuracy and when the motor is cold.

# Table of Valve Clearances

The following are the proper clearances between the exhaust valves and lifter pins and inlet levers and inlet valves according to model:

1918 and 1917 twin ex. lifter pins, .008″ to .010″ clearance for both cylinders
1916 twin ex. lifter pins, .006″ clearance for front cylinder
1915 twin ex. lifter pins, .006″ clearance for front cylinder
1916 twin ex. lifter pins, .004″ clearance for rear cylinder
1915 twin ex. lifter pins, .004″ clearance for rear cylinder
1914 and prior twin ex. lifter pins, .004″ clearance for both cylinders
Single cylinder ex. lifter pins, .004″ clearance for all models

Allow .004″ clearance between the inlet levers and inlet valve stems on all models.

Be sure that the valves are in the lowest position before making any adjustments.

# Service Dept. Bulletin

No. 73A June 17, 1918 Harley-Davidson Motor Co., Milwaukee

*To Repair Inlet Housings and Valves*
*1916 and Later Models*
*To Repair an Inlet Housing*
*To Repair an Inlet Valve*

## To Repair Inlet Housings and Valves
### 1916 and Later Models

Worn inlet housing guides and seats and worn inlet valve stems and seats of 1916 and later models can be repaired outside of the factory wherever a lathe is available. A worn inlet housing is repaired by boring out the housing to a diameter of 33/64"; then threading the bore with a 9/16"x24 V tap, and securely screwing a bushing into the housing.

Worn seats and stems of inlet valves are repaired by turning down the stem so that it will be about .002" loose in an undersized bushing, and then facing off the seat with a 30° or 45° angle, depending upon the model. If a new inlet valve is to be fitted, a standard size bushing is screwed into the housing.

The price of the bushing is 25 cents list, subject to the regular discount. Order as follows:

1916 Inlet housing bushing standard size—DA834R.

1916 Inlet housing bushing undersize —DA834RA.

1917 and 1918 Inlet housing bushing standard size—HA834.

1917 and 1918 Inlet housing bushing undersize—GA834RA.

## To Repair an Inlet Housing

Center the inlet housing in the chuck of a lathe and bore the housing out 33/64". This will remove the entire guide. Lay a straightedge or a depth-gauge across the bottom of the housing, and turn the lower end of the guide boss off until the distance between the straightedge and boss is 11/16".

Tap this hole with a 9/16"x24 V tap, entering the tap from the bottom. If a new valve is to be used, place a little white lead on the threads and screw in a guide with a standard hole. If the valve stem is worn only slightly and is to be faced down, screw in an undersize guide. Be sure to screw in the guide from the bottom of the housing and to place a little white lead on the threads before turning it in tight; otherwise there will be a leak, and the result will be nearly the same as with a worn guide and stem.



After a new guide has been turned in place, the valve seat in the housing should be trued up if it is worn. To have this seat true with the guide hole is very important, and will therefore require placing the housing on a mandrel. Before turning the housing seat down, be sure to obtain the proper taper (30° or 45° depending upon the model); then set the compound head accordingly, and turn the seat down just as much as may be necessary.

After the housing seat has been trued up, the extreme lower end may have to be turned off slightly so as not to reduce valve opening. Never turn this lower flange off so that it is less than 3/16" deep, and turn off only enough to have the lower taper edge of the valve come flush with the bottom of the housing. If these limits cannot be followed, the housing is worn too bad and should be scrapped.

## To Repair an Inlet Valve

Center the valve stem and valve head accurately. The valve head is already centered, while the valve stem can be held in a bell center, or a fixture can be made with which the valve stem can be accurately clamped to facilitate turning the stem down. Whichever method is adopted, make sure to clamp the valve centrally so that the valve stem will be at equal centers to the valve head.

Turn the stem down to about .264" diameter. Polish it with No. 00 emery cloth and try the fit of the stem in the housing guide. The fit is right when the stem is perfectly free with just a slight trace of shake noticeable.

After truing up the stem, reface the valve seat again, making sure that the valve stem is absolutely central. Valves which are worn so that the taper face runs flush with the top, or within 1/32" from the top, should be scrapped.

# Service Dept. Bulletin

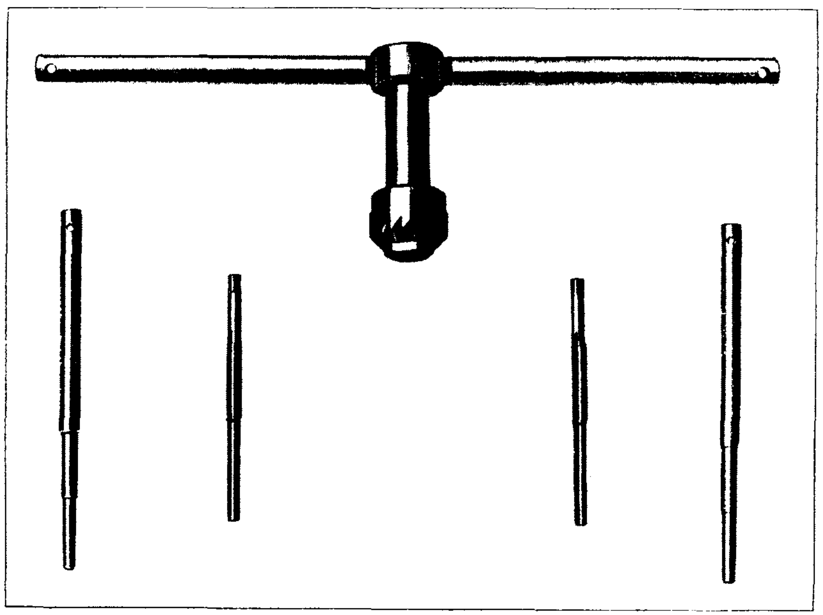
No. 72. March 5, 1918 Harley-Davidson Motor Co., Milwaukee



**[Revised Edition of Service Bulletin No. 54]**

## Cylinder Exhaust Seat Reaming Tool and How to Use

The tool shown in the accompanying illustration should be part of the equipment of every repair shop. It can be used practically on all models and is a necessity for first class valve seating work. The tool consists of the reaming cutter complete with detachable handles, two pilots and two guide reamers. One pilot





and reamer are standard size and one each 1-32 inch oversize. The oversize guide reamer and pilot are used on cylinders with badly worn valve stem guides in which the standard size pilot would fit very loosely. The tool is well designed and the material and workmanship are of the best. The price is $10.00 list. Order the tool by No. FK824.

The reamer is demountable and includes a specially heat treated tool steel cutter. It will give a long period of service before sharpening of the cutter is necessary. When sharpening does become necessary, the cutter can be sent to us. It is removed after taking off one nut.

Another important feature of the tool is that the pilot is held stationary, being a press fit in the cylinder guide. The reamer turns on the pilot. This gives the reamer an accurate guide, insuring a good seat and preventing chattering of the cutter.

Carefully read the following, explaining why and how to use the reamer. Keep these instructions for reference and follow them carefully to get the best results.

## Why the Valve Seats Should be Reamed

When a motor has been run for some time with a poorly seating exhaust valve, the cylinder and valve seat will be found pitted considerably. A seat in this condition should not be ground with a valve grinding compound to regain a good seat, for the following reasons:

1. Excessive grinding will be necessary to remove the pits in the cylinder and on the valve.

2. The valve being considerably harder than the cylinder, the cylinder seat will naturally be considerably lower after such grinding. This will allow the valve to seat deeper in the valve chamber. As a result the clearance between the valve and the cylinder when the valve is in the raised position will be reduced, the motor will not be properly scavenged and will load up with burnt gases. By using the reamer, no more stock than absolutely necessary need be removed.

On the 1917 and 1918 twin motor the approximate clearance between the exhaust valve and cylinder seat when the valve is in its raised position is 3-8 inch. Assuming that a pitted valve and seat are ground in, it can be understood that this clearance will be reduced by the time the valve seats and, combining with this the natural wear caused by the closing of the valve, it is easy to see that the size of the opening will be cut down considerably. A reduced opening will prevent free escape of the exhaust gases and therefore reduce the power and speed.

3. Excessive grinding or lapping will ruin the straight face of the valve and cylinder seat and allow only a very narrow seat. This can be understood if it is considered that during the operation of grinding, the compound is forced away considerably more from the center of the seats than from the outer edges. The greater amount of compound on the outer edges naturally will remove more stock and make the seats oval instead of a straight 45° taper.

# How to Use the Exhaust Seat Reamer and Facer

The cylinder exhaust valve seat cannot be re-reamed while the motor is in the frame. Remove the motor, take off the cylinder and strip it of the exhaust valve and inlet housing assembly. To properly hold the cylinder during the process of reaming, clamp it in a vise as in the illustration. Note that the cylinder is resting on a block of wood and that the cylinder base is clamped in the vise jaws. This is the best method for holding the cylinder to safeguard against damage, if no cylinder clamping plate is available.

## Clean and If Necessary Ream the Valve Guide

After inspecting the seat and determining that re-reaming is advisable, inspect the cylinder valve guide. If the guide does not appear badly worn, clean it of carbon with the standard guide reamer. Be careful not to ream the large or top diameter of the guide any deeper than 1 3-8 inch. If the cylinder guide is very badly worn, ream it with the 1-32 inch oversize guide reamer. This will allow the pilot to be held centrally and firmly which is essential to good reaming. A 6 inch tap wrench will enable turning the guide reamers easily.

The design of the tool is such that the pilot must be held stationary. The reamer or cutting tool must turn on the pilot. This construction will hold the reamer absolutely true, thereby eliminating all chattering and making a smooth job.

## How to Use the Reamer

After the guide has been reamed, select the pilot which is a good snug fit in the cylinder guide. Force the pilot in by hand as far as possible, to hold it firmly. These instructions are very important because if the reamer is allowed to "wobble" while the seat in the cylinder is being reamed, an uneven and poor job will be made. The exhaust valve must seat squarely and firmly, otherwise the motor will not be flexible and the burning gases passing by will again burn the seat in a very short time.

Place the seat reamer over the pilot. Use the reamer to cut through the hard scale as shown in the illustration and explained in the following paragraph. Be careful never to turn the reamer in the reverse direction and when stopping a cut to change position so that you can reach the other handle, be sure the same cut is kept right on. Never allow the reamer to stop without completing the cut.

The fact that the reamer will not cut when you first attempt to ream the seat does not indicate that the reamer is dull,



but is due to the hard scale which the heat forms on the exhaust seat. To save the cutting edges of the reamer, do not attempt to force the reamer through this scale by pressing squarely. Instead, exert a slight pressure on one end of the wrench handle, (being careful not to press hard enough to spring the pilot), then give the wrench one complete revolution and the hard scale should be cut through. After the scale has been cut, the seat should be trued up. This is done by pressing lightly and squarely on the center of the reamer while giving it about three or four complete turns, depending on the condition of the seat.

Care should of course be exercised when re-reaming a seat not to remove too much stock, because the exhaust valve may at no time be below the bottom of the valve chamber. If the seat is deep enough to allow the valve to rest too low, the bottom of the valve chamber should be turned down. This requires special tools and a cylinder in this condition should be referred to us.

## Do Not Lap a Pitted, Burned or Warped Valve

A valve that is badly pitted, burned or warped should not be lapped in a cylinder with a re-reamed valve seat. Such lapping will have the effects on the seats already described.

A valve that is badly pitted, burned or warped should be dressed off in a lathe or grinder. Very often a grinder will be found most convenient because the very hard scale which forms on the valve seat will quickly dull the lathe tool. If you are not equipped to reface exhaust valves, refer them to us. A valve that is very badly worn, burned or warped should be replaced.

## How to Fit and Grind Exhaust Valves

After the seat has been properly reamed and the valve placed in good condition or a new one selected, proceed to grind in the valve. If the oversize guide reamer was used to true up a badly worn cylinder guide, be sure to fit an oversize valve; 1-32 inch oversize valves are carried in stock at the factory. Great care should be taken during the valve grinding operation not to grind too much, otherwise the straight tapers of the valve and cylinder will be ruined. Give the valve only a few turns, take it out of the cylinder and inspect the seats. Do not expect to find a polished ring around the valve seat from this little grinding, but make sure that the valve seats properly before assembling.

## How to Test Whether a Valve Seats

One of the simplest and most accurate means of testing whether a valve seats is to mark the seats of the valve and cylinder with pencil marks about 1-8 inch apart. Place the valve in the cylinder and with a screwdriver give it 1-4 turn. Remove the valve and inspect the marks. If the marks are erased equally the valve is seating properly.

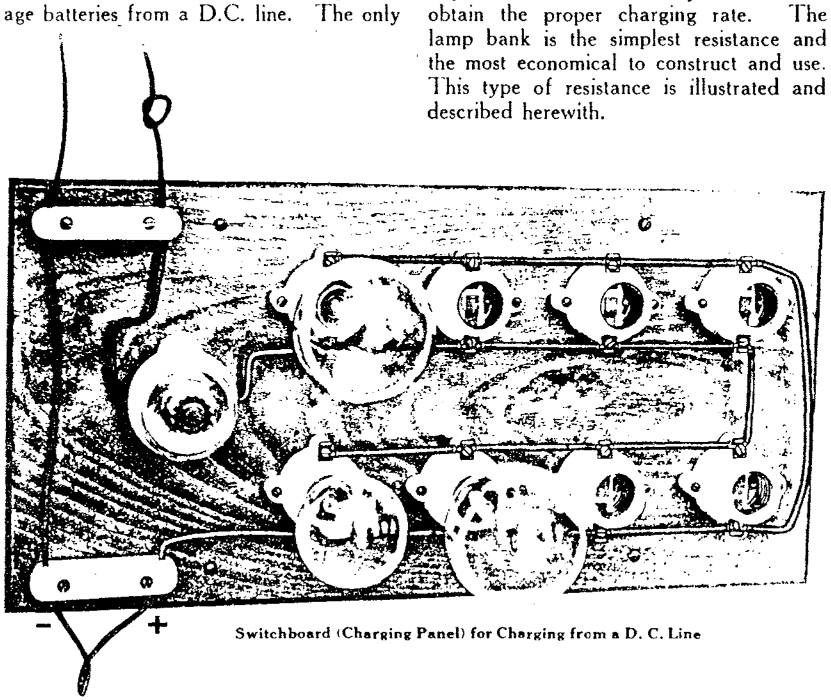
# Service Dept. Bulletin

No. 82. July 5, 1919 Harley-Davidson Motor Co., Milwaukee

## To Charge Storage Batteries

### To Charge Batteries from a D. C. Line

A rectifier is not needed to charge storage batteries from a D.C. line. The only requirement is the necessary resistance to obtain the proper charging rate. The lamp bank is the simplest resistance and the most economical to construct and use. This type of resistance is illustrated and described herewith.




Switchboard (Charging Panel) for Charging from a D. C. Line

### Making a Charging Panel

The charging panel can easily be constructed by anyone at an expenditure not exceeding $10.00. The complete lamp bank consists of the following: One 220 volt, 10 or 20 ampere, snap or double pole knife switch; six 120 watt, and two 60 watt carbon lamps; about 10 feet of No. 14 wire; 2 porcelain cleats, and 8 porcelain screw base sockets. Since it is seldom necessary to use more than 6 amperes in one circuit while charging the small motorcycle battery, a larger lamp bank is not necessary.

Carbon lamps should be used because they are inexpensive, allow more current to flow and the danger of breakage is less than with tungsten lamps. For the panel, use a well seasoned board which has been given a coat of asphaltum paint, to meet with the fire underwriters' rules. When wiring the panel, put the resistance (or lamps) in series with the positive (+) wire. Connect the negative (—) wire directly from the 110 volt line to the negative (—) of the battery.

An ammeter is not necessary in the charging circuit because the lamps themselves are sufficient indication of the approximate rate of current flowing.

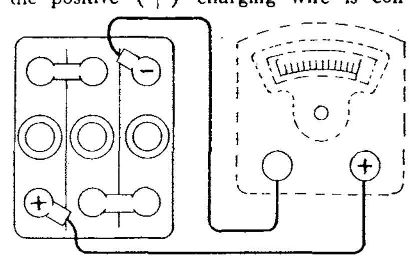
### Charging Rate Table with Lamp Resistance

| Number | Size of Lamps | Approximate Amount of Current That will Flow Through Lamp at 110 Volt Pressure |
|---|---|---|
| 1 | 60 watt (16 CP) | ½ ampere |
| 1 | 120 watt (32 CP) | 1 ampere |

The charging panel just described is for a 110 volt D.C. line only. To charge from a 220 volt circuit it will be necessary to have two lamps in series for each one on the board as illustrated, to obtain the correct charging rate.

### To Determine Polarity of Charging Wires

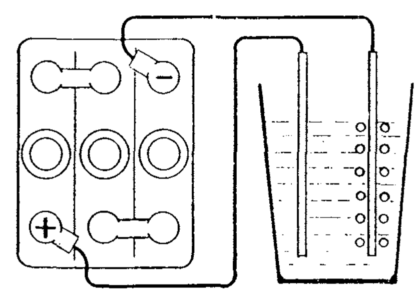
In arranging the panel be careful that the positive (+) charging wire is con-



Voltmeter Test, Showing Polarity of Storage Battery Wires

nected to the "POS" (+) terminal of the battery, and the negative (—) charging wire to the "NEG" (—) terminal of the battery. If a voltmeter is at hand, the polarity of the charging wire can readily be determined. The positive binding post of the voltmeter is marked (+) and when connected to the (+) battery terminal, or to any direct current line, providing the voltage does not exceed that of the voltmeter, the movement of the needle showing the voltage will indicate that the current is flowing through the meter in the proper direction. If the "POS" (+) of the voltmeter were connected to the "NEG" (—) of a charging wire, or "NEG" (—) terminal of a battery, the needle would read backward.

When a voltmeter is not at hand, the polarity of the charging wires can be determined as follows: We refer here to the wires from the socket that bring the current to the panel, rather than to the battery wires, although the polarity of the latter can be determined in the same manner. Without bringing the wires together, place the ends of the charging wires into a glass of water in which a tablespoonful of salt has been dissolved and turn on the current. The wire on, or from which, the greater amount of bubbles will form is the negative wire.



Salt Water Test Showing Polarity of Storage Battery Wires

To make this test safe, screw a lamp, either 16 or 32 C.P., into a socket and then connect the socket in series with one of the wires leading from the 110 volt circuit that is to be tested for polarity. This will prevent any trouble should the ends of the 110 volt line wires be touched together. Place the end of this wire with the end of the other charging wire into a glass of salt water as described, and the "NEG" (—) wire will be easily indicated.

As soon as the polarity of the charging wires has been determined, make a knot in the positive lead and place the lamps in series with that wire. The negative lead connects directly with the negative battery cable. Mark the places where the wires leave the panel (+) and (—). The arrangement of the wires and the connections are clearly shown in the accompanying illustration. Wire the switchboard accordingly.

## Regulating the Charging Rate

When charging a 3ZA5 Exide battery from a 110 volt line, using carbon lamp resistance, bear in mind that the normal charging rate is 1 ampere. This means the finishing rate at which a battery of this type should be charged. When the battery is first put on the line it may be charged at 2 or 3 amperes, but just as soon as the battery begins to gas or the electrolyte to bubble, the battery is nearing a complete charge and the 2 or 3 ampere rate of current is not being utilized. Then the current rate should be cut down to 1 ampere or even ½ ampere to finish the charge. To get a current of 2 amperes through the battery, screw 2 of the 32 C.P., (120 watt), lamps into the sockets. Screw out the other lamps far enough so that they do not burn.

*Remember that the normal charging rate is the same whether one or several batteries are charged because the full charge passes through each battery.* When charging from an A.C. line, the charging rate is increased one or two amperes for every battery added to the line because the batteries are connected in parallel, but for charging from a D.C. line with batteries connected in series, one ampere will flow through six batteries as well as through one and the charging rate should never be raised above 3 amperes at the highest unless an automobile battery is charged. Of course, the 3ZA5 battery may not be charged at the rate of charge of an automobile battery.

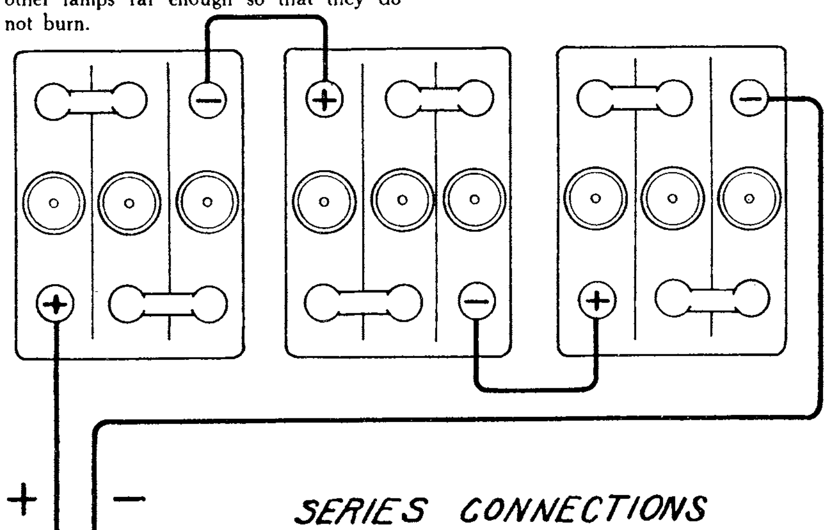



**Diagram of Three Batteries Connected in Series**

## To Charge More than One Battery

When more than one battery is to be charged, connect the batteries in series, that is, positive to negative, negative to positive, etc., as shown in the illustration below. *The two remaining ends, one positive (+) and one negative (—) must be connected to the "POS" (+) and "NEG" (—) of the line respectively.* When more than one battery is being charged in one circuit, do not depend on the exact current rate because the internal resistance of the cells causes the current to drop slightly. If 1 ampere is to flow through 4 batteries, screw in 1, 32 C.P. and 1, 16 C.P. lamp. To fully charge an average battery requires from 24 to 36 hours, depending on how low the discharge has been allowed to run and how long the battery has been discharged.

Keep on charging the battery until the specific gravity reaches a maximum, that is, a point when two hydrometer readings taken at about a two hour interval, show no rise in specific gravity. If a voltmeter is used to ascertain the condition of the battery, charge at a 1 ampere rate until the voltage of each cell reaches a maximum. With 1 ampere flowing, the voltage per cell will read from 2.45 to 2.50 volts when the battery is fully charged. If more than 1 ampere is flowing through the battery when this reading is taken, the voltage reading will be misleading.

## Important Facts When Charging Batteries

Never charge a battery at a high current rate because this only causes injury. High charging rates overheat the battery and cause excessive gassing which wears and loosens the active material of the plates unnecessarily and will also buckle and weaken them. 70°F. is the normal temperature of the electrolyte when charging, but up to 110°F. is permissible. Never allow the temperature to get over 110°F.

While a battery is charging, the temperature rises, naturally causing the electrolyte to expand. Therefore after a battery has been recharged and allowed to cool, it may be found that the solution is below the top of the separators. Add disstilled water to cover the separators by ¼ to ⅜ inch. Always charge a battery with the vent plugs in place and turned down tight, or remove them entirely.

When a battery begins to gas, it is nearing a complete charge, provided it is in good mechanical condition, and the charging rate should be reduced to normal, 1 ampere.

When a battery is fully charged, very little of the acid remains in the plates. When it discharges, the acid leaves the electrolyte and combines with the plates. This explains the difference in the hydrometer readings. In a discharged battery the electrolyte is practically free from acid, therefore light, and the hydrometer reading is low. In a fully charged battery the acid has been driven out of the plates by the charging current and restored to the electrolyte, making the latter heavier and giving a greater hydrometer reading.

The specific gravity of a normally discharged battery is 1.125 to 1.150.

The specific gravity of a half charged battery is 1.200.

The specific gravity of a fully charged battery is 1.275 to 1.300.

If the specific gravity reading is under 1.125 the battery is abnormally discharged and will require considerable charging to put it in first class shape.

If acid has been added to the battery, a greater reading than 1.300 will be obtained and the battery should be charged until a maximum is reached. If this maximum is over 1.300, draw off some of the electrolyte and add distilled water until a maximum of from 1.275 to 1.300 is obtained.

# To Charge Batteries from an A. C. Line

The dealer who can get only alternating (A.C.) current must have a means of converting this current to direct current (D.C.) to charge batteries because direct current only may be used for this purpose. This is where the rectifier is used, an instrument which changes A.C. current to D.C.

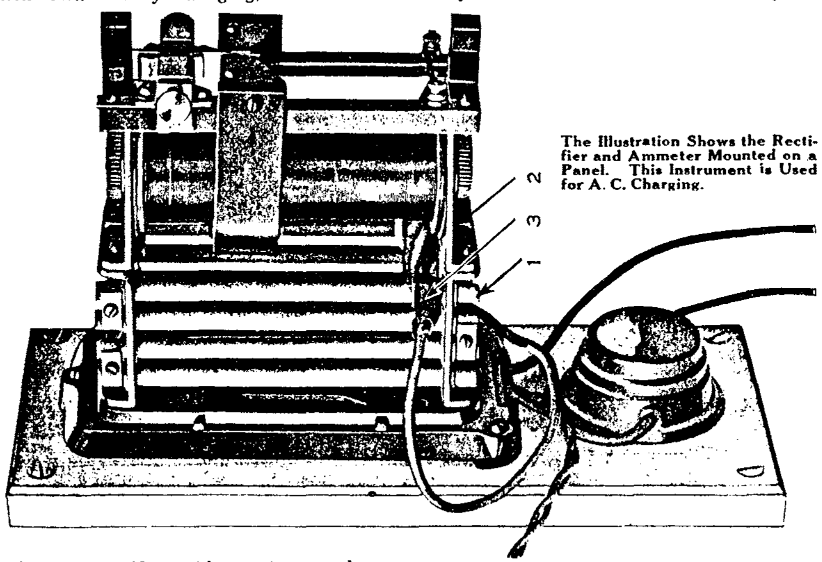
As explained under D.C. charging, the motorcycle battery is almost in a class by itself. Its charging rate is so low that it cannot be charged on the same line with automobile batteries without being damaged. Many garages and even battery charging stations, through ignorance or carelessness, charge small batteries at high rates.

Because these conditions exist and knowing that many dealers wish to do their own battery charging, we are furnishing a rectifier with an improved resistance that is ideal for the charging of small batteries. With the resistance, the current can be regulated to charge from one to eight batteries and the charging rate for one battery can be held at less than one ampere.

The rectifier can be used by every dealer who does his own battery charging and cannot get direct current. Various apparatuses were tested by our engineering department and the rectifier that was best suited to our needs was adopted. Quality, efficiency, life and cost of installation were considered.

The rectifier is generally made for use with 110 volt alternating current 60 cycle frequency. This is the type current commonly used, but before ordering a rectifier we suggest making sure that your voltage and cycle frequency are 110 and 60, respectively, and if they are not, to state so when ordering.

The instrument is not furnished mounted as illustrated, but anyone can make a first class job of mounting with a 1 inch board and a few screws. The assembled panel can then be attached to a wall, and be out of harm's way. The wires are fitted into a socket and the charging leads are ready to be connected to the battery.




**The Illustration Shows the Rectifier and Ammeter Mounted on a Panel. This Instrument is Used for A. C. Charging.**

The price of the rectifier complete with resistance and ammeter is as follows: Type 166-R, F-F Magnetic Rectifier with rheostat, ammeter and sufficient wiring for mounting as shown in illustration, $30.00, F.O.B. Cleveland.

Shipping weight about 20 pounds.

# To Charge Batteries with the F-F Rectifier

In charging storage batteries through the use of a rectifier it is also important to connect the positive, (+), wire of the rectifier with the positive, (+), wire of the storage battery, and the negative charging wire with the negative battery wire.

The positive and negative rectifier charging wires, (wires that connect rectifier to battery), can generally be identified as follows: the positive wire is red and the negative wire is black.

It is, however, advisable to test the charging wires to make sure which really is the positive and negative. If no voltmeter is at hand, the simple salt water test described under "Direct Current Charging," should be applied. However, do not connect a lamp in series with one of the wires because this is only used when determining the polarity of direct current.

Once the positive wire has been determined, place a knot in it, according to common practice, thereby doubly safeguarding against making the wrong connection.

# Regulating Charging Rate

When charging a battery, make sure that the positive wire of the rectifier is connected to the positive pole of the battery, marked "POS," (+), or indicated in red. Connect the negative wire of the rectifier to the negative pole of the battery marked "NEG," (—). If the "NEG," and "POS," marks on the battery poles cannot be seen, the polarity of the battery can be ascertained in identically the same manner as the polarity of the rectifier.

After the battery has been properly connected, insert the plug into the lamp socket and note the charging rate on the ammeter. The charging rate is regulated by moving the clip "3" between the points "2" and "1" on the resistance unit. The end of point "2" cannot be seen because it points to the extreme end of the resistance on the right side of the instrument where the highest charging rate is obtained. With the clip at point "1" the entire resistance is cut in or the charging rate is at a minimum. At point "2" the entire output of the rectifier enters the battery. The resistance allows for a wide range of battery charging rates. From one to eight or even ten batteries can be charged at one time. No fixed position for the resistance clip can be given to charge a certain number of batteries. By connecting the clip in various positions on the carbon bars, varying charging rates will be obtained that can readily be noted on the ammeter.

It has always been recommended to charge the motorcycle battery at a one ampere rate. However, with the F-F Rectifier the charge can be started at two or three amperes. In fact when a rider is in need of his battery, a higher than one ampere charging rate is recommended, because the battery begins to warm up and charge sooner. There is no danger of overcharging because as the battery becomes charged, its resistance cuts down the charging rate until, when the battery is fully charged, the current automatically tapers off to a fraction of an ampere.

Do not charge one battery at a higher rate than three amperes and as soon as the battery begins to bubble or gas, reduce the charging rate to one ampere or less. If a battery is not in healthy condition, that is, if it is internally damaged, its resistance will not cut down the charging rate. Therefore, when the temperature of the solution rises about 110° F., or when the battery begins to bubble or gas freely, reduce the charging rate.

# To Charge More than One Battery

When more than one battery is to be charged, connect the batteries in parallel as shown in the illustration. All positive wires of the batteries must be inter-connected to the positive lead of the rectifier. The negative battery wires must be connected in like manner with the negative lead of the rectifier.

If the rectifier is being used to charge one battery and another battery is connected, connect the batteries in parallel and change the position of the resistance clip so that a greater charging rate will flow through the ammeter. Adjust the flow of current with the resistance whenever another battery is added to, or removed from, the charging line.

When one battery is to be charged, allow two amperes of current to flow through the battery and cut out more resistance by moving the resistance clip from "1" towards "2," for each battery that is added to the charging line. Since one battery can be started off at two amperes, two batteries can be started at a four ampere charge, three batteries at six amperes, bearing in mind always that the charging rate must be reduced when the batteries begin to gas and the temperature of the solution rises above 110°F.

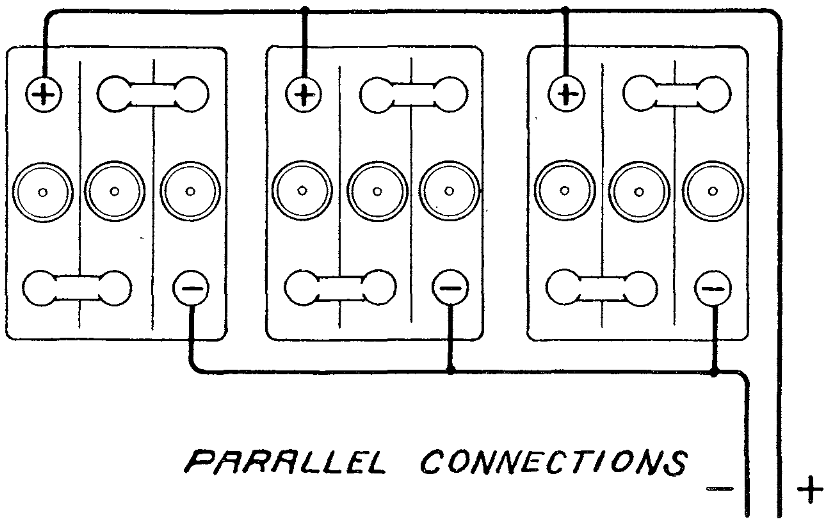



**Diagram of Three Batteries Connected in Parallel**

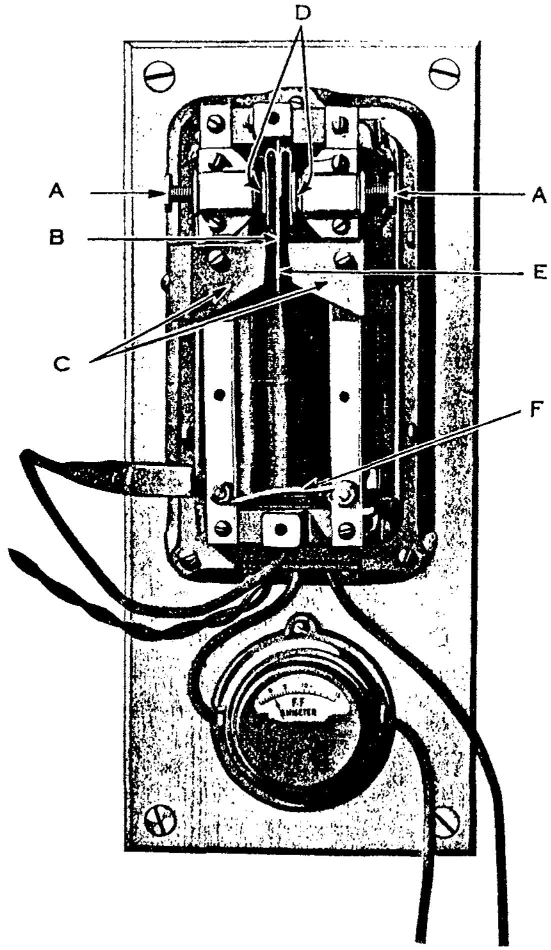
## To Adjust the Rectifier

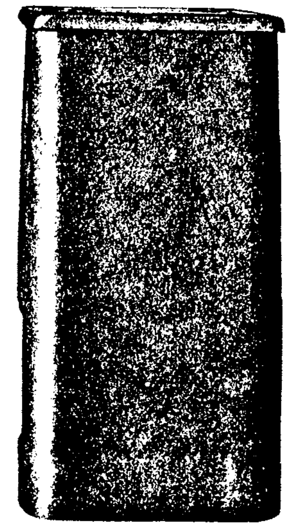
To adjust the rectifier the knurled screws "A" should first be turned outward or away from the armature. Then screw them inward. By proceeding in this way pressure will be applied to both carbon brushes which will prevent them from backing up and getting out of adjustment automatically. Be sure to have the armature "B" central between the pole pieces "C" of the magnets.

There should be a small gap at "D" between both of the carbon and copper electrodes when the rectifier is not in use. This prevents any back flow of current from the battery when the rectifier is idle and will allow the armature to vibrate freely when in use. It is very important to have the carbon brushes seat squarely against the copper electrodes.

## To Adjust the Charging Rate

The maximum output of the rectifier is regulated by sliding the small brass weight "E" on the armature spring, up and down. This weight, however, is set by the factory for best results and should not be moved unless conditions warrant.



## Fuse Protection

The rectifier is provided with a fuse "F" per illustration. With the 110 volt rectifier the fuse is of 20 ampere capacity and protects the instrument should the load be excessive, that is, over 20 amperes. If with the resistance clip "3" on contact with carbon rod at "2" end, a battery in fair condition were connected in reverse with the charging wires, that is "POS" (+) to "NEG" (—) and "NEG" (—) to "POS" (+), the fuse would blow. This of course does not apply to a dead battery because such a battery has no opposing current. If a fuse burns out do not replace with a fuse of more than 20 ampere capacity. Should the vibrator be working and the ammeter not show any deflection or there were no current at the charging wires, it is possible that the binding posts which hold the fuse are loose, or that the fuse is blown.

The thought may occur that because you use D.C. current, the subject of charging with alternating current does not interest you, or you may be interested in charging from an A.C. line and feel that you are not concerned with the subject of charging from a D.C. line. On the contrary, both subjects contain important information on battery charging and every dealer and mechanic will find it to his interest to read them carefully.

# Service Dept. Bulletin

No. 86. June 15, 1920. Harley-Davidson Motor Co., Milwaukee

## Use Our Order Form No. 1315 for Replacements and Repairs

Use a separate sheet for repairs, exchange or replacement as the case may be. Number each order and keep a duplicate copy for your file. If it is desired that a number of orders be shipped together, mark them accordingly. Example: Ship orders, 846, 847, 852 and 854 together, by express, freight or parcel post, as the case may be. Make your instructions explicit; this will prevent errors and confusion, and will also help greatly to get your goods returned more promptly.

These forms will be furnished free upon request, therefore, see that you have a supply on hand and *use them* for better service.

## The Reason for a Steel Plate Under One Cylinder Only

All Harley-Davidson motors are mechanically balanced in order to eliminate vibration and to produce the highest efficiency. Uniform combustion in both cylinders is first in line for obtaining mechanical balance. The design of the slope head type of cylinder, now used as standard equipment, is such that the foundry men cannot keep within the correct compression limits in the course of manufacturing.

To equalize the combustion, makes necessary the use of a thin steel plate (Shim) under the cylinder having the smallest compression chamber. For this reason you may get motors with a plate under either cylinder or no plates at all.

Side car motors may have an additional plate, besides the customary 1/8 inch compression plates, under one of the cylinders.

When disassembling a motor, note the number and thickness of plates under each cylinder. It may be well to mark the plates in order to put them back in their respective places.

## Sprocket Combination for Double Sidecar

In order to have a well balanced combination, especially when driving in a rough or mountainous country, the following set of sprockets have proven satisfactory:

Engine sprocket, 14 teeth.
Countershaft sprocket, 28 teeth.
Clutch sprocket, 43 teeth.
Rear wheel sprocket, 48 teeth.

This set of sprockets gives a gear ratio of 5.27 to 1.

Under the most favorable conditions a 15 tooth engine sprocket may be used; however, we advise the lower gear as it will relieve the motor of unnecessary strain.

## Engine Clamp Plates on Repaired Frames

Effective May 1st, engine clamp plates and bolts will no longer be furnished with repaired frames. However, they can be ordered from the Parts Department or fitted to repaired frames if specified on the repair order.

## The Three Plate Type of Exide Battery

The Exide 3KZ3 type of battery has been used as standard equipment on all 1920 J models. Owing to the design and construction of the battery it is superior to the five plate type, its life being much longer.

There are three cells, each cell containing an element, each element consists of three heavy duty plates, one positive and two negatives. The plates are identical with those used in automobile starting and lighting batteries; they are 1/4 inch thick and are insulated with perforated rubber and thick wood separators.

The capacity or condition of a storage battery cannot be determined by striking the terminals together and observing the arcing or "spark." When the terminals of a three plate type of battery are brushed together, the "arc" is not so intensive as that of a five plate battery. However, this does not indicate that the battery is not in a normal condition.

The proper method of determining the exact condition of a storage battery, is to use a battery hydrometer.

The ampere hour capacity of the 3KZ3 battery (engine not running) is 7½ hours. Meaning that one ampere can be drawn from the battery for 7½ hours before recharging is necessary.

## Fitting The Sport Model Manifold

When assembling the sport motor, care must be exercised in fitting the manifold. The flat surface of the cylinder inlet and exhaust ports must perfectly align with the flat port surfaces of the manifold to prevent leakage at the junction. Examine the copper gaskets and see that they are in a good condition.

Assemble the rear cylinder to the crank case and securely tighten the base nuts, then put the front cylinder in place and tighten the nuts just enough to hold the cylinder in position without binding it.

Fit the manifold and securely tighten the two nuts holding it in place. The reason for leaving the front cylinder base nuts loose is to permit the cylinder to turn and align the ports with the manifold face. The cylinder base stud holes are a little larger than the base studs, therefore, allowing the cylinder to turn slightly. Assuming that the manifold has been properly fitted, securely tighten the front cylinder base nuts.

Test the manifold and cylinder junctures by squirting gasoline over the joint when the motor is running.

## Sport Model Carburetor

If the carburetor overloads (chokes) when accelerating the motor, or the motor is sluggish in pick up, it may be necessary to change the carburetor float level to remedy the cause.

Lower the float level to 21/32 inch and try the result. The characteristics of different motors may make it necessary to try several float settings before the required result is obtained.

# Sport Model

## Assembling Sport Model Motor Into Frame

Set the motor in the frame and assemble the motor clamp plates and pass the studs through from the left side. Fit the right side clamp plates and securely tighten the stud nuts. Do not force the studs through the lugs.

Assemble the foot board support rod bracket on the right side of the crank case. The studs holding this bracket pass through the crank case. One stud is $5\frac{1}{4}$ inches long and the other is $2\frac{5}{16}$ inches long.

### Assemblies to be Made From Left Side.

Fit and adjust drive chain.

Assemble chain guard front end, place lock washers under nuts and tighten.

Assemble and clamp front foot board support.

Assemble and adjust three speed shifter rod.

Fit hand oil pump pipe.

Assemble starter with rear foot board support rod in position, and tighten lock nut on support rod.

Place rock plate rear clamp bracket on the rear foot board support rod, and place the entire assembly in position on the crank case.

Place two lock washers on crank case starter clamp bolts, followed by two nuts which should be permanently tightened.

Fit and adjust magneto control.

Remove all the screws in the felt washer retainer at the left side main bearing and fasten the inner flywheel cover in position.

To get this cover in position the starter crank pedal must be held down at its lowest point.

### Assemblies to be Made From Right Side.

Remove the two lower front cylinder stud nuts and assemble rock plate on these studs. Replace nuts and tighten.

Fasten the rock plate in the rear to the clamp on the rear foot board support rod.

Fit the compression release rod.

Put spark plugs in cylinders.

Assemble manifold with copper gaskets between manifold and cylinders.
(See special manifold instructions.)

Place two lock washers, followed by two nuts on manifold clamp studs and tighten.

Assemble carburetor to the manifold, placing a paper gasket between the union.

Assemble and tighten right foot board and brake assembly.

Place cotter pin in rear brake rod coupling.

Fit mechanical oiler pipe.

Fit gasoline pipe.

Make the throttle control connections.

Be sure the strain on the carburetor throttle shaft is relieved, that is, adjust the control so that when the right grip is turned entirely off there is a slight shake in the throttle shaft. This reduces the amount of wear on the carburetor shaft to a minimum.

### Assemblies to be Made From Left Side.

Place pin in main shaft and place starter gear spring washer on shaft with pin fitting into recess.

Place starter gear spring on shaft, followed by starter gear, flywheel key, flywheel, flywheel tongue washer and flywheel lock nut.

Tighten flywheel lock nut and bend washer over one flat side of nut with a chisel.

Assemble chain guard.

Assemble flywheel cover (outer).

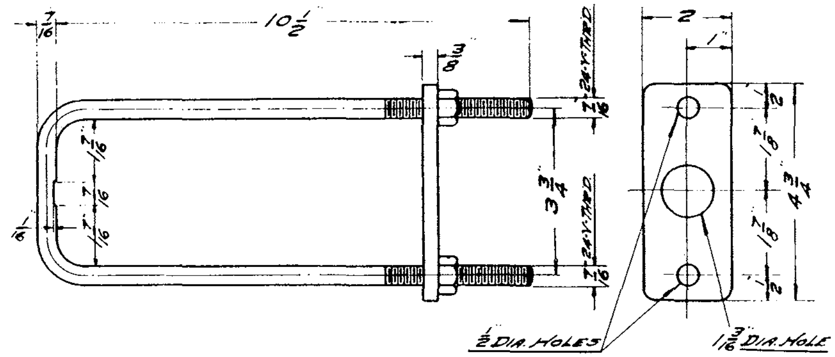
Assemble left foot board and adjust clutch control.

Place washer and cotter pin in clutch control coupling.

Place exhaust pipe in position and assemble muffler.

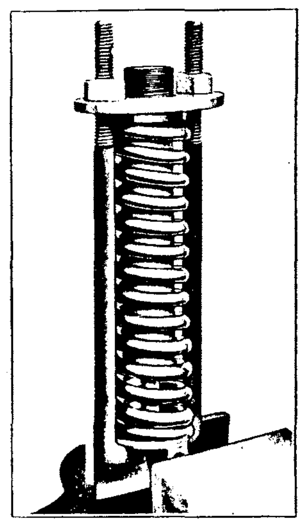
The muffler is supported to starter frame by the front muffler bolt, and is supported in the rear by a frame bracket that also clamps the muffler tail piece.

# Tool for Replacing Recoil Spring Guide Rod




The detailed drawing is self-explanatory, and with material found in the average repair shop a satisfactory assembling jig can easily be made.

It is not essential that 24 V threads be used; for that matter, use any standard $\frac{7}{16}$ inch die you may have.



# How To Use the Jig

Hold the assembly in the jaws of a vice (see illustration) and turn each nut only a little at a time until the spring has compressed enough to allow the spring guide rod to be screwed into the bracket.

# Service Dept. Bulletin

No. 66. Revised Sept. 15, 1920. Harley-Davidson Motor Co., Milwaukee

## How to Attach Top and Windshield to 1918-19-20-21 Sidecars

Locate side prop sockets along the outside edge of the arm rests and cut away just enough leather to expose the threaded hole in the props. Turn the threaded square shank studs into the side prop sockets with the square shank toward body.

Attach the rear bow rest brackets to the wooden strip which extends around the edge of the body. Remove the large headed upholstering tacks which will come under the brackets. Substitute a few ordinary tacks in place of those removed. Hold bracket in position on body making sure that lower edge lines up with wooden strip, and that distance between long stud on bracket and prop stud is about 12 3-8 inches. Mark position of rear screw hole on side of bracket and drill the wooden strip with a 1-8 inch drill about 1-2 or 5-8 inch deep and turn the screws in place. Then drill the other screw holes and turn the screws in place. No trouble will be experienced when turning in the wood screws if a little soap is placed on the threaded part of the screws first. Under no circumstances, use a hammer to drive the screws in place or fit a larger screw if a screw has been lost, because this will split the wood rib.

Place the taper bushings on prop studs with the widest part toward the upholstering. Place the top on the front studs. Hold secure with round headed square shank nuts. Pass the long hinged rods over the short rear bracket studs and secure with washer and cotton pin. Unfold the top, and bring it to shape. Pass the rear straps past the rear end of rear brackets, around under the brackets, through the slot in the bracket and then buckle them. Adjust the straps equally so that they are just tight when the long hinged rods are straightened.

If the front wind shield has previously been fitted, be sure to adjust the stop screws as explained under "To Attach Wind Shield."

Draw the curtains downward reasonably tight with straps used to hold top when folded. Adjust side curtains so that opening for back curtain is square and that sides hang properly. Fit both rear curtain fasteners to the body and attach side curtains. Locate the position for front curtain fasteners and attach to the body. When side curtains fit properly, locate and fit eyelets into rear curtain.

### IMPORTANT

Ascertain whether or not the sidecar prop socket brackets along the outside edge of the arm rests are directly opposite each other. *If they are not in line the top will not fit the body perfectly.* Measuring from the rear bow bracket studs to the side prop socket centers, the distance should be 13 1-2 inches. If they are not of equal distance, shift one of the prop socket brackets by removing the wood screws and making new screw holes.

## To Fit the Storm Curtain

Locate the position for the cowl fasteners by drawing curtain into shape over cowl and temporarily fasten the side curtains to the center bow and arm rests with small tacks. These side curtains fit outside of the top and should be drawn fairly tight. Adjust curtain by means of these tacks until assured the entire curtain sets properly. It may be necessary to move one or more of the three fasteners that



were placed into the underside of the front bow to get the curtain to hang properly. The remainder of the fasteners can now be fitted. It is necessary to place an eyelet into each lower corner of side curtains.

Two short tabs (or straps) with eyelets to hold curtain in place under top when not in use are furnished. To fold curtain disconnect from cowl and sides, fold the sides in back of window, roll apron up to window, swing entire curtain up and against inside of top. Attach tabs by means of tacks to center bow so that eyelets in tabs will line up with fasteners in curtain. Care must be taken not to buckle or crack celluloid window when folding top. If desired the curtain can be entirely detached and be carried in provided bag.

## To Attach the Wind Shield

Drill the 21-64 inch holes which are already in the 1 1-4 x 1-4 inch iron strip ahead of and opposite sidecar door, all the way through the body.

Temporarily clamp the slotted brackets marked "L" and "R" to their respective side of the body. Put the longer round bolt through the upper left hole, the shorter round bolt through the upper right hole. Put the bolts with the square head in lower holes, passing all bolts from inside.

Place fittings on large studs of brackets in following relation: fibre washers, wind shield frame, friction springs and castellated nuts. Adjust nuts until sufficient friction is obtained to prevent the wind shield moving from vibration and still be able to move it readily. When adjustment is obtained lock castellated nuts by means of cotter pins.

Attach four curtain and four glove fasteners to wind shield frame by means of provided nuts.

Place wind shield curtain on frame and adjust shield by moving it up or down to line up properly with top. Proper adjustment is obtained when the curtain fits snugly against front of top. Tighten all bracket bolts. Remove the upper left hand bracket bolt nut, pass front end of side shield over bolt and replace nut. Locate position of small clip with three holes on side arm by drawing side shield to proper tension and lining side shield up with windshield frame. Fasten small bracket to side arm using the two countersunk holes with plain hole extending downward, first drilling wood rib one-half inch deep with 1-8 inch drill. Attach spring clip to wind shield frame by means of screws and nuts, at the same time adjusting it to line up and hold side shield securely. If necessary, bend side shield at lower end so as to have it bear firmly against the top. Readjust wind shield as needed by moving it up or down to have the top, wind shield and side shield in proper relation to each other. Tighten all nuts and fittings securely and adjust set screws in square bolt for wind shield stop so that wind shield bears against set screws when it comes in contact with top.

Locate proper position for wind shield apron fittings on cowl being careful not to draw wind shield apron too tight.

## To Fit Right Side Curtain

Snap lower rear glove fastener into place. Locate position for upper glove fastener screw in center bow. Screw same in place and attach curtain. Remove right side of wind shield curtain, draw right curtain snugly in place and over wind shield frame and cowl. Mark location of eyelets and insert latter in place. When in use right curtain is to be placed under wind shield curtain. To enter or leave sidecar loosen only rear end of right side curtain and push wind shield forward.

## To Fold Top

Roll up rear curtain and fasten with provided straps. Loosen the side curtains and throw them over the top. Be careful when folding top to keep these in place. Do not overlook to strap top down securely and use slip cover to keep top clean.

# Service Dept. Bulletin

No. 88. October 15, 1920. Harley-Davidson Motor Co., Milwaukee

## Instructing your Riders on Cold Weather Starting

By the time cold weather sets in, the average riders' cylinder priming cocks are completely closed with carbon. The cocks should be removed and cleaned with a fine wire, also the holes in the cylinders should be opened to permit gasoline to enter.

A quick and satisfactory method of priming the sport model motor, **is to open the auxiliary air shutter on the carburetor and with the throttle wide open, inject a priming gunful of gasoline into the carburetor mixing chamber. Partially close the throttle, pull out the starting button** and crank the motor.

## Worn Carburetors

Carburetors that have been functioning properly in warm weather may cause trouble when the cold weather arrives. The main reason is due to the throttle shafts, air valves and air valve adjusting screw stems being worn and permitting air to leak into the mixture and weaken it. **Most all carburetors after one year's service are subjected to this trouble. To overcome such trouble, an oversize throttle shaft must be fitted and a new air valve and adjusting screw installed.**

## Fitting an oversize Trottle Shaft

Separate the throttle disc from the shaft by melting the solder. After the disc has been removed the shaft can be pulled out of the body casting. A good method for soldering or removing throttle discs, is to use an old "brilliant burner" and a Prest-O-Lite tank.

Enlarge the throttle shaft hole in the body casting by using a 1/4 inch drill. Fit the oversize shaft, throttle disc and throttle disc washer. Remove the cam casting from the original shaft by driving out the small pin. Ascertain the correct location of the cam casting on the new shaft and drill a 1/32 inch hole through the shaft. Key the cam casting to the shaft by means of a suitable pin.

If there is more than .010 inch clearance between the air valve and adjusting screw stem, renew the air valve and air valve adjusting screw. **The air valve spring should hold the valve closed with a pressure of 6 ounces. Do not stretch the spring to give this tension; use a new spring.**

**Invert the carburetor bowl and measure the float level. The measurement should be taken from the cork float, opposite the float lever bearing. From the edge of the bowl to the cork float should measure 19/32 inch. The float level can be corrected by bending the float lever. Care must be exercised when bending the float lever to prevent breaking the cork float.**

**By overhauling the carburetor as just outlined, cold weather difficulties will be overcome and all the difference in the motor's operation will be noticed.**

## Exchange Carburetors

The Service Department exchanges carburetors at a remarkably low price, the average carburetor exchange being $5.00. These service carburetors have been overhauled by the Schebler factory and are in perfect working order, any worn parts have been replaced **and the carburetors tested according to Schebler standards. Every dealer should avail himself of this opportunity. Send your carburetors in and have them exchanged; give your customers real factory service.**

## Sport Model Gasoline Dirt Trap

Owing to the dirt and sediment in the present market gasoline, the filter screening surface in the dirt trap easily becomes clogged. It is recommended that the dirt trap be cleaned at least every 1000 miles.

## Sticking Exhaust Valves

With cool mornings comes the sticking exhaust valves. No other trouble vexes the rider more. However, with a little effort on the riders' part, sticking exhaust valves can be made a thing of the past. More motorcyclists should appreciate the value of flushing the motor with kerosene.

After lubricating oil has been used under great heat and pressure it becomes undesirable for further use in an internal combustion engine. Such oil is divided, more or less, into two elements, wax and an oil with no body or lubricating properties. Such an oil is usually called a "cracked lubricant." Such lubricant will not properly care for the rapidly moving pistons, rings and other bearing surfaces; the wax from the oil congeals and gums up the piston rings, bearings and exhaust valve stems, preventing good lubrication and causing the riders endless troubles.

Advise your riders to flush out their motors with kerosene to thoroughly clean out all the gum and wax. Remove the spark plugs and make sure that the kerosene reaches the exhaust valve stems. Refer them to the Harley-Davidson Instruction book which fully covers motor flushing. They will be repaid by better motor service and less starting trouble.

When grinding exhaust valves always clean out the valve stem guides with our reamer FK-826.

## Importance of correct Motor Timing

From our service men's observations we learn that a number of our dealers are not paying enough attention to the motor timing when repairs are made. Every one should realize that to get the efficiency from a motor, it must be correctly timed. One may put in new pistons, rings, piston pins and a roller bearing set, yet, however, if the motor is not timed correctly, the customer loses the benefit of the new parts and consequently does not feel satisfied with his machine. We recently revised our timing bulletin No. 65, bringing it up to date, therefore we urgently request that every dealer and repairman take more interest in timing motors.

Keep your riders' circuit breaker points set according to the proper gauge. Show them how to adjust exhaust and inlet valve tappets. Help them to derive the horse power built into every Harley-Davidson motor.

## Oversize Cylinders used on Standard Motorcycles

Owing to the scarcity of material, we have been compelled to use oversize cylinders from time to time. However, in each case an oversize piston was fitted and the standard clearance maintained.

When fitting pistons to a motor, ascertain whether or not the cylinders are oversize. Oversize cylinders are stamped on the base, on the sprocket side. The cylinders will be stamped as follows: A cylinder that is .002″ oversize will be stamped 2; one that is .006 will be stamped 6 and so on. The largest oversize cylinder used is .008 inch, the smallest .002 inch.

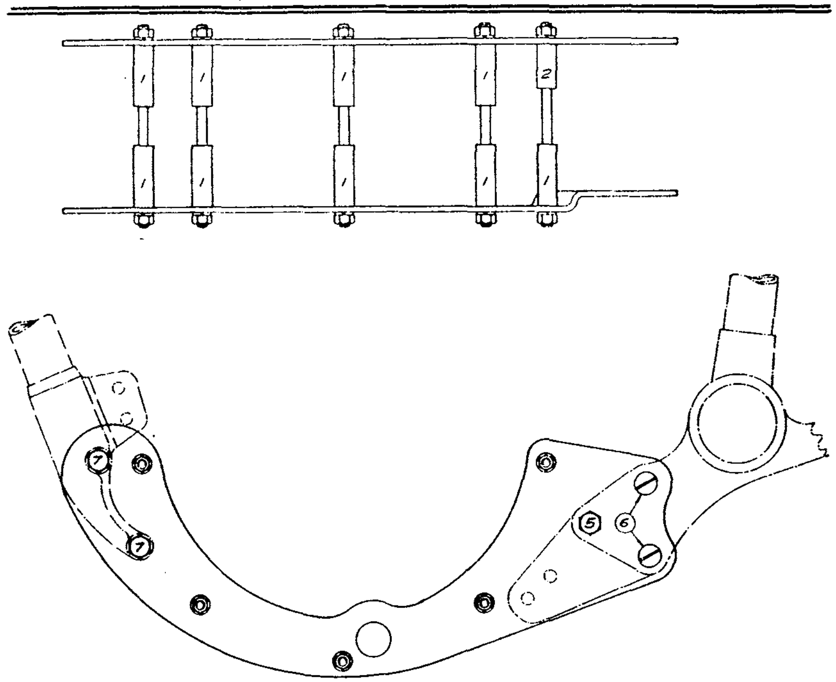
Oversize pistons to fit oversize cylinders can be obtained from the factory. Specify the size of piston wanted when ordering. Allow .003″ clearance when fitting a piston to the cylinder.

A standard cylinder should measure 3.310″ at the bottom diameter, and 3.307″ at the top diameter. A standard piston should measure 3.305″ at the skirt diameter and have the same measurement between the second and third rings.

Consult your "Motor Repair Manual" for correct piston fitting.

# Service Dept. Bulletin

No. 89. November 1, 1920. Harley-Davidson Motor Co., Milwaukee



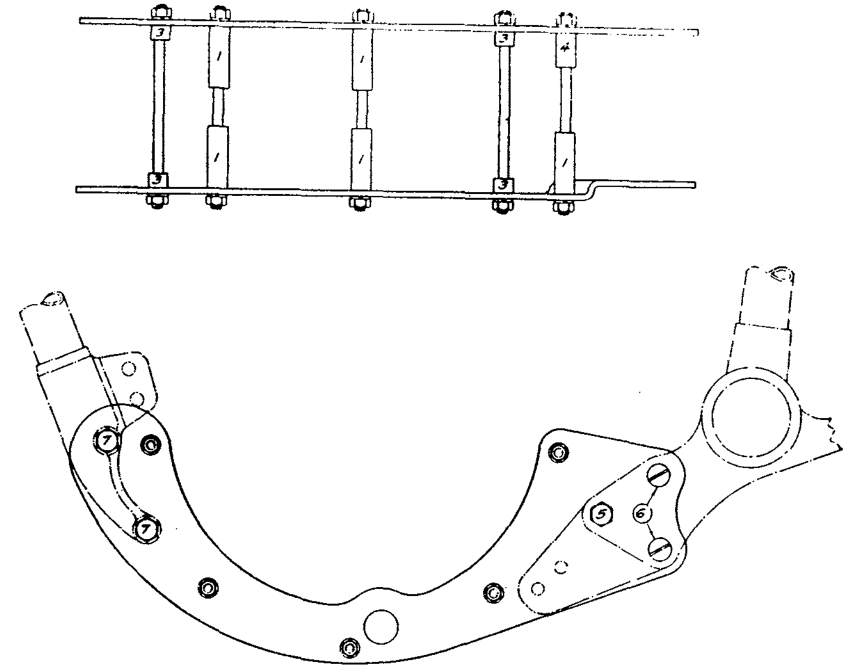
## Fitting 500 Type Motor to Dealers' Racing Frame

The 500 type motor base whether used with single cylinder or twin cylinders can be fitted to the frame by carefully following these instructions.

Fasten the crank case lugs to the frame motor brackets in the usual manner. Draw up the motor clamp bolts tight. Remove the 5 motor casing studs in order to permit the use of the long casing studs and bushings as shown in the illustration. Assemble the "left side" frame tie plate first, passing the hexagon head bolts 5 and 7 and the flat head bolts 6 thru from the left side. Do not attempt to fit the right frame tie plate at this stage of assemblage. Pass the long casing studs thru the left frame tie plate and thru the 5 No. 1 (1-19/32") Bushings and casing lugs. Fit the 4 No. 1 (1-19/32") bushings and the No. 2 (1-5/32") bushing to the casings studs on the right side of the motor. See illustration. Fit the right side frame tie plate and make sure that the casing studs will pass thru the tie plate freely. If the casing studs do not line up with the right side tie plate, it will be necessary to elongate the holes with a round file. Secure the right side tie plate by drawing up all nuts.

After the casing is securely clamped to the frame, fit the cylinder plug extension brackets and securely tighten them to the frame. Owing to difference in motor construction it may be necessary to enlarge the bracket holes in order to make a perfect fit.

With this type of frame the cylinders may be removed without removing the whole motor.



## Fitting 1920-1921 Motor to Dealers' Racing Frame

Fitting 1920 or 1921 motors to the dealers' racing frame can be easily accomplished by following these instructions and closely observing the above illustration.

Fasten the crank case lugs to the frame motor bracket in the usual manner. Draw up the motor clamp bolts tight. Remove the 5 motor casing studs in order to permit the use of the long casing studs and bushings as shown in the illustration. Assemble the "left side" frame tie plate first, passing the hexagon head bolts 5 and 7 and the flat head bolts 6 thru from the left side. Do not attempt to fit the right frame tie plate at this stage of assemblage. Pass the long casing studs thru the left frame tie plate and thru the 3 No. 1 (1-19/32") and the 2 No. 3 (3/8") bushings and casing lugs. See illustration. Fit the 2 No. 1 (1-19/32"), 2 No. 3 (3/8") and the No. 4 (29/32") bushings to the casing studs on the right side of the motor. See illustration. Fit the right frame tie plate and make sure that the casing studs will pass thru the tie plate freely. If the casing studs do not line up with the right side frame tie plate, it will be necessary to elongate the holes with a round file. Secure the right frame tie plate by drawing up all nuts.

After the casing is securely clamped to the frame, fit the cylinder plug extension brackets and securely tighten them to the frame. Owing to difference in motor construction it may be necessary to enlarge the bracket holes in order to make a perfect fit.

With this type of frame, the cylinders may be removed without removing the whole motor.

# Service Dept. Bulletin

No. 90. Feb. 25, 1921. Harley-Davidson Motor Co., Milwaukee

## How to Measure Cylinders and Pistons For a Proper Fit. New Method of Marking Oversize and Reground Cylinders

*(These instructions on piston and cylinder fitting supersede those in Service Bulletin No. 47)*

Harley-Davidson cylinders since 1914 have been taper ground, that is, the top diameter is smaller than the bottom diameter by three thousandths of an inch (.003″). This taper grinding is done to allow for the excessive heat caused by combustion of the gasses at the upper end of the cylinder and to make the cylinder walls parallel under normal working conditions. Owing to the cylinders being taper ground, it is confusing for one to properly measure cylinder diameters or fit pistons to cylinders without a good knowledge of such work or authentic instructions.

Since accuracy is necessary for good results, an inside and an outside micrometer are the essential instruments used when fitting pistons to cylinders. The cylinders should be measured at the top of the bore and the pistons should be measured between the second and bottom rings for the proper clearance diameters. See chart No. 2, for standard cylinder and piston measurements.

### Standard Motors

When the piston is properly fitted to the cylinder there should be from two thousandths (.002″) to three thousandths (.003″) clearance between it and the cylinder. This clearance is between the second and bottom rings of the piston and the top of the cylinder bore, *when the piston is at the top of the cylinder.*

### Police ("A") Type Motors

This motor is in every respect a stock motor with somewhat looser fits throughout the reciprocating action, and is block tested. The clearance between the pistons and cylinder walls at the upper end of the stroke should be from .003″ to .004″ *after the pistons are lapped in.* The marking of these motors is as follows: L20-T-1000A, also 21-JA-1000 and up. The letter "A" is stamped on each cylinder base flange. The pistons fitted to new "A" motors at the factory are marked "A" on the piston heads. Pistons furnished for "A" motors on parts and repair orders are not marked with the letter "A." When ordering pistons to fit an "A" type motor, be sure to specify that they are to be used in an "A" (police) motor.

### High Compression ("B") Type Motors

High compression motors are built up for exceedingly high altitudes, such as Denver or the Utah mountains. The atmospheric values at such high altitudes seriously affect the efficiency of any gasoline engine; therefore special consideration is given motors for high altitudes, and they are built accordingly. High compression motors have 1/8″ longer pistons. They are marked as follows: L-20-T-1000B, also 21-JB-1000 and up. The letter "B" is also stamped on each cylinder base flange. The clearance between pistons and cylinders of "B" type motors is the same as that of the standard 61″ motor, or from .0025″ to .0035″.

This model is no longer being built.

### Fast Stock, or ("E") Type, Motors

This motor is built up according to specifications that will make it both powerful and fast. It is built up about the same as the "A" motor, i. e., all working parts are perfectly free, the gear shaft is .0005″ looser than standard and the piston and cylinder clearance (at top of the stroke) is from .004″ to .005″. All "E" type motors are assembled with the greatest of care and are block tested to insure their efficiency. "E" type motors are marked as follows: L-20-E-1000 and up. The cylinders have the letter "E" stamped on their base flanges. When ordering pistons for the "E" motor, please specify IA-736A.

### Measuring Instruments

Every first class motorcycle repair shop should be equipped with a full set of inside and outside micrometers. They are the only instruments available that will actually tell you the sizes of the piston and cylinder and other accurately ground parts.

When a set of micrometers is not available, a reliable set of inside and outside calipers may be used with fairly satisfactory results. *Do not try to fit pistons to cylinders without the proper measuring instruments as the result at best would be only a guess.*

To correctly fit pistons to cylinders that have been reground at our factory and are marked with the letter "R," refer to the instructions in the following paragraphs.

### Original Method of Regrinding Cylinders

Since we are changing our method of marking reground cylinders, a few words briefly explaining the method effective until the present time, are in order. In 1917 we started to identify reground cylinders with a code, or set of symbols. This code was based on the following principles: A standard cylinder is 3.310″ diameter at the bottom and 3.307″ diameter at the top. To regrind in uniform steps of .010″, the top of the cylinder was selected for the various regrinds and symbols representing the diameters. The following example will illustrate the "R" or symbol method of marking reground cylinders and the proper piston sizes for a perfect fit.

"R2" stamped on the cylinder base flange indicates that the "top" diameter of the cylinder is 3.320″ and that it is reground .013″ larger than a standard cylinder. The bottom diameter of the cylinder would measure 3.323″, or .013″ larger than a standard cylinder.

A piston to fit this cylinder would be .013″ larger than standard, or 3.318″. "R2" cylinders are the only ones in which the first reground size is .013″. All others, "R3," "R4," etc., are in multiples of ten thousandths; the top of cylinders measuring 3.330″, 3.340″, etc. The distinguishing feature of this system is that the oversize pistons are .013″, .023″, .033″, etc., oversize and that new pistons should be ordered by these sizes or by the symbol stamped on the cylinder base flange and not by specifying .010″, .020″, .030″, etc., oversize.

## New Method of Marking Oversize and Reground Cylinders

In order to simplify the fitting of pistons to cylinders and to enable dealers to carry a limited stock of assorted oversize pistons that will meet all requirements, we have changed our method of marking all oversize pistons and cylinders. The method of regrinding cylinders heretofore effective was such that pistons had to be specially ground to fit each cylinder. This meant, for instance, that a piston ground for an "R2" cylinder (3.323″ bottom diameter, 61″ motor) would not fit any other than an "R2" cylinder. The new method of marking cylinders will not require pistons ground to special sizes for proper clearances, but will use a straight run of .010″, .020″, .030″, etc., oversize pistons.

Instead of regrinding cylinders and identifying them with the symbols "R2," "R3," "R4," etc., all cylinders that are over standard size (bottom cylinder diameter 3.310″ for 61″) will be marked in direct reading figures on the cylinder base flange. For example: A 61″ motor cylinder flange has the figure "5" stamped on the left (sprocket) side, meaning that this cylinder is .005″ oversize (larger than standard), or its bottom diameter is 3.315″. In ordering a piston for this particular cylinder, you should specify one that is .005″ oversize (larger than standard) to insure a perfect fit.

Cylinders with number "20" or a larger number stamped on their base flanges have been reground at our factory. A cylinder with "20" stamped on its base flange is .020″ oversize (reground .020″ larger than standard) and its flange end diameter is 3.330″. Other sizes of reground cylinders read accordingly.

This change became effective on factory reground cylinders January 23, 1921, and will become effective on new motors in the near future.

## Cylinder Markings for Special Motors

All special motors such as the "A," "B," and "E" types, will have corresponding letters stamped on the left side of the cylinder base flange. These letters, "A," "B," and "E," will be in addition to any oversize figures that may be stamped on the cylinder base flange. When ordering pistons for "A," "B," and "E" motors, specify which motor (letter) they are for, and mention any oversize figures that may be stamped on the cylinder base flange. This will enable us to furnish you with a piston that will correctly fit such cylinders. Example: Assuming that the letter "A" is stamped on the front left side of the cylinder flange and the figure "20" on the rear left side of the flange; these symbols mean that this cylinder is for an "A" (police) motor and is reground .020″ oversize (over standard).

## All Oversize Pistons Will Be Marked

It has been our policy in the past to encase oversize pistons in the regular carton and to designate their sizes on the carton. This method was all right as long as the piston was kept in the box, but upon removing it and mixing it with other pistons, its identity became lost.

Any piston that is oversize (larger than standard, 61″ motor, 3.305″) will be marked with a figure, designating just how many thousandths of an inch it is oversize. This method of marking will enable you to arrange your stock of pistons to suit your needs and will eliminate the possibility of giving the customer the wrong piston.

For example: If a piston has the figure "10" stamped on its head, it means that this piston is .010″ larger than standard (standard 61″ piston 3.305″). This piston when fitted to a cylinder that has the figure "10" stamped on its flange (.010″ oversize) will insure a perfect fit, assuming that the cylinder is not worn.

The letter "F" is stamped on the head of every front cylinder piston fitted to a new motor, and to front cylinders reground at the factory. This is mentioned so that the finding of this mark will cause no confusion. "E" motor pistons are not specially marked, since their design differs from that of the standard pistons.

## How to Use the New Cylinder, Piston and Ring Chart

The chart on page 5 very clearly covers the new method of marking cylinders and pistons that are oversize and shows the correct size piston rings to use in each case. The drawings of the cylinder and the pistons designate points where measurements are to be taken for correct piston fits.

The following example will illustrate the new method of marking oversize cylinders and pistons and how to use the chart:

| Legend to be Stamped on Cylinder Flange | | | Amount Oversize | Cylinder Bore Sizes | | Piston Size | Piston Ring |
|---|---|---|---|---|---|---|---|
| | | | | Top End | Flange End | | |
| Models F and J | | New motor | Standard | 3.307 | 3.310 | 3.305 | Standard |
| | 5 | New motor | .005+ | 3.312 | 3.315 | 3.310 | .005+ |
| | 10 | New motor | .010+ | 3.317 | 3.320 | 3.315 | .010+ |
| | 20 | Reground oversize | .020+ | 3.327 | 3.330 | 3.325 | .020+ |
| | 30 | Reground oversize | .030+ | 3.337 | 3.340 | 3.335 | .030+ |
| | 40 | Reground oversize | .040+ | 3.347 | 3.350 | 3.345 | .040+ |

Chart No. 1

(*Text Continued on Page 6*)

## Chart of Cylinder, Piston and Ring Sizes

| Legend to be Stamped on Cylinder Flange | | | Amount Oversize | Cyl. Bore Sizes Top End | Flange End | Piston Size | Piston Ring |
|---|---|---|---|---|---|---|---|
| Models F and J | | New Motor | Standard | 3.307 | 3.310 | 3.305 | Standard |
| | 5 | " " | .005 + | 3.312 | 3.315 | 3.310 | .005 + |
| | 10 | " " | .010 + | 3.317 | 3.320 | 3.315 | .010+ |
| | 20 | Reground Oversize | .020 + | 3.327 | 3.330 | 3.325 | .020+ |
| | 30 | " " | .030 + | 3.337 | 3.340 | 3.335 | .030+ |
| | 40 | " " | .040+ | 3.347 | 3.350 | 3.345 | .040+ |
| | 50 | " " | .050+ | 3.357 | 3.360 | 3.355 | .050+ |
| | 60 | " " | .060+ | 3.367 | 3.370 | 3.365 | .060+ |
| | 70 | " " | .070+ | 3.377 | 3.380 | 3.375 | .070+ |
| Models FD and JD | | New Motor | Standard | 3.424 | 3.427 | 3.422 | Standard |
| | 5 | " " | .005 + | 3.429 | 3.432 | 3.427 | 005+ |
| | 10 | " " | .010 + | 3.434 | 3.437 | 3.432 | .010+ |
| | 20 | Reground Oversize | .020 + | 3.444 | 3.447 | 3.442 | .020+ |
| | 30 | " " | .030+ | 3.454 | 3.457 | 3.452 | .030+ |
| | 40 | " " | .040+ | 3.464 | 3.467 | 3.462 | .040+ |
| | 50 | " " | .050+ | 3.474 | 3.477 | 3.472 | 050+ |
| | 60 | " " | .060+ | 3.484 | 3.487 | 3.482 | .060+ |
| | 70 | " " | .070+ | 3.494 | 3.497 | 3.492 | .070+ |
| Models WF and WJ | | New Motor | Standard | 2.747 | 2.750 | 2.743 | Standard |
| | 5 | " " | .005+ | 2.752 | 2.755 | 2.748 | .005+ |
| | 10 | " " | .010 + | 2.757 | 2.760 | 2.753 | .010+ |
| | 20 | Reground Oversize | .020+ | 2.767 | 2.770 | 2.763 | .020+ |
| | 30 | " " | .030+ | 2.777 | 2.780 | 2.773 | .030+ |
| | 40 | " " | .040· | 2.787 | 2.790 | 2.783 | .040+ |
| | 50 | " " | .050+ | 2.797 | 2.800 | 2.793 | .050+ |
| | 60 | " " | .060+ | 2.807 | 2.810 | 2.803 | .060+ |

FOR ABOVE SIZES MICROMETER AS PER SKETCH

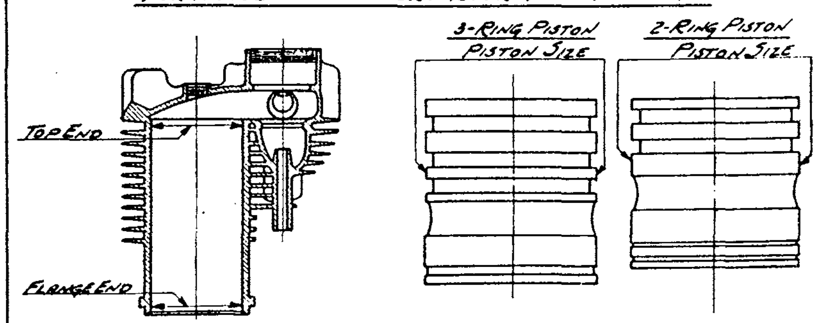



Chart No. 2

Assuming that we have an F model cylinder with "40" stamped on its base flange, we can determine from the last row of figures in chart No. 1 what this "40" means. It comes under the *reground oversize* heading, meaning that it has been reground at our factory. From the next heading, *amount oversize*, it is shown .040″ oversize. According to the heading *Cylinder Bore Sizes*, its top diameter is 3.347″, and its *flange end*, (bottom) diameter is 3.350″. The correct piston to use for this cylinder, under the heading, *Piston Size*, is one measuring 3.345″ at the point shown on the 3 ring piston in the sketch, or stamped with the number "40" on its head. Under the heading *Piston Ring*, we find that a ring that is .040″ oversize must be used.

In the same manner we can determine what cylinders and rings should be used with a certain size of piston or vice versa.

Special type motor markings are placed on the front end of the left side front cylinder flange, and on the rear end of the left side rear cylinder flange. Oversize markings are placed on the rear end of the left side front cylinder flange, and on the front end of the left side rear cylinder flange.

# Service Dept. Bulletin

No. 81. Revised. May 10, 1921 Harley-Davidson Motor Co., Milwaukee

# CARE OF THE "E" TYPE MOTOR

The fast "E" type motor is gradually coming into general use. Such a motor must receive special care, particularly before entering a race or hill climb, and it is with this in mind that the following suggestions are offered.

Remember that attention to details may mean the winning of an important contest. The following information should also be passed on to owners of motors of this type. Additional copies of this bulletin will be mailed upon request.

## How to Tune Up and Take Care of the "E" Type Motor

To be able to obtain maximum speed from any motor, it must be kept in first class condition by a careful inspection and cleaning at least every 100 miles (160 K M). In addition to the periodic inspection and cleaning, the compression and gear ratio must be in accordance with the climatic and track conditions of the place where the contest is to be held.

Do not take it for granted that a motor built and tested in Milwaukee can be shipped to any place and give the same satisfaction. To find out whether or not the compression is right, and whether or not the proper gear ratio (sprocket combination) is being used, motors should always be given careful tests where the contest is to be held.

Other items which must be given careful consideration are; lubricating oils, grade of gasoline, spark plugs, carburetor adjustment, wheel, chain, and frame alignment, bearing lubrication and adjustments.

## Lubrication

Use nothing but Harley-Davidson racing oil. Our Parts Department can supply this in one and five gallon cans. Under extreme conditions, mix one pint of castor oil with one gallon of this oil.

After warming up the motor drain the crank case, put in two hand pumps of oil and run the motor slowly for one or two laps. After this the mechanical oiler will take care of the motor, providing it is properly vented. To vent the oiler, disconnect the oil pipe at the mechanical oiler connection on the crank case letting oil flow through the pipe; forcing out the air. This will allow a full flow of oil through the pipe. To determine whether or not the mechanical oiler is taking care of the motor, use the cut-out button, cutting out the ignition and watching for smoke from both cylinders. This is very easily determined because the motor emits a regular haze when properly lubricated. When cutting out the ignition, as mentioned, also try for heat in the motor. If either cylinder fires when ignition is cut out, the motor is overheating. This can be overcome by making the mixture a little rich, causing it to burn a little slower and overcoming the premature explosion.

We suggest inspecting the hand pump for leaks before entering a race of any importance, as we have had cases where dirt or some foreign substance would hold the ball open, and the oil would keep dripping in the crank case; this in turn *would cause the motor to overheat, due to excessive oil.* This detail should not be overlooked because it is important.

## Spark Plugs

In all cases use a mica spark plug for racing, because the extreme heat generated by the motor will have disastrous effects on other type plugs. In some cases the spark plugs are the direct cause of a motor overheating, and trying another type of plug will suggest itself.

Do not use spark plugs which have more than one core electrode and one base electrode, because such plugs will cause trouble. We have had good results with Wright spark plugs after they have been used for about 25 miles (40 K M). Do not use a new plug.

Adjust the spark plug electrodes so that the gap is no wider than .030″ (.76 M M), nor less than .025″ (.64 M M). Too great a gap will cause overheating, while too small a gap may cause the spark plugs to foul.

## Carburetor Adjustments

The carburetor should be adjusted so that the motor receives a fairly rich mixture. Of course, too rich a mixture will cut down the speed of a motor, while too lean a mixture will cause over-heating. If it is impossible to obtain an adjustment to get satisfactory speed without overheating, the spark plugs are at fault, the sprocket combination is not right, or the compression of the motor is too high.

The use of the ported air sleeve, which is standard equipment on the fast stock motor, can briefly be explained as follows:

Keep the ports closed for ordinary running. After the machine has warmed up and is driven about 45 m. p. h. (72 K M) the ports can be opened one-half way, without turning the needle valve. This will permit a greater speed than could be obtained without the ported sleeve.

If the highest possible speed is desired, the ports should be opened wide and immediately thereafter the carburetor needle valve given from one to two complete turns extra. The exact number of turns the needle valve should be given can only be ascertained by trying various adjustments. When the speed is again cut down to normal, the ported air sleeve is to be closed and the carburetor needle valve turned down to its original position.

## Gasoline

Low test gasoline (62° Baume) should be used in preference to high test gasoline because the motor will not heat up as much with the lower test. Note: Never under any circumstances use ether, naptha, picric acid or any other highly volatile fuels. The Harley-Davidson motor is not designed for such fuels.

## Overheating

There are several conditions that prove whether or not a motor overheats, such as bucking, slowing down, and keeping on running with the magneto short-circuited. Under these conditions find out which cylinder is really doing the overheating by examining both spark plugs. If the mica core of a plug is puffed out, blistered or rough, overheating in that cylinder is indicated. Whether this condition is found in both cylinders or only in one, replace the puffed or blistered plug with a new one, give the carburetor needle valve another one-half turn of gasoline, and again test the motor for overheating. While testing, cut the gasoline down again, and if the motor still overheats, place a 1/32″ (.79 M M) thick compression plate under the cylinder or cylinders, whichever the case may be. If this will not eliminate all overheating, substitute a 1/16″ (1.5 M M) or a ⅛″ (3.1 M M) thick compression plate in place of the 1/32″ (.79 M M) thick plate.

# Service Dept. Bulletin

No. 91. March 1, 1921 Harley-Davidson Motor Co., Milwaukee

## Lubrication and Carburetion of the 74" Motor

Because of the longer stroke and larger bore of the 74" motor, its pistons cover more feet per minute than the standard, or 61" motor; therefore it requires special lubrication at the higher motor speeds.

Between 35 and 40 miles an hour we recommend that the hand-pump be brought into use, and about 1/3 of a pumpful of oil injected into the motor base every few miles. This ruling also holds good for 74" motor lubrication when negotiating muddy, sandy or gradient roads, or under any circumstances that require special attention as to oiling.

## Operating New 74" Motors Just Out of the Crate

The very thought of driving a Super Powered 74" makes the motorcyclist forget that a new motor must be "run-in." He wants to "open-it-up" immediately and "see-what-it-will-do." Such cases frequently happen, with the rider never giving his new motor a thought, other than "she's a dandy." Scored cylinders and pistons and damaged valves are the likely result. The rider forgets that the metals in a new motor are green (not accustomed to working temperatures and other existing conditions), that the bearing surfaces are not worn in, and that all parts were fitted at the factory to allow for any initial wear.

The 74" motor, like any other new motor, must be "run-in" gradually and not subjected to any severe use during the first few hundred miles. The motor should be "run-in" for at least 200 miles. During that time the motorcycle should never exceed 30 miles an hour; also care should be exercised to insure plenty of oil for lubrication. Advise your riders of these facts, and tell them that the future life and service of their mounts depend entirely upon the treatment received during the first few hundred miles.

## Adjusting Schebler Carburetors

It is only natural that the proper functioning of the carburetor has been affected by the present low quality of gasoline motor fuel. Perfect carburetion is absolutely essential if one expects the motor to respond to every move of the throttle and to give out all of the power which is built into it.

It may often be necessary to resort to precision carburetor adjustments in order to get a flexible control over the motor; in other words, each motor should be put to a test under its normal working conditions and the carburetor then adjusted to function properly in the following various tests.

The following outline should, in every case, enable properly adjusting a carburetor to any motor.

Set the idler, or low speed adjusting screw so that it is approximately 1/16" open. Get a favorable mixture at low speed with the motor idling by adjusting the needle valve. Drive the machine on the road at about 20 m.p.h. or until the throttle is open far enough so that cam on the casting has moved 3/16" under the roller of the lift lever. With this throttle position adjust the needle valve until the motor fires uniformly. Open and close the throttle a trifle and try to locate a point where the carburetor has a tendency to spit back. If such a point is located, try and eliminate the spitting by re-adjusting the needle valve. If the needle valve adjustment will not eliminate the spitting at this certain point, increase the tension of the air valve spring until the motor fires evenly.

Close the throttle and allow the motor to idle. If the slow speed (idling speed) adjustment is not correct, do not move the needle valve, but vary the cam track adjustment until the motor fires evenly with a closed throttle. The slotted cam track adjusting screw controls the needle valve rise and fall. By screwing it into the cam casting the mixture is made rich; by screwing it out of the cam casting, the mixture is made lean. Full instructions for setting the low speed cam adjusting screw are contained in the Harley-Davidson Instruction Book.

With the low and intermediate speed adjustments set so that the carburetor will not load up or spit, set the high speed adjustment by moving the indicator between one and three on the dial until smooth acceleration at high speed is obtained.

Oftentimes the motor will choke at high speed and it will be no fault of the carburetor's adjustment; such an occurrence is caused by air pockets forming in the gasoline line and temporarily shutting off the fuel.

## Carburetor and Motor Valve Springs

The air valves on the carburetor are used to maintain a normal velocity of air through the primary or venturi tube. At low motor speeds the majority of air passing through the carburetor is taken in by the hot air, or primary opening, and as the motor speed increases the additional air is drawn in through the auxiliary air valve. It is essential that the air valve springs have the proper tension. Weak air valve springs will cause hard starting, will make low speed adjustments hard to obtain and will cause loss of power. The air valve spring should have from 6 to 7 ounces tension to insure a perfect working carburetor.

Weak valve springs and poorly adjusted, or poorly seating valves are frequently responsible for loss of power and very unsatisfactory motor performance.

If a motor, particularly a 74", does not run right, inspect the valve springs, especially the exhaust, and replace them if shrunk 3/32" or more. See that the tappets are adjusted accurately; viz., with from .008" to .010" clearance between the exhaust valves and lifter pins, and .004" between the inlet valves and inlet levers.

The exhaust valves should be inspected from time to time to make sure that they are not gummed with oil. If a motor has been run for some time with poorly adjusted tappets or sticking valves, it will be necessary to reface the valve seats in the cylinders and the valves, and then to grind in the latter carefully and thoroughly. It is best to send exhaust valves needing refacing directly to the factory. The exhaust valve seat facing tool, FK824, is to be used for refacing the cylinder valve seats. It is especially important to watch the valve action of the 74" motor with the foregoing in mind.

## Fitting the Manifold to a 74" Motor

The manifold used on the 74" motors does not project into the cylinder nipples as far as in the case of the 61" motor. This makes it necessary to exercise more care when fitting the manifold so that the inlet packing bushings will correctly fit on the manifold ends and will not be "crimped" when the packing nuts are drawn up tight. Any ill fitting at the manifold packings will result in a leaking joint and will affect the mixture to such a degree that the motor will be "hard starting" and will not run properly at low speeds.

## Caution

Under no condition reduce the compression by adding too many plates between the cylinders and crank case, or add plates to tune up a stock motor for speed, because this will not let the motor get hot enough to work at its best. From this it can be understood that the motor must be allowed to get as hot as possible, without overheating, in order to get best results.

## To Tune Up for Long Races

When tuning up a machine for long races, add a 1/16″ (1.5 M M) thick compression plate to those already under the cylinders, and fit a larger motor sprocket so that the motor will not overheat and slow down if driven at its maximum for a considerable length of time.

## To Tune Up for Short Races

When tuning up a machine for short races, i. e., two or three miles (3 to 4 K M); the compression can generally be raised by removing the compression plates. In addition to this a smaller motor sprocket can be used. This combination will have a good pick-up and will give good results if the machine is slowed down momentarily at times so that it cannot overheat.

## Missing at High Speed

If the motor runs without missing up to a good speed, but sputters and misses at extremely high speed, and if no change in carburetor adjustment nor any other adjustment will eliminate this condition, inspect the valve springs. The exhaust valve springs should be 2½″ (64. M M) long free length. Inlet springs should be between 1¾″ (44.4 M M) and 2″ (51.8 M M) long free length.

If the valve springs are O. K., the motor may be geared too low, or may be in serious need of an overhauling.

## Piston Rings

When stripping the motor, pay special attention to the condition of the top piston rings. These rings must be in first class condition and a good fit. A loose fitting, burned, or scored ring should be replaced. When ordering new rings, specify the motor number.

Before placing a ring on a piston, put it squarely in the cylinder and gauge the gap at the slot. This gap should be between 1/64″ (.39 M M) and 1/32″ (.79 M M). If necessary, file the slots carefully to obtain the proper gap. It is also important to have this ring just a free fit in the piston groove *without any shake.* When fitting one of the lower rings, the gap at the slot should be between 1/32″ (.79 M M) and 1/16″ (1.5 M M).

## Tappet Adjustments

Adjust the exhaust valve tappets so that there is a clearance of from .006″ (.15 M M) to .008″ (.21 M M) between the lifter pins and exhaust valve stems when the motor is hot. The inlet push rods should be adjusted so that they are just free when the motor is cold.

## Valve Seats

Always inspect valve seats when the motor is taken apart, and be careful that the valves are not mixed. If the seats are not in good shape, grind the valves. If the seats are badly burned, the cylinder seats should be rereamed and other valves should be ground in. If the valve seats show that they bear all around, do not grind them, because the seats may be damaged. When fitting a valve into a cylinder, put a film of oil and graphite on the valve stem.

## Scored Cylinders

Inspect the cylinders for scores. If the cylinders are scored more than .002″ (.05 M M) deep, send them to us for regrinding and new pistons and rings. If the scores are less than .002″ (.05 M M) deep, another piston and set of rings can be lapped in to make a fairly good job.

## Removing Carbon

Always make a perfect job of removing carbon. Do not let any particles of carbon or grit fall into the crank case. In addition to scraping the carbon from the piston and cylinder heads, remove it from the underside of the piston, from the piston ring grooves, from under the rings, the valve chamber and the exhaust port of the cylinders.

## Gear Ratios for Fast Stock Motors

After the oiling of the motor has been tested and the motor runs without overheating, try out for proper gearing; this is about half the battle in racing on mile (1.6 K M) dirt tracks. It requires some experimenting to learn the best and quickest way to come out of a turn on a mile (1.6 K M) track. Some riders use the throttle to control their speed going into and coming out of a turn; others use the cut-out button and let the motor act as a brake. The latter is the quickest and easiest way and works very well if the carburetor is so adjusted that the motor does not load up with gas, making it slow to pick up.

The rider will have to determine which method is best by trying out both on the track because the kind of turns have a bearing on the subject.

Three speed gear ratios for "E" motors: Motor 16, clutch 43, countershaft 28, rear wheel 44, high gear ratio 4.22:1.

Standard for high speed track, or road work: Motor 18, clutch 43, countershaft 28, rear wheel 48, high ratio 4.10:1.

For long level stretches, etc.: Motor 18, clutch 43, countershaft 28, rear wheel 44, high gear ratio 3.76:1.

If a fast motor is used with a sidecar, the gear ratio will generally have to be changed. If the machine and sidecar are to be used for demonstrating speed on a good level road, do not change the sprocket combination until the machine has been accurately timed for speed. Then remove the 18 tooth motor sprocket and try a 17 tooth sprocket. Again test the machine to see whether it will cover the same course under the same conditions in less time.

For hill climbing and other tests for power, a 15 or even a 14 tooth motor sprocket may be found better suited.

Questions pertaining to other types of fast motors will be answered by letter.

# Service Dept. Bulletin

No. 65. Revised June 1, 1921 Harley-Davidson Motor Co., Milwaukee

## Working Principles of the Harley-Davidson Motor

The Harley-Davidson motor is of the conventional four-stroke-cycle principle. The power stroke being the chief cycle of the motor. It is made up of four events, or strokes; hence the term "four-stroke-cycle." Each 180 degrees of fly-wheel travel is one event or stroke. The flywheel must make two revolutions to complete one power cycle of the motor. Each cylinder of a four-stroke-cycle engine goes through the following cycle of events.

### Intake

The intake valve opens at the proper time by means of cam and gear action. The piston being on a downward stroke creates a partial vacuum in the cylinder. A gaseous vapor passes into the cylinder due to the atmospheric pressure passing through the carburetor and manifold. The atmospheric pressure at sea level is 14.7 pounds per square inch at 60 degrees F. The intake valve closes as the piston starts on the upward stroke.

### Compression

With both the intake and the exhaust valves closed, the cylinder chamber is now comparatively air tight. The piston on its upward stroke compresses and squeezes the gaseous vapor into a small space. This compression heats the mixture to a very much higher temperature and makes it more volatile. The ratio of compression in a motorcycle motor is usually 3.75 to 1, meaning that when the piston is at the lower most extremity of its stroke the chamber above it is 3.75 times greater than when the piston is at the upper extremity of its stroke. The sidecar motor has a compression of 55 pounds per square inch, and the solo motor 60 pounds per square inch. The compressed gases at this point are ready for ignition by an electric spark. After ignition takes place the gases expand from three to four times their initial compression pressure, that is, with a compression of 60 pounds per square inch, the gases would expand to 240 pounds per square inch after ignition.

### Ignition or Power Stroke

The generator or magneto being timed to produce an electric spark at the opportune time, ignites the highly compressed gases and starts combustion. The piston being the only movable part subject to the combustion starts on its downward stroke. The connecting rod transmits this power to the flywheels, driving the vehicle and storing up kinetic energy to carry the piston through the three minus strokes of the cycle.

### Exhaust and Scavenging Stroke

At the end of the power stroke the burnt gases still remain in the cylinder, so some provision must be made to expel these gases and prepare for the next series of events. On the upward stroke of the piston the exhaust valve opens and the spent gases are driven out, these hot gases coming in contact with the atmospheric pressure cause the report commonly heard from the gas engine. At the top of this stroke the exhaust valve closes and the intake valve opens, the motor starting on another cycle.

Briefly the cycle of events may be termed, 1, intake; 2, Compression; 3, Ignition; 4, Exhaust.

## Complete Timing Instructions for Harley-Davidson Motors

To insure the most accurate results in valve and ignition timing, the motor should be taken out of the frame and the front cylinder plug removed.

The close relation between the piston travel and the valve operation requires extreme accuracy in measurements when timing an internal combustion motor. For an example: With a difference of only one thousandth of an inch (.03 m/m) between the exhaust valve lifter pin and the valve stem, will cause the flywheel to travel approximately 3/16 inch (4.7 m/m) to make up the difference. For the best results in timing, use a 6 inch (150 m/m) scale graduated to at least 1/32 inch (.5 m/m), and measure the piston positions through the cylinder plug opening. The exact location of the piston can be determined by this method. Since accuracy is essential for correct timing, we do not recommend the practice of locating the piston through the inlet housing chamber.

Piston positions are determined from either upper (top) or lower (bottom) dead centers. Dead center is the point at the extreme upper or lower end of piston travel—the point where the piston is "dead."

## The Valve Lift Clearances Must Be Accurate

Before retiming the valves, make sure that the exhaust lifter pins and the inlet push rods are set according to the following specifications.

On all the twin cylinder models prior to 1915 and all the single cylinder models (except model 21 CD), allow .004 inch (.10 m/m) clearance between the exhaust lifter pins and the valve stems or caps. The earlier models had small steel caps placed over the ends of the exhaust valve stems to prevent the stems from wearing and to provide a means for taking up wear. These caps are made in various thicknesses and should be ground until the correct clearance is obtained.

Model 21 CD should have .004 inch (.10 m/m) clearance between the inlet rocker and valve stem, and .008 inch (.21 m/m) to .010 inch (.26 m/m) between the exhaust lifter pin and valve stem.

Allow .004 inch (.10 m/m) clearance between the inlet levers or rocker arms, and valve stems on all models.

On the 1915 and 1916 twin motors, allow .004 inch (.10 m/m) exhaust lifter pin clearance for the rear cylinder and .006 inch (.15 m/m) for the front cylinder.

On the 1917, and all later "V" type motors, allow from .008 inch (.21 m/m) to .010 inch (.26 m/m) clearance for both front and rear cylinder exhaust valve tappets. This also holds good for the "500," "A," "B" and "E" type fast stock motors.

The sport model lifter pin clearance for both the inlet and exhaust valves and for both cylinders is .006 inch (.15 m/m). Whenever making any adjustments to the valve tappets, be sure that the motor is cold, because the expansion of the cylinders and valve lifting mechanism varies when the motor is hot.

# Service Dept. Bulletin

No. 77. August 12, 1918 Harley-Davidson Motor Co., Milwaukee, Wis.

## Increase in Repair Labor Rates

Beginning August 15, 1918, the following rates are effective on factory repair labor:

| | |
|---|---|
| Motor and electrical repair work .......... | $1.25 per hour |
| Transmission, frame, fork, wheel, and tank repair work . . . . . . . . . . . . . | 1.10 per hour |
| Floor work, including stripping and assembling. . . | 1.00 per hour |
| Brazing and welding. . . . | 1.50 per hour |
| Enameling and nickelplating . . . . . . . . . . . . . . . | 1.50 per hour |

Increases in the cost of labor make these changes necessary.

A number of dealers are charging from $1.00 to $1.25 per hour for labor, and a minimum rate of $1.00 per hour is recommended. Labor of all kinds, especially skilled labor, is scarce, and the dealer must pay good wages to keep or engage first class men. The rate of repair labor must advance accordingly.

The average owner is willing to pay a fair rate for repair work, in preference to receiving indifferent or poor work at a low rate. If the quality of the labor is in proportion with the rate, there will be no dissatisfaction. The dealer's problem, therefore, is to pay wages that will enable him to keep or engage competent repair men, and charge for his labor at a rate that will pay the repair wages, his overhead expenses and net him a fair return on his investment.

## Changes in Dealer's Service Policies Become a Patriotic Duty

The shortage of competent mechanics and the consequent rise in the cost of labor affecting both dealer and rider, make necessary, and in some cases have already brought about, reforms in service practices by individual dealers and dealers' associations.

The object is three-fold: first, to release as many men as possible for military or essential industrial service; second, to retain sufficient skilled help to handle the important motorcycle work so that the commercial use of motorcycles can continue and even expand. The third object is the saving of light and fuel by evening and Sunday closing. Similar regulations have been adopted nationally by the National Automobile Dealers' Association.

The plan requires every dealer's attention. A set of regulations should be drafted, agreed to, and adopted by the motorcycle and bicycle dealers of every city. The following should be among the important features of the plan and agreement.

## Elimination of Free Service

Ordinarily the giving of a certain amount of free service with the purchase of every new machine is commendable. At present, the purchaser should not expect it. Labor must be employed to better advantage. The use of free service cards should be discontinued. Free road service should be eliminated, and the time required to call for and deliver a machine should be charged for.



## Discontinuation of Road Repair Work

As far as possible, the repairing of motorcycles on the road should be eliminated. In the majority of states, the lien law requires that equipment undergoing repairs be in the possession of the dealer or repairman. A motorcycle is not in the dealer's possession on a public highway or even at the curb in front of his store. There is no objection to performing work on the road if a man's credit is good or the transaction is cash. We suggest that every dealer look up the lien law of his state.

## Education of Owners

The purchaser of a new or used machine should be given the instructions necessary for its successful operation and care. He should be urged to study the manufacturer's manual so that he can help himself. This may require a little more of the dealer's or salesman's time when the sale is made, but there will be fewer comebacks for additional information and fewer calls for small adjustments and repairs. Some dealers have already conducted schools for both new and old riders, placing the work in charge of a competent man. The owners are taught how to use their tools and how to make the simple adjustments and repairs, especially those adjustments needed at definite intervals. Classes are conducted one night a week.

## Repairs on Cash Basis

The sale of parts, accessories and supplies, as well as all repair work, should be put on a strictly cash basis. This will result in a saving of help and protection against losses.

Other means of conservation of labor, material and fuel may suggest themselves, depending upon local conditions. The regulations can be adopted by all dealers in a city by mutual agreement. Those pertaining to the elimination of free service, Sunday closing, night work, and cash for all repairs can be issued in printed form and posted in each dealer's store. They should be issued with a note that they are made necessary as a patriotic movement.

On another page we are reprinting the regulations adopted by the Milwaukee Motorcycle, Bicycle and Sporting Goods Dealers' Association. They are printed on a heavy cardboard poster measuring 22"x27", which is displayed in every dealer's window.

Be the leader in this movement in your city. The other dealers will readily see the necessity and advantages of the plan, and your riders will gladly abide by the service regulations, because they will regard them as a patriotic movement.

Two other important considerations that need not appear among the regulations printed for public notice, but should be agreed upon by the dealers and lived up to, are the following:

## Preferred Service for Industrial Users

The rider who uses his motorcycle for pleasure will not resent a delay in the finishing of his repair work if a repair job on a commercial machine is put ahead of his job. It is one of his sacrifices to help win the war.

# Conservation of Parts

This subject has been mentioned before. If a part can be salvaged, it should not be discarded. The demand made upon material of every description for successful prosecution of the war has already caused delays and shortage. To conserve material is as patriotic as to save food.

# Service Dept. Bulletin

No. 56. June 11, 1917. Harley-Davidson Motor Co., Milwaukee



## Important Adjustments on 1917 Motors

It frequently happens that in trying to correct an imperfect running motor, the cause is looked for in the out of the ordinary places. In almost every case, however, the cause is poor adjustment or a slight imperfection and the remedy not far to seek. It is true that the seemingly serious difficulty is generally traceable to a small cause. A very slight change in the adjustment of a carburetor may make the difference between a motor that will run poorly and one that will operate perfectly.

When a motor does not hit right at all speeds, when a machine lacks speed or loses power, when a motor overheats or does not perform right in some other respect, the fault should be looked for in the places where it is likely to be found, before out of the ordinary tests are made. If the ignition, carburetion, lubrication and valve action are O. K., every motor will run as it should. In locating and correcting a fault in a motor, the chart on pages 97, 98 and 99 of the 1917 manual will be found of valuable assistance. It was prepared under the supervision of our engineering department and follows the natural sequence already suggested—to look for a fault at the obvious point and having located it, to apply the remedy. This chart is an excellent basis of operation for the repair man in seeking the cause of and remedy for practically any form of unsatisfactory motor performance.

If the small items are taken care of, the large ones will take care of themselves. The small causes are generally the most important and motor adjustments and repairs practically without exception, should be made on that basis. Below are covered a number of conditions that may arise especially in 1917 twin motors and we recommend that in seeking the cause and remedy for a certain trouble these recommendations be followed carefully and closely with the above in mind.

## Motor Misses at Certain Speeds

If a motor misses at certain speeds and the suggestions in the chart on page 98 of the 1917 manual have been carefully applied, the cause is a poorly adjusted carburetor to which the chart makes reference. However, since the 1917 carburetor is sensitive and the adjustment must be very accurate to get proper results, we advise a careful reading of pages 84 and 85 of the 1917 manual. The following should also be read carefully, bearing in mind that the adjustment of the carburetor needle valve must be accurate to the notch. One notch either way will affect the running of the motor. Prior to 1917 several notches either way did not seriously affect the running of the motor.



## To Adjust the Carburetor on a 1917 Motor

It is very important not to have the low speed adjusting screw turned in too far. The motor will run slowly when the screw is turned out 1/16 inch, providing the throttle control is adjusted so that the butterfly valve is shut when the right grip is turned to the right, and providing there are no leaks around the manifold, carburetor and inlet housings.

Let the motor warm up as it does from regular driving before changing the needle valve adjustment and have the motor running idle with spark advanced and the throttle closed. Then cut down the mixture by turning the needle valve to the right. The correct adjustment is reached when the motor will just fire evenly and will start to miss or stop if the needle valve is turned down another notch. This is the correct low speed adjustment. Do not adjust for low speed when the motor is cold for in that case the mixture will be too rich when the motor gets warm. A cold motor naturally needs a richer mixture than a motor that is warm.

To obtain the proper adjustment for high speed the machine should be taken on a good road and be driven in high speed for at least a mile. Do not adjust for high speed while the motor is running idle. If the carburetor seems to get too learn a mixture when the throttle is opened, the proper adjustment can be obtained by moving the indicator on the cam casting on top of the carburetor toward figure No. 3.

If the indicator is over No. 1 and the carburetor gets too rich a mixture, do not turn the needle valve down but open the auxiliary air lever on the side of the carburetor. The indicator should not be turned for any other adjustment than for open throttle work.

If the motor seems to be getting too rich a mixture when the throttle is opened half way, the auxiliary air lever on the side of the carburetor should be opened enough to get the proper mixture and be closed when driving slowly or when the motor has been stopped.

If the motor will spit and backfire when it is cold, with the carburetor adjusted as just explained, do not change the needle valve adjustment but run the machine for a short distance with the air valve closed by pulling out the starting stem. Leave the stem in this position until the motor has warmed up slightly or until it starts to miss due to the rich mixture.

When driving a machine up a steep grade and the motor seems to die down, the trouble is invariably due to a poor carburetor adjustment. When a carburetor is adjusted wrong, the motor receives a mixture which will be slow in exploding thereby reducing power and speed and causing the motor to overheat.

If the carburetor adjustment is O. K. for both high and low speed but the motor seems to load up with gasoline when driven open for long distances at low motor speed, the air lever on the side of the carburetor can be used to good advantage.

## Why Crank Cases Overheat and Motor Loses Power and Speed

If the crank cases of a motor get so hot that the hand cannot be placed on them after the motor has been run for some time, the motor is almost invariably full of oil. Generally an oilfilled motor will not smoke a particle. For that reason do not try to determine the amount of oil in the crank case by watching the exhaust. A motor that is oilfilled, is bound to heat up, in fact the oil will reach the boiling point, greatly retarding the pistons on their downward stroke. Loss of power and speed are natural results.

Several cases of too much oil in the crank cases have come to our attention. The crank cases had turned brown from the heat. The riders complained of overheating and lack of power and speed. After the crank cases had been drained and the correct quantity of oil refilled, the motor developed normal power and speed. Overoiling is a more prevalent cause of unsatisfactory motor service than is generally supposed.

To safeguard against overoiling the hand pump should not be used too freely and the mechanical oiler should be adjusted so that the machine will cover at least 600 miles per gallon. The 1917 manual covers the adjustment of the mechanical oiler very thoroughly and will therefore not cover the same ground here.

## Pre-ignition

The causes of pre-ignition vary. The chart on pages 98 and 99 covers the causes and remedies. Attention is called here to the fact that pre-ignition is frequently due to poorly adjusted or faulty spark plugs. If a motor pre-ignites, overheats or does not work properly at high speed in other respects, try a new set of good spark plugs or a set that is giving satisfaction in another motor.

The quality of even the best spark plugs has been affected in some cases by the present unusual condition of the material market; therefore, faulty plugs will be found a more prevalent cause of pre-ignition with resultant overheating and other evils, than even a year ago.

To use good spark plugs and to have them properly adjusted is of vital importance for satisfactory motor performance. The electrodes should be spaced according to the gauge furnished with the machine. If set too far apart, they will get red hot and cause pre-ignition.

All of the above recommendations apply especially to the 1917 twin motors. It will be noted that no out of the ordinary causes and remedies for overheating, choking, missing, loss of power, lack of speed and pre-ignition have been mentioned. Yet, the causes and remedies have been covered and with the assistance of the manual chart, every case of unsatisfactory motor service can be corrected.

Attention is also called to the importance of accurate adjustment of exhaust and inlet mechanism. For 100 per cent efficient motor service these adjustments must be accurate within .001 inch. This subject was fully covered in service bulletin No. 52 under the heading "Important Notice."

# Service Dept. Bulletin

No. 59. July 24, 1917 Harley-Davidson Motor Co., Milwaukee

## Special Notice

At this time of the year Harley-Davidson dealers and riders sometimes ride to the factory to have work done on their machines. We are always glad to give such work our best attention but cannot promise to complete an extensive overhauling within eight or nine hours, or even less time. Our repair department is naturally very busy right now, during the heart of the riding season. No dealer or rider should therefore ride to the factory with the expectation of having his motor overhauled within a few hours, say for instance on a Saturday with the factories closing at noon. We gladly offer our best service but will appreciate taking the above into consideration to avoid possible disappointment.

## Bending Relief Pipe Away from Drive Chain

Attention is called here to the paragraph on page 36 of the 1917 manual on the above subject. For convenience we are repeating this paragraph herewith:

"The drive chains do not need external lubrication since the crank case relief pipe sprays oil on the chains. In country where deep sand and dust abound, it is advisable to keep all the oil away from the chains because sand and dust will stick in the oil, causing excessive sprocket and chain wear. Therefore, where this condition exists, bend the relief pipe so that the oil is not sprayed on the chain."

This is very good advice. We will leave the matter to the discretion of each dealer. Ordinarily, the oil sprayed on the short drive chain by the relief pipe, performs a useful service by lengthening the life of the chain. In very sandy or dusty country, on the contrary, thin oil is positively injurious. The sand, dust and grit that accumulate in the oil will cause excessive wear of sprockets and chains.

## Venting the Mechanical Oiler to Regulate Oil Supply

It may happen that a motor will over-oil with the adjusting screw of the mechanical oiler raised as far as possible. In that case, provided the hand pump does not leak, the mechanical oiler should be vented as explained below. We know of cases where it was attempted to reduce the oil supply by cutting off the head of the adjusting screw or taking a cut off the oiler. This is not the remedy because when the adjusting screw is raised flush with the mechanical oiler, the stroke of the plunger is reduced to nothing. Therefore, no good is accomplished by trying to raise the screw further.

On a single cylinder motor it is necessary to remove only the vent screw or cap in the operating shaft chamber.

After venting, place three or four .010″ washers on the plunger adjusting screw, drain the crank cases and refill 1½ to 2 pumpfuls of oil with the hand pump.

These instructions can be followed very easily and will prove effective in every case. Do not try to vent the oiler by filling the chambers with oil after removing the screws or caps. To expell the air, the motor must be turned over, if the oil does not overflow readily. Also refer to



the illustrations and instructions on pages 42 and 43 of the 1917 manual.

Before venting the oiler, which simply means to expel any air in the oil chambers, see that there is oil in the tank and that the feed pipe is connected. Remove the vent screw in the forward or operating shaft chamber cap. On an earlier than 1917 motor, remove the cap itself. If the oil does not overflow, turn the motor slowly a few times until it does. Replace the screw or cap firmly. Then remove the screw in the plunger chamber cap, or the cap itself, and turn the motor slowly until the oil overflows. Replace the screw or cap.

## 17-J Style Battery Box Furnished for all Models

The 1917 battery box is now furnished for 1915 and 1916 electric models. The battery box complete with fittings sells for $3.40 list and is furnished under part number FJ40. Instructions for fitting are furnished with each box, although the job is a very simple one. The advantages of the 1917 battery box are that it can be removed easily and is reinforced with a metal strap running across the bottom and up the sides.

## 44 Tooth Rear Wheel Sprocket for 1916 and 1915 Three Speed Models

The 44 tooth rear wheel sprocket has been standard equipment on all 1917 three speed machines, both solo and sidecar type, for some time, in place of the 40 tooth sprocket. Beginning July 9th the 44 tooth sprocket is also furnished on orders for rear wheel sprockets for 1916 and 1915 three speed models. The only extra fitting necessary to fit the 44 tooth sprocket is a longer rear chain guard bracket to give the chain guard the proper clearance. This bracket is furnished with every 44 tooth sprocket. The use of the larger sprocket will mean longer sprocket and chain life.

The 44 tooth sprocket can be used for solo or sidecar service with the same size engine sprockets used with the 40 tooth sprocket, viz., 14 tooth for sidecar service and 15 tooth for solo service. If these sprocket combinations give too low a gearing, a 16 tooth sprocket can be used for solo service and 15 tooth for sidecar work. The use of the larger sprockets is recommended whenever possible, because larger sprockets mean longer sprocket and chain life. The following sprocket combinations are recommended:

| Engine | Clutch | Counter-shaft | Rear Wheel | High Gear ratio |
|---|---|---|---|---|
| For ordinary solo service: | | | | |
| 16 | 43 | 28 | 44 | 4.22 |
| For solo service on rough roads or very hilly country: | | | | |
| 15 | 43 | 28 | 44 | 4.50 |
| For ordinary sidecar service: | | | | |
| 15 | 43 | 28 | 44 | 4.50 |
| For sidecar service on rough roads or very hilly country: | | | | |
| 14 | 43 | 28 | 44 | 4.83 |

Heretofore the following sprocket combinations have been standard on '16 and '15 models:

| Engine | Clutch | Counter-shaft | Rear Wheel | High Gear ratio |
|---|---|---|---|---|
| For solo service: | | | | |
| 15 | 43 | 28 | 40 | 4.10 |
| For sidecar service: | | | | |
| 14 | 43 | 28 | 40 | 4.39 |

The 44 tooth rear wheel sprocket will be supplied on all orders for rear wheel sprockets for 1916 and 1915 three speed models. The extra long rear chain guard bracket will be furnished with every sprocket unless instructed to the contrary.

# Service Dept. Bulletin

No. 60. August 10, 1917 Harley-Davidson Motor Co., Milwaukee

## Proper Adjustment of Controls is an Important Factor in Getting the Most Out of Your Motors



Too much emphasis cannot be placed on the importance of correct adjustment of the throttle and spark controls so as to have full control over the motor. These instructions are prompted by the experience that many cases of unsatisfactory motor service are due to poor adjustment of the controls. Not every one appreciates that irregular running, loss of power and speed and overheating may be directly due to improper motor control adjustments.

## Be Careful When Setting Up a New Machine

When setting up a new machine make sure that the controls are connected and adjusted properly. Follow the instructions and illustrations in the 1917 manual covering the setting up of machines. The control coils should be clamped to the frame according to the black marks on them. These marks are painted on after the factory assembler has obtained the proper adjustment. This is very important because if the coils are connected otherwise, the throttle may not open all the way, interfering with power and speed, or the throttle may not close, making it impossible to throttle the motor down to a slow pace. If the spark control coil is not adjusted properly, the spark cannot be advanced or retarded far enough. Insufficient spark advance will affect the motor in the form of overheating and loss of power and speed, while too much advance on twin cylinder model will keep the exhaust valves from raising shortly after the ignition unit has been retarded. On the electrically equipped model, the entire interrupter assembly is forced out of alignment when the spark control has too much advance. The result is an unsatisfactory running motor.



## To Adjust the Controls

When the black painted marks on the control coils are no longer visible and the entire mechanism is out of adjustment, the following instructions should be followed carefully, depending on the model.

## To Adjust Throttle Control on Twin Cylinder Models

Turn the throttle grip to the right as far as it will go. Pass the carburetor control sleeve over the control wire and coil, or if the sleeve is already over the coil, loosen the two set screws and push the sleeve over the coil as far as it will go. Hold the grip in this position while pulling the sleeve off about 1/8 inch. Then tighten the two set screws.

If the throttle lever is not in line with the front cylinder push rod when the throttle is closed, loosen the nut on the end of the throttle shaft enough to move the lever to the required position and tighten the clamp nut. Pass the stud of the sleeve through the hole in the throttle lever and fit the washer and cotter pin. Place the control coil clamp over the coil and fit the two screws temporarily. Draw the coil out between the forks as far as possible (being sure the throttle is closed and the grip is turned outward). Hold the coil in this position and tighten the two coil clamp screws.

The throttle control should now be adjusted properly but it is advisable to open and close the throttle several times to make sure that it is working properly and that the provided stops on the cam casting strike the lug on the carburetor body, indicating that the throttle can be fully opened and closed. If the adjustment is off just slightly, loosen the two control sleeve set screws and slip the throttle to the required position. Then tighten both screws.

## To Adjust Spark and Relief Control on Twin Cylinder Models

Before adjusting the control coil or wire make sure that the spark and relief rods are adjusted properly. Make sure that the spark can be fully advanced and retarded and that the exhaust valves will just start to lift after the interrupter has reached the retarded position. These adjustments are about right when the exhaust lever is in a horizontal and the spark lever in a vertical position when the interrupter is fully retarded. To obtain this adjustment lengthen or shorten the relief rod so that the exhaust valves will just start to lift when the exhaust lever is in a horizontal position. Then to obtain the proper spark control rod adjustment, the bell crank bracket which is placed over the rear cylinder plug should be moved either forward or backward as may be necessary

Place the intermediate control sleeve over the control coil as far as it will go. Then pull it off about 1/8 inch. Hold the sleeve stationary, turn the left grip to the extreme left and tighten both sleeve set screws. Place the control coil clamp over the coil and hold it to the frame with the two clamp screws. Connect the intermediate control sleeve to the intermediate control rod. Hold the grip to the extreme left, retarding the spark and lifting the valves as far as they will go, pull the control coil out toward the fork as far as possible and tighten the coil clamp screws.

Be sure to test this adjustment before using the machine. Turn the grip to the extreme right, then try the circuit breaker of the generator or magneto, depending on the model, to see whether the spark advances fully. Be especially careful on the electric model. Do not let the generator advance lever bear down hard enough when in the advanced position, to push the interrupter assembly out of alignment, because this would result in the motor missing or stopping entirely with a fully advanced spark.

## To Adjust Throttle and Relief Controls on Single Cylinder Models

Make sure that the relief and carburetor control rods are properly adjusted before proceeding to adjust the throttle control coil. To do this, turn the motor over until the exhaust valve is in its lowest position. Close the throttle. The relief rod should now be adjusted so that the exhaust valve will just start to lift. Then open the throttle to make sure that it can be opened fully and that everything works freely.

After this adjustment has been obtained, pass the control sleeve over the coil as far as it will go. Then draw it off about 1/8 inch. Hold the sleeve in this position, turn the right grip to the extreme right and then to the left far enough to draw in about 1/16 inch of the control wire and fasten the sleeve to the wire by tightening both set screws. Connect the control sleeve to the magneto lever. Place the control coil clamp over the coil and hold it in position with the two screws. Turn the magneto lever to the position where the exhaust valve will be raised as far as it will go and hold it in this position. Then draw the control coil out toward the forks as far as possible and tighten the coil clamp screws.

Try the adjustment by turning the grip to all positions making sure that the throttle can be fully opened and closed and that the exhaust valve can be raised after the throttle is closed. If the adjustment is off only slightly, get the proper adjustment by first loosening the sleeve set screws and slightly changing the position of the control wire in the sleeve. Then tighten the sleeve set screws.

## To Adjust Spark Control on Single Cylinder Models

Pass the control coil through the curved sleeve leaving it extend through about 1 1/2 to 1 3/4 inches from the lower clamp nut. Tighten the coil clamp nuts on both sides of the curved sleeve and place the loop of the sleeve over the cylinder plug.

Tighten the cylinder plug nut while holding the curved sleeve so that the end of the control coil is in line with the magneto interrupter housing lever. Pass the coil clamp over the control coil and draw both coil clamp screws tight, being sure not to allow any slack between the cylinder plug and the clamp. Turn the left grip to the extreme left. Pass the magneto control sleeve over the coil, put the magneto interrupter in the upper or retarded position and connect it to the control sleeve. Hold the grip in this position,



press down on the interrupter lever and slip the sleeve over 1/16 inch of the control wire. Then tighten both sleeve set screws.

Turn the grip to both advance and retard positions and take hold of the interrupter lever to see whether the magneto can be fully advanced and retarded. If the adjustment is not just right, either bend the curved sleeve slightly or loosen the sleeve set screws and change the position of the control wire in the sleeve. Do not overlook to securely tighten the two sleeve set screws.

More cases of unsatisfactory motor service are due to faulty adjustment of the throttle and spark controls than is generally known. A motor can be injured seriously by running with retarded spark for any length of time or with open throttle and retarded spark. This is of course an extreme application of the effects of poorly adjusted controls. However, many cases of uneven running, overheating, missing or skipping at high speed, lack of power and speed, and inability to throttle down are directly due to improperly adjusted controls.

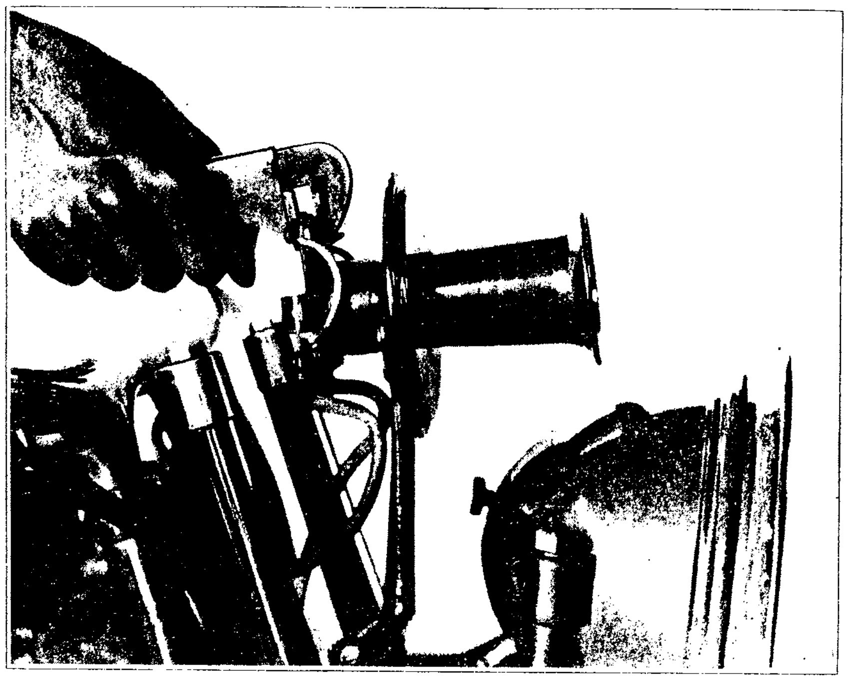
# Service Dept. Bulletin

No. 61. August 15, 1917 Harley-Davidson Motor Co., Milwaukee

## How to Adjust and Repair the Electric Horn



The electric horn like anything mechanical may require adjusting at some time. Since it is of great importance to apply the various adjustments properly, a careful reading of these instructions is recommended.





## To Adjust the Horn

If the horn does not sound right and the battery and the circuit between the horn and battery are O. K., the horn can be adjusted by bending the vibrator assembly. Remember it is very important to have the battery, wiring and connections in good shape before proceeding to adjust a horn.

To bend the vibrator assembly, the cover "19" must of course, be removed first. Do not disconnect or loosen any other part. The horn should be firmly bolted to the bracket and the bracket to the forks, because a little distortion of the horn bracket will interfere with the sound of the horn.

Place a monkey wrench such as is furnished with every tool equipment over the vibrator assembly and pull upward or bear downward as may be necessary to improve the sound. Refer to illustration and be sure to remove the wrench before trying the horn. In most cases, the horns will sound best and consume the least current when the armature "7" clears the diaphragm stem "10" by about 3/32 inch, and when the contact points of the vibrator springs "2" and "4" break about 1/64 inch when the armature is bearing firmly against the diaphragm stem. Current consumption is an important factor to consider when adjusting a horn. A horn properly adjusted will not require more than 1½ to 2 amperes, whereas a poorly adjusted horn may consume as much as 7 amperes.

To make sure that the current consumption is right, it is advisable to connect an ammeter in series with the horn. If the horn is mounted on a machine, connect the ammeter between the battery ground wire and the machine. Then turn "on" the ignition switch and note the discharge through the generator. The additional discharge when the horn button is pressed will then indicate the horn's current consumption.

If the contact points on the vibrator springs are too close together when the armature is bearing against the diaphragm stem, the housing bail "9" should be removed and the upper spring can then be bent outward by forcing a screw driver between both contact springs. Be sure that the contact points break at least 1/64 inch. If the contact points do not make contact at all, the upper spring should be removed and be bent downward. If this spring is removed, be sure that the various parts are properly replaced before the clamp screws are tightened. Instructions covering this subject are given later in this bulletin.

Make sure that the armature strikes the diaphragm stem and not the horn body. If the armature strikes the body, the horn should be stripped and the lower edge of the disc which is riveted to the armature should be ground off taper.

## If the Horn Blows Without Pressing the Button

If the horn blows constantly or intermittently without pressing the horn button, the trouble will be found in the horn or the wire leading from the button to the horn.

Remove the switch cover of the horn button. Examine the insulating block to see whether it is cracked or whether the insulation of the wire is punctured, causing a ground. The wire should also be examined where it leaves the center of the handle bar and under the horn cover. A cracked or broken insulating block should be replaced with another. If the wire is the cause of trouble, fit a new one.

If trouble is experienced in passing a new wire through the copper tubing in the handle bar, the tubing is kinked and should be straightened out. To do this will not require removing the copper tube from the bar. Simply double over one end of a piece of handle bar control wire and pull this control wire through the copper tube. The doubled end of the control wire is just large enough to straighten out the kinks sufficiently to allow passing the wire through easily.

## Make Your Own Test Lamp

A test lamp which can conveniently be used in the following tests can easily be made out of a single point dimmer or tail lamp globe. Solder two pieces of wire to the globe, one to the center point, the other to the body of the lamp. Be careful not to overheat the globe while soldering. Use friction tape generously to protect and insulate the connections. Do not use a larger than 2 candle power bulb.

## To Repair the Horn

If the horn will not sound and a test lamp connected to the horn wire clamp screws "20", indicates that the circuit is O. K., the trouble should be looked for in the horn. Make sure that the points break and that the armature is properly adjusted as is covered under "To adjust the Horn." If these points are found O. K., inspect the horn to see whether it is properly assembled. The vibrator assembly must be assembled in the follow- manner:

| | |
|---|---|
| Connector plate | "1" |
| Vibrator spring | "2" |
| Leatheroid insulator | "3" |
| Contact spring | "4" |
| Leatheroid insulator | "5" |
| Middle spring insulator | "6" |
| Armature | "7" |

The armature is not insulated from the horn body.

Note whether the large vibrator spring "4" is placed under the small spring "2" and whether it is hooked under the fibre strip which is riveted to armature "7", making sure that the fibre strip is not torn. This is the proper position for the large spring.

Inspect the springs to see whether they have been turned around which would prevent the large points making contact. It is also important to inspect the vibrator points for pits. If pitted, draw "00" sandpaper between the points; then follow up with plain writing paper to clean out all grit. Any insulators which are torn or only slightly cracked should be replaced. If the peaned end of the contact point on the large vibrator spring is too large or has sharp edges, trim it off sufficiently to prevent puncturing insulator "6".

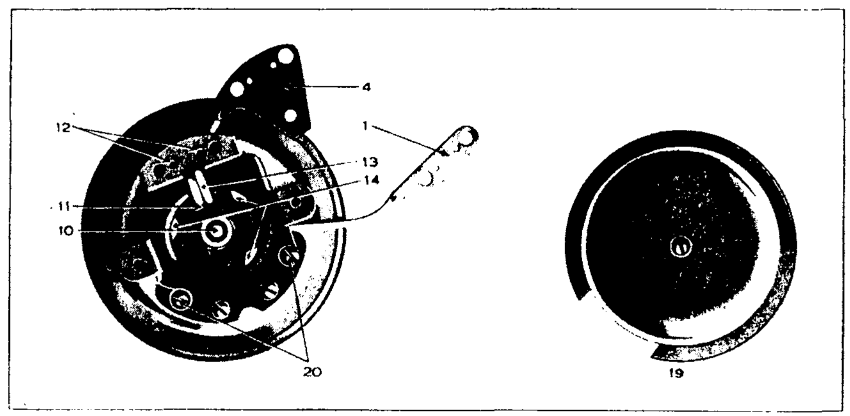
The hole in the center of the armature spring may have a sharp edge which has



punctured insulator "6", causing a short circuit between the large vibrator spring and the armature. In this case, another insulator should be fitted after the sharp edge has been scraped off. To absolutely prevent any further short circuits at this place, the hole in the armature can be filled with solder.

## To Test the Coil

If a test lamp indicates a closed circuit to the horn and the horn will not sound after a careful inspection of the vibrator assembly, the coil should be tested. This can easily be done after the vibrator assembly has been removed. Connect one of the battery wires to the large vibrator spring which is soldered to one of the coil wires. Then rub the other battery wire against the coil wire leading to the left wire clamp screw "20". Light sparking indicates that the coil is O. K. No sparking indicates a faulty coil. If an ammeter




is used to test the coil, the discharge will amount to from six to seven amperes.

To test a coil to see whether it is short-circuited, do not use an ammeter. Remove the vibrator assembly, disconnect both horn wires and attach one of the battery wires to one of the coil wires. Then rub the other battery wire against the horn body. If arcing occurs, the coil is short-circuited and should be repaired as explained under "If the Horn Fuse Burns Out," or replaced with another coil.

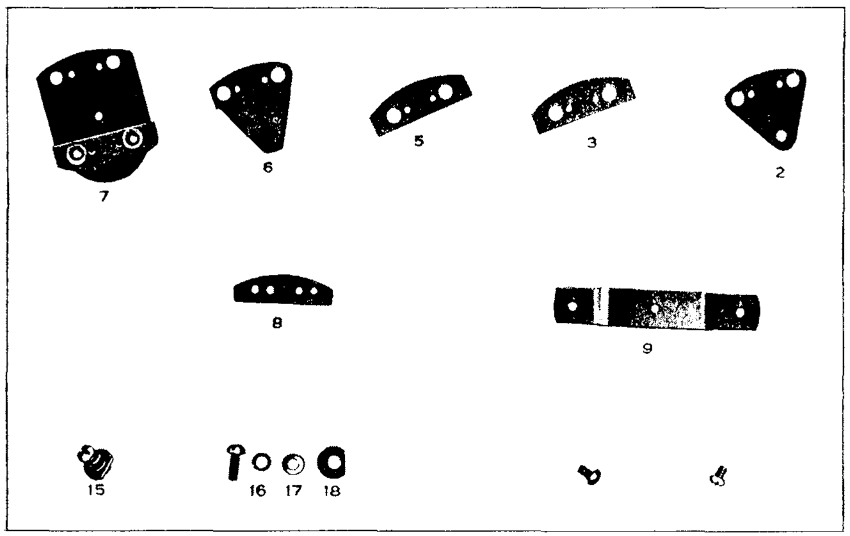
## To Remove the Coil

To remove the coil take off the housing bail and with a hot soldering iron remove the 2 or 3 drops of solder at "14". The early 1917 horns or earlier style horns have no solder at this place but should in all cases be soldered when they are overhauled. With a small screw driver or tool of some kind the fibre washer "11" should be pried out of the horn body. The coil can then be removed. If the coil sticks, it can easily be drawn from the iron bushing with a pair of pliers or by striking the horn with coil downward, against the bench. If the coil must be replaced with another, disconnect the large vibrator spring from the wire leading to the coil by first melting the solder at this connection with a soldering iron.

## If the Horn Fuse Burns Out

If the horn fuse constantly burns out, carefully inspect the wiring leading from the generator switch box to the horn and then test the horn to locate the short circuit. To test the wiring, disconnect the wire from the horn which leads from the generator to the left connection on the horn. Hold this wire in such a manner that the end cannot ground and cause a short circuit. Then place a good fuse in the fuse holder and turn "ON" the ignition switch. If the fuse will not burn out, the wiring is O. K., and all trouble is in the horn. If the fuse does burn out, the wire is at fault and should be replaced with another.

If the short circuit is traced to the horn, inspect the vibrator assembly and insulation as explained under "To Adjust the Horn."






## To Repair a Coil

A coil which has tested out to show an open circuit will invariably be an easy matter to repair. Examine the wires closely where they pass the fibre washer "11" and under the rubber tubes "13". See whether the wires are broken even though the insulation appears O. K. If a wire is broken, cut the insulation in two over the break and solder in another piece of wire of the same grade. If the outside winding of the coil shows a break, little trouble will be experienced in making a satisfactory splice. Be sure to thoroughly insulate the repair with friction or rubber tape.

If during the test the coil has proven to be shortcircuited, examine the inside winding carefully to see whether the insulation has rubbed through. If the insulation is worn or rubbed through, it undoubtedly was due to the coil having fitted loosely on the iron core or bushing. In this case do not attempt to insulate the exposed wire but remove the entire layer of inside winding by pulling it out, saving just enough of this layer to allow for a connection.

After the coil has been repaired, test it to see whether it is O. K. Before again placing the coil over the iron bushing, place about two wrappings of sheet fibre about 1 inch wide and 2 inches long and measuring about .008 inch thick on the inside of the coil. If two wrappings of fibre will not make the coil fit tightly over the bushing, add more sheet fibre. If two wrappings are too much, tear off a piece of the fibre.

To add this fibre between the coil and bushing is very important, because it will protect the coil from injury due to friction with the iron bushing. Therefore, place some of this fibre under every coil of each horn that requires repairing, whether or not the coil is in good condition. Care should be taken when placing the coil over the bushing to protect the coil from injury during this operation.

Place the piece of sheet fibre about one half way through the coil leaving the other half extend toward the bushing. Then carefully place the coil over the bushing and turn it back and forth while pressing it in place by hand. After the coil has been pressed over the bushing place a piece of pipe just large enough to pass, over the bushing and with a small hammer lightly drive the coil down tight. If some of the sheet fibre should extend the full length of the bushing, bend the extra length over onto the end of the coil with a jack-knife.

## To Assemble the Horn

If the vibrator assembly was taken apart for some reason, be sure to assemble it by placing armature "7" against the horn body first. Then follow with "6", "5", "4", "3", "2" and "1".

To line up this assembly, place the ½ inch clamp screws through the bracket of the horn body from the back side and through the numbered parts in above paragraph. While holding the screws in this position, place two nails or a piece of forked wire or spoke measuring 3/32 inch in diameter through holes "12" so as to line up these parts properly and accurately, thereby preventing all danger of a short circuit. Remove the two screws. Insulate these clamp screws with tape before passing them through and clamping the vibrator assembly. Do this with a piece of tape 1 inch long and 3/16 inch wide. Wrap the tape around the threaded part of the screw close to the head.

Be careful to wrap the tape around the screws in the right direction. The best way is to hold the screws and tape between two fingers and with a screw driver turn the screws to the right, thereby wrapping the tape around the screws. If the tape is wound around the screws in the wrong direction, it will unwind and tear while the screw is turned in place, allowing the vibrator springs to short circuit onto the screws. If the later style screws are used, insulate them with the fibre bushings. Firmly turn the screws into the horn body, clamping the assembly securely and withdraw the tool used to line up the vibrator assembly. The washers must be placed on the clamp screws as indicated at "15", first the lock washer "16", then plain metal washer "17" and fibre insulating washer "18". The vibrator mechanism is next in line to be adjusted. For instructions refer to instructions under "To Adjust the Horn."

# Changes Made on Horns

Careful inspection of horns on machines received after about June 1st will show that they differ slightly from the earlier horns. These changes do not alter the horns to any extent and were made only to render them more trouble proof. The changes are as follows: The coil is shimmed with fibre holding it secure onto the bushing. The thick fibre washer "11" is prevented from working loose by adding two or three drops of solder ("at 14") to the horn body. The screws which clamp the vibrator assembly together and turn into the tapped plate "8" are replaced with regular bolts and nuts, the tapped plate having been discarded. These clamp screws are insulated with turned fibre bushings which absolutely prevents all danger of a short circuit at this place. The hole through the center of the armature "7" is filled with solder to prevent the edge of the hole from puncturing the fibre insulator "6". A metal strip is being riveted over the fibre strip which is riveted to the armature, to prevent the fibre strip from tearing and the peaned end of the contact point on vibrator spring "4" is trimmed of sharp edges.

To repair a horn it is not necessary to apply the changes covered in the preceding paragraph, but careful application of the remainder of this bulletin is recommended. If it is desired to apply the latest changes to a horn as explained in the preceding paragraph, the necessary fittings can be obtained from us. Whenever a certain trouble is experienced refer to the various headings and apply the remedies.

# Service Dept. Bulletin

No. 62. November 1, 1917 Harley-Davidson Motor Co., Milwaukee

## Care of the Commutator—Electrically Equipped Model



A commutator which is grooved, showing that the brushes are gradually cutting into it, should not be neglected. Inspection of the commutator is recommended whenever the circuit breaker or distributor points are inspected and adjusted. Neglect will in time render the commutator and armature useless. A careful periodic inspection for wear and the application of the proper remedy when wear is found, will make renewal of the commutator unnecessary during the life of the machine.

## Causes of Quick Wear

Quick commutator wear can generally be traced to one or more of the following three causes: Hard carbon brushes, brushes bearing with too much pressure against the commutator, or failure to clean the commutator if the machine is used in very sandy or dusty country, especially if sand and dust can get under the circuit breaker cover.

## Hard Carbon Brushes

If a commutator is found grooved and inspection of the brush tension, as described hereinafter, proves that the springs are properly adjusted and the mechanism on the inside of the circuit breaker cover is clean, hard brushes are the cause of the commutator wear.

The reference to hard brushes does not mean that the brushes are as hard as a piece of steel, but rather that the composition of the material in the brush lacks graphite. The amount of graphite in a brush cannot be seen with the eye. Therefore, when a faulty brush is suspected, all three brushes and brush holders should be replaced.

Never replace a brush without replacing the holder because it is very important to have a perfect circuit between the two, and to obtain this circuit very careful soldering and tinning are required. The cost of a brush holder is less than the cost of the labor required to solder and tin a new brush to an old holder.



## To Fit and Adjust New Carbon Brushes

Trim the new brushes to conform with the radius of the commutator. Place the brush holders on the studs. Cut some "00" sandpaper (never use emery) into strips 3-8 inch wide. Place this sandpaper between the commutator and brush with the coarse side toward the brush.

After the sandpaper has been properly placed, bear down lightly on the brush holders and pull out the sandpaper. Be careful when pulling out the sandpaper not to damage the near edge of the brush. Follow the radius of the commutator with the sandpaper as much as possible. Refer to illustration. To obtain a good bearing of the brush against the commutator may require pulling the strip of sandpaper through several times, but the operation should be repeated only as often as is necessary.

When trimming the forward brush, be sure to pass the sandpaper between the lower bearing housing support and the commutator if the strip is long enough, and pull upward and backward so that the edges of the brush will not be trimmed off. When trimming the two rear brushes pass the strip of sandpaper under the upper housing support, then under the upper and lower brushes, and draw the sandpaper toward the front.

After the brushes have been properly seated, remove all traces of grit by wiping the commutator with a gasoline soaked rag and then drawing plain writing paper between the brushes and commutator. For instructions on adjusting the brush springs refer to instructions under "Proper Pressure of Brushes against Commutator" and "To Adjust Tension of Brush Springs."

## Proper Pressure of Brushes Against Commutator

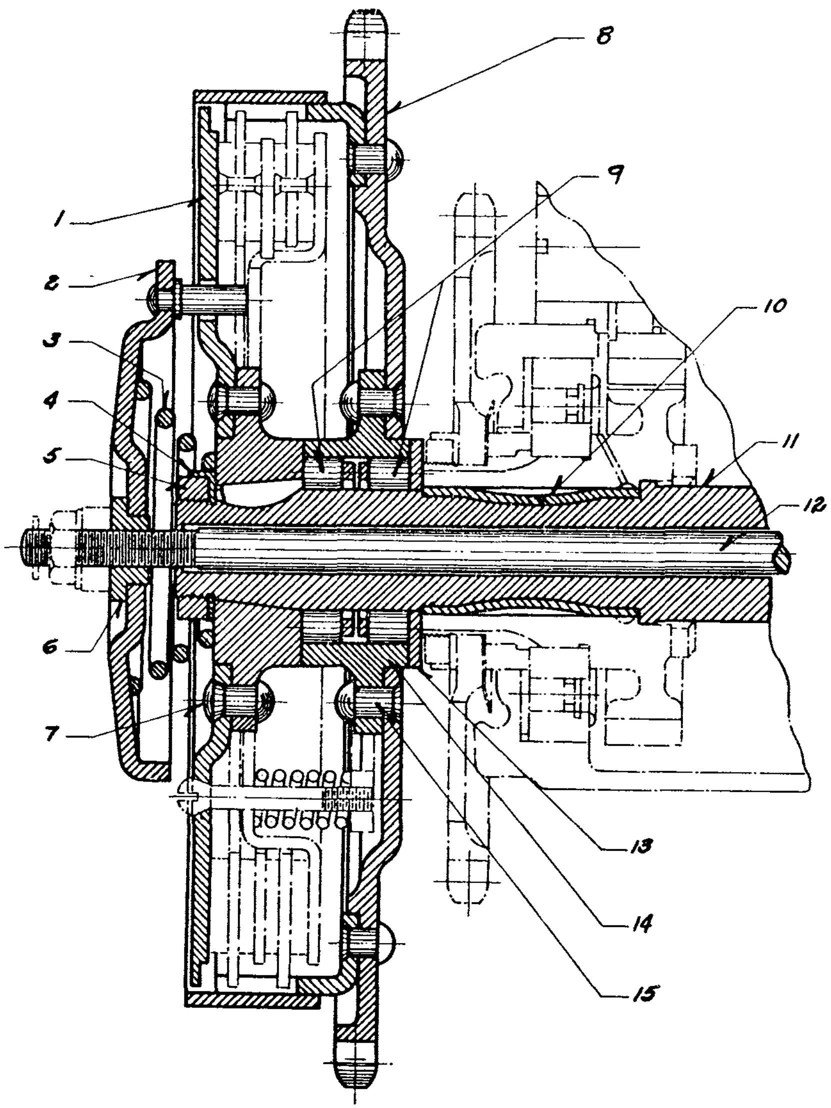
The proper brush pressure against the commutator is six ounces. Determine the proper pressure with a small spring scale or hook the end of the brush holder with a piece of wire to a scale graduated to ounces. Then pull the generator away, the exact brush pressure is determined at the point when the brush is just leaving the commutator and the scale is balancing. Never let a brush bear with greater pressure, nor have it considerably less. Too much pressure will cause quick wear of both the commutator and brushes, while too little pressure will affect the conductivity of the brush and interfere with the current output of the generator.

## To Adjust the Tension of the Brush Springs

When inspection proves that the brush springs are improperly adjusted, the following instructions should be applied: The cotter pins holding the brushes on

# Service Dept. Bulletin

No. 79. January 20, 1919 Harley-Davidson Motor Co., Milwaukee




Cross-section of 1919 Clutch.
*Parts drawn in heavy lines show changes.*



## The 1919 Clutch

The simplified construction of the 1919 clutch (which has eliminated ten parts) embodies several important features worthy of more than passing attention, such as the automatic lubrication, accomplished through the medium of the transmission, and the elimination of the split ring assembly, which, of course, now makes it impossible for a novice to put the clutch out of adjustment by altering the adjustment of the split ring.

Dealers and their repairmen should be familiar with the new construction to be able to explain its advantages and to make repairs when necessary.

The lubrication of the new clutch is taken care of entirely automatically through the transmission.

The cross section reproduced herewith shows the change in the clutch bearing. The change made in the actuating mechanism is not shown. It is but a few minutes work to gain access to these parts, and those who wish to become familiar with the construction, can inspect it after removing the pull rod. Care should be taken that the pull rod is properly adjusted when reassembling. The pull rod nuts should be adjusted so that the top end of the clutch hand lever has a free forward and backward movement of about ½ inch when the lever is forward.

### *Explanation of New Parts*

All parts that supersede other parts are clearly indicated with arrows and are more clearly visible, being drawn in heavy lines. The parts that are illustrated in a very thin dot and dash outline, have not been changed.

Arrow No. 1 points to the driving disc. It will be seen that the driving disc is riveted to a heavy taper bored bushing with ¼″ rivets, (see arrow No. 7). The taper bored bushing is in turn keyed to the main shaft as was the driving hub on the earlier clutches. It is through these parts that the power is conveyed from the friction assembly to the main shaft.

Arrows No. 2 and No. 3 indicate the actuating plate and the clutch takeup spring, respectively.

Arrow No. 4 refers to the special lock washer for the main shaft left side nut No. 5. The lock washer has three blades and secures the clamp nut when one of these blades is bent over one of the flat sides of the nut. As will be seen, in addition to holding the clutch on the main shaft, nut No. 5 also holds the clutch together. No special wrench is required to reach this nut. Any wrench that can open 1¼″ or that has a 1¼″ hexagon opening can be used.

If it is desired to remove the clutch from the main shaft, it will only be necessary to strike the end of the main shaft squarely with a hammer while pulling on the clutch shell with the other hand after the nut has been removed. A rawhide mallet, or a copper hammer such as is recommended for flywheel truing, is best suited for this work because the shaft or the threads are easily damaged with a steel hammer.

Arrow No. 6 points to the pull rod adjusting collar. This collar differs from the other type in that it is not as thick. It can be used on the earlier type model, although it will not be possible to use the earlier collars on the new clutch, because the pull rod is not long enough.

Arrow No. 8 directs attention to the clutch sprocket. It shows that the construction of the sprocket differs considerably from that used previously. The sprocket is enlarged,—not in diameter, but the inside area has been increased so as to eliminate the necessity of the clutch shell. There are many other advantages to this construction, the most important, that the former hub shell cone, now the outer roller race, No. 14, is riveted directly to the sprocket, see No. 15, whereas formerly the parts were held together with solder.

Arrow No. 9 points to the clutch bearing. The bearing is of the roller type identical with those used for the crank pin in the latest motors. This obviates the necessity of carrying a special size retainer and rollers in stock for clutch spares. The rollers run directly on the hardened main shaft. This construction helps to eliminate the driving hub, and also permits automatic lubrication from the gear box.

When the clutch bearing is fitted up, the size rollers are selected which will permit the sprocket assembly to turn perfectly free without any perceptible shake. The proper size rollers for this fit are those over which it will be just possible to pass the clutch roller race.

Arrow No. 10 points to the bronze bushing which is the bearing for the main drive gear. With this construction there will never be any danger of the gear running tight on the shaft with the proper amount of oil in the gear box. The bushing is made in two interchangeable parts, each part being keyed to the shaft so that the bushing will turn with the shaft only. To permit machining an even, true, bearing, the bushings are clamped securely to the shaft and while being held in this position are soldered together. They are then turned down to give the main drive gear .003″ clearance.

Arrows No. 11 and No. 12 lead to the main shaft and clutch pull rod, respectively. The change in the main shaft can readily be seen, while the length of the pull rod has been increased.

Arrow No. 13 points to the roller bearing washer. With these hardened steel washers the proper end play of the clutch is obtained. They are made in thicknesses varying .005″ from .085″ to .110″. If no end play is allowed, the clutch will not release, because the taper bushing which is riveted to the driving disc, the clutch roller race, the roller bearing washer, and the main drive gear are in contact.

Too much play between the clutch and the main drive gear also has its evils and for that reason a clearance of between .005″ and .010″ should be allowed between the roller bearing washer and the clutch roller race. It is important to gauge this clearance after the left side main shaft nut has been drawn up as tight as possible, or the washer will not be free after the clutch is tightened, and the clutch will drag.

# Service Dept. Bulletin

No. 65. Revised June 1, 1921 Harley-Davidson Motor Co., Milwaukee

## Working Principles of the Harley-Davidson Motor

The Harley-Davidson motor is of the conventional four-stroke-cycle principle. The power stroke being the chief cycle of the motor. It is made up of four events, or strokes: hence the term "four-stroke-cycle." Each 180 degrees of flywheel travel is one event or stroke. The flywheel must make two revolutions to complete one power cycle of the motor. Each cylinder of a four-stroke-cycle engine goes through the following cycle of events.

### Intake

The intake valve opens at the proper time by means of cam and gear action. The piston being on a downward stroke creates a partial vacuum in the cylinder. A gaseous vapor passes into the cylinder due to the atmospheric pressure passing through the carburetor and manifold. The atmospheric pressure at sea level is 14.7 pounds per square inch at 60 degrees F. The intake valve closes as the piston starts on the upward stroke.

### Compression

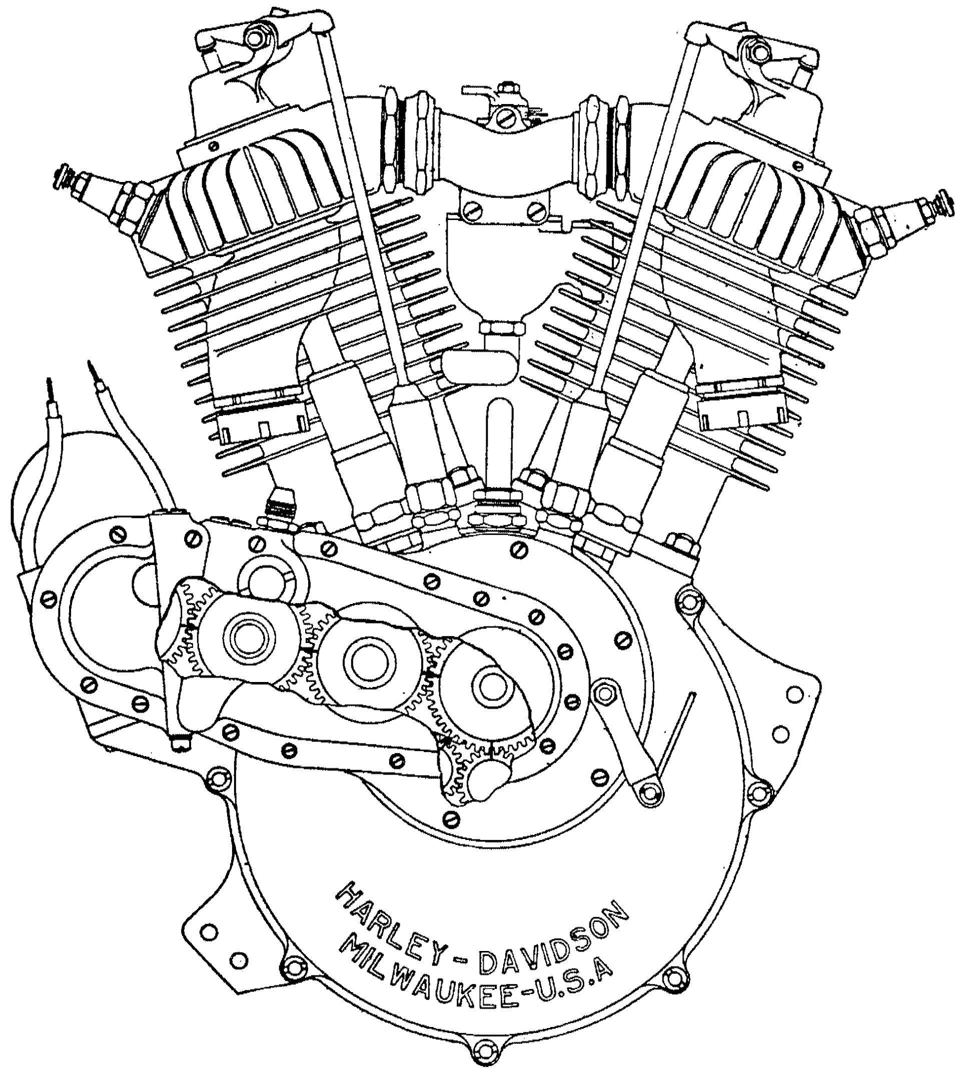
With both the intake and the exhaust valves closed, the cylinder chamber is now comparatively air tight. The piston on its upward stroke compresses and squeezes the gaseous vapor into a small space. This compression heats the mixture to a very much higher temperature and makes it more volatile. The ratio of compression in a motorcycle motor is usually 3.75 to 1, meaning that when the piston is at the lower most extremity of its stroke the chamber above it is 3.75 times greater than when the piston is at the upper extremity of its stroke. The sidecar motor has a compression of 55 pounds per square inch, and the solo motor 60 pounds per square inch. The compressed gases at this point are ready for ignition by an electric spark. After ignition takes place the gases expand from three to four times their initial compression pressure, that is, with a compression of 60 pounds per square inch, the gases would expand to 240 pounds per square inch after ignition.

### Ignition or Power Stroke

The generator or magneto being timed to produce an electric spark at the opportune time, ignites the highly compressed gases and starts combustion. The piston being the only movable part subject to the combustion starts on its downward stroke. The connecting rod transmits this power to the flywheels, driving the vehicle and storing up kinetic energy to carry the piston through the three minus strokes of the cycle.

### Exhaust and Scavenging Stroke

At the end of the power stroke the burnt gases still remain in the cylinder, so some provision must be made to expel these gases and prepare for the next series of events. On the upward stroke of the piston the exhaust valve opens and the




"V" Twin motor with cutaway gear cover, showing how 1915 to 1922 twin magneto models should be set according to gear marks

Illustration No. 1

spent gases are driven out, these hot gases coming in contact with the atmospheric pressure cause the report commonly heard from the gas engine. At the top of this stroke the exhaust valve closes and the intake valve opens, the motor starting on another cycle.

Briefly the cycle of events may be termed, 1, intake; 2, Compression; 3, Ignition; 4, Exhaust.

## Complete Timing Instructions for Harley-Davidson Motors

To insure the most accurate results in valve and ignition timing, the motor should be taken out of the frame and the front cylinder plug removed.

The close relation between the piston travel and the valve operation requires extreme accuracy in measurements when timing an internal combustion motor. For an example: With a difference of only one thousandth of an inch (.03 m/m) between the exhaust valve lifter pin and the valve stem, will cause the flywheel to travel approximately 3/16 inch (4.7 m/m) to make up the difference. For the best results in timing, use a 6 inch (150 m/m) scale graduated to at least 1/32 inch (.5 m/m), and measure the piston positions through the cylinder plug opening. The exact location of the piston can be determined by this method. Since accuracy is essential for correct timing, we do not recommend the practice of locating the piston through the inlet housing chamber.

Piston positions are determined from either upper (top) or lower (bottom) dead centers. Dead center is the point at the extreme upper or lower end of piston travel—the point where the piston is "dead."

## The Valve Lift Clearances Must Be Accurate

Before retiming the valves, make sure that the exhaust lifter pins and the inlet push rods are set according to the following specifications.

On all the twin cylinder models prior to 1915 and all the single cylinder models (except model 21 CD), allow .004 inch (.10 m/m) clearance between the exhaust lifter pins and the valve stems or caps. The earlier models had small steel caps placed over the ends of the exhaust valve stems to prevent the stems from wearing and to provide a means for taking up wear. These caps are made in various thicknesses and should be ground until the correct clearance is obtained.

Model 21 CD should have .004 inch (.10 m/m) clearance between the inlet rocker and valve stem, and .008 inch (.21 m/m) to .010 inch (.26 m/m) between the exhaust lifter pin and valve stem.

Allow .004 inch (.10 m/m) clearance between the inlet levers or rocker arms, and valve stems on all models.

On the 1915 and 1916 twin motors, allow .004 inch (.10 m/m) exhaust lifter pin clearance for the rear cylinder and .006 inch (.15 m/m) for the front cylinder.

On the 1917, and all later "V" type motors, allow from .008 inch (.21 m/m) to .010 inch (.26 m/m) clearance for both front and rear cylinder exhaust valve tappets. This also holds good for the "500," "A," "B" and "E" type fast stock motors.

The sport model lifter pin clearance for both the inlet and exhaust valves and for both cylinders is .006 inch (.15 m/m). Whenever making any adjustments to the valve tappets, be sure that the motor is cold, because the expansion of the cylinders and valve lifting mechanism varies when the motor is hot.

# To Time Inlet and Exhaust Valves

Assuming that the explosion of the fuel has taken place, it can easily be understood that there must be an outlet for the spent gases, at the proper time, in order to get the full benefit of the energy obtained by the explosion and to prevent possible injury to the motor. The exhaust valve and its lifting mechanism serves this purpose. The time of valve opening and closing can best be determined at the point when the push rod or lifter pin begins to tighten or loosen when operating the valve stem. This can easily be ascertained by turning the push rod while the motor is being turned over.

With the "V" type and the single cylinder motor, the point of exhaust valve opening is when the piston is between ¾ inch (19. m/m) and 9/16 inch (14.2 m/m) before bottom dead center. The exhaust valve closes when the piston is 1/32 inch (.79 m/m) to 3/32 inch (2.3 m/m) past (after) top dead center.

The exhaust valve of the Sport Model opens when the piston is between 9/16 inch (14.2 m/m) and 7/16 inch (11. m/m) before bottom dead center. It should close when the piston is 1/32 inch (.79 m/m) to 3/32 inch (2.3 m/m) past (after) top dead center.

Since the inlet and exhaust cams are mounted on the same timing gear (made integral) on all twin motors, the inlet valves do not require independent timing.

# Single Cylinder Inlet Timing

All 1913 and 1918 single cylinder motors require independent timing of the inlet valves, because the inlet cam is mounted on one of the intermediate timing gears. The single inlet valve should open 3/16 inch (4.7 m/m) before the piston reaches top dead center, to top center. The inlet valve should close when the piston is from ⅛ inch (3.1 m/m) to ⅜ inch (9.5 m/m) past (after) bottom dead center. Single cylinder motors prior to 1913 have automatic inlet valves, therefore require no timing.

# To Time Mechanical Relief Valve

To assure releasing the exact volume of crank case compression at the proper time, all motors are fitted with a relief or breather valve. All twin motors beginning with the 1914, but excluding the EH model, are fitted with a mechanically operated rotary relief valve. As the pistons descend in the cylinders a certain amount of compression is formed in the crank case. Some outlet for this compression must be provided for, in order that the motor can function properly. The timing of the relief valve controls the lubricating system to a large degree. When the pistons rise in the cylinders the relief (breather) valve closes and causes the piston to create a partial vacuum in the crank case and cylinders. This partial vacuum draws the oil and oil vapor into the crank case and cylinders, thereby lubricating all the moving parts on the interior of the motor.

The port in the sleeve of the relief valve (1915 to 1922) must be open between 1/16 inch (1.5 m/m) and 3/32 inch (2.3 m/m) when the FRONT piston is on either top dead center. This port opens gradually when the motor is turned in the direction it runs, and closes when the piston has reached bottom dead center. All single cylinder motors (except 21CD), the EH motor, and all twin motors prior to 1914, are fitted with an automatic relief, or breather valve which, of course, requires no timing. Single cylinder model 21CD, should be timed according to 1915 instructions as outlined above.

## To Time Spark

When the fuel charge is properly compressed, it must be ignited. Ignition of the compressed gases is accomplished by a storage battery and generator-ignition unit, or by a high tension magneto. Ignition, or the electric spark, occurs at the time when the generator or magneto circuit breaker points are just separating. At this juncture, a high tension (high voltage) spark is induced to jump between the spark plug points and ignite the highly compressed gases, causing the gases to explode and expand, forcing the piston downward and giving energy to the rear wheel of the motorcycle in the form of power. Since an interval of time is required for ignition to propagate a flame thru the gases and cause complete combustion, the timing of the electric sparks occurrence is always set before the piston reaches its top dead center on the compression stroke. The following paragraphs will enable one to correctly time the ignition for any Harley-Davidson Motor.

## Magneto Equipped, Standard Solo "V" Twin

High compression solo motors with magneto ignition are timed to spark when the piston is 17/64 inch (6.7 m/m) to 5/16 inch (7.9 m/m) before top dead center on the compression stroke. The circuit breaker lever must be fully advanced and the circuit breaker points just breaking when timing all motors for ignition.

## Magneto Equipped, Sidecar "V" Twin

To time low compression sidecar motors with magneto ignition, set the piston 13/64 inch (5.1 m/m) to 17/64 inch (6.7 m/m) before top dead center on compression stroke, with the circuit breaker lever fully advanced and the breaker points just separating.

## Generator Equipped, Standard Solo "V" Twin

High compression solo motors with generator ignition should be timed when the piston is 15/64 inch (5.9 m/m) to 9/32 inch (7.1 m/m) before top dead center on the compression stroke.

## Generator Equipped, Sidecar "V" Twin

Side car motors equipped with generator ignition should be timed when the piston is 13/64 inch (5.1 m/m) to 17/64 inch (6.7 m/m) before top dead center.

## All Single Cylinder Motors

Time all single cylinder motors (except 21 CD) when the piston is 3/16 inch (4.7 m/m) to ¼ inch (6.3 m/m) before top dead center on the compression stroke, with the circuit breaker lever fully advanced and the breaker points just breaking. The 1921 CD, commercial single should be timed with the piston ¼ inch (6.3 m/m) to 9/32 inch (7.1 m/m) before top dead center.

## Sport Model Ignition Timing

Time all Sport Model motors for ignition when the piston is ⅜ inch (9.5 m/m) to 7/16 inch (11. m/m) before top dead center on the compression stroke. On the magneto models, the front interrupter shoe times for the front cylinder.

## Ignition Timing for Fast "500," "M," "A" and "E" Type Motors

Ignition timing for special built fast motors should be set with the piston ⅜ inch (9.5 m/m) to 7/16 inch (11. m/m) before top dead center. Remember that ignition timing alone will not make any motor fast, it must be built for speed in the first place.

> It is common practice to set automobile ignition timing with the circuit breaker lever retarded, pistons located at top dead center and the circuit breaker points just opening. This method cannot be practiced on motorcycle motors, because the ignition would occur ⅛ inch (3.1 m/m) late. This, of course, would cause the motor to overheat and not develop its fullest efficiency.

## Circuit Breaker Adjustments

To insure extreme accuracy in ignition timing, make sure that the circuit breaker points are set according to the manufacturers specifications. An adjusting wrench fitted with a thickness gauge accompanies each ignition apparatus. If such a gauge is not available, adjust the breaker points according to the following data:

| | | |
|---|---|---|
| Harley-Davidson Generator | .020 inch | (.51 m/m) |
| Remy model 250 Generator | .020 inch | (.51 m/m) |
| Remy model 235 Generator | .020 inch | (.51 m/m) |
| Bosch magneto | .015 inch | (.4 m/m) |
| Berling magneto | .018 inch | (.46 m/m) |
| Dixie magneto | .020 inch | (.51 m/m) |

## Reasons for Advancing and Retarding the Spark

Theoretically the proper time for exploding the charge is at top dead center on the compression stroke, when the charge is compressed as much as it can be. However, there is a slight lapse of time between the sparking and explosion. When the spark occurs, it first ignites the charge around the spark plug points. This flame then spreads through the rest of the mixture, forcing the piston downward. The time between the spark and complete explosion of the mixture is very short, but it can easily be understood that as the speed of the motor is increased, the spark should be advanced. For this reason, the time of ignition is made adjustable with the use of the left grip.

If the motor is run at high speed with a retarded spark, the spark will occur when the piston is 1/16 inch (1.5 m/m) to ⅛ inch (3.1 m/m) past top center on the power stroke, and considerable energy will be lost on account of the lapse of time between the spark and complete explosion. Then again, running the motor at slow speed with an open throttle and fully advanced spark will result in injury to the motor in time, because complete combustion of the charge will take place before the piston has reached top dead center on the compression stroke. The effects of this can be more easily noticed in the form of a knock, when driving at low motor speed with an open throttle on a hard pull. Therefore, to get the full effect of the explosion, the spark should occur slightly before top center on the compression stroke.

The time of sparking is controlled by turning the left grip to the right or to the left, depending on the speed of the motor and whether or not under a hard pull. If the above is understood, the left grip will always be carried in the proper position. Running the motor accordingly will mean added life, because the explosion is taking place when the piston is in the proper position.

Do not form the impression from the above explanation that it is necessary to carry the spark in retarded position whenever driving slowly. Do not do this unless the motor is pulling hard at a low motor speed.

## To Time Model 235 Generator for the First Time

When a model 235 generator is fitted to a motor for the first time, gear marks cannot be referred to, to get the timing correct, because the interrupter cam is loose on the shaft and must be set for that particular motor. Proceed to time the generator by first placing all the gears with marks in line in their respective places. An inspection will prove that the front piston is near the top center on the compression stroke. Turn the motor, whichever way is necessary, to bring the front piston between 7/32 inch (5.5 m/m) to 9/32 inch (7.1 m/m) before top center on the compression stroke. Remove the bakelite distributor cap and the high tension distributor segment. Remove the hexagon nut clamping the circuit breaker cam, and with the special wrench (see illustration No. 2) pry the cam loose from the tapered timer shaft. Advance the circuit breaker as far as it will go by pushing it forward. Move the cam on the shaft in the direction it runs so that the SMALL CAM is just causing the circuit breaker points to break contact. Then tighten the cam clamp nut securely.

Be careful when setting this cam, not to use the wrong cam for the cylinder that is being timed. The small cam times the front cylinder while the large cam times the rear cylinder. After the cam has been properly set and securely clamped, check over the timing and if it is O. K., place the high tension distributor segment over the end of the shaft in such a position that the driving pin on the cam lines up with the provided hole in the distributor segment. Later models have a special clip to support the distributor segment. The bakelite distributor cap can then be placed over the circuit breaker assembly, it being only necessary to line up the stop of this cap with the slot in the upper rear edge of the timer head and securing it by means of the springs. When placing the ignition cables into the distributor cap, be sure to place the short cable, which is for the rear cylinder, into the extreme left boss. The long front cylinder cable should be placed into the extreme right boss of the distributor cap.

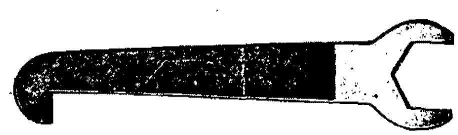


Illustration No. 2
HX-1114 Price $.25

## To Time Model 235 Generator According to Gear Marks

Assuming that the pinion, relief, secondary, intermediate, and intermediate worm gears have been set according to marks as is covered under: To Time Twin Cylinder Motors According to Gear Marks, only the generator intermediate and generator gears remain to be set.

Place the generator gear and key on the generator shaft, fit the washer and draw up the LEFT HAND clamp nut temporarily. Remove the distributor cap from the generator. Turn the generator drive gear backward or to the left until the small cam just touches the fibre block on the circuit breaker lever. This is very important because the generator drive gear and circuit breaker cam are geared three to one respectively. Place the intermediate generator gear on the stud so that the marks on the generator gear, intermediate generator gear, and intermediate worm gear line up exactly true. Pay special attention to this because if one of these gears is just one tooth from the proper position, the point of ignition will be off ¼ inch (6.3 m/m), which would have a decided effect on the running of the motor. After having the gears lined up properly, securely tighten the generator gear clamp nut and fit the split rings and collars on the gear studs.

As a matter of safety, check over the timing of the ignition following previous instructions.

# To Time the Harley-Davidson Generator on "V" Type Twins

Owing to the circuit breaker cam and the timer shaft being made integral, new timing instructions are obvious. It will not be possible to time the ignition properly by lifting the timer base from the generator body and meshing the spiral gear on timer

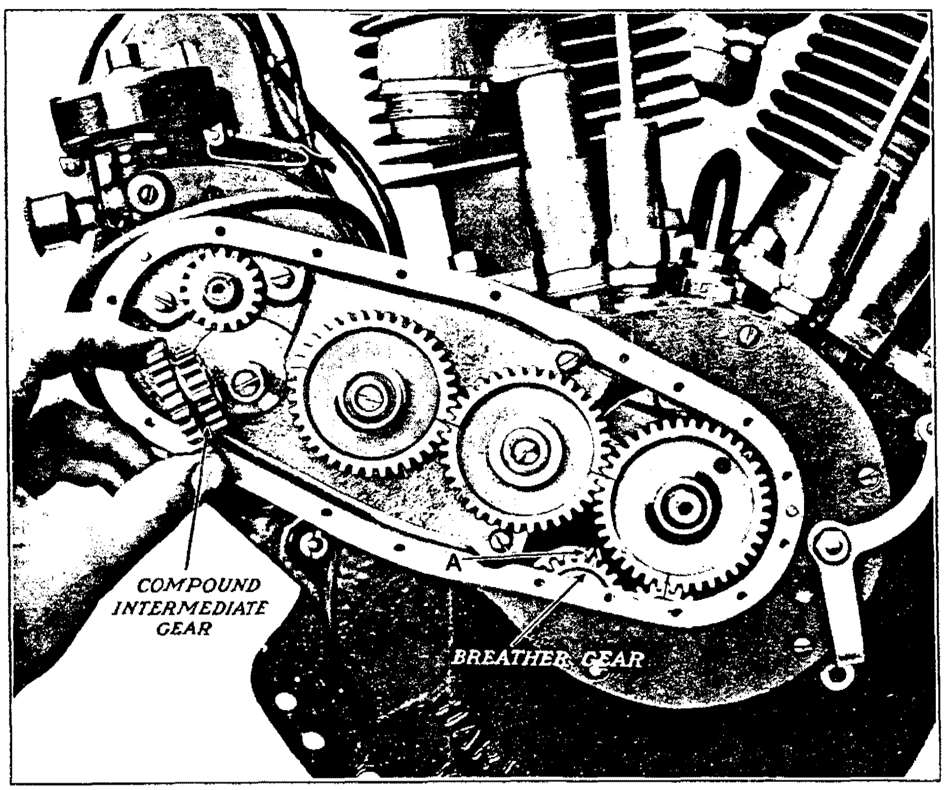



Illustration No. 3

shaft with the worm gear on the armature shaft.

The generator drive gear and the intermediate compound gear are not marked, however, the remainder of the gears: intermediate worm (oiler) gear, intermediate, secondary (cam), pinion, and relief gears retain their original markings. When all of the marked gears are set properly, i.e., all marks in line, the front cylinder piston will be approximately 3/16 inch (4.7 m/m) from top center on the compression stroke. Refer to illustration 3 for proper gear settings.

Advance the timer lever (illustration No. 4) by moving it forward to the full (.4 m/m). Note: The full opening of the circuit breaker points when properly adjusted is between .020 inch (.51 m/m) to .024 inch (.61 m/m). With the circuit breaker points set as specified (open .015 inch .38 m/m) and the marked gears in perfect line, hold the small generator gear firmly with the thumb of the left hand. Insert the compound intermediate gear by turning it and trying to mesh it with the generator and intermediate oiler gears. The construction of the compound intermediate gear (one gear being smaller than the other) allows proper meshing of the teeth at several positions. Do not force the compound gear into meshing with the


Illustration No. 4

extent of its travel, as indicating by the arrow. Since ignition for the front cylinder is in order, select the SMALL END of the timer cam (illustration No. 4) and turn it to the right (clockwise) until it has opened the circuit breaker points .015 inch

other two gears—but keep turning it and trying different positions until it slips in place freely. After properly meshing the gears put the split lock ring in place; this prevents the gear from coming off of the stud and losing the correct timing just obtained. These timing instructions if properly carried out will be accurate to within a small margin. Should the motor be out of the frame, the cylinder plug (found in the cylinder head) may be removed with a special wrench, and a steel scale (ruler) inserted in the hole and the results may be checked as follows:

Advance the spark lever. Rotate the motor in a right hand (clock-wise) direction until the small or front cylinder cam just *begins* to separate the breaker points. If it should be necessary to turn motor backward (anti-clockwise) in order to get the proper setting of breaker points be sure to remove back lash in the timer shaft if any, by trying to turn the timer shaft to the left with the hand, as the gears should be in the same position while timing as when being driven by the motor. Insert a 6-inch (150. m/m) steel scale (ruler) into the front cylinder and lay some flat object across the vertical cylinder flanges to facilitate the reading of the scale. Note the reading of the scale in this position, then turn the motor (clockwise) and note how much the scale rises until it reaches its highest point. When the ignition is properly timed the scale should rise between 15/64 inch (5.9 m/m) and 9/32 inch (7.1 m/m) for standard solo motors, and 13/64 inch (5.1 m/m) to 17/64 inch (6.7 m/m) for sidecar motors. Should the readings not check according to these figures the first time they are checked, do not change timing until it has been rechecked several times.

## To Time Twin Cylinder Motors According to Gear Marks

Assuming that all of the gears have been removed, but that no new gears are to be fitted, it is a simple matter to retime the motor correctly according to the following: Place the pinion gear on the fly wheel shaft, and fit the key and the pinion lock screw. (The lock screw has a left hand thread). Fit the compression relief valve in the bronze bushing. On 1914 and 1915 motors, line up the marks on the compression relief valve gear and the pinion gear.

On 1916, 1917, 1918, 1919, 1920, 1921 and 1922 motors, line up the mark of the compression relief valve gear with the mark ("A") stamped in the crank case. See "A" illustration No. 3. Before fitting this gear, be sure that the motor is in such a position that the mark on the driving pinion is in perfect alignment with the secondary gear stud and lifter arm stud as shown in the illustration. It is always advisable to check over the timing after a gear has been set according to marks. We therefore urge that the timing of the compression relief valve be checked over to see whether it corresponds with the timing mentioned previously in this article.

After the compression relief valve has been properly fitted and timed, place the secondary gear on the stud in such a manner that the mark will line up with the mark on the pinion gear. In order to get this result with the 1914 and 1915 motors, the motor must first be turned until the mark on the pinion gear is in an upward position. The secondary gears on all 1915, 1916, 1917, 1918, 1919, 1920, 1921 and 1922 motors have two marks. Be sure to place the gear on the stud in such a position that the other mark will be toward the intermediate drive gear. See illustration No. 1. The exhaust valve timing can now be checked over and must correspond within the limits already mentioned. Fit the drive case after being sure that the marks of the pinion and secondary gear are in line. Then place the intermediate gear so that its mark will coincide with the mark on the secondary gear. After the intermediate gear has been placed in position, the motor should not be turned again. The intermediate worm gear is then placed on the stud in such a way that one of the marks of this gear and the intermediate gear line up.

The magneto or 250 model generator drive gear (not the 235 or Harley-Davidson generator) is then lined up with the intermediate worm gear after the key has been properly placed in the keyway of the shaft. If the keyway of the shaft and gear are not in line, the shaft only may be turned, because gear marks must be in line to have the timing right. Fit the lock washer and draw the clamp nut tight. After completing these operations the gear marks will be in line as shown in illustration No. 1.

## To Time Single Cylinder Motors According to Gear Marks

Place the pinion gear on the fly wheel shaft. Turn the motor until the mark on this gear is upward. Then place the secondary gear on the stud so that the marks of this gear and the pinion gear are in line. Replace the drive case. Turn the motor until the mark on the gear which is mounted with the secondary gear will be toward the intermediate cam gear stud (toward the rear of the motor). Place the intermediate or intake cam gear on the stud so that the proper mark will line up with the mark on the gear mounted with the secondary gear. Fit the other intermediate gear and then the magneto gear according to marks. When the gears are set according to marks, all marks visible will be in line.

These instructions, as already mentioned, apply to retiming a motor when the original gears are used. If a new gear is fitted, time the motor according to piston positions, as previously explained under: To Time Inlet and Exhaust Valves.

## Timing Ignition for the Sport Model Without Removing the Generator Drive Gear

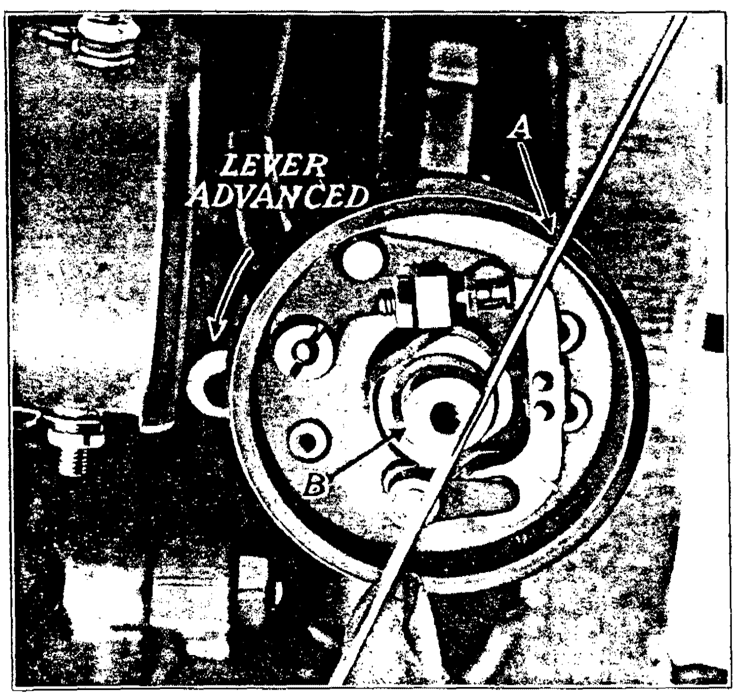



Illustration No. 5

When disassembling generator from the motor do not remove the generator drive gear unless generator must be entirely disassembled. The hole in the rear of gear case is large enough to permit the passage of the gear while on drive shaft. Inspect circuit breaker points before starting to time motor, for proper gap which should be .020 inch (.51 m/m) and can be determined by thickness gauge or by the steel gauge on the back of the generator wrench. Remove the generator intermediate gear. Rotate the motor until pinion gear marks "A" and "B" are directly in line with secondary gear and intermediate drive gear. See illustration No. 7.

It is very essential that these marks are acccurately aligned. Every circuit breaker casting or frame has a filed mark on the outer edge of this casting. Remove distributor segment and holder, and by placing the edge of a 6 inch (150. m/m) scale against the flat side of the timer shaft "B," the flat side of the timer shaft should be accurately aligned with the filed mark "A" on the outer edge of circuit breaker casting or frame. When aligning timer shaft with filed mark on casting, be sure that the flat side of the shaft is to the right rear of the shaft center. See illustration No. 5.

When timer shaft is in the above described position and the marks on the pinion gear, secondary gear, and intermediate gear are properly lined up, the generator intermediate gear will mesh with the intermediate gear and the generator drive gear. Place this gear in position and secure with split locking ring. After generator is correctly timed be sure that outside terminal of distributor cap leads to the front cylinder. These terminals being the same length makes it possible for them to become crossed which would, of course, change the timing. See illustration No. 6.

## Timing Sport Model Ignition When the Generator Drive Gear Has Been Removed

Inspect circuit breaker points before starting to time motor, for proper gap, which should be .020 inch (.51 m/m) and can be determined by a thickness gauge, or the steel gauge on the back of the generator wrench. The generator drive gear has three keyways, which are placed in different positions, permitting the changing of timing by 1/3 of a tooth, 2/3 of a tooth or by 1 tooth. Rotate the motor until pinion gear marks are directly in line with secondary gear and intermediate gear. See illustration No. 7. It is very essential that these marks are accurately aligned. Every circuit breaker casting or frame has a filed mark on the outer edge of this casting after the motor has once been timed at the factory. Remove distributor segment and holder, and by placing the edge of a 6 inch (150. m/m) scale against the flat side of the timer shaft, the flat side of the timer shaft should be accurately aligned to the field mark on the outer edge of circuit breaker casting or frame. See illustration No. 5. When aligning timer shaft with filed mark on casting be sure that the flat side of the shaft is to the rear of shaft center. When timer shaft is in the above described position and the marks on the pinion gear, second-

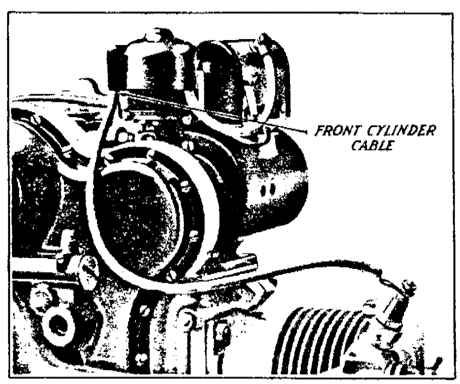



Illustration No. 6

ary gear and intermediate gear are properly lined up, try the generator drive gear in each of the keyways, until it slips in mesh, without changing the position of timer shaft or without turning the pinion gear. It is advisable to recheck timing by inserting a 6 inch (150. m/m) scale in front cylinder to determine whether circuit breaker points are just beginning to separate when piston is from 3/8 inch (9.5 m/m) to 7/16 inch (11. m/m) before top dead center, on compression stroke, with interrupter fully advanced. It is necessary to remove the front foot board support and the front cylinder plug for this operation. After generator is correctly timed, be sure that the outside terminal of distributor cap leads to the front cylinder. These terminals being both the same length makes it possible for them to become crossed which would entirely change the timing. See illustration No. 6.

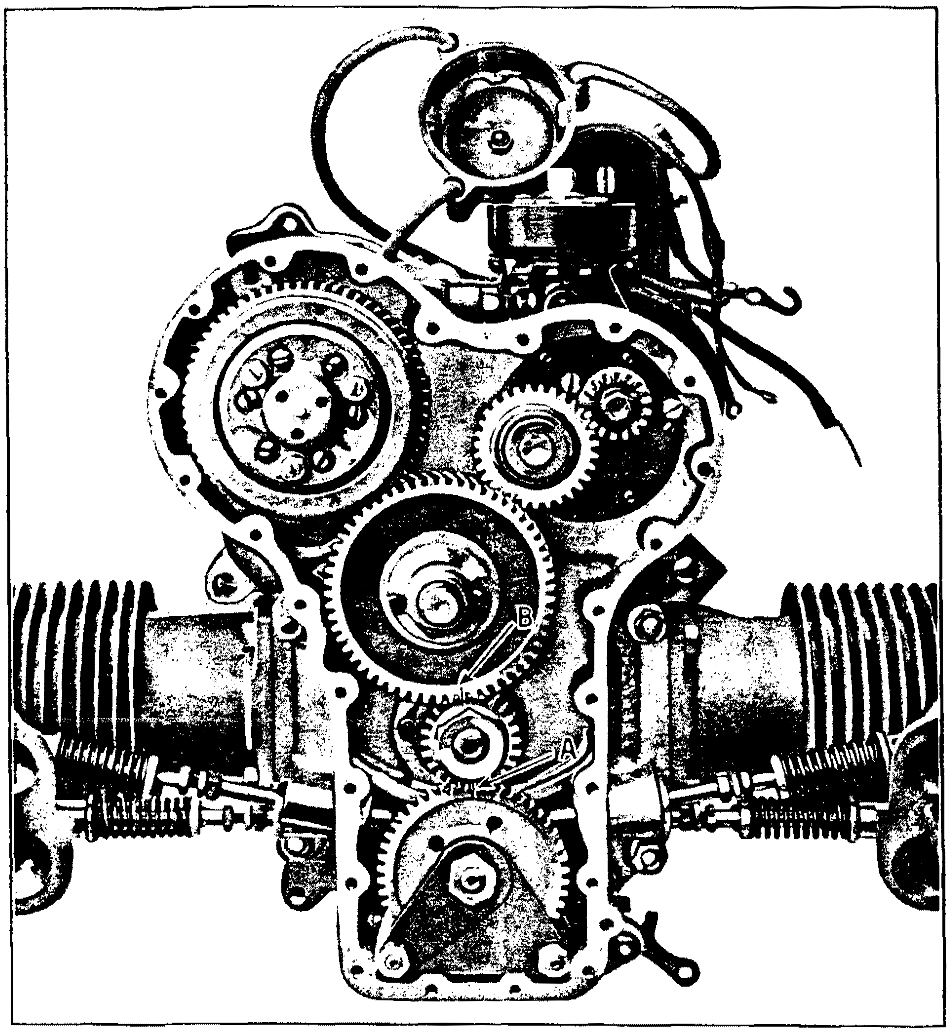



Illustration No. 7

# Summary of All Motor Valve Timing

### 1912 TO 1916 "V" TWINS

Exhaust valve opens with piston ⅝ inch (15.8 m/m) to ¾ inch (19. m/m) before bottom dead center.

Exhaust valve closes with piston 1/32 inch (.79 m/m) to 3/32 inch (2.3 m/m) after top dead center.

Inlet valve opens with piston 1/32 inch (.79 m/m) to 3/32 inch (2.3 m/m) before top dead center.

Inlet valve closes with piston ⅛ inch (3.1 m/m) to ¼ inch (6.3 m/m) after bottom dead center.

### 1917 TO 1922 "V" TWINS,

### All Standard 61", Standard 74", "500", "A" and "E" Motors.

Exhaust valve opens with piston 19/32 inch (15. m/m) to 23/32 inch (14.2 m/m) before bottom dead center.

Exhause valve closes with pistons 1/16 inch (1.5 m/m) to 7/64 inch (2.7 m/m) after top dead center.

Inlet valve opens with pistons 5/32 inch (3.9 m/m) to 19/64 inch (7.5 m/m) before top dead center.

Inlet valve closes with piston ¾ inch (19. m/m) to ⅞ inch (22.2 m/m) after bottom dead center.

### SINGLE CYLINDER VALVE TIMING 1912 TO 1918

Exhaust valve opens with piston ⅝ inch (15.8 m/m) to ¾ inch (19. m/m) before bottom dead center.

Exhaust valve closes with piston 1/32 inch (.79 m/m) to 3/32 inch (2.3 m/m) after top dead center.

Inlet valve opens with piston 1/32 inch (.79 m/m) to ⅛ inch (3.1 m/m) before top dead center.

Inlet valve closes with piston ¼ inch (6.3 m/m) to ⅜ inch (9.5 m/m) after bottom dead center.

### SPORT MODEL VALVE TIMING

Exhaust valve opens with pistons 7/16 inch (11.1 m/m) to 9/16 inch (14.2 m/m) before bottom dead center.

Exhaust valve closes with piston 1/32 inch (.79 m/m) to 3/32 inch (2.3 m/m) after top dead center.

Inlet valve opens with piston 1/16 inch (1.5 m/m) to 3/16 inch (4.7 m/m) before top dead center.

Inlet valve closes with piston 7/16 inch (11.1 m/m) to ⅝ inch (15.8 m/m) after bottom dead center.

The sport model breather valve is made integral with the secondary gear, therefore it does not require special timing.

# Miscellaneous

### TWIN BERLING MAGNETO

Lower cam (or shoe) in interrupter housing times ignition for front cylinder. Upper cam (or shoe) in interrupter housing times ignition for rear cylinder.

### TWIN DIXIE MAGNETO

Cam No. 2 times ignition for front cylinder. Cam No. 1 times ignition for rear cylinder.

### TWIN BOSCH MAGNETO

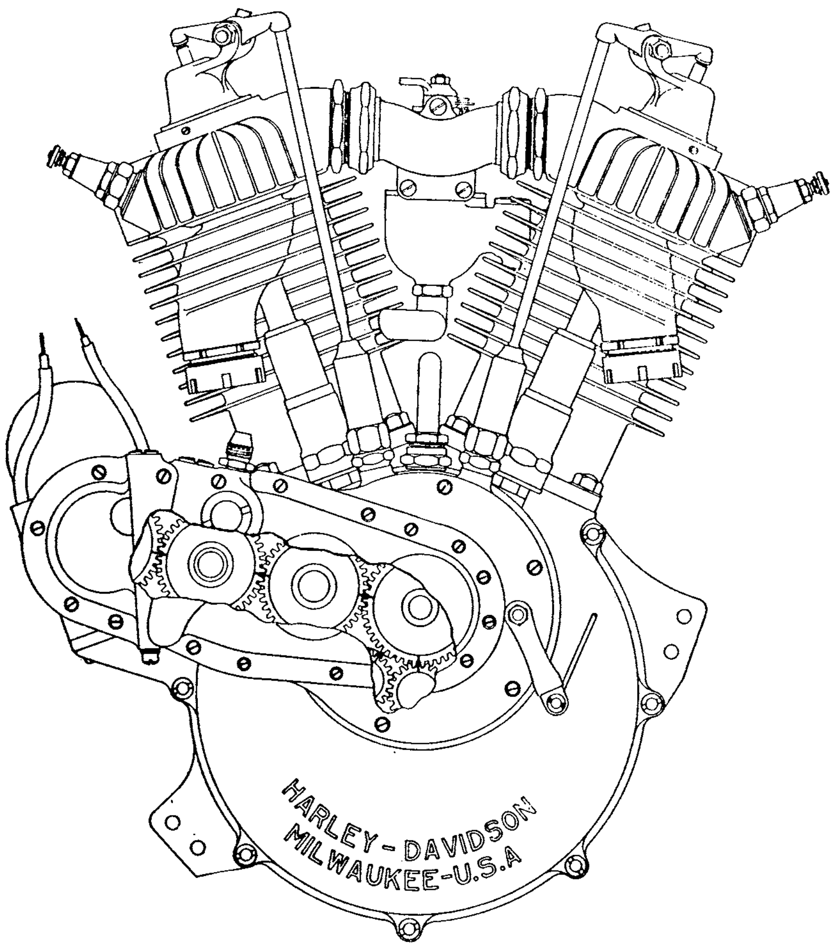
Interrupter shoe No. 2 times ignition for front cylinder. Interrupter shoe No. 1 times ignition for rear cylinder.

### ALL "V" TYPE TWIN GENERATORS

Small cam times ignition for front cylinder. Large cam times ignition for rear cylinder.

### SPORT MODEL MAGNETO

The front interrupter shoe on the Sport Model magneto times ignition for the front cylinder. The front high tension cable also goes to the front spark plug.




"V" Twin motor with cutaway gear cover, showing how 1915 to 1922 twin magneto models should be set according to gear marks

Illustration No. 1

## To Time Inlet and Exhaust Valves

Assuming that the explosion of the fuel has taken place, it can easily be understood that there must be an outlet for the spent gases, at the proper time, in order to get the full benefit of the energy obtained by the explosion and to prevent possible injury to the motor. The exhaust valve and its lifting mechanism serves this purpose. The time of valve opening and closing can best be determined at the point when the push rod or lifter pin begins to tighten or loosen when operating the valve stem. This can easily be ascertained by turning the push rod while the motor is being turned over.

With the "V" type and the single cylinder motor, the point of exhaust valve opening is when the piston is between ¾ inch (19. m/m) and 9/16 inch (14.2 m/m) before bottom dead center. The exhaust valve closes when the piston is 1/32 inch (.79 m/m) to 3/32 inch (2.3 m/m) past (after) top dead center.

The exhaust valve of the Sport Model opens when the piston is between 9/16 inch (14.2 m/m) and 7/16 inch (11. m/m) before bottom dead center. It should close when the piston is 1/32 inch (.79 m/m) to 3/32 inch (2.3 m/m) past (after) top dead center.

Since the inlet and exhaust cams are mounted on the same timing gear (made integral) on all twin motors, the inlet valves do not require independent timing.

## Single Cylinder Inlet Timing

All 1913 and 1918 single cylinder motors require independent timing of the inlet valves, because the inlet cam is mounted on one of the intermediate timing gears. The single inlet valve should open 3/16 inch (4.7 m/m) before the piston reaches top dead center, to top center. The inlet valve should close when the piston is from ⅛ inch (3.1 m/m) to ⅜ inch (9.5 m/m) past (after) bottom dead center. Single cylinder motors prior to 1913 have automatic inlet valves, therefore require no timing.

## To Time Mechanical Relief Valve

To assure releasing the exact volume of crank case compression at the proper time, all motors are fitted with a relief or breather valve. All twin motors beginning with the 1914, but excluding the EH model, are fitted with a mechanically operated rotary relief valve. As the pistons descend in the cylinders a certain amount of compression is formed in the crank case. Some outlet for this compression must be provided for, in order that the motor can function properly. The timing of the relief valve controls the lubricating system to a large degree. When the pistons rise in the cylinders the relief (breather) valve closes and causes the piston to create a partial vacuum in the crank case and cylinders. This partial vacuum draws the oil and oil vapor into the crank case and cylinders, thereby lubricating all the moving parts on the interior of the motor.

The port in the sleeve of the relief valve (1915 to 1922) must be open between 1/16 inch (1.5 m/m) and 3/32 inch (2.3 m/m) when the FRONT piston is on either top dead center. This port opens gradually when the motor is turned in the direction it runs, and closes when the piston has reached bottom dead center. All single cylinder motors (except 21CD), the EH motor, and all twin motors prior to 1914, are fitted with an automatic relief, or breather valve which, of course, requires no timing. Single cylinder model 21CD, should be timed according to 1915 instructions as outlined above.

## To Time Spark

When the fuel charge is properly compressed, it must be ignited. Ignition of the compressed gases is accomplished by a storage battery and generator-ignition unit, or by a high tension magneto. Ignition, or the electric spark, occurs at the time when the generator or magneto circuit breaker points are just separating. At this juncture, a high tension (high voltage) spark is induced to jump between the spark plug points and ignite the highly compressed gases, causing the gases to explode and expand, forcing the piston downward and giving energy to the rear wheel of the motorcycle in the form of power. Since an interval of time is required for ignition to propagate a flame thru the gases and cause complete combustion, the timing of the electric sparks occurrence is always set before the piston reaches its top dead center on the compression stroke. The following paragraphs will enable one to correctly time the ignition for any Harley-Davidson Motor.

## Magneto Equipped, Standard Solo "V" Twin

High compression solo motors with magneto ignition are timed to spark when the piston is 17/64 inch (6.7 m/m) to 5/16 inch (7.9 m/m) before top dead center on the compression stroke. The circuit breaker lever must be fully advanced and the circuit breaker points just breaking when timing all motors for ignition.

## Magneto Equipped, Sidecar "V" Twin

To time low compression sidecar motors with magneto ignition, set the piston 13/64 inch (5.1 m/m) to 17/64 inch (6.7 m/m) before top dead center on compression stroke, with the circuit breaker lever fully advanced and the breaker points just separating.

## Generator Equipped, Standard Solo "V" Twin

High compression solo motors with generator ignition should be timed when the piston is 15/64 inch (5.9 m/m) to 9/32 inch (7.1 m/m) before top dead center on the compression stroke.

## Generator Equipped, Sidecar "V" Twin

Side car motors equipped with generator ignition should be timed when the piston is 13/64 inch (5.1 m/m) to 17/64 inch (6.7 m/m) before top dead center.

## All Single Cylinder Motors

Time all single cylinder motors (except 21 CD) when the piston is 3/16 inch (4.7 m/m) to ¼ inch (6.3 m/m) before top dead center on the compression stroke, with the circuit breaker lever fully advanced and the breaker points just breaking. The 1921 CD, commercial single should be timed with the piston ¼ inch (6.3 m/m) to 9/32 inch (7.1 m/m) before top dead center.

## Sport Model Ignition Timing

Time all Sport Model motors for ignition when the piston is ⅜ inch (9.5 m/m) to 7/16 inch (11. m/m) before top dead center on the compression stroke. On the magneto models, the front interrupter shoe times for the front cylinder.

## Ignition Timing for Fast "500," "M," "A" and "E" Type Motors

Ignition timing for special built fast motors should be set with the piston ⅜ inch (9.5 m/m) to 7/16 inch (11. m/m) before top dead center. Remember that ignition timing alone will not make any motor fast, it must be built for speed in the first place.

> It is common practice to set automobile ignition timing with the circuit breaker lever retarded, pistons located at top dead center and the circuit breaker points just opening. This method cannot be practiced on motorcycle motors, because the ignition would occur ⅛ inch (3.1 m/m) late. This, of course, would cause the motor to overheat and not develop its fullest efficiency.

## Circuit Breaker Adjustments

To insure extreme accuracy in ignition timing, make sure that the circuit breaker points are set according to the manufacturers specifications. An adjusting wrench fitted with a thickness gauge accompanies each ignition apparatus. If such a gauge is not available, adjust the breaker points according to the following data:

Harley-Davidson
 Generator ..—.020 inch (.51 m/m)
Remy model 250
 Generator ...—.020 inch (.51 m/m)
Remy model 235
 Generator ...—.020 inch (.51 m/m)
Bosch magneto—.015 inch (.4 m/m)
Berling magneto—.018 inch (.46 m/m)
Dixie magneto—.020 inch (.51 m/m)

## Reasons for Advancing and Retarding the Spark

Theoretically the proper time for exploding the charge is at top dead center on the compression stroke, when the charge is compressed as much as it can be. However, there is a slight lapse of time between the sparking and explosion. When the spark occurs, it first ignites the charge around the spark plug points. This flame then spreads through the rest of the mixture, forcing the piston downward. The time between the spark and complete explosion of the mixture is very short, but it can easily be understood that as the speed of the motor is increased, the spark should be advanced. For this reason, the time of ignition is made adjustable with the use of the left grip.

If the motor is run at high speed with a retarded spark, the spark will occur when the piston is 1/16 inch (1.5 m/m) to ⅛ inch (3.1 m/m) past top center on the power stroke, and considerable energy will be lost on account of the lapse of time between the spark and complete explosion. Then again, running the motor at slow speed with an open throttle and fully advanced spark will result in injury to the motor in time, because complete combustion of the charge will take place before the piston has reached top dead center on the compression stroke. The effects of this can be more easily noticed in the form of a knock, when driving at low motor speed with an open throttle on a hard pull. Therefore, to get the full effect of the explosion, the spark should occur slightly before top center on the compression stroke.

The time of sparking is controlled by turning the left grip to the right or to the left, depending on the speed of the motor and whether or not under a hard pull. If the above is understood, the left grip will always be carried in the proper position. Running the motor accordingly will mean added life, because the explosion is taking place when the piston is in the proper position.

Do not form the impression from the above explanation that it is necessary to carry the spark in retarded position whenever driving slowly. Do not do this unless the motor is pulling hard at a low motor speed.

## To Time Model 235 Generator for the First Time

When a model 235 generator is fitted to a motor for the first time, gear marks cannot be referred to, to get the timing correct, because the interrupter cam is loose on the shaft and must be set for that particular motor. Proceed to time the generator by first placing all the gears with marks in line in their respective places. An inspection will prove that the front piston is near the top center on the compression stroke. Turn the motor, whichever way is necessary, to bring the front piston between 7/32 inch (5.5 m/m) to 9/32 inch (7.1 m/m) before top center on the compression stroke. Remove the bakelite distributor cap and the high tension distributor segment. Remove the hexagon nut clamping the circuit breaker cam, and with the special wrench (see illustration No. 2) pry the cam loose from the tapered timer shaft. Advance the circuit breaker as far as it will go by pushing it forward. Move the cam on the shaft in the direction it runs so that the SMALL CAM is just causing the circuit breaker points to break contact. Then tighten the cam clamp nut securely.

Be careful when setting this cam, not to use the wrong cam for the cylinder that is being timed. The small cam times the front cylinder while the large cam times the rear cylinder. After the cam has been properly set and securely clamped, check over the timing and if it is O. K., place the high tension distributor segment over the end of the shaft in such a position that the driving pin on the cam lines up with the provided hole in the distributor segment. Later models have a special clip to support the distributor segment. The bakelite distributor cap can then be placed over the circuit breaker assembly, it being only necessary to line up the stop of this cap with the slot in the upper rear edge of the timer head and securing it by means of the springs. When placing the ignition cables into the distributor cap, be sure to place the short cable, which is for the rear cylinder, into the extreme left boss. The long front cylinder cable should be placed into the extreme right boss of the distributor cap.

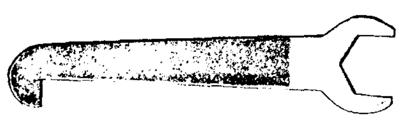


Illustration No. 2
HX-1111 Price $.25

## To Time Model 235 Generator According to Gear Marks

Assuming that the pinion, relief, secondary, intermediate, and intermediate worm gears have been set according to marks as is covered under: To Time Twin Cylinder Motors According to Gear Marks, only the generator intermediate and generator gears remain to be set.

Place the generator gear and key on the generator shaft, fit the washer and draw up the LEFT HAND clamp nut temporarily. Remove the distributor cap from the generator. Turn the generator drive gear backward or to the left until the small cam just touches the fibre block on the circuit breaker lever. This is very important because the generator drive gear and circuit breaker cam are geared three to one respectively. Place the intermediate generator gear on the stud so that the marks on the generator gear, intermediate generator gear, and intermediate worm gear line up exactly true. Pay special attention to this because if one of these gears is just one tooth from the proper position, the point of ignition will be off ¼ inch (6.3 m/m), which would have a decided effect on the running of the motor. After having the gears lined up properly, securely tighten the generator gear clamp nut and fit the split rings and collars on the gear studs.

As a matter of safety, check over the timing of the ignition following previous instructions.

## To Time the Harley-Davidson Generator on "V" Type Twins

Owing to the circuit breaker cam and the timer shaft being made integral, new timing instructions are obvious. It will not be possible to time the ignition properly by lifting the timer base from the generator body and meshing the spiral gear on timer

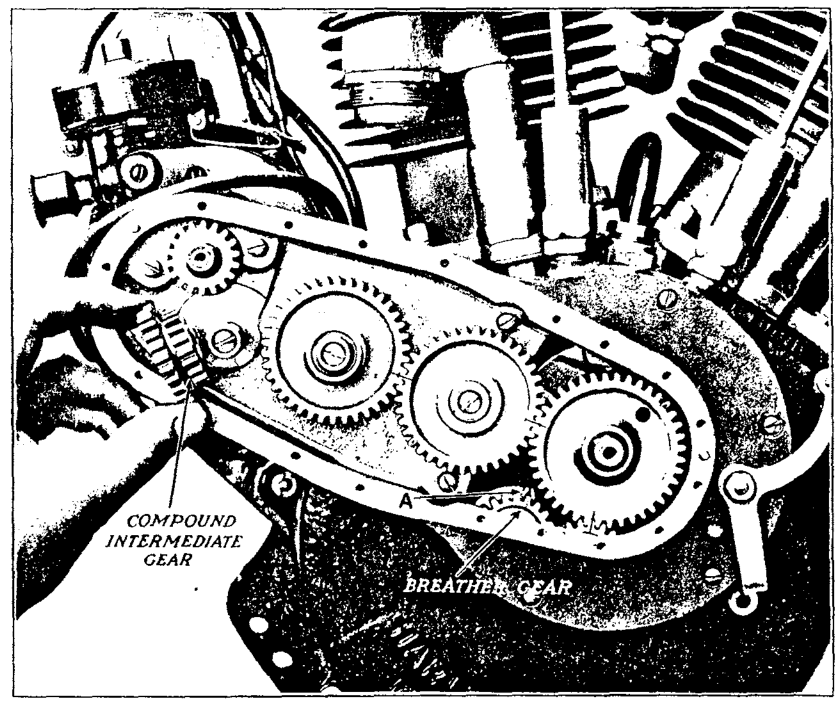



Illustration No. 3

shaft with the worm gear on the armature shaft.

The generator drive gear and the intermediate compound gear are not marked, however, the remainder of the gears; intermediate worm (oiler) gear, intermediate, secondary (cam), pinion, and relief gears retain their original markings. When all of the marked gears are set properly, i.e., all marks in line, the front cylinder piston will be approximately 3/16 inch (4.7 m/m) from top center on the compression stroke. Refer to illustration 3 for proper gear settings.

Advance the timer lever (illustration No. 4) by moving it forward to the full extent of its travel, as indicating by the arrow. Since ignition for the front cylinder is in order, select the SMALL END of the timer cam (illustration No. 4) and turn it to the right (clockwise) until it has opened the circuit breaker points .015 inch (.4 m m). Note: The full opening of the circuit breaker points when properly adjusted is between .020 inch (.51 m m) to .024 inch (.61 m/m). With the circuit breaker points set as specified (open .015 inch .38 m m) and the marked gears in perfect line, hold the small generator gear firmly with the thumb of the left hand. Insert the compound intermediate gear by turning it and trying to mesh it with the generator and intermediate oiler gears. The construction of the compound intermediate gear (one gear being smaller than the other) allows proper meshing of the teeth at several positions. Do not force the compound gear into meshing with the other two gears—but keep turning it and trying different positions until it slips in place freely. After properly meshing the gears put the split lock ring in place; this prevents the gear from coming off of the stud and losing the correct timing just obtained. These timing instructions if properly carried out will be accurate to within a small margin. Should the motor be out of the frame, the cylinder plug (found in the cylinder head) may be removed with a special wrench, and a steel scale (ruler) inserted in the hole and the results may be checked as follows:


Illustration No. 4

Advance the spark lever. Rotate the motor in a right hand (clock-wise) direction until the small or front cylinder cam just *begins* to separate the breaker points. If it should be necessary to turn motor backward (anti-clockwise) in order to get the proper setting of breaker points be sure to remove back lash in the timer shaft if any, by trying to turn the timer shaft to the left with the hand, as the gears should be in the same position while timing as when being driven by the motor. Insert a 6-inch (150. m m) steel scale (ruler) into the front cylinder and lay some flat object across the vertical cylinder flanges to facilitate the reading of the scale. Note the reading of the scale in this position, then turn the motor (clockwise) and note how much the scale rises until it reaches its highest point. When the ignition is properly timed the scale should rise between 15/64 inch (5.9 m/m) and 9/32 inch (7.1 m/m) for standard solo motors, and 13/64 inch (5.1 m/m) to 17/64 inch (6.7 m/m) for sidecar motors. Should the readings not check according to these figures the first time they are checked, do not change timing until it has been rechecked several times.

## To Time Twin Cylinder Motors According to Gear Marks

Assuming that all of the gears have been removed, but that no new gears are to be fitted, it is a simple matter to retime the motor correctly according to the following: Place the pinion gear on the fly wheel shaft, and fit the key and the pinion lock screw. (The lock screw has a left hand thread). Fit the compression relief valve in the bronze bushing. On 1914 and 1915 motors, line up the marks on the compression relief valve gear and the pinion gear.

On 1916, 1917, 1918, 1919, 1920, 1921 and 1922 motors, line up the mark of the compression relief valve gear with the mark ("A") stamped in the crank case. See "A" illustration No. 3. Before fitting this gear, be sure that the motor is in such a position that the mark on the driving pinion is in perfect alignment with the secondary gear stud and lifter arm stud as shown in the illustration. It is always advisable to check over the timing after a gear has been set according to marks. We therefore urge that the timing of the compression relief valve be checked over to see whether it corresponds with the timing mentioned previously in this article.

After the compression relief valve has been properly fitted and timed, place the secondary gear on the stud in such a manner that the mark will line up with the mark on the pinion gear. In order to get this result with the 1914 and 1915 motors, the motor must first be turned until the mark on the pinion gear is in an upward position. The secondary gears on all 1915, 1916, 1917, 1918, 1919, 1920, 1921 and 1922 motors have two marks. Be sure to place the gear on the stud in such a position that the other mark will be toward the intermediate drive gear. See illustration No. 1. The exhaust valve timing can now be checked over and must correspond within the limits already mentioned. Fit the drive case after being sure that the marks of the pinion and secondary gear are in line. Then place the intermediate gear so that its mark will coincide with the mark on the secondary gear. After the intermediate gear has been placed in position, the motor should not be turned again. The intermediate worm gear is then placed on the stud in such a way that one of the marks of this gear and the intermediate gear line up.

The magneto or 250 model generator drive gear (not the 235 or Harley-Davidson generator) is then lined up with the intermediate worm gear after the key has been properly placed in the keyway of the shaft. If the keyway of the shaft and gear are not in line, the shaft only may be turned, because gear marks must be in line to have the timing right. Fit the lock washer and draw the clamp nut tight. After completing these operations the gear marks will be in line as shown in illustration No. 1.

## To Time Single Cylinder Motors According to Gear Marks

Place the pinion gear on the fly wheel shaft. Turn the motor until the mark on this gear is upward. Then place the secondary gear on the stud so that the marks of this gear and the pinion gear are in line. Replace the drive case. Turn the motor until the mark on the gear which is mounted with the secondary gear will be toward the intermediate cam gear stud (toward the rear of the motor). Place the intermediate or intake cam gear on the stud so that the proper mark will line up with the mark on the gear mounted with the secondary gear. Fit the other intermediate gear and then the magneto gear according to marks. When the gears are set according to marks, all marks visible will be in line.

These instructions, as already mentioned, apply to retiming a motor when the original gears are used. If a new gear is fitted, time the motor according to piston positions, as previously explained under: To Time Inlet and Exhaust Valves.

## Timing Ignition for the Sport Model Without Removing the Generator Drive Gear

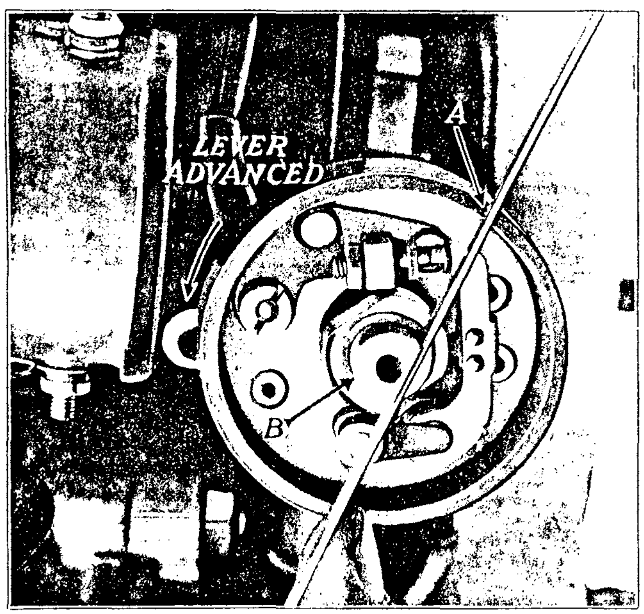



Illustration No. 5

When disassembling generator from the motor do not remove the generator drive gear unless generator must be entirely disassembled. The hole in the rear of gear case is large enough to permit the passage of the gear while on drive shaft. Inspect circuit breaker points before starting to time motor, for proper gap which should be .020 inch (.51 m/m) and can be determined by thickness gauge or by the steel gauge on the back of the generator wrench. Remove the generator intermediate gear. Rotate the motor until pinion gear marks "A" and "B" are directly in line with secondary gear and intermediate drive gear. See illustration No. 7.

It is very essential that these marks are acccurately aligned. Every circuit breaker casting or frame has a filed mark on the outer edge of this casting. Remove distributor segment and holder, and by placing the edge of a 6 inch (150. m/m) scale against the flat side of the timer shaft "B," the flat side of the timer shaft should be accurately aligned with the filed mark "A" on the outer edge of circuit breaker casting or frame. When aligning timer shaft with filed mark on casting, be sure that the flat side of the shaft is to the right rear of the shaft center. See illustration No. 5.

When timer shaft is in the above described position and the marks on the pinion gear, secondary gear, and intermediate gear are properly lined up, the generator intermediate gear will mesh with the intermediate gear and the generator drive gear. Place this gear in position and secure with split locking ring. After generator is correctly timed be sure that outside terminal of distributor cap leads to the front cylinder. These terminals being the same length makes it possible for them to become crossed which would, of course, change the timing. See illustration No. 6.

## Timing Sport Model Ignition When the Generator Drive Gear Has Been Removed

Inspect circuit breaker points before starting to time motor, for proper gap, which should be .020 inch (.51 m/m) and can be determined by a thickness gauge, or the steel gauge on the back of the generator wrench. The generator drive gear has three keyways, which are placed in different positions, permitting the changing of timing by 1/3 of a tooth, 2/3 of a tooth or by 1 tooth. Rotate the motor until pinion gear marks are directly in line with secondary gear and intermediate gear. See illustration No. 7. It is very essential that these marks are accurately aligned. Every circuit breaker casting or frame has a filed mark on the outer edge of this casting after the motor has once been timed at the factory. Remove distributor segment and holder, and by placing the edge of a 6 inch (150. m/m) scale against the flat side of the timer shaft, the flat side of the timer shaft should be accurately aligned to the field mark on the outer edge of circuit breaker casting or frame. See illustration No. 5. When aligning timer shaft with filed mark on casting be sure that the flat side of the shaft is to the rear of shaft center. When timer shaft is in the above described position and the marks on the pinion gear, second-

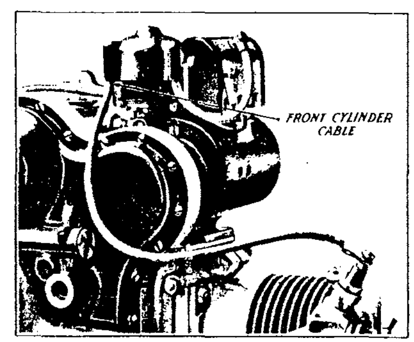



Illustration No. 6

ary gear and intermediate gear are properly lined up, try the generator drive gear in each of the keyways, until it slips in mesh, without changing the position of timer shaft or without turning the pinion gear. It is advisable to recheck timing by inserting a 6 inch (150. m/m) scale in front cylinder to determine whether circuit breaker points are just beginning to separate when piston is from ⅜ inch (9.5 m/m) to 7/16 inch (11. m/m) before top dead center, on compression stroke, with interrupter fully advanced. It is necessary to remove the front foot board support and the front cylinder plug for this operation. After generator is correctly timed, be sure that the outside terminal of distributor cap leads to the front cylinder. These terminals being both the same length makes it possible for them to become crossed which would entirely change the timing. See illustration No. 6.

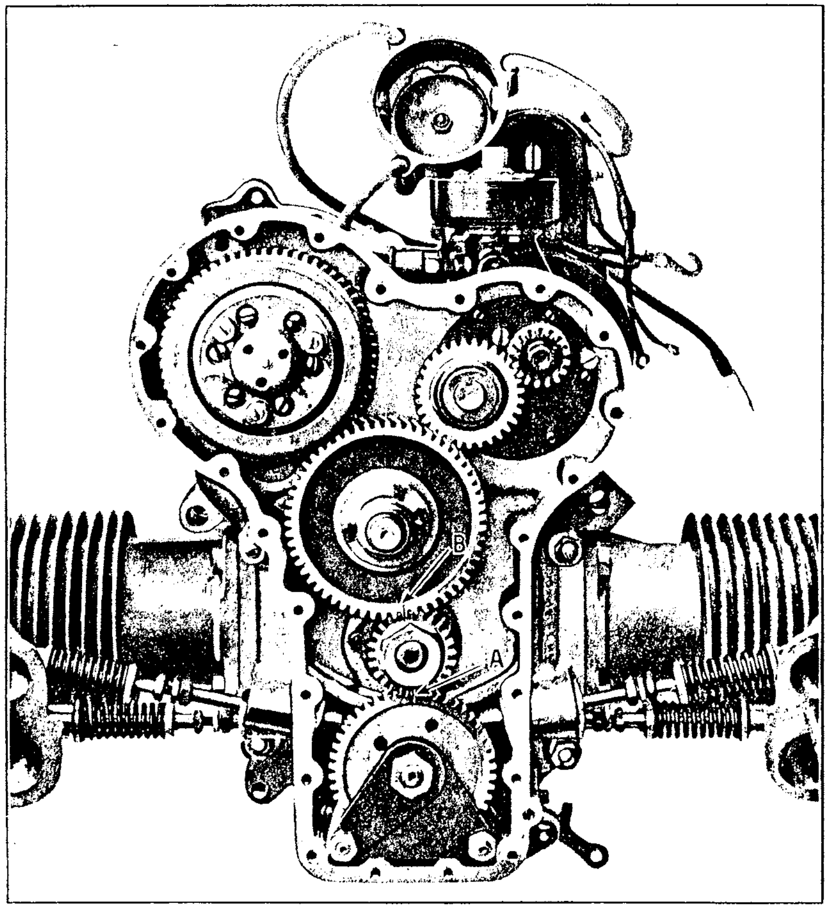



Illustration No. 7

# Summary of All Motor Valve Timing

### 1912 TO 1916 "V" TWINS

Exhaust valve opens with piston ⅝ inch (15.8 m/m) to ¾ inch (19. m/m) before bottom dead center.

Exhaust valve closes with piston 1/32 inch (.79 m/m) to 3/32 inch (2.3 m/m) after top dead center.

Inlet valve opens with piston 1/32 inch (.79 m/m) to 3/32 inch (2.3 m/m) before top dead center.

Inlet valve closes with piston ⅛ inch (3.1 m/m) to ¼ inch (6.3 m/m) after bottom dead center.

### 1917 TO 1922 "V" TWINS,

All Standard 61", Standard 74", "500", "A" and "E" Motors.

Exhaust valve opens with piston 19/32 inch (15. m/m) to 23/32 inch (14.2 m/m) before bottom dead center.

Exhause valve closes with pistons 1/16 inch (1.5 m/m) to 7/64 inch (2.7 m/m) after top dead center.

Inlet valve opens with pistons 5/32 inch (3.9 m/m) to 19/64 inch (7.5 m/m) before top dead center.

Inlet valve closes with piston ¾ inch (19. m/m) to ⅞ inch (22.2 m/m) after bottom dead center.

### SINGLE CYLINDER VALVE TIMING 1912 TO 1918

Exhaust valve opens with piston ⅝ inch (15.8 m/m) to ¾ inch (19. m/m) before bottom dead center.

Exhaust valve closes with piston 1/32 inch (.79 m/m) to 3/32 inch (2.3 m/m) after top dead center.

Inlet valve opens with piston 1/32 inch (.79 m/m) to ⅛ inch (3.1 m/m) before top dead center.

Inlet valve closes with piston ¼ inch (6.3 m/m) to ⅜ inch (9.5 m/m) after bottom dead center.

### SPORT MODEL VALVE TIMING

Exhaust valve opens with pistons 7/16 inch (11.1 m/m) to 9/16 inch (14.2 m/m) before bottom dead center.

Exhaust valve closes with piston 1/32 inch (.79 m/m) to 3/32 inch (2.3 m/m) after top dead center.

Inlet valve opens with piston 1/16 inch (1.5 m/m) to 3/16 inch (4.7 m/m) before top dead center.

Inlet valve closes with piston 7/16 inch (11.1 m/m) to ⅝ inch (15.8 m/m) after bottom dead center.

The sport model breather valve is made integral with the secondary gear, therefore it does not require special timing.

# Miscellaneous

### TWIN BERLING MAGNETO

Lower cam (or shoe) in interrupter housing times ignition for front cylinder. Upper cam (or shoe) in interrupter housing times ignition for rear cylinder.

### TWIN DIXIE MAGNETO

Cam No. 2 times ignition for front cylinder. Cam No. 1 times ignition for rear cylinder.

### TWIN BOSCH MAGNETO

Interrupter shoe No. 2 times ignition for front cylinder. Interrupter shoe No. 1 times ignition for rear cylinder.

### ALL "V" TYPE TWIN GENERATORS

Small cam times ignition for front cylinder. Large cam times ignition for rear cylinder.

### SPORT MODEL MAGNETO

The front interrupter shoe on the Sport Model magneto times ignition for the front cylinder. The front high tension cable also goes to the front spark plug.

# Service Dept. Bulletin

No. 74.—July 1, 1921 Harley-Davidson Motor Co., Milwaukee

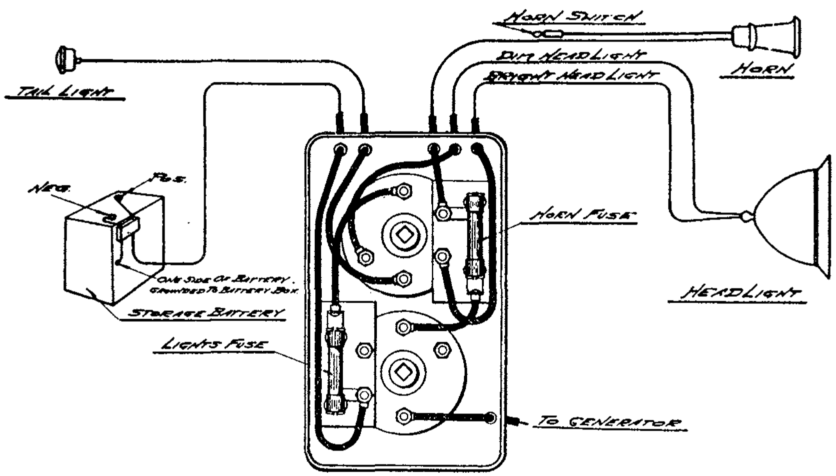


**Illustration No. 1**

**General wiring diagram for electrically equipped models with type 250 Generator. Note—Some 1916 generators have two wires leading to the terminal clamp connection "10," illustration "5" while the other one leads to the circuit breaker. These wires can be connected either to top, bottom or upper right hand binding post of the ignition switch.**

This bulletin is based upon instructions issued during the past five seasons on the care and adjustments of the model 250 generator used on 1915, 1916 and 1917 models. The current instruction book does not cover this type generator and since there are many thousands of such generators in service, it is suggested that this bulletin be filed for ready future reference if it is not needed immediately. The ignition and lighting system will require attention from time to time and the instructions and suggestions herein will frequently be found valuable.

## Model 250 Generator

The model 250 generator generates low tension 6 volt direct current for the lights, signal system, and for charging the battery. This current is "stepped up" or transformed into high tension current for ignition by the spark coils on top of the generator.

The generator supplies current directly to the lamps, horn, and for ignition; the surplus current keeping the storage battery properly charged. The latter provision is necessary, for the battery in 'urn supplies current for the lights when the motor is not running, and for ignition when starting the motor.

## Why Battery Must Be Kept in Circuit

The battery acts as an accumulator and governor, and keeps the voltage down to 6 volts regardless of the speed of the generator. Without the battery in circuit the voltage raises above 20 volts at 60 miles per hour (96 km) which is sufficiently high to cause injury to the generator and to burn out the lamps. Therefore, even though the storage battery be exhausted and not capable of furnishing current, it must be left in its place, connected up if the machine is used.

## Do Not Overload the System

Be careful not to add electrical accessories of any kind nor to equip the lamps with higher candlepower bulbs than those regularly furnished, because the system is designed for a definite load. The only exception to this is the use of a sidecar light and this may not be over 2 candlepower.

## Important Instructions

Stop your motor ONLY by turning off the ignition switch, which is the lower switch in the switch box. Failure to turn this switch off will cause complete discharge of the battery in a short time (45 minutes). Turn the switch off, regardless of how short the stop is. After switching off the ignition, be sure to remove the switch key. This will prevent meddlesome persons from tampering with the switch, thereby causing discharge of the battery.

Be sure to see that your generator advance lever advances all the way down. It is equally important that the circuit breaker cannot be advanced too far or forced. If the control rods are adjusted so that they are too long and too much pressure is applied when the circuit breaker is already fully advanced, the circuit breaker will be forced out of line and change the gap of the breaker points. When this takes place, the motor will miss with a fully advanced spark and sometimes stop entirely.

## The Lighting System

The headlight contains two bulbs, the bright bulb a twenty-one candlepower nitrogen, and the dimmer bulb a two candlepower tungsten. The tail light carries a two candlepower tungsten bulb also. The lighting switch has three positions; all off, bright headlight and tail light, and dim headlight and tail light.

Never let the machine stand with the bright headlight turned on or the battery will be exhausted in a short time. The generator and battery are designed for a definite number of lamps. Do not add any lamps, with the exception of one for the sidecar, and this bulb must not be over two candlepower.

If any of the lamp bulbs need renewal, be sure to replace with lamps of the same candlepower. This is extremely important; 6 to 8 volt bulbs should be used. In ordering, specify single point bulbs. The sidecar light, or the trouble lamp connection, is made by inserting the plug into the terminal box on the battery box.

## Key to Wiring Diagram on Page 3

1, horn switch; 2, high tension post for front cylinder; 3, primary post and winding for front cylinder coil; 4, high tension post for rear cylinder; 5, primary post and winding for rear cylinder coil; 6, positive or main brush; 7, commutator, consisting of 12 segments; 8, third or regulating brush (non-movable); 9, negative or ground brush; 10, condenser, located in the generator for convenience; 11, rear field coil; 12, circuit breaker lever; 13, contact points; 14, circuit breaker adjusting screw; 15, circuit breaker cam (small end times for front cylinder); 16, front field coil; 17, coil primary distributor points; 18, lighting switch; 19, horn fuse; 20, ignition or manual switch; 21, lights fuse; 22, tail bulb; 23, battery positive post; 24, storage battery; 25, battery negative post; 26, dim headlight bulb; 27, bright headlight bulb; 28, horn; 29, distributor blade for spark coil primary windings.

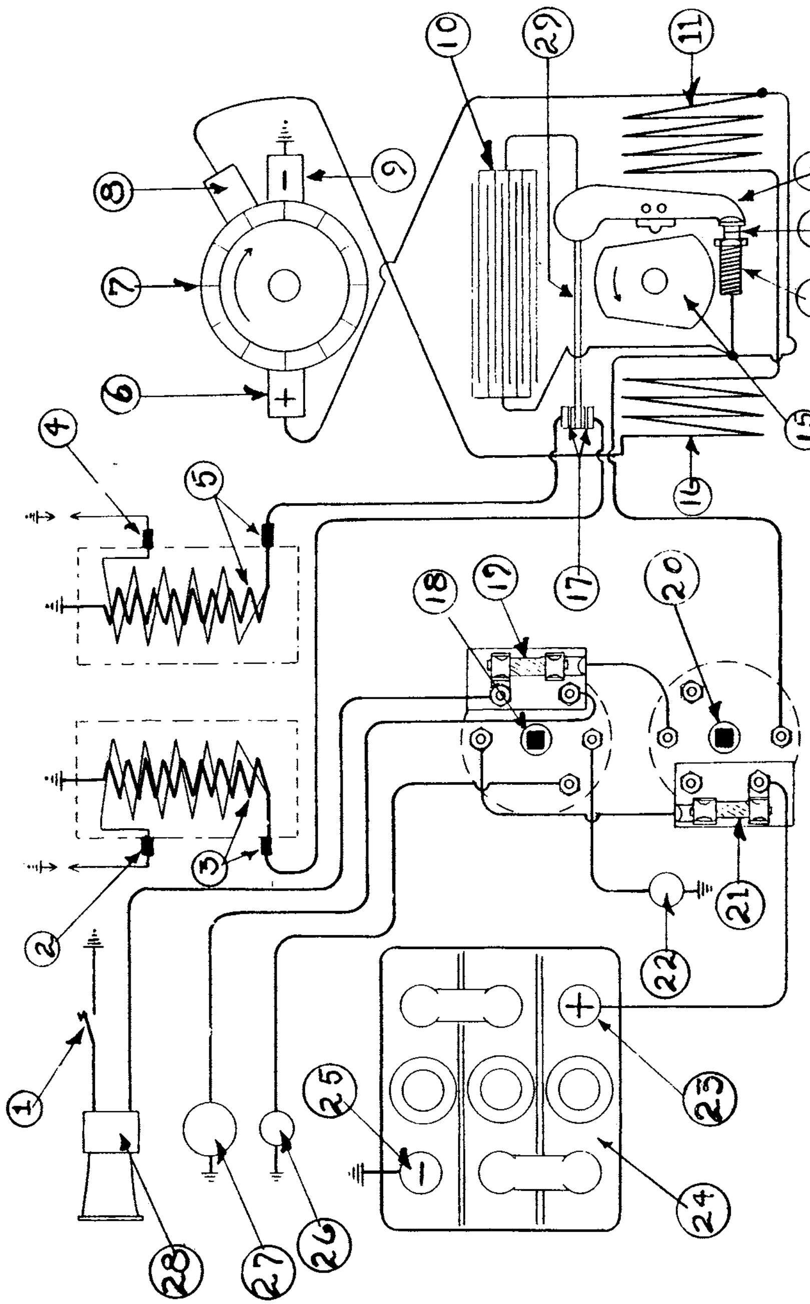


Illustration No. 2

## When Lights Do Not Burn While Motor is Idle

Failure of the lamps to burn while the motor is not running, generally indicates that the battery is discharged or that the lighting fuse is burned out due to a defect or short circuit in the lamp wiring. In the latter case, remedy the defect before replacing the fuse. See that the fuse is held firmly in the holder. Examine the sliding contacts of the lighting switch as shown in illustration and explained on page 7 under inspection of ignition switch instructions. The construction of the lighting and ignition switches is practically alike.

To ascertain whether the battery is discharged, test it with a hydrometer. The subject of battery care is covered in another pamphlet, copy of which will be furnished upon request. If the fuse and battery are found to be in good condition, the trouble lies in the lamps or in the wiring. Inspect the bulbs and examine the wiring for a break, also look over the connections to see if any are loose or broken. If the battery is discharged, have it recharged immediately (see instructions on recharging in battery pamphlet) and if the trouble was due to a loose or broken connection, or a short circuit in the wiring, remedy before replacing. See reasons for discharged battery, pages 6 and 7.

After some riders had complained that their storage batteries had become discharged, investigation has shown the cause to be excessive or careless use of the lights. If the motor is not running, the use of the large headlight will completely exhaust the storage battery in a very short time. A fuse is mounted in the switch box in the lighting circuit between the lights and the battery to prevent discharge and possible injury to the battery should a short circuit occur in the lamp wiring.

## When Replacing a Fuse

In case a fuse burns out, do not use a piece of wire or any other substitute. Locate the cause of the trouble, and replace the fuse with a new Harley-Davidson fuse. By using a substitute, the short circuit that was responsible for the fuse burning out may cause serious injury to the switches or wiring, and discharge the battery. This holds true of both the horn and lighting fuses. In an emergency, if the fuse in the lighting switch has burned out and the short circuit has been remedied, the horn fuse can safely be used in the lighting system.

## Faulty Lamps

If all the lamps but one burn, the fault lies in that particular lamp, or in the wiring thereto. It may be that the sliding contact for that lamp has been forced and is making a poor connection with the binding pole head. See ignition switch instructions, page 7. Failure of a lamp to burn may be due to a burnt out bulb, and the test of inserting a good bulb in place of the suspected one immediately suggests itself. If the good bulb fails to burn, the wiring and connections to the lamp should be carefully examined.

## If Both Headlights Fail to Burn

If the tail light burns and both head light bulbs do not, the trouble must lie either in the bulbs, the wiring, the lighting switch, or the double connector in the headlight. Sometimes trouble with the small headlight is caused by failure of the reflector to make a good connection or ground to the lamp body. If it is necessary to examine the reflector, use the greatest care not to touch the reflecting surface.

To open the lamp for replacing a bulb, loosen the screw in the bottom of the front bezel and remove both screw and bezel. Front of lamp will then slide off.

## Fluctuating Lights

If the lamps burn brightly when the motor is running at moderate speed, but vary and flicker when the motor is running slowly, the cause is a discharged battery or a poor circuit between the battery and the lights at one or more of the following points:

Carefully inspect the ground wire clamped on the outside of the battery box and leading to the negative pole. In like manner examine the positive wire leading from the battery to the ignition switch. See that the lower fuse is O.K., that it is held securely, and that the wire connections on the ignition switch binding posts are firmly clamped. Examine the sliding contacts of the lighting switch as explained and illustrated on page 7. Under inspection of ignition switch instructions. Examine the wiring leading to the lamps and the connections on the inside of the lamps.

## The Warning Signal

The warning signal or horn can only be sounded while the ignition switch is closed or turned ON, therefore, only when the motor is running if the rider uses the manual ignition switch as he should. This feature discourages meddling and prevents discharge of the battery through unnecessary use of the horn.

**It is well to get into the habit of attempting to sound the horn after stopping the motor to make sure that the ignition switch has been turned to the OFF position.**

A fuse is placed in the horn circuit so that if a short circuit should occur in the horn or in the wiring thereto, from any cause, the battery will not be discharged. This fuse will burn out in the case of a short circuit and, of course, with a burnt out fuse, the horn cannot be sounded. The cause of any such short circuit must be found and remedied at once before the fuse is replaced. If the horn sounds continually while the ignition switch is turned on, there is a short circuit either in the horn switch on the handlebar, or in the wire from the horn switch to the horn.

If the horn cannot be sounded while the ignition switch is on, remove the horn cover and make sure that the vibrator contacts are not pitted or stuck together, and that there is a clearance of about $\frac{1}{64}$ inch (.4 m/m) at the points when the armature is pressed against the diaphragm stem. If the points are not at fault, see that the wiring from the switch box to the horn and from the horn switch to the horn is not damaged, that the fuse is O. K. and not blown out or held loosely in the fuse holder.

Do not use any electric horn except that supplied regularly with this model, since some horns consume an excessive amount of current.

## To Run With a Discharged Storage Battery

The motorcycle may be run with a discharged or disabled battery, but it is very important to have the battery recharged or repaired immediately, because if the battery is left in a discharged or disabled condition for any length of time, it will be ruined.

If the storage battery is disabled, turn off all lights before attempting to start the motor. Prime the motor, as per manual instructions given for starting the motor in cold weather. See that the spark plug points are clean, and adjusted to .025 inch (.64 m/m). Switch on the ignition and turn over the motor rapidly. It may take several strokes of the starter to start the motor under these conditions because the spark is being taken directly from the generator.

If after three or four attempts it is found that the motor will not start by means of the starter, it is a good plan to put the gear shifting lever in second or low gear, engage the clutch, raise the exhaust valves, push the machine at a good pace, run alongside, drop the valves, and jump on as soon as the motor starts. If the machine will not start, the battery ground wire on the outside of the battery box should be disconnected, and the motor turned over as before. After starting, the battery ground wire must be reconnected at once to put the battery in circuit or the generator may be ruined.

## Caution

If the battery needs outside charging, or extensive attention be sure to take it to your dealer or a competent charging station where intelligent, experienced service is obtainable if no dealer is convenient. Do not let anyone work on the battery who is not experienced in this particular line of work. Before disconnecting any of the wires other than the spark plug wires, disconnect the battery ground wire on the outside of the battery box to prevent burning out a fuse or short-circuiting the battery. The battery ground wire should be reconnected before the motor is started for the reason already explained.

## To Test Whether the Generator is Charging the Battery

If the storage battery is exhausted and it is suspected that the generator is not charging, make the following tests: Start the motor in the regular way; then disconnect the ground connection. If the motor continues to run, the generator is furnishing current. If the motor stops, the generator is faulty. During this test the motor must not be run at a speed exceeding 20 miles per hour (32 km) for the reasons explained under the heading Why Battery Must Be Kept in Circuit.

After determining whether or not the generator is charging, it is easy to ascertain whether the circuit between the generator and battery is closed by rubbing the ground wire against some metallic part of the machine. If arcing occurs, the circuit is O. K. This is an important test, for if the circuit between the generator and battery is not closed, the excess current produced by the generator cannot keep the battery charged and the high voltage may cause injury to the generator.

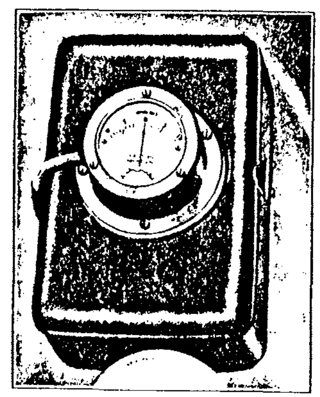


**Illustration No. 3**

**JK 123—Ammeter Complete with mounting and wiring.......... $5.50**

If no sparking occurs at the ground wire according to the above test, the circuit between the generator and battery is not closed. In that case examine the battery ground wire, likewise the positive wire leading from the battery to the ignition switch. Be sure that this wire is firmly clamped to the switch binding post.

The best way to determine the exact charging condition of the generator is to install a suitable ammeter in the circuit. The ammeter shown in the illustration was designed for motorcycle duty and is a thoroughly reliable instrument. The wiring and special mounting make it easily adapted to the machine.

To connect an ammeter in the circuit, remove the battery negative or ground wire from the battery box and connect the positive (+) post of the ammeter to the battery wire. Then ground the negative (—) post of the ammeter on the battery box, under the cover screw.

When the generator is working properly the ammeter should show a charge of from 3 to $4\frac{1}{2}$ amperes. If it does not show this output, refer to instructions under, "To Clean and Reseat Brushes and Commutator."

If the ignition switch has been forced by applying too much pressure on the key, the sliding contacts may have been bent and the circuit is not closed when the switch is turned to the ON position. In that case remove the switch and make the inspection of the sliding contacts as shown in the accompanying illustration.

## To Inspect and Correct a Forced Ignition Switch

Be sure that the sliding contacts bear with sufficient pressure against the post heads to insure a closed circuit. Pitted or blackened post heads are a sure indication of a poor circuit in the ignition switch.

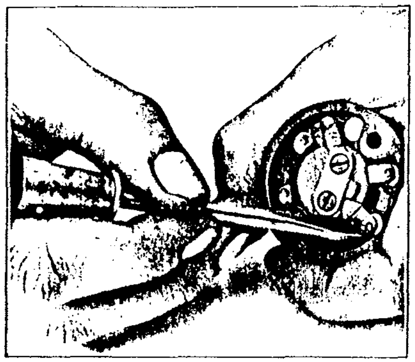


**Illustration No. 4**
**How to Inspect Ignition Switch Contacts**

To correct a forced ignition switch remove the pitted binding post; then turn the sliding contact over the countersunk hole into which the binding post head fits, and force the sliding contact into the hole. This will increase the tension to insure a closed circuit. Replace the binding post and make another inspection to see that the sliding fingers make proper contact and cannot slide beyond their respective binding pole heads. If these tests prove that the generator is charging and that the circuit between the generator and battery is closed, and if any existing fault has been corrected, the discharged condition of the battery is most likely due to excessive use of the lamps or failure to turn off the ignition switch. The remedies are apparent.

## To Recharge a Dead Battery

A discharged battery, if otherwise in good condition, can be recharged by sufficient daylight riding at a reasonable speed. The output of the generator is greatest at a speed of 25 to 30 miles per hour (40 to 48 km). Below 10 miles per hour (16 km) the battery furnishes the ignition current. However, the best way to charge an exhausted battery is from an outside source. After riding a reasonable distance see that the battery is really charging, by turning on the lights while the motor is not running. If they do not burn, the battery is charging very slowly or not at all. In such event there is a leakage of current, the generator output is low, or the ignition switch is not making good contact.

## If Battery Discharges Without Apparent Cause

If the battery discharges with normal use of the lamps and correct use of the ignition switch, and provided the generator is charging according to the previous test, one of the following conditions applies: There may be a partial short circuit between the battery and the ignition switch. This short circuit may be due to a saturated battery and box. If so, clean both thoroughly with household ammonia, or baking soda, and fit a new set of wood liners. Be sure that the insulation of the positive wire is not damaged. Test for a short circuit between the generator and battery as follows: Have both the ignition and lighting switches turned to the OFF position. Disconnect the ground wire on the outside of the battery box and rub it against some metallic part of the machine. If sparking occurs, there is a short circuit and the just mentioned suggestions should be applied.

## How to Test a Suspected Battery

If this test and the above explained conditions do not apply, the battery itself may be at fault. In that case it is best to get in touch with the nearest Harley-Davidson dealer or Exide battery service station. If it is not convenient to do this, the battery can easily be tested as follows: Have the battery charged. After charging tape the ends of the wires. Take a hydrometer reading and make note of the specific gravity of each cell. Set the battery in a cool, clean, and dry place for twenty-four hours; then take a second hydrometer reading of each cell. If the battery is O. K., the readings will practically check up with the previous readings. If there is a decided difference, the battery is at fault, and should be referred to the nearest Exide battery service station for inspection and repairs.

If the above tests prove that the generator is charging, that the circuit between the generator and battery is closed, that there is no short circuit, and that the battery is not at fault, the output of the generator most likely is not normal due to a dirty commutator and brushes. In that case, clean and reseat the commutator and brushes as explained under that heading.

## Circuit Breaker and Distributor

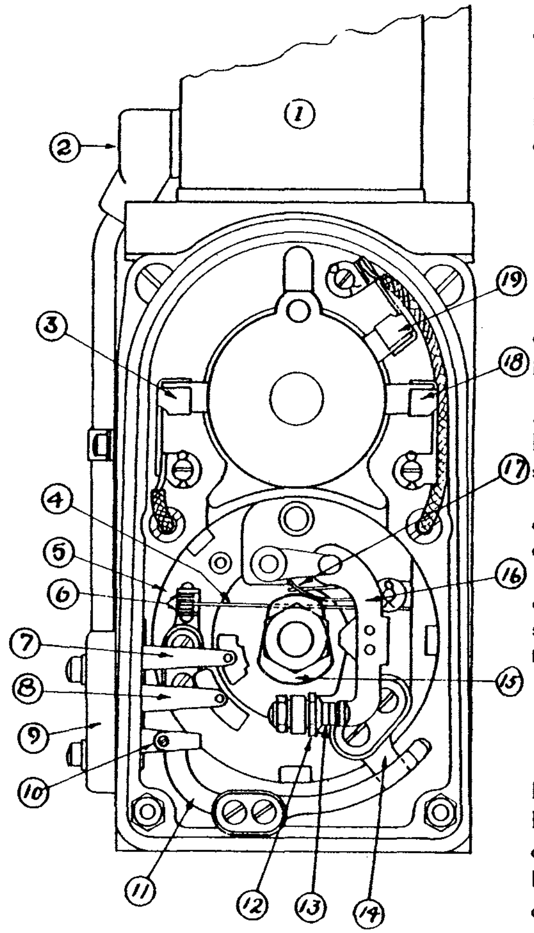



**Illustration No. 5**

Inspect the circuit breaker points at "13," see accompanying illustration, every 1500 miles (2400 km) to see that they are in good condition and not pitted or burned. At the same time examine the distributor terminals "6" as well as the two points on the distributor blade "4."

### Key to Illustration No. 5

1, spark coil; 2, coil primary terminal; 3, positive brush; 4, distributor blade; 5, circuit breaker ring; 6, distributor blade points; 7, rear cylinder contact blade; 8, front cylinder contact blade; 9, conduit and terminal assembly; 10, main circuit knife connection (this must be connected securely); 11, top sliding switch blade; 12, circuit breaker adjusting screw; 13, circuit breaker points; 14, sliding switch contact assembly; 15, circuit breaker cam (small end times for front cylinder); 16, circuit breaker lever; 17, distributor blade spring; 18, ground or negative brush; 19, third or regulating brush.

### Lubricating the Generator

Never use thin oil on any part of the Remy Generator. Once a year put a little vaseline about half the size of a pea on the top of the fibre block of the circuit breaker lever and insert a limited quantity of vaseline in the ball bearing at the left end of the armature shaft.

## To Clean Circuit Breaker Points

To clean the circuit breaker points, it will, of course, be necessary to remove the chain guard and the breaker cover on the generator to expose the circuit breaker parts.

When removing the spider, hold a screw driver against the circuit breaker plate near the top so as not to damage the sliding switch contacts. Be sure to replace the felt gasket before replacing the circuit breaker cover.

If the circuit breaker points at "13" are slightly pitted or burned, they should be cleaned with fine sandpaper (never use emery cloth).

When cleaning the circuit breaker points or making any adjustments on the generator, extreme care should be exercised so as not to bend any of the sliding contacts.

## To Adjust the Circuit Breaker

The fibre block on the circuit breaker arm is subject to a certain amount of wear in service and after several thousand miles it will be necessary to readjust the contact points to make up for this wear. As a matter of precaution, an inspection and adjustment, if necessary, should be made, say every 1500 miles (2400 km).

It is necessary when adjusting these points that the fibre block is resting on the center of the steel cam "15" so that the points at "13" are separated as far as they will go. If the steel cam "15" is not in contact with the fibre block, it will be necessary to turn over the generator slowly by means of the rear wheel, (transmission must be in high gear and the clutch engaged), until the steel cam hits the fibre block and separates the contact points "13" and as far as they will go. The lock nut should then be loosened with the generator wrench, and the point "12" screwed out by turning the hexagon head until it is just possible to insert the flat steel gauge on the wrench between the points at "13." After the points are correctly adjusted, carefully tighten the lock nut and measure the clearance again to be sure that the adjustment is correct.

## Care of the Distributor Points

The distributor blade "4" works both ways between the points "6." The distance between the points on the distributor blade and the points should be twice the thickness of the gauge on the generator wrench.

In rare cases, the points "6" and both points on the blade "4" may require cleaning by drawing a piece of fine sandpaper between them, taking care to see that the contacts are not bent or sprung during the process. The blade "4" should bear with equal pressure on points "6."

## Care of the Commutator

A commutator which is grooved, showing that the brushes are gradually cutting into it, should not be neglected. Inspection of the commutator is recommended whenever the circuit breaker or distributor points are inspected and adjusted. Neglect will in time render the commutator useless. A careful periodic inspection for wear, and the application of the proper remedy when wear is found will make renewal of the commutator unnecessary during the life of the machine.

## To Clean and Reseat Brushes and Commutator

Inspect the commutator and brushes every month or every 1500 miles (2400 km). If the commutator is found blackened, it should be cleaned by burnishing with 00 sandpaper. Normally, the commutator is dark brown or copper colored, and if found in that condition should not be touched. Carbon from the brushes will blacken the commutator, therefore do not clean the commutator because it is black unless it is covered with grease or dirt. Clean the commutator with a piece of clean soft cloth by holding the cloth on the commutator while the motor is running slowly. Be careful not to get a finger caught in the drive chain. When cleaning the commutator see that the brushes have a good and clean bearing surface against the commutator.

## Causes of Commutator Wear

Commutator wear can generally be traced to one or more of the following three causes: Hard carbon brushes, brushes bearing with too much pressure against the commutator, or failure to clean the commutator if the machine is used in very sandy or dusty country, especially if sand and dust can get under the circuit breaker cover.

## Hard Carbon Brushes

If a commutator is found grooved and inspection of the brush tension, as described hereinafter, prooves that the springs are properly adjusted and the mechanism on the inside of the circuit breaker cover is clean, hard brushes are the cause of the commutator wear.

The reference to hard brushes does not mean that the brushes are as hard as a piece of steel, but rather that the composition of the material in the brush lacks graphite. The amount of graphite in a brush cannot be seen with the eye. Therefore, when a faulty brush is suspected, all three brushes and brush holders should be replaced. Never replace a brush without replacing the holder because it is very important to have a perfect circuit between the two, and to obtain this circuit very carefully soldering and tinning are required. The cost of a brush holder is less than the cost of the labor required to solder and tin a new brush to an old holder. *Use only the genuine product when renewing brushes.*

## To Fit and Adjust New Carbon Brushes

Trim the new brushes to conform with the radius of the commutator. Place the brush holders on the studs. Cut some 00 sandpaper (never use emery) into strips ⅜ inch wide (9.5 m/m). Place this sandpaper between the commutator and brush with the coarse side towards the brush.

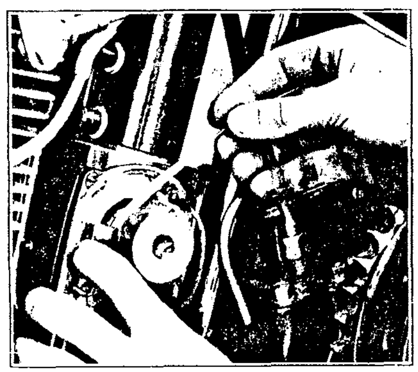


**Illustration No. 4**
**How to clean and seat brushes. Have the sandpaper follow the radius of the commutator as much as possible to prevent trimming off the edges of the brush.**

After the sandpaper has been properly placed, bear down lightly on the brush holders and pull out the sandpaper.

Be careful when pulling out the sandpaper not to damage the near edge of the brush. Follow the radius of the commutator with the sandpaper as much as possible. Refer to illustration. To obtain a good bearing of the brush against the commutator may require pulling the strip of sandpaper through several times, but the operation should be repeated only as often as necessary.

When trimming the forward brush, be sure to pass the sandpaper between the lower bearing housing support and the commutator if the strip is long enough, and pull upward and backward so that the edges of the brushes will not be trimmed off. When trimming the two rear brushes, pass the strip of sandpaper under the upper housing support, then under the upper and lower brushes, and draw the sandpaper towards the front.

After the brushes have been properly seated, remove all traces of grit by wiping the commutator with a gasoline soaked rag and then drawing plain writing paper between the brushes and commutator. For instructions on adjusting the brush springs refer to instructions under Proper Pressure of Brushes against Commutator and To Adjust Tension of Brush Springs.

## Proper Pressure of Brushes Against Commutator

The proper brush pressure against the commutator is six ounces. Determine the proper pressure with a small spring scale or hook the end of the brush holder with a piece of wire to a scale graduated to ounces. The exact brush pressure is determined at the point when the brush is just leaving the commutator and the scale is balancing. Never let a brush bear with greater pressure, nor have it considerably less. Too much pressure will cause quick wear of both the commutator and brushes, while too little pressure will affect the conductivity of the brush and interfere with the current output of the generator.

## To Adjust the Tension of the Brush Springs

When inspection proves that the brush springs are improperly adjusted, the following instructions should be applied: The cotter pins holding the brush holders on their studs should be withdrawn, so that the holders and springs can be removed from the studs far enough to release the springs from the slots in the studs. A piston pin lock pin, or something similar to it, should then be placed through the outside opening of the brush holder and over the straight end of the spring. Wind up the spring to the proper tension by turning the piston pin lock pin and pushing the brush holder back over the stud. When this is done, the spring will have to follow and no trouble will be experienced if the slot of the lock pin lines up with the slot in the brush holder stud.

Again test the tension of the brush against the commutator. If the brush seems to be bearing with too much pressure, release the coil spring one-half turn, or if the pressure is too little, give the coil spring another half turn.

If it is impossible to obtain the proper pressure by turning the spring one-half turn one way or the other, proceed as follows: Release the spring entirely by withdrawing the brush holder part way from the stud; then replace the brush holder and spring on the stud without having any pressure on the brush. With a pair of narrow-jawed pliers take hold of the end of the spring which bears against, or is hooked onto, the brush holder. Pull this end of the spring out until the proper tension has been obtained and cut off the spring, leaving just enough of the spring to overcome all danger of it slipping off the brush holder. Be sure to try the pressure of the brush from time to time while pulling out the spring so that no more is pulled out than is necessary. After the spring has been properly adjusted, replace the cotter pin.

## To Repair a Grooved Commutator

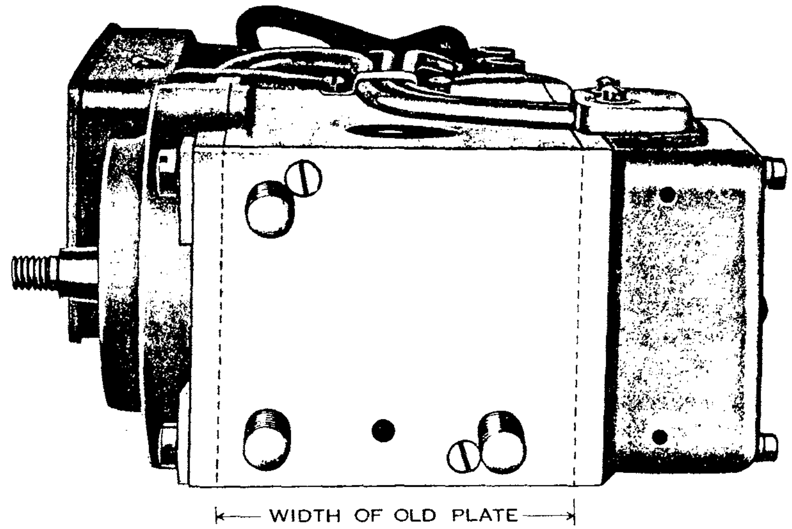
A grooved commutator can be repaired if the groove is not more than 1/16 inch (1.5 m/m) deep. Place the complete armature in a lathe, holding it between centers, and turn down the face of the commutator. When turning the commutator down, be sure to take off light cuts at a time, and under no circumstances turn off any of the shoulder of the commutator which is toward the armature end of the commutator and is about 1/8 inch (3. m/m) wide.

After the commutator has been turned down, remove all copper chips from between the segments and reassemble the instruments. Careful inspection will show that the brushes have only a little bearing surface on the commutator, necessitating retrimming of the brushes as already explained. If a commutator, necessitating retrimming of the brushes as already explained. If a commutator is cut too deep to be refaced, the generator should be referred to the Harley-Davidson Motor Co., to be repaired.

## Poorly Fitting Circuit Breaker Cover

If grit and dirt are found on the circuit breaker and distributor mechanism whenever the circuit breaker cover is removed, examine the felt washers and note whether the cover is bent. The cover must fit well enough against the generator to prevent the entrance of dirt or grit. If dirt can enter, it will wear the brushes and commutator unnecessarily and may get on the breaker and distributor mechanism, causing irregular running of the motor.

## To Secure Drive End Bearing Housing




It sometimes happens that the drive end bearing housing (right end plate), of a model 15 or 250 Remy generator works loose regardless of how securely the screws are drawn up. To prevent this, we furnish a steel plate to fit under the generator that serves as a support to both end plates and pole piece assembly. This plate holds the drive end bearing housing secure. The plate is listed under factory No. HK-122 and sells for 10 cents list. When you have occasion to remove a generator, fit one of these plates. Instructions for fitting the plate are as follows:

Remove the generator from the motor, take off and discard the bottom plate. Loosen the drive end bearing housing clamp screws, pull the housing upward as far as possible, and while holding it in this position, again tighten the clamp screws. With a file carefully trim off the bottom of both end plates until they are flush with the bottom of the pole piece assembly, (body of the generator). The steel bottom plate is then secured with the two screws that secured the original bottom plate. Draw all screws tight. Make sure the drive end bearing screws are tight by drawing up on them with a screw driver every week or two.

## When New Parts Are Needed

Genuine parts for Remy generators used on Harley-Davidson motorcycles are sold exclusively by the Harley-Davidson Motor Co., and its dealer organization. If you are a rider do not take a generator apart: If you are a dealer and have a generator needing extensive repairs that you are not prepared to take care of, refer it to the Harley-Davidson Motor Co.

# Service Dept. Bulletin

No. 93.—Dec. 10, 1921 Harley-Davidson Motor Co., Milwaukee

## Ignition Tests With Special Reference to Easy Starting

In presenting this bulletin we realize that because the facts stated are simple and fundamental, they are likely to be discounted in some cases or even ignored.

A factory Service Man found, on a recent trip among a considerable number of dealers, that hard starting was blamed to spark coils when, as a matter of fact, fouled spark plugs or improperly adjusted cut-out switches were at fault. In several cases hard starting was found due to nothing more than loading the motor with raw gasoline while attempting to start. This will illustrate the necessity of a careful study of this bulletin by every dealer and repairman whether he sells or repairs one machine a year or one hundred.

The coming of cold weather always increases interest in the question of easy starting. Hard starting is usually due to a well defined cause and can be readily located and easily corrected if gone after intelligently.

## How to Clean and Adjust Mica Spark Plugs

Mica core spark plugs can be used to better advantage in an air cooled motorcycle motor, than most porcelain core plugs. The one difficulty arising in mica core plugs is that the cores may absorb oil, gas and carbon easily and in consequence, foul at low speeds. It should be realized at the outset, therefore, that fouled plugs may be the cause of hard starting, especially in a new motor adjusted for a liberal oil supply, and that the spark plugs should be the first item tested when ignition difficulty is suspected.

Remove an oil soaked or carbonized mica core and after thoroughly cleaning it, burn it in an open flame until all traces of oil and gasoline have disappeared. Plug cores treated after this fashion will work more satisfactorily. Fouling and premature ignition at high speed will be minimized.

## Correct Method for Starting Motor

Comparatively few motorcyclists understand the function of the carburetor. The importance of proper carburetion when starting the motor is, therefore, likely to be overlooked. To start a motorcycle motor requires that a charge of gas of proper consistency be drawn into the cylinders to be ignited on the completion of the compression stroke. The proportion of this mixture may vary with each motor's characteristics, in other words, some motors may require an open throttle to start, while others require a closed throttle. These individual characteristics must be learned by the rider. In case of a new rider, it is up to the dealer to teach him the best method of starting his particular motor.

## To Start a Cold Motor

With low temperature may come the necessity for cylinder priming, in order to start the motor. If priming is necessary, never use more than one-third priming gun of gasoline for each cylinder; to use more gas for priming, may flood the motor and make starting more difficult. After priming the cylinders and closing the carburetor air valve, open the throttle, raise the valves and turn the motor over several times with the starter. This will charge the cylinders with a vaporous mixture. Advance the spark three-fourths and with the throttle closed, start the motor in the usual manner. If the weather is not cold enough to warrant priming, a cold motor may be started by closing the carburetor air valve and charging the cylinders as outlined above.

## To Start a Warm or Hot Motor

After the cylinders and manifold have become warm, it should not be necessary to introduce a heavy gas mixture into the motor for starting. An extremely rich mixture used when starting a warm motor may be difficult to ignite and interfere with easy starting. This applies especially to starting warm or hot 74″ motors.

The correct method of starting a warm motor is as follows: Pull out the air valve button, advance the spark three-fourths and with the throttle slightly open, use the starter in the usual manner.

When starting a hot motor, completely close the throttle and slightly retard the spark. The air valve button should be in its normal position.

When starting a hot 74″ motor, make sure that the throttle is not unconsciously opened at the same time the starter is used. To do so will load the cylinders with gas and prevent easy starting.

## Use Winter Oil

Heavy oil will make a motor hard starting. Its use is moreover accompanied by the danger of damaging the mechanical oiler, bearings, cylinders and pistons before the oil becomes distributed. Use winter oil for temperatures below 40° F. (4° Centigrade).

## How to Test Spark Coils and Diagnose Ignition Troubles

From time to time it becomes necessary to test the spark coil or some other part of the ignition unit. The test should be quick and sufficiently accurate to insure a logical decision. The rider's future confidence and satisfaction as well as the repairman's reputation are at stake; therefore one cannot afford to fumble when testing.

Very often when a motor is hard to start the spark coil is condemned, whereas the trouble is due to fouled spark plugs, improper carburetion, a poor electrical connection or a poorly adjusted cut-out switch.

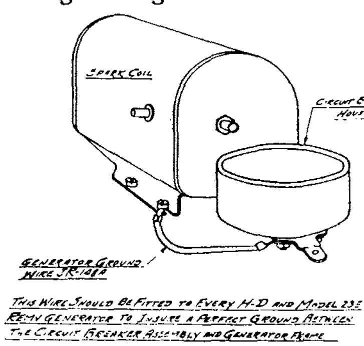



Illustration No. 1

Coil tests are often faulty and lead to incorrect deductions or conclusions. The repairman should, therefore, be able to make a prompt and reliable test.

The first thing is to determine just what is expected of the spark coil,—what length of spark it should give in dry open air, and the volume of the spark; next, the method of testing should be selected, depending upon whether the coil is mounted on the generator or not.

## Testing a Spark Coil While on the Generator

The best way to test a spark coil is under actual working conditions on the motorcycle, because the coil is properly connected and the test is likely to be accurate. Testing a coil removed from a machine may lead to false conclusions because the test is inaccurate or incorrect due to improper connections.

Before testing a coil be sure that a ground wire JR 148A, is permanently fitted, one end of it to one of the circuit breaker control lever studs and the other end to one of the coil mounting screws. Make sure that all connections are clean when fitting the ground wire; this is to insure a perfect "ground" between the circuit breaker assembly and the coil base. Refer to illustration No. 1.

Clean the circuit breaker points and remove and clean the circuit breaker lever stud. This stud may be rusty in its socket and prevent the primary current from passing freely to the ground.

The storage battery should be at least one half charged.

Make a jumper wire about 12 inches long, using testing clips for each end. The testing clips will be found most convenient when making quick temporary connections. Thru the jumper test wire, connect the battery direct to the rear spark coil primary

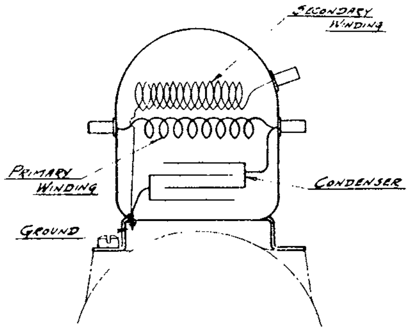


Illustration No. 2

terminal post. Hold one of the spark plug cables 3/16" (5 m m) from the cylinder, and give the starter several strokes. If a spark jumps the 3/16" (5 m m) gap, it is proof enough that the spark coil is functioning satisfactorily. This is the simplest test that can be applied to the spark coil, yet it is sufficiently accurate to be reliable.

## Testing a Spark Coil While Removed from the Generator Body

Before testing a coil removed from the generator, the internal construction of the coil, and the condenser connections should be thoroughly understood. Within the coil housing is contained a simple, induction, or transformer coil consisting of an iron core and a primary and secondary winding. A condenser for protecting the circuit breaker points and increasing the efficiency of the spark is secured in the bottom of the coil housing.

One condenser lead is connected to the front primary terminal post and the other is grounded with the coil mounting base. The primary winding is connected to the front and rear primary terminal posts. One end of the secondary winding is grounded with the coil mounting base and the other end is connected to the high tension terminal post, mounted on top of the housing. The complete assembly is then filled with an insulating and weatherproofing compound.

Illustration No. 2 plainly shows the internal connections of all Harley-Davidson and Remy 235 coils.

To test a coil, use a 6-8 volt storage battery which is at least one half charged.

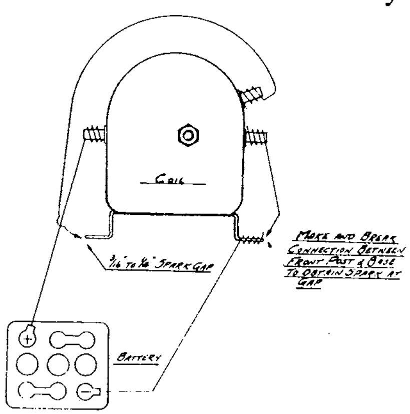


Illustration No. 3

In emergency, 4 good dry cells may be used. Connect one battery lead to the rear primary coil terminal post and connect the other battery lead to the coil mounting base proper. Arrange a spark gap between the high tension terminal and the coil mounting base. This gap should be between 3/16" and 1/4" (5 m m). With a piece of wire, make and break a circuit between the *front* primary terminal post and the coil base. A spark will jump the provided gap if the coil is in good working condition, and these instructions are carefully followed. Refer to illustration No. 3 for graphic explanations of the above coil test.

## If a Coil Tests Satisfactorily and the Motor is Difficult to Start

It must be remembered that the ignition unit and the generator unit are two entirely different elements and their functions are for different purposes. The system is designed for battery ignition and therefore a storage battery and direct current generator are the main sources of current supply. The ignition unit receives its current from either the battery or generator, depending upon the speed of the motorcycle. When the motor is first started, the down stroke of the starter closes the centrifugal cut-out switch and causes battery current to enter the generator and ignition units. After the motor has reached approximately 12 miles per hour, the generator voltage is in excess of the battery voltage and the ignition current is furnished by the generator. This, of course, holds good only as long as the head lights or warning signal are not being used; when they are, higher speed is necessary for the generator to carry ignition.

It may be seen from the foregoing that the efficiency of the ignition system depends upon the action of the centrifugal cut-out switch. This switch must be accurately adjusted and not tampered with by the novice. Only too frequently riders tamper with the sensitive adjustment of the cut-out switch and then register the complaint that their motors are hard to start. Illustration No. 4 shows the factory setting of the cut-out switch blades and points.

On rare occasions the cut-out weights may be found magnetized, thus sticking to the base proper and causing sluggish action of the switch. Magnetized weights should be replaced with weights free from magnetism. They may be tested for magnetism by trying to lift small particles or chips of iron or steel.

## How to Adjust the Centrifugal Cut-Out Switch Blades and Contacts

Referring to Illustration No. 4, adjust the upper blade so that the Bakelite button "B", is .004" (.10 m m) from the plane of the switch cover "C". A simple way to gauge this adjustment is to set the blade so that a piece of average writing paper may be slipped between the switch cover and the button. *Never adjust the upper blade to cause the bakelite button to be "within" the switch cover hole.* Next adjust the lower blade to give the contact points "D", a distance of 1/32" (.79 m m) to 3/64" (1.19 m m). The clearance between the points should never exceed 3/64" (1.19 m m).

After adjusting the blades as outlined above and dressing the points so that they make a clean square contact, the switch will function properly.

Never apply oil to the switch weights or

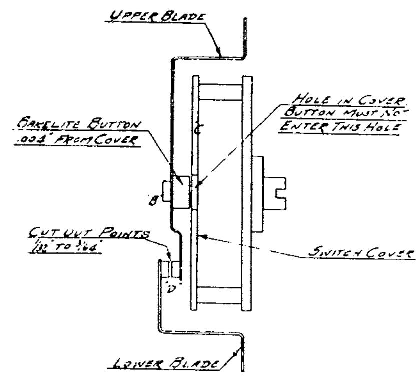


Illustration No. 4

the ball. To do so would only cause the oil to find its way to the points and cause difficult starting.

## Ready Reference Charts for Locating Ignition Troubles

**FAILURE TO START**
- Discharged storage battery.
- Oil soaked or fouled spark plugs.
- A poor electrical connection.
- Circuit breaker points dirty.
- Circuit breaker points not opening.
- Circuit breaker lever stud rusty.
- Broken primary wire or fibre insulating bushing.
- No short circuit wire, IR148A on circuit breaker housing.
- Cut-out switch not closing. (Try horn button.)
- Make spark coil test to ascertain condition of coil.

**MISSING AT LOW SPEED.**
- Spark plugs
  - Points too close.
  - Fouled—oil soaked or sooted mica.
- Circuit breaker points set too close.
- Circuit breaker points set too far apart.
- Dirty circuit breaker points.
- Improperly adjusted cut-out switch.
- Circuit breaker head loose—no IR148A ground wire.
- Primary wire broken or has loose connections.
- Primary wire stud fibre washer cracked.
- Circuit breaker screw stud loose in plate.
- Tungsten points beaten off lever and point.
- Circuit breaker lever rusty in stud socket.
- Crystallized points.
- Battery out of circuit, generator not running fast enough to charge.
- Battery discharged, generator not running fast enough to charge.
- Water soaked distributor cap.
- Sweating inside distributor cap.

## Ready Reference Chart for Locating Ignition Troubles (Continued)

**MISSING AT HIGH SPEED.**
- Spark plugs
  - Points too far apart.
  - Fouled—oil soaked or sooted mica.
  - Porcelain cracked or defective, causing premature ignition.
- Circuit breaker points not properly adjusted.
- Circuit breaker points dirty or crystallized.
- Circuit breaker lever spring weak. (Should have 16 oz. compression.)
- Circuit breaker housing loose—no IR148A ground wire.
- Primary wire broken or has loose connections.
- Primary wire stud fibre bushing cracked.
- Circuit breaker screw stud loose in plate.
- Tungsten contact points beaten off lever or screw.
- Battery out of generator circuit.
- Water soaked distributor cap or cap is sweating. (Thoroughly clean and dry.)
- Using distributor segment made for automobile ignition. This holds good only on Remy 235 generators. Test for short circuited generator two wire cable. (May occur where cable enters generator body.)
- Defective spark coil.

**MOTOR MISSES OR CUTS OUT AFTER BECOMING WARM.**
- If the motor misses or cuts out entirely after becoming warm, the primary or secondary coil winding may be broken down. Coils thus affected may function again after being allowed to cool.

# Service Dept. Bulletin

No. 94.—June 15, 1922 Harley-Davidson Motor Co., Milwaukee

## The New Manual Switch and Buzzer

For some time all big twins have been equipped with a manual switch and buzzer instead of the centrifugal switch. Operating instructions accompany each machine.

In the following the switch and buzzer principle and construction, as well as the method of fitting the switch to earlier machines in place of the centrifugal switch, are explained in detail for the dealer and repairman.

The manual switch and buzzer are of simple, sturdy construction but inasmuch as they are new to Harley-Davidson design, the dealer and repairman should understand their construction and the functions of the various members in order to be able to render proper service.

The complete functions of the manual switch, relay coil and buzzer are as follows:

**The Manual Switch:** The manual switch controls the battery, generator and ignition circuits; that is, upon closing the switch, disc No. 9 (illustration No. 1) makes contact with generator switch blade No. 2, battery switch blade No. 3 and ignition switch blade No. 8, thus connecting these three circuits in unit to make ready for starting the motor. Upon turning the manual switch OFF, the three main, or generator, battery and ignition circuits are opened. A close examination of the manual switch proper will reveal unique simplicity of design and ruggedness of construction, thus assuring positive action at all times.

When the switch stem is released, the proper distance between the contact disc and the three switch blades is 3/32 inch (2.3 m/m). When necessary, this adjustment can be obtained by bending the blades accordingly. The coil spring No. 7 (illustration No. 1) opens the switch when the stem is turned to the proper position. As this spring carries no electric current it should never require attention.

**Relay Coil:** The relay coil No. 4 (illustration No. 2) consists of a soft iron core and two (series and shunt) windings. The outside or heavy winding is the series coil, which is connected in series with the battery and generator; while directly over the core and under this winding, are wound many turns of fine wire to form the shunt coil. One end of the shunt winding is grounded and the other end is connected with one end of the heavy or series winding.

The heavy outside or series winding and the fine inside or shunt winding are wound over the core in opposite directions. This is done to cause the relay core to become magnetized when current comes from the battery, and to be neutral (not magnetized) when the generator furnishes the current. This theory holds good only when the battery and generator are in the circuit.

When the switch is turned on, current from the battery passes through the relay series and shunt windings in the same general direction and causes the vibrator blade No. 1 (illustration No. 2) to be drawn down and make contact with the buzzer coil vibrator blade No. 8 (illustration No. 2). Thus the buzzer coil is put into the circuit and its vibrating blade serves as a warning signal that the battery is being discharged and that the motor should be started immediately or the switch be turned OFF.

When the motor is started, the generator charging current passes through the relay series and shunt windings in opposite directions, causing them to neutralize (demagnetize) the core and open the vibrator blade points and stop the buzzer action.

**The Buzzer Coil:** The buzzer coil No. 6 (illustration No. 2) has one winding only, which is connected to the vibrator blade No. 8 (illustration No. 2) and the manual switch contact blade No. 8 (illustration No. 1). It is connected in such a way as to work only when the manual switch is turned on and the relay coil vibrator blade held down by either battery or generator current. The buzzer proper is quite simple, being simpler (less complicated) than a common electric door bell.

**To Adjust the Vibrator Blade Points:** To ascertain the adjustment of the vibrator contact points, hold the blades No. 1 and No. 2 (illustration No. 2) firmly against the lower brass stops No. 3 and No. 7, and observe the gap between the points. The correct gap is 1/32 inch, (.7 m/m). When necessary this adjustment can easily be obtained by bending the vibrator blades accordingly. When the vibrator blades are released, their ends should bear lightly against the upper part of the brass stops No. 3 and No. 7 (illustration No. 2). If the vibrator blade ends do not lightly touch the upper brass stops, bend the blade supports No. 10 (illustration No. 1) either up or down, as may be necessary to obtain the proper adjustment. If necessary, the contact points may be cleaned with No. 00 sandpaper.

As long as the buzzer is functioning properly and sounds when the switch is pushed in or turned on, do not tamper with it.

**Important Instructions for Making Ammeter Connections:** When an ammeter is used in the electrical system, it must be of the two wire type and connected as follows: Connect the meter positive terminal wire to the battery negative wire and thoroughly insulate the joint with tape and shellac. Then ground the meter negative terminal wire on the battery ground lock washer No. 2 (illustration No. 3) or some other clean metallic part of the frame.

Do not depend on tool boxes for good grounds because enamel, parkerization and rust in many cases practically insulate them from the frame. Hence, if a one wire ammeter is used, an additional wire must be connected to the meter negative terminal post and then securely grounded on the battery ground lock washer.

**Battery Ground Lock Washer—KK-381-P:** It is imperative that the battery, or ammeter, negative wire be securely grounded in order to keep the electrical system balanced at all times and prevent the generator voltage from dangerously increasing with the higher motorcycle speeds.

A simple yet positive ground for the battery has been made in the form of a lock washer which fits under the seat post clamp bolt nut. This special washer is provided with a screw and lock washer to clamp the battery, or ammeter, negative terminal. For a likeness of this new ground terminal refer to No. 2, (illustration) No. 3.

**Instructions for Operating the Manual Switch:** To start the motor turn the switch ON by pushing the key and stem all the way in and then turning the key one quarter turn in either direction. Start the motor in the regular way as quickly as possible after closing the switch, to prevent excessive discharge of the battery.

In cold weather particularly, the switch should not be turned ON until the motor has been made ready for starting according to the directions in the instruction book. This will prevent the battery from being discharged unnecessarily.

To facilitate starting a 74" (1208 cc.) motor, the spark control should be retarded slightly. This will permit the fly wheels to carry the piston over top dead center on the compression stroke and thus prevent backfiring.

To stop the motor turn the switch OFF by turning the key in either direction to original position and allowing the switch stem to project out of the cover. The buzzer will stop sounding when the switch is turned OFF.

**If the switch is left turned ON with the motor not running, a fully charged battery will be discharged within one hour; hence the importance of using the switch correctly.**

The horn is connected with the ignition circuit as on former electrically equipped models and will sound only when the manual switch is turned ON.

### THE BATTERY MUST BE KEPT IN CIRCUIT

**If the motor is run with the battery out of the circuit, the relay coil will function because of the excessively high generator voltage. The switch buzzer points (vibrator blade contact points) will be damaged by such high voltage and there is also danger of damaging the armature and coil, making apparent the need of keeping the battery in circuit while the motor is running.** It is, therefore, necessary should the buzzer points become burned, to examine all connections carefully and make them secure if necessary.

The motorcycle can be operated even though the buzzer is out of order (points burned so that the buzzer will not sound); all that is necessary in such a case is to separate the buzzer points or insulate them so that they cannot make contact with each other. It is well to pass this information on to the rider so that he can help himself in an emergency. Naturally a buzzer thus burned should be replaced as soon as possible to keep the electrical system properly balanced.

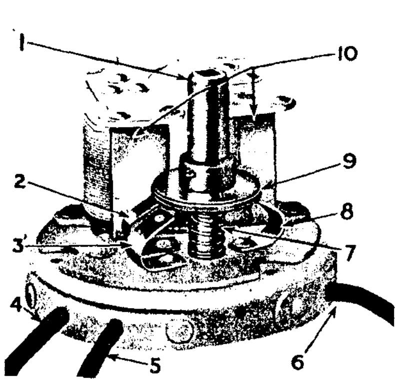



**Illustration No. 1**

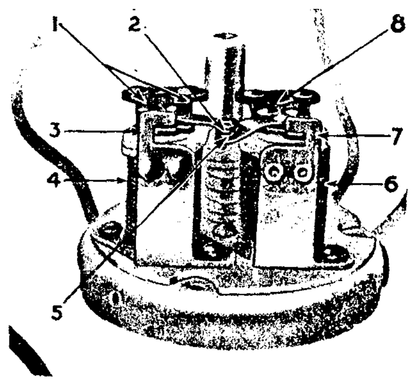



**Illustration No. 2**

**Spare Parts:** It will be noticed that the various components of the switch and buzzer units are securely riveted together. If any part of the assembly develops trouble, it cannot be rebuilt by the rider or dealer and must be referred to the factory for repairs or exchange. The parts that can be obtained are listed below.

| | | |
|---|---|---|
| KK-344P | —Manual switch complete less fuse box parts | $4.95 |
| KK-344AP | —Manual switch and fuse box complete | 6.25 |

(Either of these assemblies can be used to replace a centrifugal switch. Instructions for fitting are included with each set of parts.)

| | | |
|---|---|---|
| KK-385 | —Manual switch only | 4.00 |
| KK-342 | —Mounting plate assembly | .45 |
| KK-339 | —Switch cover | .20 |
| BO-13W | —Switch mounting screws (3) each | .01 |
| GO-13W | —Switch mounting screw washers | .01 |
| KK-381P | —Battery ground lock washer complete | .05 |
| KR-15 | —Generator left bearing cover plate | .08 |
| DK-321 | —Switch key | .15 |

# Instructions for Fitting the Harley-Davidson Manual Ignition Switch to 1920, 1921 and 1922 Models

To fit the manual switch, the centrifugal switch parts, the original fuse box bracket and the generator two wire cable must be removed. The front field coil wire which connects the positive (front) brush with the upper centrifugal switch blade should be cut so that it connects the field coil and brush only. Wire No. 14 (see illustration No. 3) should be passed up through the bushing in the bottom of the generator and connected together with the field wire to the positive (front) brush holder. The terminals should be arranged so that there will be no possible chances of grounding with the generator frame.

The commutator end bearing cover should be replaced with the plain cover furnished with the manual switch. The new cover is provided to close the bearing end in order to keep out the dust and grit as much as possible. This is the only work necessary to convert the generator.

## Using Manual Switch Assembly, KK 344P, with Original Fusė Box Parts

Transfer the original fuse base to the manual switch bracket. Also transfer the tail and sidecar light terminal No. 6 (illustration No. 3) to the new bracket, making sure that it is properly insulated. The fuse box should have its upper edge filed or cut away to fit the new bracket.

If the complete manual switch and fuse box assembly KK344AP is used, the above mentioned changes are not necessary.

## Fitting Manual Switch Bracket to Frame

Fit the manual switch bracket to the frame tube, making sure that it is in good contact with the frame. The switch bracket clamp must be grounded to complete the buzzer circuit. The top edge of the bracket clamp should be 1 inch (25. m/m) from the frame seat post cluster. Turn the switch bracket on the frame tube so that there is approximately ⅜ inch (9.5 m/m) clearance between the battery box and the switch cover. The cover is recessed to permit the battery positive wire to pass without being pinched. The switch and fuses are now ready for final connections.

## Instructions for Making All Electrical Connections for 1920, 1921 and 1922 Models

Refer to illustration No. 3 when making the following connections:

Connect eyelet of wire No. 3 to eyelet of wire No. 14 and thoroughly tape the connection. No. 13 shows this connection. Tape the joint to the frame tube just below the gear shifter bracket and shellac it.

Connect the central eyelet of wire No. 7 to the rear spark coil terminal, No. 8. Have this wire in a vertical position to prevent grounding on the metal coil end and loop back to horn fuse terminal No. 10.

Connect the central eyelet of wire No. 4 to the battery box bakelite terminal block. The end of this wire must be connected to light fuse terminal No. 11.

Make sure that the battery negative wire is securely grounded to the battery ground lock washer, see No. 2, which fits under the seat post pinch bolt or the frame brace eye bolt nut. This battery ground lock washer is furnished with the switch. The battery negative wire must be positively grounded to prevent the manual switch vibrator points from burning.

The manual switch is now in circuit with the battery and generator.

## Connecting Horn and Light Cable Wires to Fuse Box

Connect the eyelet of the RED cable wire to light fuse terminal No. 12. Connect the eyelet of the GREEN cable wire to horn fuse terminal No. 9. Connect the large eyelet of the BLACK cable wire to the insulated terminal No. 6. Also connect the tail light wire eyelet to this terminal. The hole in terminal No. 6, is for plugging in a side car light or trouble light connection.

All wiring and connections are now complete.

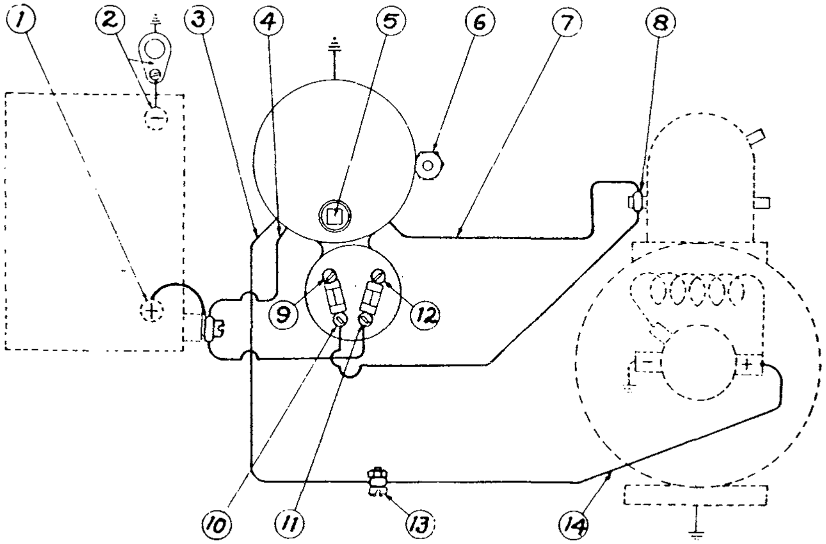


Illustration No. 3

## Key to Above Diagram for Fitting the Harley-Davidson Manual Ignition Switch to 1920, 1921 and 1922 Models

1—Battery positive wire connected with eyelet of wire No. 4 at terminal block; 2—Battery negative wire grounded to battery ground lock washer; 3—Switch-Generator wire, connects with generator feed wire at terminal No. 13; 4—Switch-Battery wire connects with light fuse terminal; 5—Switch key shaft, used when starting and stopping the motor; 6—Tail and sidecar light terminal, black wire of three wire lighting cable connects here; 7—Switch-Ignition wire, connects with rear spark coil terminal No. 8 and horn fuse terminal No. 10; 8—Rear spark coil terminal; 9—Horn fuse terminal, green wire of three wire lighting cable connects here; 10—Horn fuse terminal, fed from wire No. 7; 11—Light fuse terminal, fed from wire No. 4; 12—Light fuse terminal, red wire of three wire lighting cable connects here; 13—Bolted connection of switch wire No. 3 and generator wire No. 14; 14—Generator feed wire, connects with field coil wire to generator positive brush holder, and with switch wire No. 3 at terminal No. 13.

# Instructions for Fitting the Manual Switch to 1918 and 1919 Models

To fit the manual switch to 1918 and 1919 models using the new style head light (the head light with the switch mounted on it) and lighting cable, follow directions under Instructions for Fitting the Harley-Davidson Manual Ignition Switch.

The following instructions are for fitting the Harley-Davidson manual ignition switch to 1918 and 1919 electrically equipped models using the original headlight and lighting switch.

Make all changes in the generator according to directions under Instructions for Fitting the Harley-Davidson Manual Ignition Switch. Then assemble the lighting switch and manual ignition switch as follows:

Remove the light switch and bracket from the frame. Remove the light switch cover together with the fuses and wiring and observe two rivets which secure the base plate to the bracket. With a ¼ inch (6.3 m/m) drill, counterbore the peaned ends of the rivets in order to remove them. Separate the base plate from the frame bracket.

The short tail light wire should remain, with the insulating bushing, in the base plate.

Mount the light switch base plate on the fuse block extension of the manual switch bracket in the following manner.

Temporarily place the light switch base over the bracket extension (have the base slightly forward with the cable outlet at the bottom) and mark the plate, from the rear, through the three threaded holes in the bracket extension.

Strike these marks with a center punch and drill the three holes in the plate with a ⅛ inch or 5/32 inch (3 m/m or 3.9 m/m) drill. Secure the plate to the bracket extension with three 6-32 screws ¼ inch (6.3 m/m) long.

Transfer the tail and sidecar light insulated terminal No. 6 (illustration No. 4) to the manual switch bracket.

Follow instructions under Fitting Manual Switch Bracket to Frame to fit the assembly to the motorcycle.

## Making All Electrical Connections for 1918 and 1919 Models Only

Refer to illustration No. 4 when making the following connections:

Connect eyelet of wire No. 3 to eyelet of wire No. 17 and thoroughly tape the connections. No. 16 shows this connection.

Tape the joint to the frame tube just below the gear shifter shaft bracket and shellac it.

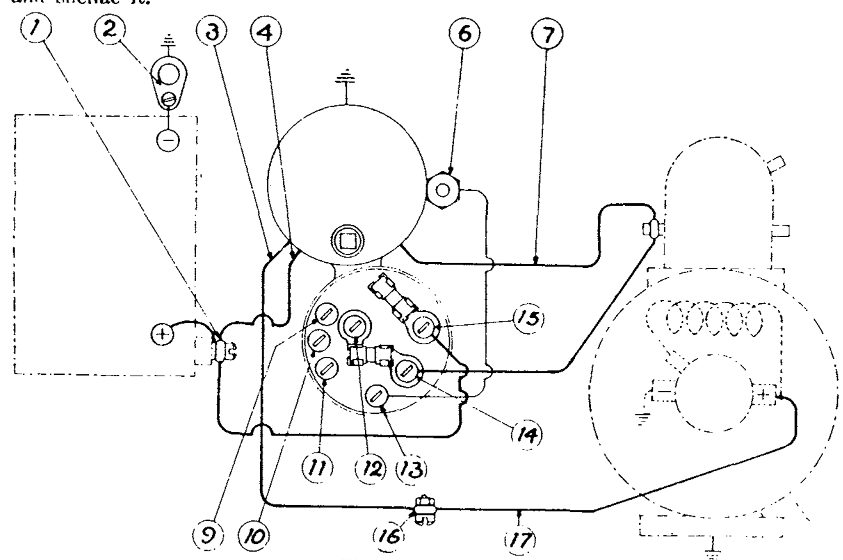


Illustration No. 4

spring "4" to the high tension terminals at "2"; 6—Slot in timer head casting lines up with lug "1" when the distributor cap "3" is properly fitted; 7—Circuit breaker lever; 8—Circuit breaker cam; 9—Circuit breaker points; 10—Adjusting screw with which the gap at the circuit breaker points "9" is adjusted; 11—Adjusting screw lock nut, prevents adjusting screw "10" from turning automatically. The lock nut must be loosened before an adjustment is made, and must be securely tightened after adjusting; 12—Primary wire connects primary winding of coil "16" to ground through circuit breaker points at "9"; 13—Distributor cap spring (two used) holds the distributor cap "3" securely in position; 14—High tension carbon contact insert which carries the ignition current from wire "15" to distributor segment contact spring "4"; 15—High tension wire which carries the ignition current from the secondary winding of the coil to the carbon contact insert "14" in the distributor cap; 16—Coil, one only used.

## To Adjust the Circuit Breaker Points

The fibre block on the circuit breaker arm is subjected to a certain amount of wear in service, and after several thousand miles it will be necessary to readjust the contact points to make up for this wear. As a matter of precaution, an inspection and adjustment if necessary, should be made, say, every 1,500 miles. If the high side of one of the steel cams is not in contact with the fibre block, it will be necessary to turn over the generator slowly by means of the rear wheel (transmission must be in high gear and the clutch engaged), until the steel cam hits the fibre block and separates the contact points as far as they will go. The lock nut "11" should then be loosened with the generator wrench, and the adjusting screw "10" should be turned in or out by turning the hexagon head until it is just possible to insert the flat steel gauge on the wrench between the points at "9". After the points are correctly adjusted, tighten the lock nut carefully and measure the clearance again to be sure that the adjustment is correct.

## Lubricating the Generator
(All Models Between 1918 and 1920)

Never use thin oil on any part of the generator. Once a year put a little vaseline about half the size of a pea on the top of the fibre block of the interrupter lever and keep the cup on the right side of the generator filled with good vaseline if the cup is provided with a wick. This cup will require filling about every 1,000 miles. If the generator has a regular grease cup here instead of a vaseline cup, give this one-half turn every 500 miles and keep it filled with a good grade of cup grease.

## When New Parts are Needed

Order new parts through your dealer or from the Harley-Davidson Motor Co. direct, if you are not near to a dealer. Specify whether your generator is a Remy or Harley-Davidson and mention its serial number and model.

## To Regulate the Charging Rate [Output] of the Harley-Davidson and Model 235 Remy Generators
(1918 to 1923 Models)

The output of a generator should not be changed if the machine is used for ordinary service when the lights are used reasonably, because each instrument is accurately adjusted at the factory to meet the requirements of such service and danger of overcharging will never occur. A change in adjustment is recommended only for machines, either in commercial, or in private service, which are driven considerable distances during the daytime and are not used at night; and for machines which are driven considerably with the lights burning and very little without, as in the winter time due to the short days. If additional lights are used, the output of the generator should be increased to take care of them. Care should be taken, however, not to overload the system. The battery also requires a higher charge in winter to keep it up.

A dirty commutator or improperly seating brushes will affect the output of the generator; therefore, before changing the position of the regulating brush be sure that the commutator is clean and the brushes are seating properly. Use No. 00 sand paper to clean the commutator and seat the brushes. NEVER USE EMERY CLOTH. After cleaning the commutator and seating the brushes, remove all traces of sand and carbon.

If the charging rate of a generator is sufficiently high to overcharge a battery, it should be reduced. Whether or not a battery is receiving an overcharge can best be determined by the state of charge of the battery, and the amount of water consumed. If water is added weekly, and there is not enough solution above the plates to obtain a hydrometer reading with the standard hydrometer, and provided the jar does not leak, the battery is receiving an overcharge.

### How to Determine the Proper Generator Charging Rate

The output of a generator may be regulated with the generator either on or off the motorcycle.

The generator output can be tested by connecting a reliable direct current ammeter, having a 0 (zero) to 10 ampere scale, in the circuit between the generator and battery and running the motor. If the condition of the ammeter mounted on the machine is questionable; then use a meter of known quality.

To cut in an ammeter to test the output of a generator on a machine, disconnect the ammeter on the machine, and connect the positive post of the test ammeter to the negative post of the battery; then ground the negative post of the ammeter to the machine.

All Remy model 235 generators when adjusted for ordinary service generate from 3½ amperes to 4 amperes; Harley-Davidson generators are adjusted to give a maximum of 4 amperes. This rate will be found to be too much if the machine is never driven at night, and the position of the regulating brush should be changed so that the highest charging rate is from 2½ amperes to 3 amperes.

Run the machine either on the stand or on the road at approximately 20, 30 and 45 miles per hour to check the charging output of the generator.

The current rate at 20 miles an hour should be approximately 2 amperes; at 30 miles an hour, 3 or 3½ amperes and at 40 miles an hour, 3½ or 4 amperes.

If the generator has been removed from the motor for testing it should be mounted on a bench and driven by a variable speed motor or line shaft at speeds approximating 20, 30, 40 and 50 miles an hour (sidecar gearing).

The armature revolutions at the suggested speeds are respectively—1750, 2630, 3500 and 4375.

### Making Connections for Testing Generators on Bench

Connect the RED wire of the double cable leading from the bottom of the generator to the positive wire of a motorcycle battery that is at least one-half charged (gravity reading 1200 or more). The battery negative wire must be connected to the positive terminal of a reliable ammeter. The remaining ammeter terminal can now be grounded to the generator frame.

Make some provision for testing the spark; a pair of spark plugs grounded to the generator frame will suffice.

Remove the generator commutator end cover and the generator is then ready for testing.

# Adjustment of the Brushes

When the generator has not been taken entirely apart it is only necessary to change the position of the regulating (upper right hand) brush "3" (Illustration No. 3) on the commutator. To reduce the output, loosen the third brush plate clamp screw "1" (Illustration No. 4) a few turns with a special wrench, LK881, and move the regulating brush "3" and brush plate assembly "4" away from the negative brush "5" about 1/16". To increase the output, move the regulating brush "3" and brush plate assembly "4" toward the negative brush "5" about 1/16". After moving the regulating brush "3", make sure that it bears squarely against the commutator and again tighten the third brush plate clamp screw "1".

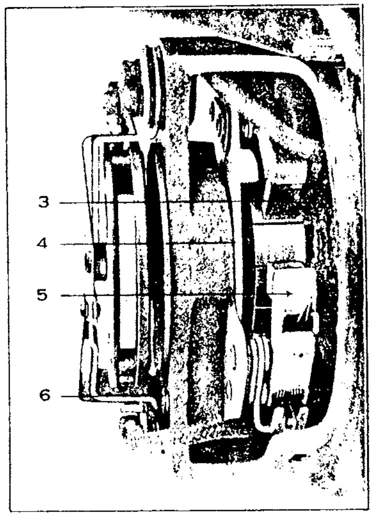


Illustration No. 3

Test the output of the generator and see whether or not there is considerable arcing (sparking) between the regulating brush and commutator. If the arcs (sparks) appear to jump from either edge of the brush, the brush is not bearing squarely against the commutator. To square up the brush, insert a strip of No. 00 sandpaper between the brush and the commutator, the sanded side against the brush. Press lightly on the brush and withdraw the strip. The curvature of the commutator and abrasive will cut the brush face clean. After seating brushes, clean brushes and commutator, and remove all traces of sand and carbon. NEVER USE EMERY CLOTH.

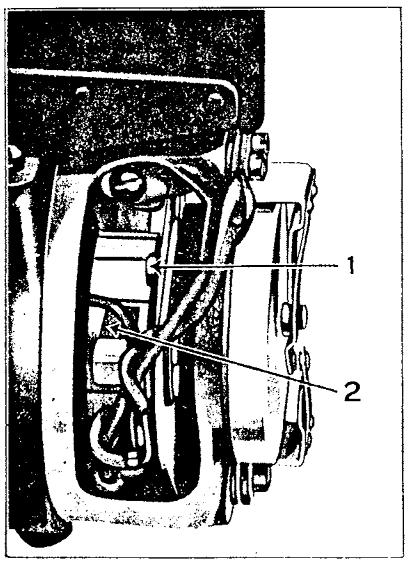


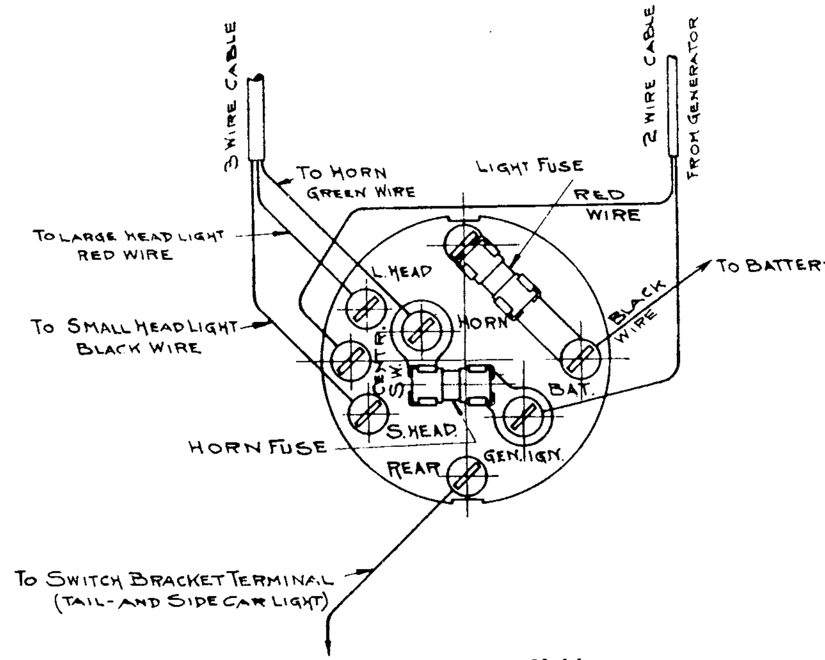
Illustration No. 4

Test the generator again to see whether or not the reseating of the brush on the commutator affected the output to such an extent that the regulating brush plate must be moved once more. It may be necessary to change the position of the regulating brush several times before the desired results are obtained.

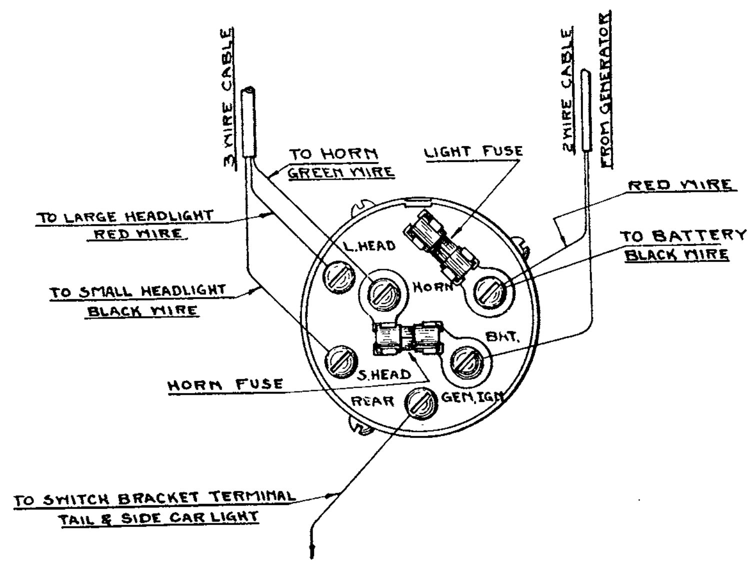
## To Reseat All Brushes

(Remy Generators Only)

If a generator has been completely stripped and the main brush plate has been removed, the proper (neutral) position of the brushes is determined by watching the arcing between the positive and ground brushes, and the commutator. Most arcing will appear between the positive brush "2" (Illustration No. 4) and the commutator. No attention should be paid to the regulating brush during this test.



Switch Wiring Diagram of 1918 Models



Switch Wiring Diagram of 1919 and early 1920 Models

Illustration No. 5

The generator should be run approximately 30 miles an hour and the brush plate moved back and forth until a place is found where the least arcing (sparking) will occur; then tighten the main brush plate clamp screw "6". When making this adjustment on the machine, be careful not to get your hand caught in the drive chain. The best method is to stop the motor, shift the brush plate, then restart the motor—doing this until the desired results have been accomplished.

The output of the generator is then adjusted by moving the regulating brush plate "4" to the proper position as explained previously.

## Notice

The armature and brush plate of the Harley-Davidson generator are so constructed that it is not necessary to locate the neutral brush plane; therefore, the main brush plate is rigidly secured to the generator body and requires no adjustment.

When assembling the centrifugal switch, take special care to tighten the cutout switch base screw as tight as possible. Examine the hard rubber insulators of the terminal screws (switch blade clamp screws) for cracks. These bushings must be in good condition, and the fibre terminal washers must be properly placed, or a short circuit will result which may cause serious trouble.

## How to Test Spark Coils and Diagnose Ignition Troubles

(All Models between 1918 and 1922)

It may become necessary to test the spark coil or some other part of the ignition unit and the test, therefore, should be quick and sufficiently accurate to insure a logical decision.

Very often when a motor is hard to start the spark coil is condemned, whereas the trouble is due to fouled spark plugs, improper carburetion, a poor electrical connection or a poorly adjusted cut-out switch.

Coil tests are often faulty and lead to incorrect deductions or conclusions. The rider or repairman should, therefore, be able to make a prompt and reliable test.

The first thing is to determine just what is expected of the spark coil,—what length of spark it should give in dry, open air, and the volume of the spark; next, the method of testing should be selected, depending upon whether the coil is mounted on the generator or not.

## Testing a Spark Coil while on the Generator

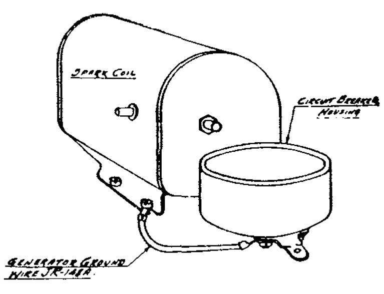



Illustration No. 6

The best way to test a spark coil is under actual working conditions on the motorcycle, because the coil is properly connected and the test is more likely to be accurate. Testing a coil removed from a machine may lead to false conclusions because the test is inaccurate or incorrect due to improper connections and the method used.

Before testing a coil, be sure that a ground wire JR 148A, is permanently fitted, one end of it to one of the circuit breaker control lever studs and the other end to one of the coil mounting screws. This wire can be obtained from your dealer or the factory at small cost. Make sure that all connections are clean when fitting the ground wire; this is to insure a perfect "ground" between the circuit breaker assembly and the coil base. Refer to illustration No. 6.

Clean the circuit breaker points and remove and clean the circuit breaker lever stud. This stud may be rusty in its socket and prevent the primary current from passing freely to the ground.

The storage battery should be at least one-half charged when making this as well as all electrical tests.

Make a jumper wire about 12 inches long, using, if possible, testing clips for each end. The testing clips will be found most convenient when making quick temporary connections. Thru the jumper test wire, connect the battery direct to the rear spark coil primary terminal post. That is, connect one end of the wire to the battery positive terminal and the other end to the rear spark coil terminal post.

Hold one of the spark plug cables about 3/16" from the cylinder to make a spark gap, and if a good snappy spark occurs after using the starter several times, it is proof enough that the spark coil is functioning satisfactorily. This is the simplest test that can be applied to the spark coil, yet it is sufficiently accurate to be reliable.

## Testing a Spark Coil Removed from the Generator Body

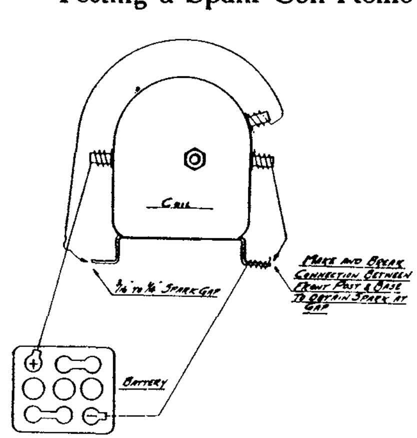



Illustration No. 7

Before testing a coil removed from the generator, the internal construction of the coil, and the condenser connections should be understood thoroughly. Within the coil housing is contained a simple induction, or transformer coil consisting of an iron core and a primary and secondary winding. A condenser for protecting the circuit breaker points and increasing the efficiency of the spark is secured in a metal case in the bottom of the coil housing.

One condenser lead is connected to the front primary terminal post and the other is grounded with the coil mounting base. The primary winding is connected to the front and rear primary terminal posts. One end of the secondary winding is grounded with the coil mounting base and the other end is connected to the high tension terminal post, located on top of the housing. The complete assembly is then filled with an insulating and weatherproofing compound.

Illustration No. 7 shows quite clearly the internal connections of all Harley-Davidson and Remy 235 model coils.

To test a coil, use a 6 to 8 volt storage battery which is at least one-half charged. In emergency four good dry cells connected in series may be used. Connect one battery lead to the rear primary coil terminal post and connect the other battery lead to the coil mounting base proper. With a piece of stiff wire arrange a spark gap between the high tension terminal and the coil mounting base. This gap should be between 3/16" and ¼". With another piece of wire, or a screw driver, make and break a circuit between the front primary terminal post and the coil base. If these instructions are followed carefully a spark will jump the provided gap if the coil is in good working condition. Refer to the illustration No. 7 for graphic explanations of the above coil test.

## If a Coil Tests Satisfactorily and the Motor is Difficult to Start
(1918 to 1922 models)

It must be remembered that the ignition unit and the generator unit are two separate and entirely different elements and their functions are for different purposes. The Harley-Davidson electrical system is designed for battery ignition and therefore a storage battery and direct current generator are the main sources of current supply.

The ignition unit receives its current from either the battery or generator, depending upon the speed of the motorcycle. When the motor is first started, the down stroke of the starter closes the centrifugal cut-out switch and causes "battery current" to enter the generator and ignition units. After the motor has reached approximately 12 miles per hour, the generator voltage is in excess of the battery voltage and the ignition current is furnished by the "generator". This, of course, holds good only as long as the head lights or warning signal are not being used; when they are brought into use, higher speed is necessary for the generator to carry ignition.

Ammeter readings at various speeds and under variable conditions indicate the movement of current in the system as follows:

When driving during daylight and the ammeter needle shows, say 3 amperes, it means that 3 amperes current are passing into the battery.

If the meter shows a 0 (zero) reading, the system is more or less balanced, that is, current is coming from both battery and generator for ignition.

If the meter needle shows a discharge of, say, 1 or 2 amperes when driving with or without the lights turned on, it indicates that the current is coming from the battery. This can be caused by the generator not furnishing sufficient current to offset the current used by the lights, if the lights are turned on, or else the generator is not charging at all if the lights are turned off.

It may be seen from the foregoing that the efficiency of the ignition system depends upon the action of the centrifugal cut-out switch. This switch must be accurately adjusted and not tampered with unless absolutely necessary. Only too frequently riders tamper with the sensitive adjustment of the cut-out switch and then register the complaint that their motors are hard to start. Illustration No. 1 shows the factory setting of the cut-out switch blades and points.

## Ready Reference Charts for Locating Ignition Troubles

NOTE: Before condeming the ignition system, make sure gasoline is actually reaching the carburetor and that there is sufficient compression in the cylinders to cause combustion after the gas es are ignited.

**FAILURE TO START IF DUE TO IGNITION**

- Discharged storage battery
- Oil soaked or fouled spark plugs
- A poor electrical connection
- Circuit breaker points dirty
- Circuit Breaker points not opening
- Circuit Breaker lever stud rusty
- Broken primary wire or fibre insulating bushing
- No short circuit wire, JR148A on circuit breaker housing
- Cut-out switch not closing. (Try horn button )
- Make spark coil test to ascertain conditions of coil

**MISSING AT LOW SPEED IF DUE TO IGNITION**

- Spark plugs
  - Points too close
  - Fouled (oil soaked) or sooted mica
- Circuit breaker points set too close
- Circuit breaker points set too far apart
- Dirty circuit breaker points
- Improperly adjusted cut-out switch
- Circuit breaker head loose—no JR148A ground wire
- Primary wire broken or has loose connections
- Primary wire stud fibre washer cracked
- Circuit breaker screw stud loose in plate
- Tungsten points beaten off lever and point screw
- Circuit breaker lever rusted in stud socket
- Crystallized points
- Battery out of circuit, generator not running fast enough to produce current
- Battery discharged, generator not running fast enough to produce current
- Water soaked distributor cap
- Sweating inside distributor cap
- Short circuited distributor cap. (Usually fires on one cylinder only.)

**MISSING AT HIGH SPEED IF DUE TO IGNITION**

- Spark plugs
  - Points too far apart
  - Fouled (oil soaked) or sooted mica
  - Porcelain cracked or defective, causing premature ignition
- Circuit breaker points not adjusted properly
- Circuit breaker points dirty or crystallized
- Circuit breaker lever spring weak. (Should have 16 oz. compression or tension)
- Circuit breaker housing loose—no JR148A ground wire
- Primary wire broken or has loose connections
- Primary wire stud fibre bushing cracked
- Circuit breaker screw stud loose in plate
- Tungsten contact points beaten off lever or screw
- Battery out of generator circuit
- Water soaked distributor cap or cap is sweating. (Clean and dry thoroughly)
- Using distributor segment made for automobile ignition. This hold good only on Remy 235 generators
- Test for short circuited generator cable. (May occur where cable enters generator body.)
- Defective spark coil

**MOTOR MISSES OR CUTS OUT AFTER BECOMING WARM IF DUE TO IGNITION**

- If the motor misses or cuts out entirely after becoming warm, the primary or secondary coil winding may be broken down. Coils thus affected may function again after being allowed to cool

# Mechanics' Bulletin

No. 100 April 1, 1924 Harley-Davidson Motor Co., Milwaukee

## Complete Timing Instructions for Harley-Davidson Motors

### Working Principles of the Harley-Davidson Motor

The Harley-Davidson motor is of the conventional four-stroke-cycle principle. Each complete power cycle is made up of four events, or strokes; hence the term "four-stroke-cycle". This type of motor is commonly referred as a "four-cycle" motor.

Each 180 degrees of fly-wheel travel is one event or stroke. The flywheel must, therefore, make two revolutions to complete one power cycle of the motor. The four-stroke-cycle principle is briefly: 1—Intake or admission stroke; 2—Compression stroke; 3—Ignition and power stroke; 4—Exhaust or scavenging stroke.

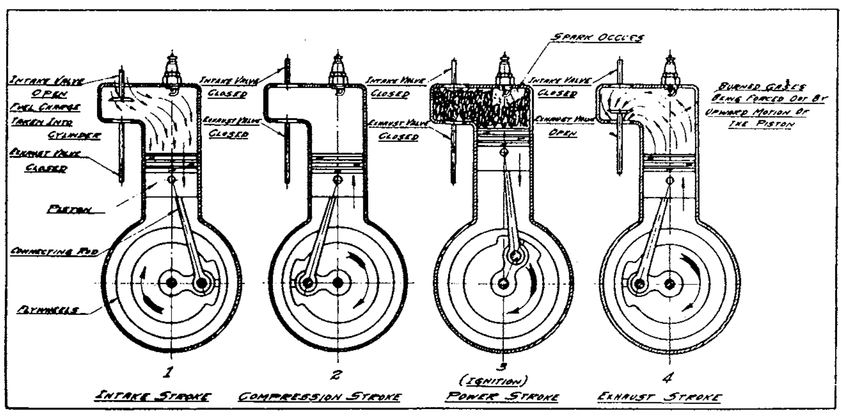



ILLUSTRATION NO. 1

The Accompanying Illustration Graphically Explains the Four-Stroke-Cycle Principle

### General

To insure the most accurate results when timing valves and ignition, the motor should be taken out of the frame and the front cylinder plug removed. After the cylinder plug is removed, a 6" scale can be passed through the opening to reach the piston head so as to locate it properly in the cylinder for setting valves and timing ignition.

Piston positions in motor timing are determined from either top (upper) or bottom (lower) dead centers. Dead center

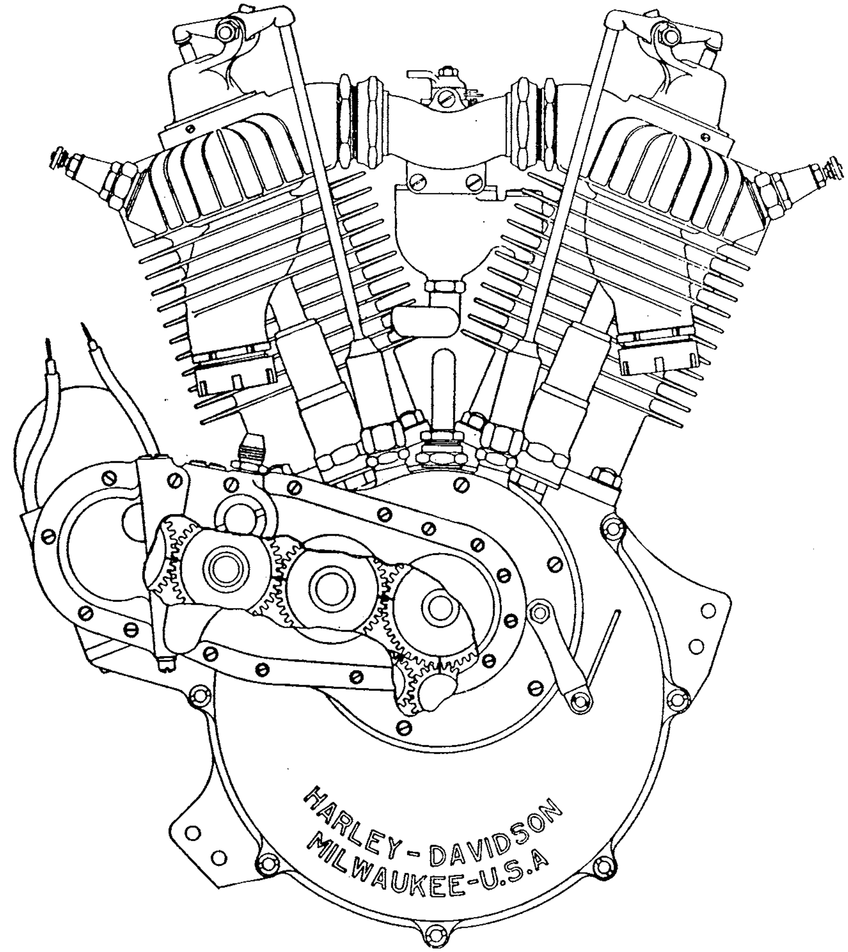



ILLUSTRATION NO. 2

"V" Twin Motor with Cutaway Gear Cover, showing how 1915 to 1924 Twin Magneto Models should be set according to Gear Marks. Valve Timing on all motors since 1915 should have Gear Marks Aligned as shown in this Illustration is the point at the extreme top or bottom end of piston travel—the point where the piston is "dead".

The close relation between piston travel and valve operation requires close measurements when timing a motor. The following instructions must, therefore, be studied and applied carefully to obtain the original factory timing.

Complete valve and ignition timing for each type of motor will be found under a heading covering that type of motor.

### To Convert Inches Into Millimeters

First of all convert the fraction into decimals as follows: Add ciphers (naughts) to the numerator and divide this by the denominator. Place the decimal point so as to make as many decimal places in the result as there were ciphers (naughts) added.

Example: 7/8 inch fraction equals .875 inch (decimal).

Process 8/7.000

0.875

The decimal or fraction can now be converted into millimeters by multiplying it by 25.4

Example: 7/8 inch=.875=22.22 millimeters.

Process .875
25.4

3500
4375
1750

22.2250

# Twin Cylinder "V" Type Motors

### To Time Valves on "V" Twins

All twin motors, since 1915, have the pinion and cam gears marked which, of course, makes valve timing on these models a very simple matter. By merely lining up these marks as shown in illustration No. 2, the pistons and cams will be in proper relation; however, the valves will not open and close properly until the valve tappets and push rods are adjusted according to the following specifications.

### Valve Tappet Adjustment
(1915 and Later Models)

When making adjustments to valve tappets, the motor must be cold in order to obtain accurate results.

The exhaust valve tappets must be adjusted to have a clearance of .008″ to .010″ between their heads and the valve stems.

The inlet valves must have a clearance of .004″ between their stems and levers.

### Valve Timing Specifications for "V" Twin Motors
(The Following Covers Valve Timing Regardless of Gear Marks)

The exact time of valve opening and closing can be determined easily by turning the push rod or lifter pin while the motor is being turned over. When the push rod or lifter pin begins to tighten or loosen, as the motor is being turned over, the valve is beginning to open or close.

The following are piston locations in fractions of an inch, from either top or bottom dead centers, when the valves are opening and closing.

For an example: With the gears meshed properly the inlet valve opens when the piston is between 3/16″ and 5/16″ before top dead center. This means that the piston is on an upward stroke and when it is between 3/16″ and 5/16″ from the top end of its travel, the cam gear has turned so the inlet valve starts to open.

### Inlet Valve Timing Specifications

The inlet valve should open when the piston is between 3/16″ and 5/16″ *before top dead center* (piston is coming up on exhaust stroke).

The inlet valve should close when the piston is between 3/4″ and 7/8″ *after bottom dead center* (piston is coming up on compression stroke).

### Exhaust Valve Timing Specifications

The exhaust valve should open when the piston is between 5/8″ and 3/4″ *before bottom dead center* (piston is going down on power stroke).

The exhaust valve should close when the piston is between 1/16″ and 1/8″ *after top dead center* (piston is going down on intake stroke).

### Breather Valve Specifications

The port in the sleeve of the relief valve must be open between 1/16″ and 3/32″ when the *front* cylinder piston is on either top dead center. The breather valve port opens as the shaft is turned in a left handed direction.

### To Timer Breather Valve or Mechanical Relief Valve
(1914 and Later "V" Twins)

The relief valve is provided to allow the crank case compression to be expelled when the pistons descend.

Besides relieving the crank case compression, the breather valve controls the lubricating system to a large degree. The importance of correct timing for this valve is therefore obvious.

When the pinion gear and cam gear marks are aligned the breather valve gear can be meshed with the pinion gear so the marked tooth is within the "V" stamped in the crank case. Refer to Illustration No. 2 showing correct valve and breather valve timing according to gear marks.

# Ignition Timing for "V" Twin Motors

### Circuit Breaker Contact Point Specifications

To insure extreme accuracy in ignition timing, make sure that the circuit breaker points are set according to the manufacturer's specifications. An adjusting wrench fitted with a thickness gauge accompanies each ignition apparatus. If such a gauge is not available, adjust the breaker points according to the following data:

Harley-Davidson
Generator ....—.020 inch
Remy Model 250
Generator ....—.020 inch
Remy Model 235
Generator ....—.020 inch
Bosch magneto ...—.016 inch
Berling magneto..—.018 inch
Dixie magneto ..—.020 inch

# Mechanics' Bulletin

No. 100 April 1, 1924 Harley-Davidson Motor Co., Milwaukee

## Complete Timing Instructions for Harley-Davidson Motors

### Working Principles of the Harley-Davidson Motor

The Harley-Davidson motor is of the conventional four-stroke-cycle principle. Each complete power cycle is made up of four events, or strokes; hence the term "four-stroke-cycle". This type of motor is commonly referred as a "four-cycle" motor.

Each 180 degrees of fly-wheel travel is one event or stroke. The flywheel must, therefore, make two revolutions to complete one power cycle of the motor. The four-stroke-cycle principle is briefly: 1—Intake or admission stroke; 2—Compression stroke; 3—Ignition and power stroke; 4—Exhaust or scavenging stroke.

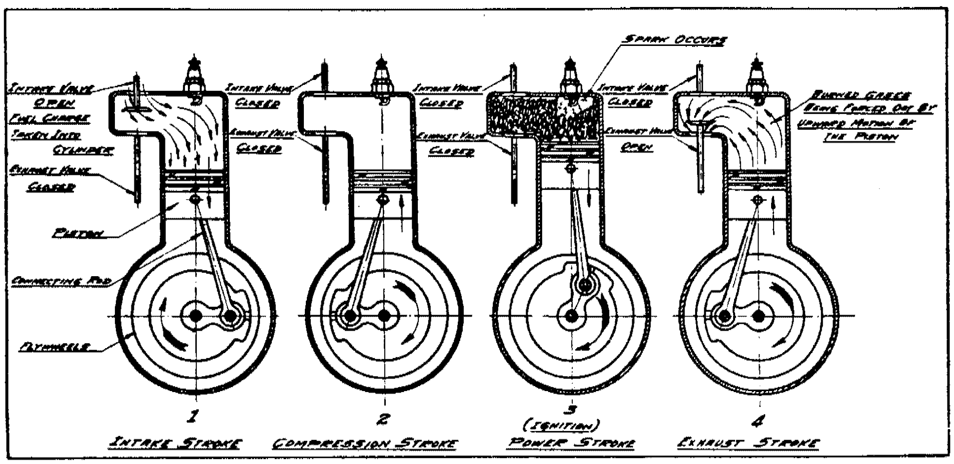



ILLUSTRATION NO. 1

The Accompanying Illustration Graphically Explains the Four-Stroke-Cycle Principle

### General

To insure the most accurate results when timing valves and ignition, the motor should be taken out of the frame and the front cylinder plug removed. After the cylinder plug is removed, a 6″ scale can be passed through the opening to reach the piston head so as to locate it properly in the cylinder for setting valves and timing ignition.

Piston positions in motor timing are determined from either top (upper) or bottom (lower) dead centers. Dead center

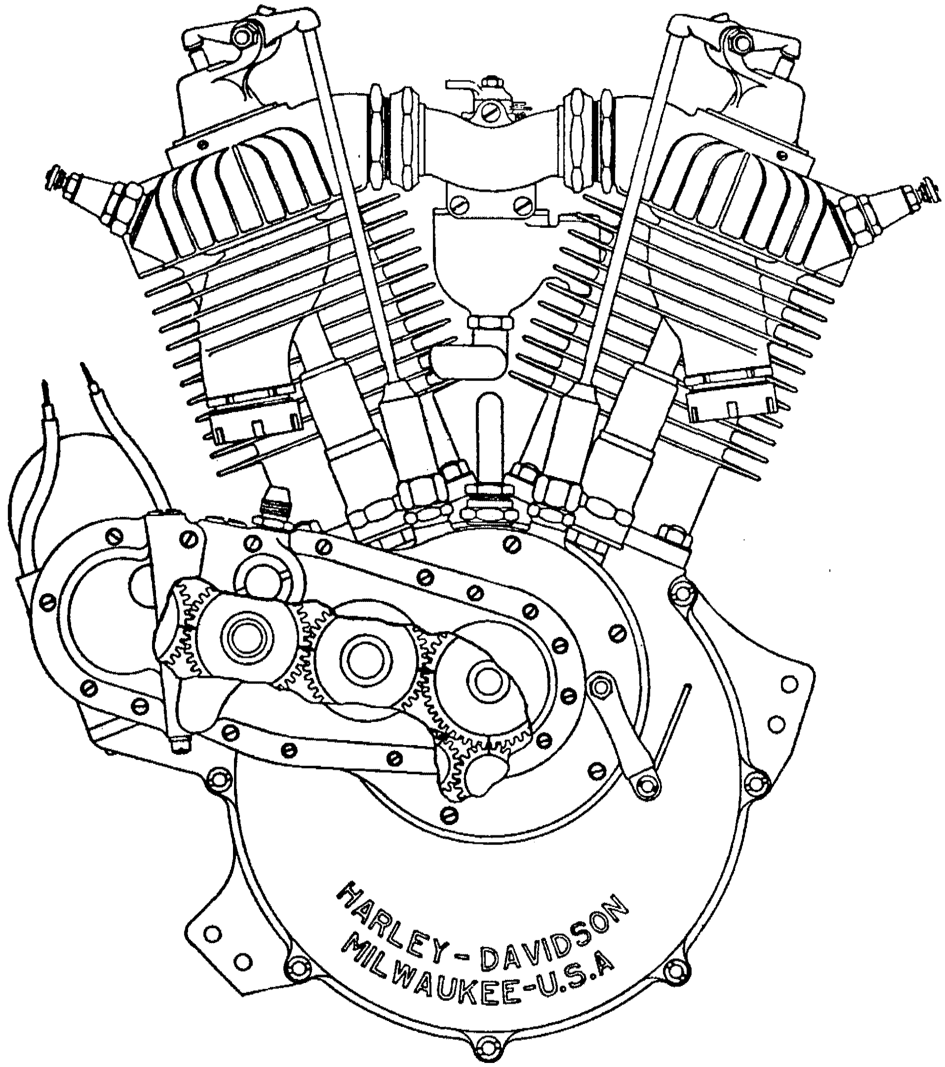



ILLUSTRATION NO. 2

"V" Twin Motor with Cutaway Gear Cover, showing how 1915 to 1924 Twin Magneto Models should be set according to Gear Marks. Valve Timing on all motors since 1915 should have Gear Marks Aligned as shown in this Illustration is the point at the extreme top or bottom end of piston travel—the point where the piston is "dead".

The close relation between piston travel and valve operation requires close measurements when timing a motor. The following instructions must, therefore, be studied and applied carefully to obtain the original factory timing.

Complete valve and ignition timing for each type of motor will be found under a heading covering that type of motor.

### To Convert Inches Into Millimeters

First of all convert the fraction into decimals as follows: Add ciphers (naughts) to the numerator and divide this by the denominator. Place the decimal point so as to make as many decimal places in the result as there were ciphers (naughts) added.

Example: 7/8 inch fraction equals .875 inch (decimal).

Process 8/7.000

0.875

The decimal or fraction can now be converted into millimeters by multiplying it by 25.4

Example: 7/8 inch=.875=22.22 millimeters.

```
Process .875
         25.4
        -----
         3500
        4375
       1750
       -------
       22.2250
```

# Twin Cylinder "V" Type Motors

## To Time Valves on "V" Twins

All twin motors, since 1915, have the pinion and cam gears marked which, of course, makes valve timing on these models a very simple matter. By merely lining up these marks as shown in illustration No. 2, the pistons and cams will be in proper relation; however, the valves will not open and close properly until the valve tappets and push rods are adjusted according to the following specifications.

### Valve Tappet Adjustment
(1915 and Later Models)

When making adjustments to valve tappets, the motor must be cold in order to obtain accurate results.

The exhaust valve tappets must be adjusted to have a clearance of .008″ to .010″ between their heads and the valve stems.

The inlet valves must have a clearance of .004″ between their stems and levers.

### Valve Timing Specifications for "V" Twin Motors
(The Following Covers Valve Timing Regardless of Gear Marks)

The exact time of valve opening and closing can be determined easily by turning the push rod or lifter pin while the motor is being turned over. When the push rod or lifter pin begins to tighten or loosen, as the motor is being turned over, the valve is beginning to open or close.

The following are piston locations in fractions of an inch, from either top or bottom dead centers, when the valves are opening and closing.

For an example: With the gears meshed properly the inlet valve opens when the piston is between 3/16″ and

5/16″ before top dead center. This means that the piston is on an upward stroke and when it is between 3/16″ and 5/16″ from the top end of its travel, the cam gear has turned so the inlet valve starts to open.

### Inlet Valve Timing Specifications

The inlet valve should open when the piston is between 3/16″ and 5/16″ *before top dead center* (piston is coming up on exhaust stroke).

The inlet valve should close when the piston is between 3/4″ and 7/8″ *after bottom dead center* (piston is coming up on compression stroke).

### Exhaust Valve Timing Specifications

The exhaust valve should open when the piston is between 5/8″ and 3/4″ *before bottom dead center* (piston is going down on power stroke).

The exhaust valve should close when the piston is between 1/16″ and 1/8″ *after top dead center* (piston is going down on intake stroke).

### Breather Valve Specifications

The port in the sleeve of the relief valve must be open between 1/16″ and 3/32″ when the *front* cylinder piston is on either top dead center. The breather valve port opens as the shaft is turned in a left handed direction.

### To Timer Breather Valve or Mechanical Relief Valve
(1914 and Later "V" Twins)

The relief valve is provided to allow the crank case compression to be expelled when the pistons descend.

Besides relieving the crank case compression, the breather valve controls the lubricating system to a large degree. The importance of correct timing for this valve is therefore obvious.

When the pinion gear and cam gear marks are aligned the breather valve gear can be meshed with the pinion gear so the marked tooth is within the "V" stamped in the crank case. Refer to Illustration No. 2 showing correct valve and breather valve timing according to gear marks.

## Ignition Timing for "V" Twin Motors

### Circuit Breaker Contact Point Specifications

To insure extreme accuracy in ignition timing, make sure that the circuit breaker points are set according to the manufacturer's specifications. An adjusting wrench fitted with a thickness gauge accompanies each ignition apparatus. If such a gauge is not available, adjust the breaker points according to the following data:

Harley-Davidson
  Generator . . . .—.020 inch
Remy Model 250
  Generator . . . .—.020 inch
Remy Model 235
  Generator . . . .—.020 inch
Bosch magneto . . .—.016 inch
Berling magneto. .—.018 inch
Dixie magneto . .—.020 inch

Ignition, or the electric spark occurs at the time when the generator or magneto circuit breaker points are just separating. Since an interval of time is required for ignition to propagate a flame through the gasses and hence cause complete combustion, the timing of the spark's occurence is always set before the piston reaches top dead center on the compression stroke.

## How to Locate Compression Stroke of Piston for Ignition Timing (All Motors)

As the inlet valve opens, the piston descends, taking in a charge of fuel. The next up stroke of the piston will be the compression stroke. Both the inlet and exhaust valves on the same cylinder will be closed when the piston is coming up on the compression stroke.

## Setting the Piston for Ignition Timing (All Motors)

After locating the compression stroke, move the piston to top dead center; then back it down (turn motor backward) the required distance (see specifications for your motor) from the top of the stroke. By reading the graduations on the scale, the distance between the piston head and top center can be determind easily.

## Ignition Timing Specifications for "V" Twin Motors

The following specifications give the correct piston positions before top dead center for solo and sidecar motor ignition timing. The measurements are given so the piston can be set and the circuit breaker points timed on the proper cam, to just separate with the spark lever advanced fully.

### 74" Sidecar or Low Compression DCA Motors

(Generator or Magneto Equipped)

Pistons must be set between 7/32" and 1/4" before top dead center.

### 74" Solo or High Compression DCA Motors

(Generator or Magneto Equipped)

Pistons must be set between 13/32" and 7/16" before top dead center.

### 74" Sidecar or Low Compression Motors Using Standard Cast Iron Pistons

(Generator or Magneto Equipped)

Pistons must be set between 7/32" and 1/4" before top dead center.

### 74" Solo or High Compression Motors Using Standard Cast Iron Pistons

(Generator or Magneto Equipped)

Pistons must be set between 9/32" and 5/16" before top dead center.

## 61″ Sidecar or Low Compression Motors Using Standard Cast Iron Pistons

(Generator or Magneto Equipped)

Pistons must be set between 7/32″ and 1/4″ before top dead center.

## 61″ Solo or High Compression Motors Using Standard Cast Iron Pistons

(Generator or Magneto Equipped)

Pistons must be set between 9/32″ and 5/16″ before top dead center.

## 61″ Sidecar or Low Compression Motors Using Aluminium Pistons

(Generator or Magneto Equipped)

Pistons must be set between 7/32″ and 1/4″ before top dead center.

## 61″ Solo or High Compression Motors Using Aluminum Pistons

(Generator or Magneto Equipped)

Pistons must be set between 11/32″ and 3/8″ before top dead center.

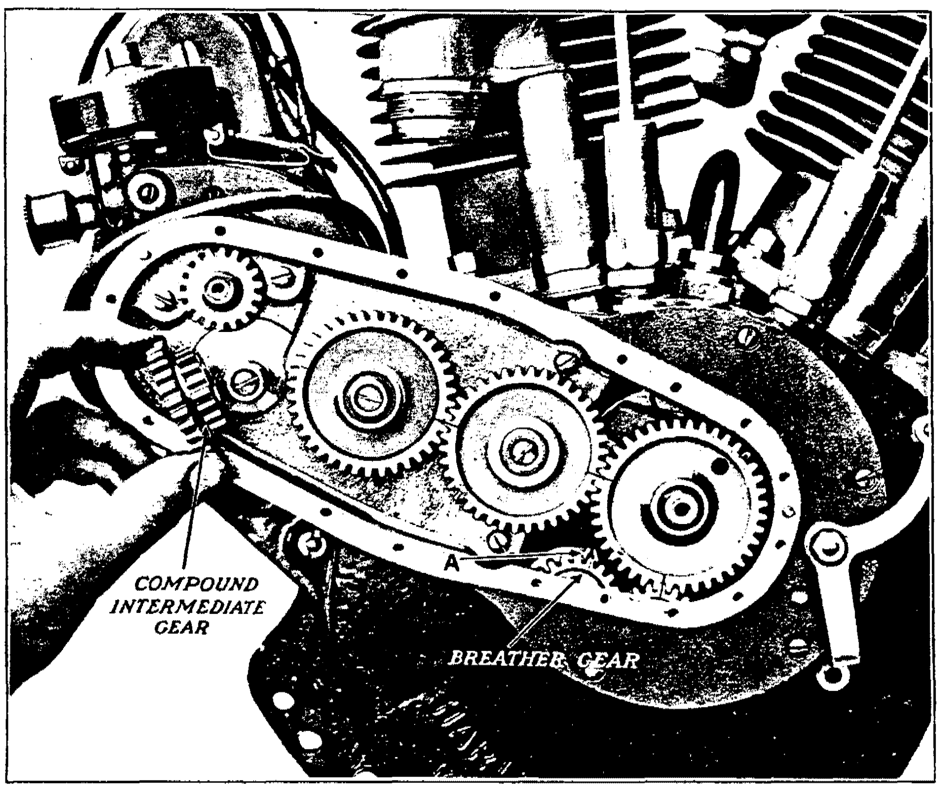



ILLUSTRATION NO. 3

# 61″ Special Fast Stock 500, M, A and E Type Motors

(Generator or Magneto Equipped)

Pistons must be set between 3/8″ and 7/16″ before top dead center.

## To Time Generator for Ignition on "V" Type Twins

Before attempting to time the generator, remove the gear case cover and compound intermediate gear. Refer to illustration No. 3.

The timer cam for "V" Twins is shaped to have a large and a small end, the *small* end being used for timing the *front* cylinder. Looking at the circuit breaker housing from above, the cam turns in a clockwise (right hand) direction.

The timer advance and retard lever must be all the way advanced (forward) when timing ignition. With the front cylinder piston set according to specifications for the particular model of motor, turn the timer cam clockwise, by means of the generator gear until the small cam is just starting to separate the circuit breaker or contact points. Now that the piston and timer cam are set, hold the generator gear with the thumb of the left hand to keep it from turning; then mesh the compound intermediate gear. The compound intermediate gear may not mesh with the generator and large intermediate gears on the first attempt. However, by turning the compound gear a tooth at a time, a place will be found where it will slide into mesh easily.

It is a good policy to check the timing after the piston has been located, the points set and the gears meshed. This can be done by turning the motor until the points are just separated; then pass a scale through the cylinder plug hole to the top of the piston, finally turning the motor forward until the piston reaches top dead center. Note the piston's upward travel in fractions of an inch and if it does not check with the specifications, retime the motor as may be necessary.

When timing ignition, the backlash of the gears and timer cam must be taken into consideration. Otherwise, the piston location and breaker points will not check according to the specifications.

## Magneto Ignition Timing for "V" Twin Motors

(Roadside or Temporary Timing)

The magneto can be timed by lining up all motor gear marks; then fitting the magneto gear to the armature shaft. The magneto drive key must, of course, be in place. This method of timing will be close enough for emergency or quick timing, however, it must not be taken as a factory standard. The best method is, of course, to remove the front cylinder plug, locate piston and set the interrupter according to the following instructions. Refer to illustration No. 2.

## Factory Method for Timing Magneto Ignition

The magneto drive key used between the gear and shaft should be filed thin so as to allow movement of the gear on the shaft if necessary, to obtain the correct interrupter and piston setting.

Locate the piston in the *front* cylinder according to specifications for solo or sidecar service. Loosen the magneto drive gear nut (do not remove the nut) and loosen the drive gear on the shaft. The gear should be loosened with gear puller FK831, or, if this tool is not at hand, by tapping it sharply with a small hammer, preferably a brass hammer.

Advance the magneto timer by shifting it downward. Turn the interrupter in an anti-clockwise (lefthand) direction, until the lever fibre block is just touching the *rear* housing interrupter shoe. Hold the interrupter in this position so it cannot turn, then force the drive gear on the shaft, tightening the lock nut to hold the gear in place.

Check the timing by observing the opening of the interrupter points and measuring the distance of the piston's upward travel before it reaches top dead center. If necessary, retime the motor until it does check with the specifications for that particular type of motor.

## Ignition Timing for Model 250 Remy Generator

The 250 model generator timing is similar to that of the magneto. The timer cam has a small and a large end. The small end is used to time the front cylinder.

The circuit breaker ring assembly is advanced when turned to the right or clockwise.

The timer should be advanced fully and the cam turned clockwise until the circuit breaker points are just ready to separate. After the proper piston position has been obtained, the generator gear can be fitted to the shaft and secured in place with the lock nut. As in the case of the magneto, the drive key should be filed thin in order to allow the gear to be shifted on the shaft if necessary.

## Valve Timing for 1913 & 1914 "V" Twin Motors

Since the cam gear used in these motors is not marked, it will be necessary to locate the pistons in the proper places in the cylinders and then set the cam to operate the valves accordingly.

It is probably easier to set the exhaust valve on its closing period because this takes place when the piston is just over top dead center. That is, the piston has reached top dead center and has just started on the next downward stroke.

Locate the front cylinder piston between 1/16" and 3/8" *after top dead center*, then mesh the cam gear with the pinion gear so the exhaust valve is *just closing*. The roller arm roller for the front cylinder will be just riding off the first or exhaust valve cam. Looking at the gears from the right side of the motor, the small pinion gear turns in a righthanded direction and the cam gear turns in a left handed direction. When timing valves according to this method, the exhaust valve tappets must, of course, be adjusted to have between .008" and .010" clearance.

Since the exhaust and inlet valve cams are mounted on the same timing gear (made integral) the inlet valves do not require independent timing.

## Valve Tappet Clearance for 1913 and 1914 "V" Twin Motors

On all Twin cylinder motors, prior to 1915, allow .004" clearance between the exhaust lifter pins and the valve stems or caps. The caps used on the end of the exhaust valve stems on these motors are made in various thicknesses and if necessary, can be ground until the correct clearance is obtained.

The inlet levers and valve stems should be adjusted to have .004" clearance.

# Single Cylinder Motors

## Single Cylinder Valve Timing (All Models)

The exhaust valve timing in all single cylinder motors should be such as to cause the valve to open when the piston is between 3/4″ and 9/16″ before bottom dead center and close when the piston is between 1/16″ and 1/8″ after top dead center.

On most single cylinder models the pinion and cam timing gears are marked, thus making exhaust valve timing a simple matter. All that is necessary in this case is to line up the pinion and cam gear marks and the valve is timed.

## Exhaust Valve Tappet Clearance for All Single Cylinder Motors Except Model 21CD

Adjust the exhaust tappet to allow .004″ clearance for all single motors except model 21CD. On early model motors steel caps were placed over the end of the valve stems. These caps are furnished in various thicknesses, and can, therefore, be ground to give the correct clearance.

## Single Cylinder Motor Inlet Valve Timing

All 1913 to 1918 single cylinder motors require independent timing of the inlet valves, because the inlet cam is on one of the intermediate timing gears. The inlet valve should be timed to open when the piston is 3/16″ before top dead center.

The inlet valve should be timed to close between 1/8″ and 3/8″ after bottom dead center. Allow .004″ clearance between inlet lever and valve stem when motor is cold.

Single cylinder motors made prior to 1913 have automatic inlet valves, which therefore, do not require timing.

## 1921 CD Single Motor Inlet Valve Timing

The inlet valve in this motor is operated by the secondary or cam gear and does not, therefore require independent timing.

## Valve Tappet Clearance for 21CD Single Motor

When motor is cold, allow .004″ clearance for the inlet valve stem and lever, and between .008″ and .010″ for the exhaust valve stem and tappet.

## Breather Valve Timing for Single Cylinder Motors

All single motors except model 21CD have automatic relief or breather valves, which, of course, requires no timing.

To time the breather valve on model 21CD single motors, align the pinion and cam gear marks, then mesh the breather gear so its marked tooth checks with the Λ stamped in the crank case. Refer to illustration No. 2 showing the proper setting for valves and breather according to marks.

## Single Cylinder Motor Ignition Timing
(All models except 21CD)

All single cylinder motors should be timed for the spark to occur with the piston set between 3/16″ and 1/4″ before top dead center on compression stroke. The interrupter housing must be advanced fully (shifted downward) and the interrupter lever set just ready to break the points with the piston located as mentioned above.

## Model 21CD Single Ignition Timing

The 1921 CD model commercial single should be timed with the piston set 1/4" to 9/32" before top dead center.

## Timing Single Cylinder Motor Ignition According to Gear Marks

With the pinion gear and cam gear marks aligned, fit the magneto drive key and gear, then fit the intermediate gears so all marks are aligned.

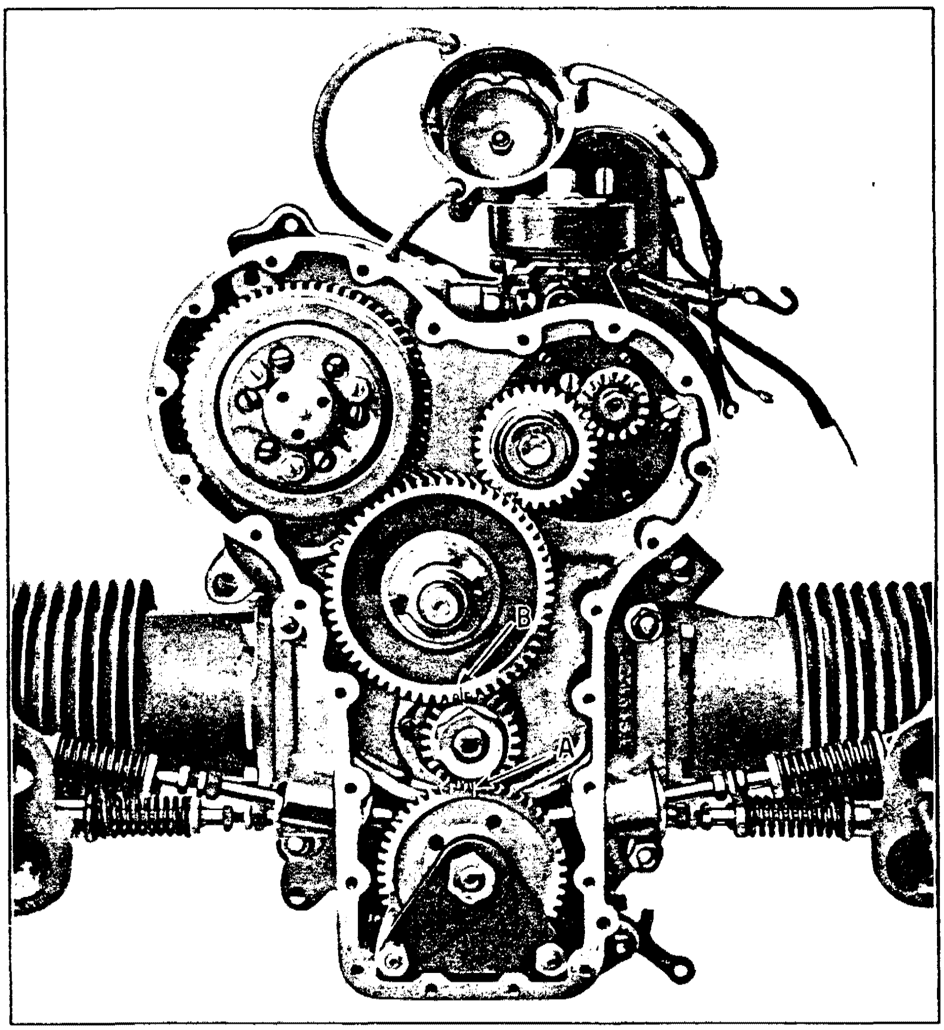



ILLUSTRATION NO. 4

Connect the central eyelet of wire No. 7 to the rear spark coil terminal (have this wire in a vertical position to prevent grounding on the metal coil end) and loop back to horn terminal No. 14.

**Connect the central eyelet** of wire No. 4 to the battery box bakelite terminal **block with the positive** battery wire. The end of this wire must be connected to **light fuse terminal** No. 15.

Make sure that the battery negative wire is securely grounded to the battery lock washer, see No. 2, which fits under the seat post pinch bolt or the frame brace eye bolt nut. This battery ground lock washer is furnished with the switch. The **battery negative wire** must be positively grounded to prevent the manual switch **vibrator points from burning.**

The manual switch is now in circuit with the battery and generator. Make the light and warning signal connections as follows:

**Connect the eyelet** of the RED cable wire to terminal No. 9. Connect the eyelet **of the BLACK cable** wire to terminal No. 11. Connect the eyelet of the GREEN **cable wire to terminal** No. 12.

Note:—Terminal No. 10 on 1918 lighting switches becomes void when fitting **the manual switch.**

The short wire which passes through the bushing in the light switch base must be connected to Terminal No. 13 and with the large eyelet of the tail light wire to terminal No. 6. Make sure that this terminal is properly insulated from the manual switch bracket.

All wiring and connections are now complete and the manual and lighting switches are ready for use.

The lighting switch is used in the regular manner. The manual ignition switch must be operated according to directions under Instructions for Operating the Manual Switch.

For adjustment to any part of the manual switch, refer to directions under To Adjust the Vibrator Blade Points.

HARLEY-DAVIDSON MOTOR CO.

MILWAUKEE, U. S. A.

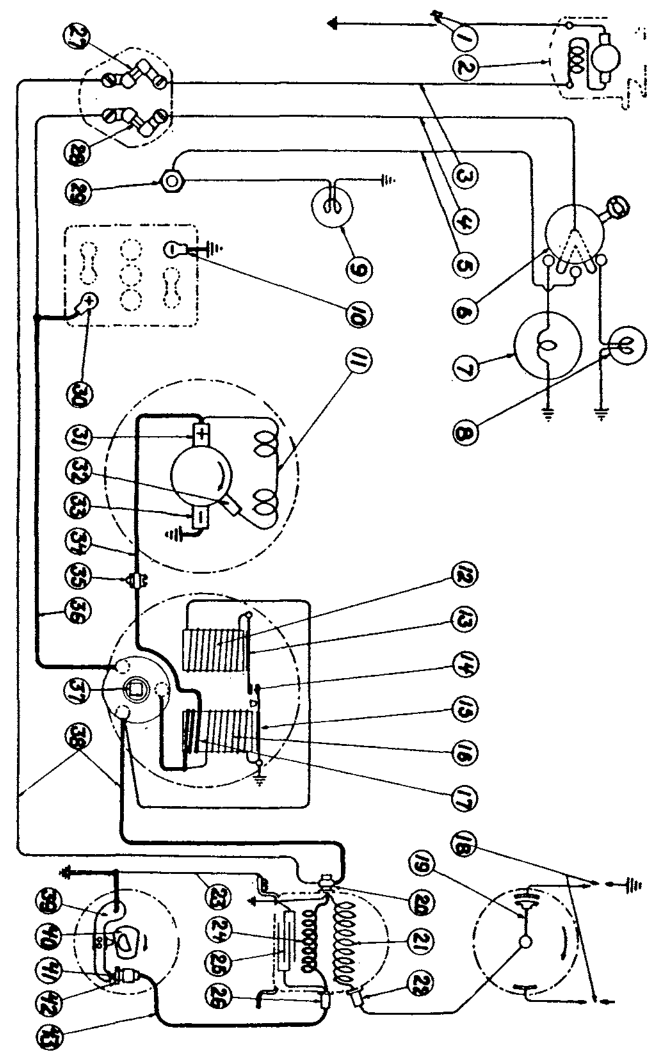



Diagram of the Harley-Davidson Electrical System

1—Horn switch; 2—Motor driven horn; 3—Green horn wire; 4—Red light switch wire; 5—Black tail light wire; 6—Lighting switch in headlight; 7—Large headlight bulb; 8—Small headlight **bulb;** 9—Tail light bulb; 10—Battery negative wire grounded to frame; 11—Generator field coils; 12—Manual switch buzzer coil; 13—Buzzer vibrating blade; 14—Vibrator blade contact points; 15—Manual switch relay coil vibrating blade; 16—Relay shunt coil; 17—Relay main or series coil; 18—Spark plug gaps; 19—Distributor segments; 20—Spark coil rear primary terminal; 21—Spark coil secondary winding; 22—Spark coil high tension terminal; 23—Circuit breaker auxiliary ground wire; 24—Spark coil primary winding; 25—Condenser; 26—Spark coil front primary terminal; 27—Horn fuse; 28—Light fuse; 29—Tail and sidecar light terminal; 30—Battery positive wire, connects with manual switch and light fuse; 31—Generator Positive brush; 32—Generator regulating brush; 33—Generator negative brush; 34—Generator main feed wire; 35—Generator feed wire and manual switch wire terminal; **36—Manual switch, battery and light fuse wire; 37—Manual switch stem, used when starting and stopping the motor; 38—Manual switch, ignition and horn fuse wire; 39—Circuit breaker lever; 40—Circuit breaker cam; 41—Circuit breaker contact points; 42—Circuit breaker point adjusting screw; 43—Spark coil and circuit breaker low tension wire.**

# Service Dept. Bulletin

No. 83 B    April 1st. 1922    Harley-Davidson Motor Co., Milwaukee

## Instructions for Fitting and Making Necessary Adjustments on Set HG-133

### Cam Action Set HG-133 for HARLEY-DAVIDSON REAR HUB CLUTCHES USED WITH SINGLE SPEED MODELS

The left cone that is supplied with the new cam action set replaces the original actuating worm cone. This new cone should be screwed on the axle just far enough to permit a very slight shake at the rim; this insures the wheel bearings against being cramped.

The actuating cam drum assembly is then placed over the left cone after the actuating plate has been fitted, and is followed by the drum stationary cam, outer cam bearing, axle bushing, spacer washers, axle lock washer, and the lock nut.

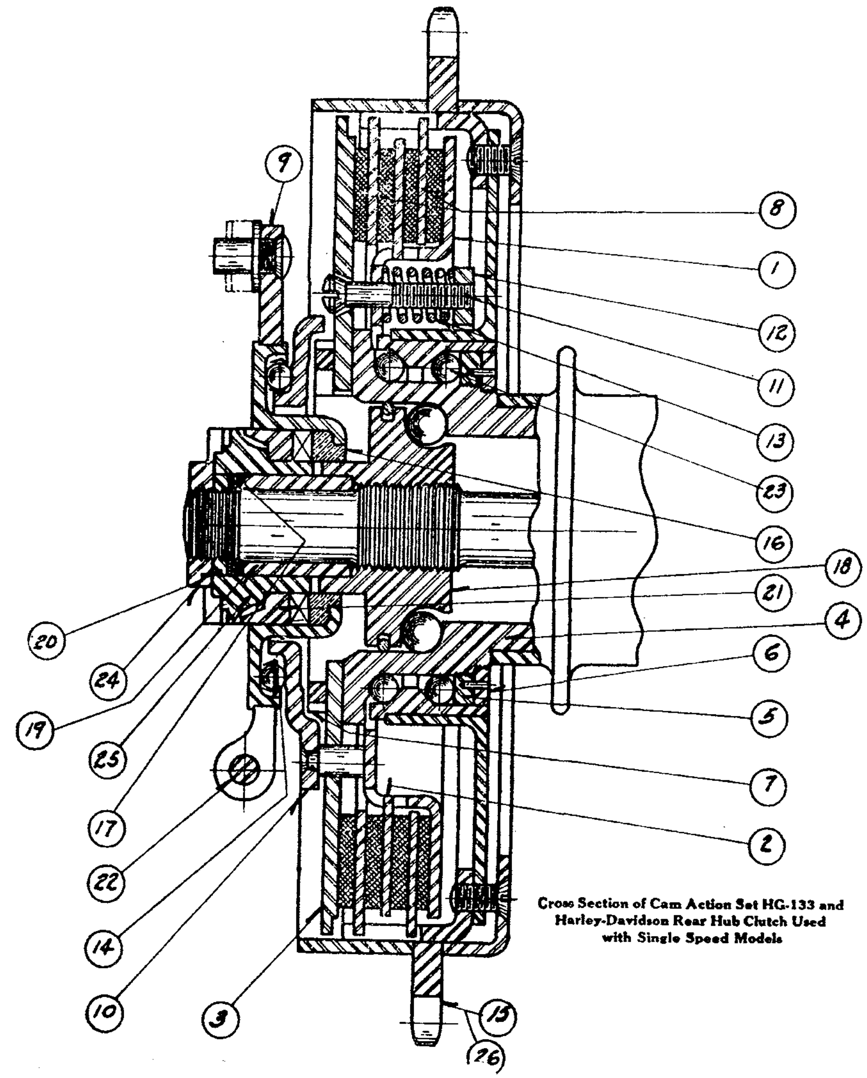
The plain washers are spacer washers (See No. 17) which, when *not* properly fitted, interfere with the control of the clutch. For that reason care must be taken to place the proper number of washers in the outer cam bearing. The proper number of washers are in position when there is a distance of 1/32″ or less between the top spacer washer and the outer edge of the hole in the outer cam bearing.

As the friction discs of the clutch wear, additional washers (No. 17) will have to be ***ADDED*** to compensate for this wear, otherwise the clutch cannot be released provided it is adjusted so that it will hold.

If the space between the axle bushing and the outer cam bearing is entirely filled with spacer washers, the clutch will not hold, because the discs cannot come together. This explains the importance of the correct adjustment that is obtainable with these washers.

The clutch adjustment is effected in the same way as it was heretofore, i. e., changing the position of the actuating collar on the actuating cam drum assembly, (formerly the actuating nut), and turning the six clutch spring adjusting screws. If the adjustments explained in this paragraph will not give the desired results, the number of washers must be increased or decreased, whichever the case may be.

| No. | Part No. | Name of Part |
|---|---|---|
| 1 | AG 5 | Releasing disc |
| 2 | AG 7 | Friction disc |
| 3 | AG 8 | Drive disc |
| 4 | CG 351 | Driving hub |
| 5 | AG 13 | Driving hub nut |
| 6 | AG 14 | Driving hub lock nut |
| 7 | AG 15 | Driving disc lock nut |
| 8 | AG 6 | Friction disc assembly |
| 9 | AG 19 | Actuating collar |
| 10 | CG 20 | Actuating plate |
| 11 | AG 22 | Clutch spring screw |
| 12 | AG 23 | Spring nut sector |
| 13 | BG 24 | Clutch spring |
| 14 | AG 33 | Ball retainer assembly |
| 15 | CG 85 | Hub shell assembly (1914) |
| 16 | HG 122 | Actuating cam drum assembly |
| 17 | HO 389 | **SPACER WASHER** |
| 18 | HG 127 | Left cone |
| 19 | HG 129 | Axle bushing |
| 20 | CG 265 | Lock washer |
| 21 | WHA534 | Drum stationary cam |
| 22 | BO 43 | Actuating collar clamp screw |
| 23 | BO 453 | ¼″ ball |
| 24 | HO 768 | Lock nut |
| 25 | HG 128 | Outer cam bearing |
| 26 | DG 85 | Hub shell assembly (1915-16-17-18) |




**Cross Section of Cam Action Set HG-133 and Harley-Davidson Rear Hub Clutch Used with Single Speed Models**

# Service Dept. Bulletin

No. 95. October 1, 1922. Harley-Davidson Motor Co., Milwaukee

## Miscellaneous Bulletin

Most of the contents of this miscellaneous bulletin have appeared from time to time in the Weekly News Bulletin. Owing to the fact that the repair shop does not often retain copies of the News Bulletin, we are, therefore, publishing this Service Bulletin for the repairman's reference.

## Important Instructions for Machines Equipped with Ammeters

We have traced many cases of so-called battery and generator trouble directly to the ammeter installation. Very few riders realize that the ammeter is in direct series with the battery and generator and if it should cease to function, that these units may possibly be damaged. It is, therefore, imperative that the ammeter be kept in circuit at all times.

When an ammeter is used in the electrical system it must be of the two-wire type and connected as follows: Connect the meter positive terminal wire to the battery negative wire and thoroughly insulate the joint with tape and shellac. Then ground the meter negative terminal wire on the battery ground lock washer, KK-381-P, or some other clean metallic part of the frame.

Do not depend on tool boxes for good grounds because enamel, parkerization and rust in many cases practically insulate them from the frame. Hence, if a one-wire ammeter is used an additional wire must be connected to the meter negative terminal post and then securely grounded on the battery ground lock washer or elsewhere.

## Importance of Generator Brush Inspection

The generator voltage is controlled by the 6-volt storage battery being in the circuit and should the battery be removed, purposely or by an accidental open circuit, the generator current and voltage will be extremely high when high speeds are attained. Such high current and voltage may prove disastrous to the generator and ignition units. Hence the importance of the following is obvious.

On all model 235 and Harley-Davidson generators, a stop is provided for each brush holder to prevent the brushes from wearing until the holders bear on the commutator.

This arrangement makes periodical inspection of the brushes absolutely necessary because serious damage may result to the armature if the brushes wear until they are held away from the commutator.

Should the negative brush wear until the holder strikes the stop, thus holding the brush away from the cummutator, the battery will be out of the circuit and in consequence a high voltage will be generated in the armature. This high current and voltage will heat the armature excessively and cause the soldered connections to loosen which in turn may damage the armature beyond repair.

## Method for Retaining Head Lamp Glasses

Head lamp glasses vary considerably in thickness, sometimes as much as 1/32" (.79 mm) which, of course, would make it impossible to keep a thin glass tight without additional gaskets.

If a glass is too thin it can usually be used by using a cardboard gasket. If this method does not work satisfactorily, the clamp ring may be squeezed together in a vise so as to make the inside dimension about 1/32" (.79 mm) less than standard.

When fitting the head lamp ring, it must not be assumed that the glass and ring are tight by merely tightening up the retaining screw. The best method is to tap the ring lightly around its circumference and then tighten the screw again.

## Satisfactory Method for Repairing Model 235 Generator Right End Plates

If the right end plate on a model 235 generator becomes loose and the generator is used for any length of time with it in this condition, serious damage may result to the armature.

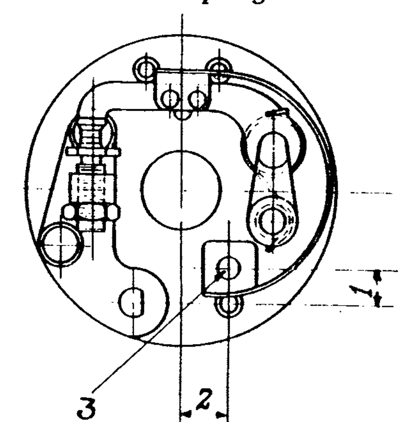
The clearance between the armature core and pole pieces is approximately .007" (.17 mm). Should the end bearing plate work loose and wear the generator body excessively, the armature core will rub against the pole pieces and in consequence will become damaged — perhaps beyond repair. It is, therefore, important that the repairman be on the lookout for difficulties of this nature and effect a remedy before they become serious.

A worn generator body register can be usually repaired by peening its outside edges inward with a hammer to reduce the diameter to give a press fit on the right end plate. The peening process should be done on the lower half of the body's open end, striking the hammer against the outer edge at a 45° angle. The peening process should be continued until the body has shrunk so that it will be necessary to force the right end plate in place. Note: Before attempting to peen a generator body, make sure that it is malleable and not cast iron. Bodies have been made from both of these metals. Cast iron would chip and break if peened as above described, while malleable iron is tough and will give under hammer blows. Hence, there is no apparent remedy for repairing a worn cast iron body — except replacing it with a new one.

## Instructions for Fitting New Circuit Breaker Lever Ground Spring

Good, clean metallic connections at all primary circuit joints are absolutely essential for easy starting and efficient operation of the motor. Although the circuit breaker lever stud is bearing in a bronze bushing and is held tight by a strong spring, chances still remain for oxidation which would partially insulate the lever electrically.

To overcome the possibilities of bad connections at this point, we have attached a bronze spring to the circuit breaker lever, which should be grounded to the circuit breaker base.




To ground the lever spring requires that the base be drilled with a No. 35 (.110" or 2.79 mm) drill at the location specified in the illustration, and then tapped with a 6-32 machine screw tap.

The hole No. 3 is located as follows: No. 2 is 5/16" (7.9 mm) from the center vertical line, and No. 1 is 1/4" (6.3 mm) from the line upon which the base stud and primary terminal holes are drilled. The illustration is self-explanatory.

# Turning Commutators

Oftentimes the repairman is called upon to turn down or dress a commutator and he should, therefore, have a knowledge of such work. Whenever possible, a lathe should be used for this kind of work because accuracy is absolutely essential.

When setting up a commutator job in the lathe, never use the shaft centers because in many cases they are not the true center and in consequence the commutator would be turned untrue. Chuck the shaft drive end and hold the commutator end bearing in the lathe center or steady rest. This method will, of course, require more time and care in setting up the job. However, the results obtained will more than offset these differences.

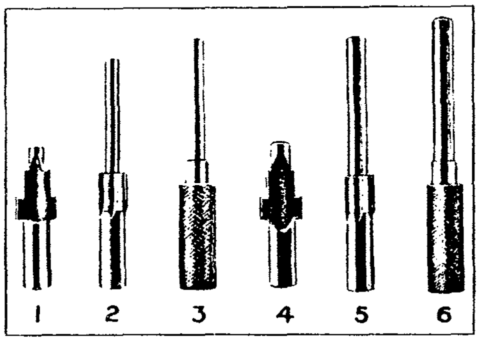
After chucking and centering the armature, fit a diamond point cutting tool to the tool holder and after setting it slightly below the center of the work, set the feed to cut as fine as possible. The work should be turned approximately 300 r.p.m. for best results.

After dressing the commutator as just outlined, smooth it with a fine cut mill file and finally with No. 00 sandpaper.

Remove all traces of copper and carbon from the grooves between the segments and if necessary undercut the mica as follows: With a knife or tool made from a hack saw blade, remove the mica insulation to a depth of 1/32″ (.7 mm) for the full width of the groove.

If the armature leads require soldering, it is best to solder them before turning the commutator as the surplus solder can then be removed by the lathe tool.

# Repairing Worn Carburetors by Fitting Monell Metal Bushings




Heretofore when a Schebeler Carburetor body became worn at the throttle shaft, it was necessary to fit an oversize shaft. The manufacturers have recently developed monel metal bushings for the carburetor body and throttle shaft to be fitted to worn carburetors, instead of using oversize shafts. Monel is a non-corrosive long-wearing metal, and these bushings, therefore, make a much more satisfactory repair than oversize shafts.

The throttle shaft proper is bushed with a monel bushing. This bushing is not furnished separately. The bushed throttle shaft operates in another monel bushing which is fitted to the body casting.

Carburetor body monel bushing is fitted as follows:

After removing the throttle disc and shaft, enlarge the body casting bearing with the boring tool. Use tool No. 1 for 61″ (988 cm³) carburetor, and No. 4 for 74″ (1208 cm³) carburetors. Note: The boring tool should be used in a drill press to prevent possible breakage.

Next, enlarge the hole with the reamer. Use reamer No. 2 for 61″ (988 cm³) carburetors, and No. 5 for 74″ (1208 cm³) carburetors. The bushing can now be inserted. Start the tapered end of the bushing in the reamed hole and drift it in place with the special drift. Use drift No. 3 for 61″ (988 cm³) carburetors and No. 6 for 74″ (1208 cm³) carburetors.

If the throttle shaft binds in the monel metal bushing, the fit can be improved by dressing the shaft bushing carefully.

Note: If a carburetor body casting has once been fitted with a ¼″ (6.3 mm) or oversize throttle shaft, it is beyond economical repair.

Parts and tools for making above repairs:

Monel body bushings for 61″ and 74″ (988 and 1208 cm³) carburetors — KX-1744.

Monel bushed throttle shaft for 61″ (988 cm³) carburetors — KX-1712.

Monel bushed throttle shaft for 74″ (1208 cm³) carburetors — KX-1712D.

Complete set of six tools for fitting monel bushings — KX-480.

# Lubrication of Rear Mud Guard Hinge on 1923 Models

Owing to the fact that the new style mud guard hinge is exposed to the weather, it is, therefore, advisable to lubricate it from time to time with motor oil.

# Starter Crank Bushing Assembly HG-591-P

A much better job can be made when fitting a new starter crank bushing if slightly oversize rivets are used. These oversize rivets take care of any wear that may occur in the rivet holes in the starter cover and will make a tight fit.

A set of oversize rivets will be included with each starter crank bushing shipped. To fit them, it is necessary to drill out the holes in the starter cover with a 9/32″ (7.1 mm) drill, using the new bushing as a templet.

# Sidecar Support Rod Bolts and Nuts

The sidecar support rod bolts and nuts should be examined from time to time to prevent the body from working loose and damaging the metal bottom of the car.

Small repairs like these will in many cases prevent a large repair and, incidentally, will help to keep a customer satisfied.

# Rear Frame Sidecar Bracket Alignment

When fitting the rear frame bracket, DQ-54-Z, for attaching a sidecar, the following instructions should be carefully observed.

It is absolutely essential that the frame bracket be fitted to the frame studs in such a way as to be vertical and with no twisting strains on the studs proper.

If the motorcycle is fitted with a luggage carrier, the frame bracket will align perfectly without the use of the spacing washer. However, if no luggage carrier is used, the thick spacing washer, furnished with the motorcycle, should be fitted to the stud before attaching the bracket. This washer acts as a distance piece, thus relieving any strains on the bracket studs which might be caused when tightly clamping the stud nuts.

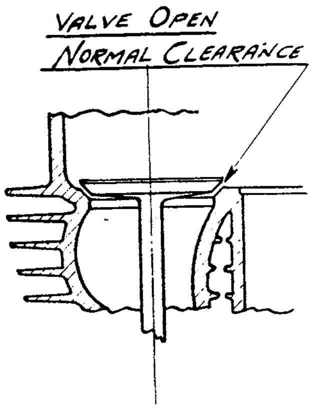
# New Style Solid Fly Wheels

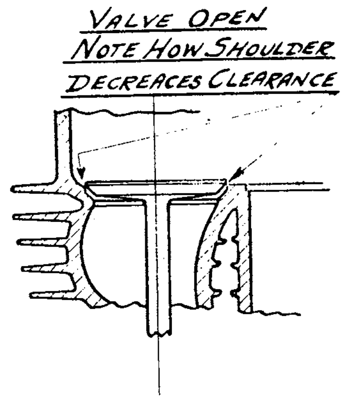
A few 1921 and all 1922 and 1923 61 cu. in. (988 cm³) motors are fitted with new style solid fly wheels. These wheels are somewhat heavier than the old style webbed or spoked wheels. However, the new solid flywheel is interchangeable with the old style either singly or in pairs. We, therefore, supply only the solid type wheel on parts orders. Bear this in mind if you are called upon to replace an old style wheel because it will be impossible to duplicate the original.

All 74 cu. in. (1208 cm³) motors use solid type flywheels. Therefore, it will be impossible to become confused when replacing flywheels in these motors.

## Good Exhaust Valve Seats Are Important

After combustion takes place, the burned gases remain to be scavenged by the next upstroke of the piston. The only means of exit for these excessively hot




gases is through the exhaust port after the exhaust valve is opened. This port is open for only a brief interval and its greatest area is a trifle over one square inch (six and four tenths square centimeters). It is, therefore, obvious that the valve, valve seat and lifting mechanism be in good condition and adjusted properly.

Constant beating of the exhaust valve head against the cylinder seat will eventually wear the seat, that is lower its position. Lowered valve seats leave a shoulder that partially envelops the valve head and consequently prevents a full port opening even with the valve in an open position. Refer to the two illustrations for a graphical explanation of a normal and abnormal cylinder valve seat.

Lowered valve seats will, therefore, prevent perfect scavenging and hence will cause the motor to overheat excessively. The direct result of an overheating motor is loss of power, speed and improper lubrication. In addition to these, the exhaust valves may be warped and burned.

All cylinders having lowered exhaust valve seats should, therefore, be machined with the special clearance cutter JK-845-A. This cutter is made to fit the standard valve seat reamer handle. The cutting edges are ground to a 3° angle to give the proper clearance for the valve. This cutter will work in all cylinders since 1915.

When using the clearance cutter, do not remove any more metal than is necessary from the bottom of the valve chamber. The proper method is to remove just enough metal to remove the shoulder from the valve seat.

## Long Connecting Rod Roller Bearing KA-807

This roller bearing has been used in the rear connecting rod of all 1922 motors numbered above 22-JD-8385, thus displacing the twenty-four short rollers formerly used in this bearing. The spacer washer, DA-746, will be used at one side of the assembly in order to maintain the same length. The new long rollers will give unusually long service with minimum of wear.

Owing to the necessity of a perfectly true bearing surface in order to use long rollers satisfactorily, a repair job cannot successfully be made without first referring the rods to the factory for regrinding. We, therefore, suggest that all rods that are to be fitted with long rollers be referred to us for rebushing and regrinding. This will insure a perfectly paralleled bearing surface for the long roller bearings.

This connecting rod bushing cannot be lapped with the lapping arbor when fitting long rollers because of the width of the bushing. The bushing would be bell-shaped and cause the long rollers to bind in the center, which may cause breakage.

NOTE: If the bearing has already used long rollers, it can then be lapped for use with new long rollers. However, this does not hold good for bearings fitted previously with short rollers.

## Instructions for Using Reamer KK-847

This reamer is designed to ream gear shaft bushing DA-51-P for both standard and .002″ (.05 mm) oversize gear shafts. To accomplish this, the cutting edges of the reamer are slightly tapered throughout their length.

When reaming new bushings for standard shafts, pass the reamer through the bushing until its end projects ⅛″ (3. mm) beyond the end of the bushing. This will give the standard factory clearance for the shaft and in addition a slightly tapered bushing hole which is ideal for this particular bearing.

To ream a worn bushing for a .002″ (.05 mm) oversize shaft, pass the reamer through the bushing until its end projects 1¾″ (44 mm) beyond the end of the bushing.

Should the reamer become dull, it can be sharpened as follows: Rub the cutting face of one blade with a hardened steel tool. Such a tool can be made by grinding off the teeth of a broken file. This method of sharpening will "turn up" the cutting edge and renew the usefulness of the reamer. It is best to mark one cutting blade and sharpen it only, from time to time as may be necessary.

When not in use, keep the cutting edges of the reamer well oiled and away from hardened steel objects.

## Compression of 74 cu. in. (1208cm$^3$) Motors

The 1922 model JD (74″ solo) motor is fitted with 1/16″ (1.5 mm) compression plates. The 1922 model JDS (74″ sidecar) motor is fitted with a set of ⅛″ and 1/16″ (3.1 and 1.5 mm) compression plates. The compression of these motors is 1/16″ (1.5 mm) lower than the 1921 motors. It is well to bear this in mind when overhauling the 1921 motors. If a motor is inclined to overheat or "knock," it may be well to lower the compression. On the other hand, if a motor has been running satisfactorily it is not necessary to change the compression.

Note: All 1922 74″ (1208 cm$^3$) motors above 22JD6649 are fitted with 1/16″ (1.5 mm) longer cylinders. Therefore it should never be necessary to lower the compression of these motors for ordinary service.

For solo service, these motors use no compression plates. For sidecar service ⅛″ (3.1 mm) compression plates only are used.

All cylinders that are 1/16″ (1.5 mm) longer than previous standard cylinders will be marked with an arrow on the right side of the base flange.

HARLEY-DAVIDSON MOTOR CO.,

Milwaukee, Wis., U. S. A.

# Service Dept. Bulletin

No. 83A. November 1, 1922 Harley-Davidson Motor Co., Milwaukee

## Instructions for Fitting and Making Necessary Adjustments on Set HG-134 for TWO-SPEED HUBS

In the following instructions, the numbers mentioned will correspond to the enumerated parts in the sectional illustration. The assembly should, therefore, be made without difficulty providing these instructions are followed closely.

The inner cone bearing 4 which replaces the actuating worm cone must be screwed onto the axle just far enough to permit a slight shake at the wheel rim. This insures the wheel bearings against being cramped.

After the actuating plate (triangular plate with three legs) and ball thrust bearing have been fitted, the remaining parts are put in place in the following order:

1—Actuating cam drum assembly; 7—drum stationary cam; 5—axle bushing with counterbored end inward; 11—outer cam bearing spacer washers (large); 3—the outer cam bearing; 2—spacer washers (small); 6—axle lock washer, and left cone lock nut 10.

The small spacer washers 2, when not properly fitted, interfere with the control of the clutch, and for that reason care must be taken to place the proper number of these washers between the axle bushing 5, and the lock washer 6. The proper number of washers is in position when there is a distance of 1/32″ or less between the top spacer washer and the outer edge of the hole in cam bearing 3.

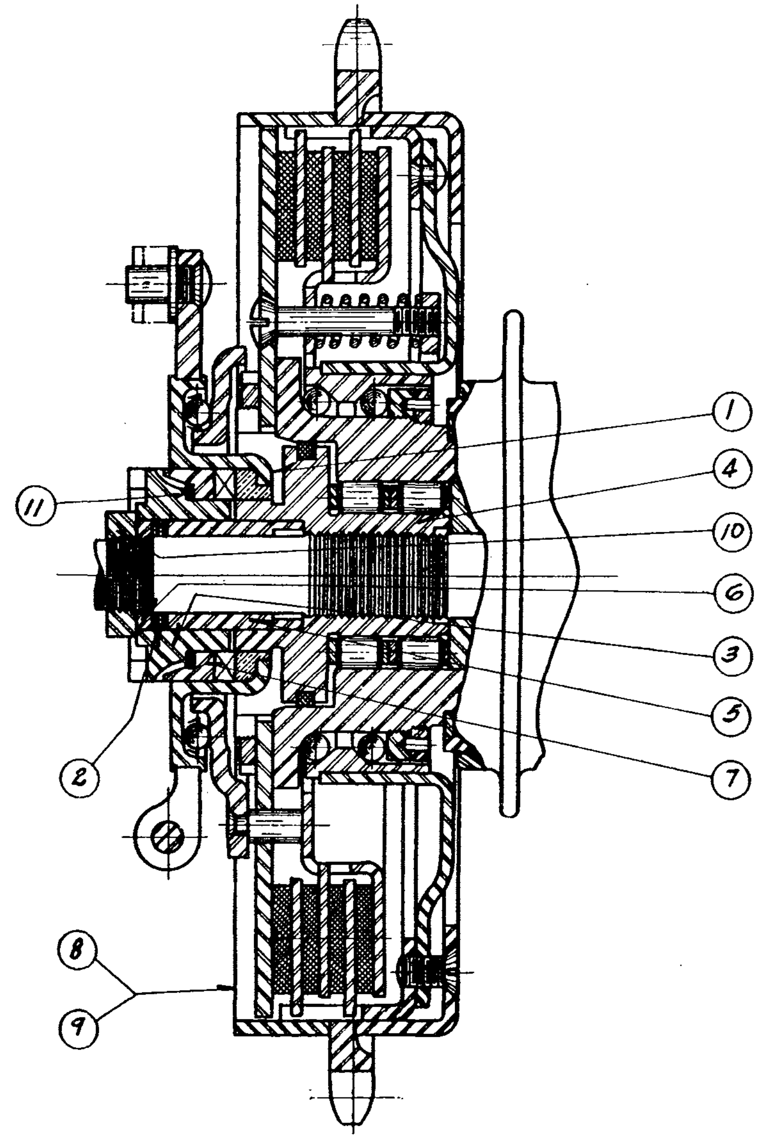
As the friction discs of the clutch wear, additional spacer washers 2 will have to be *added* to compensate for this wear, otherwise the clutch cannot be released provided it is adjusted so that it will hold when fully engaged.

If the space between the axle bushing 5 and the outer edge of the cam bearing 3 is entirely filled with spacer washers 2, the clutch will not hold, because the clutch discs cannot come together. This explains the importance of the correct adjustment that is obtainable with these washers.

To compensate for the wear of the actuating cams, additional spacing washers 11, can be added to give the proper adjustment.

The clutch adjustment is made in the same way as it was heretofore; that is, changing the position of the actuating collar on the cam drum assembly, (formerly the actuating nut), and turning the six clutch spring adjusting screws. If the adjustments explained in this paragraph will not give the desired results, the number of spacing washers 2, have to be increased or decreased, whichever the case may be.

| No. | Part No. | Name of Part |
|---|---|---|
| 1 | HG 122 | Actuating cam drum assembly |
| 2 | HO 389 | Spacer washer |
| 3 | HG 128 | Outer cam bearing |
| 4 | HO 130 | Inner cam bearing |
| 5 | HG 131 | Axle bushing |
| 6 | CG 265 | Lock washer |
| 7 | WHA 534 | Drum stationary cam |
| 8 | CG 85 | Hub shell assembly (1914) |
| 9 | DG 85 | Hub shell assembly (1915-16-17-18) |
| 10 | HO 768 | Lock nut |
| 11 | HO 390 | Large Spacing Washer |




Cross Section of Cam Action Set HG-134 and Clutch Used with all Two-Speed Models

# Service Dept. Bulletin

No. 98. Oct. 10, 1923. Harley-Davidson Motor Co., Milwaukee

## How to True Commutators Using Collar M-K-883 for Bearing Center

When armatures are finished in the factory, that is, when final turning and grinding is done, the shaft centers are not used. All commutators are turned from bearing centers because the armature must revolve in ball bearings and be true to within .001 inch (.025mm) of accuracy.

Therefore, when redressing or turning commutators use bearing and not shaft centers.

Refer to the illustration, showing how the special collar, MK883, is used to replace the ball bearing when turning commutators. This collar makes a true shaft bearing center for the turning job.

The lathe tail stock center point must be ground off about 3/8 inch (9.5mm) to prevent the point of the center from touching the armature shaft.

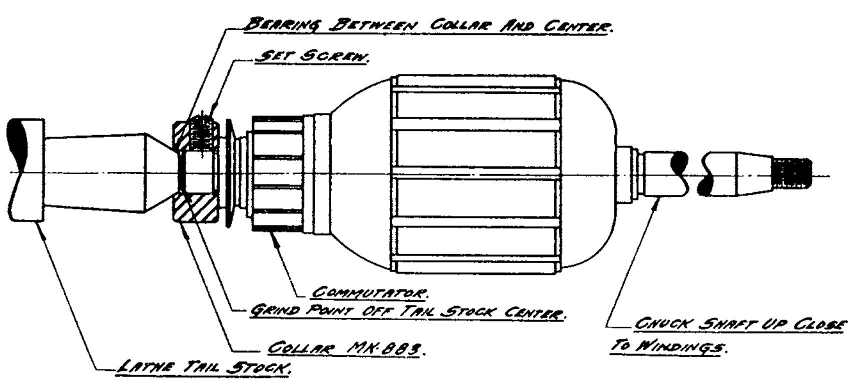
Remove the armature shaft bearings and worm gear and fit the collar to the commutator end, securing it in place by the set screw. The side with the beveled center hole should face outward to serve as a center for the tail stock point.

Clamp the drive end of the armature shaft in the lathe chuck close up to the armature windings. Center the commutator end and oil the tail stock and collar centers.

Use a diamond cutting tool, set at the proper angle, and turn the armature about 300 R. P. M. for best results. Take off very fine cuts. Finish the commutator with a fine tooth file and the finest grade of sandpaper obtainable, preferably No. 00.

Clean out the grooves between the commutator bars with a knife or specially made tool. The grooves should be between 1/64 and 1/32 inch (.39 and .79 mm) deep and the full width of the slot to prevent the mica from striking the brushes and cause arcing.

If the armature leads are to be soldered, it is best to do this before turning the commutator. Use powdered rosin and alcohol as a flux and half-and-half solder for the best results. Thoroughly heat the commutator bars so the solder will flow into the wire slots.




## Reseat Brushes after Turning Commutator

After turning and dressing a commutator, make sure the brushes are in good condition and that the brush springs, on models up to 1924, have a tension between 8 and 9 ounces, (.22 or .25 KG). The 1924 model generator brushes should have a spring tension between 8-1/2 to 9-1/2 ounces, (.23 to .26KG).

On earlier than 1924 models it is a good policy to fit new brush springs every time the motor is down for carbon removal. If the generator is not already fitted with new style brushes, IR160A and IR163A, by all means fit these brushes as they are much larger and consequently longer lived.

The commutator will be slightly smaller after turning, therefore making it necessary to reseat the brushes.

Use No. 00 or the finest grade of "sand paper" obtainable for reseating carbon brushes. Cut the sand paper in strips 3/8 inch (9.5 mm) wide for convenience. Lift one of the brushes and place a strip of sand paper between it and the commutator, sand side next to the brush. Press lightly on the brush and withdraw the sand strip. Repeat this operation until the brush face conforms to the curvature of the commutator.

Reseat all three brushes accordingly.

Set the regulating brush to give a current output of not more than 3 1/2 or 4 amperes. This current rate will be found sufficient for all general conditions of service.

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### The following are the factory charges for making commutator and armature repairs:

Soldering and turning commutator on Harley-Davidson and Remy armatures . . . . . . . . . . . . $1.25 net

Fitting commutator to Remy 235 type armature, GX1067 or GX1067C . . . . . . . . . 6.25 net

The price of a new Harley-Davidson armature is such that it does not pay to replace commutators on old armatures. Remy 250-type commutators cannot be replaced without rewinding armatures.

Rewinding 250-type armature including new commutator . . . . . . . . . $12.00 list

Harley-Davidson and Remy 235-type armatures are not rewound.

With the collar above described, it becomes easy to reface commutators properly. If, however, you cannot do the job or have it done locally, we advise sending armatures with commutators that need refacing directly to us, because unless such commutators are refaced, the generators will not perform satisfactorily, even though new brushes are installed.

If someone is refacing commutators for you, see that he uses an MK883 collar and is not turning the armatures on the shaft centers.

# Standard Factory Repair Prices

Nov. 1st 1923. *This replaces Service Dept. Bulletin No. 96.* Harley-Davidson Motor Co., Milwaukee

THIS list is intended to enable the dealer to quote his customers on repair jobs which are ordinarily sent to the factory for attention. The advantages of such a price list are these:

1. The dealer can exchange a damaged frame or other piece of equipment for a rider from his stock of repaired parts at a price fair to both, the rider getting immediate service at a fair cost.

2. If a rider is supplied with a new part from stock the dealer can easily figure the allowance to be made for the damaged part.

3. Prices for factory repair work become standardized. The chance of under—or over-charging the rider is eliminated.

In estimating the cost of repairs on frames and forks, it should be remembered that the charges given in the first part of this bulletin are for labor only. To arrive at the repair cost, the price of the parts needing replacement must be added to the labor charge. Frame and fork fittings are listed in this bulletin. As an example, the cost of repairing a frame needing a new rear stay and two casing clamps will be estimated as follows:

| | | |
|---|---|---|
| Labor charge (3 parts replaced) | $10.00 | net |
| 1—EE85R rear stay | .90 | list |
| 2—DE2 casing clamps @ .20 | .40 | |
| | $11.30 | |

Any part on which the dealer quotes a repair or exchange price should be inspected very carefully. It may be found, for example, that a frame which on first inspection seems to be out of line, has one or more cracked parts such as cylinder or casing clamps, or even more expensive fittings.

All prices on parts, except where otherwise noted, are list. Where list prices are not subject to usual discount, net prices are shown. All labor prices are net.

All quotations are subject to change without notice.

QUOTATIONS COVER ONLY SPECIFIED OPERATIONS

**We suggest that the dealer go over the list carefully, and set a definite schedule of retail prices.**

## Motor Repairs

Pistons are always lapped in when cylinders are reground.

| | | | |
|---|---|---|---|
| Regrinding 61″ cylinders and fitting oversize cast-iron pistons, rings, new pins and lock pins . . . per set | Mat'l | $ 6.26 | list |
| | Labor | 5.63 | net |
| Regrinding 74″ cylinders and fitting oversize cast-iron pistons, rings, new pins and lock pins . . . per set | Mat'l | 6.68 | list |
| | Labor | 5.63 | net |

**When cast-iron piston motors are fitted with aluminum pistons, the fly-wheels must be rebalanced and the connecting rods drilled. See prices below. Instructions for this purpose are furnished upon request.**

| | | | |
|---|---|---|---|
| Regrinding 61″ cylinders, any model, and fitting 1923 over size aluminum pistons, rings, new pins and lock rings . . per set | Mat'l | 13.62 | list |
| | Labor | 7.25 | net |
| Regrinding 61″ cylinders, any model, and fitting 1924 oversize aluminum pistons, rings, new pins and lock rings . . per set | Mat'l | 12.72 | list |
| | Labor | 7.25 | net |
| Regrinding 74″ cylinders, any model, and fitting 1923 oversize aluminum pistons, rings, new pins and lock rings . . per set | Mat'l | 12.72 | list |
| | Labor | 7.25 | net |
| Regrinding 74″ cylinders, any model, and fitting 1924 oversize aluminum pistons, rings, new pins and lock rings . . per set | Mat'l | 12.82 | list |
| | Labor | 7.25 | net |

**When having cast-iron piston cylinders fitted with aluminum pistons, specify whether 1923 or 1924 parts are wanted. To fit 1924 aluminum pistons to an earlier than 1924 or 24 JD or FD motor requires the fitting of 1924 connecting rods because of the larger piston pins.**

| | | | |
|---|---|---|---|
| Reaming 61″ cylinders for 74″ exhaust valves . . . each | Labor | $1.00 | net |
| Sandblasting and rewhitening cylinders . . . per set | Labor | 1.50 | net |
| Cylinders are rewhitened only when specified. | | | |
| Fitting oversize inlet housing clamp nut . . . | Mat'l | .50 | list |
| | Labor | 1.25 | net |
| Rebushing one set 61″ or 74″ connecting rods at both ends and lapping steel bushings . . . | Mat'l | 2.16 | list |
| | Labor | 1.56 | net |
| Rebushing one set 61″ or 74″ connecting rods at both ends and fitting rollers, retainers and crank pin . . . per set | Mat'l | 5.56 | list |
| | Labor | 2.19 | net |
| Drilling one set of 61″ or 74″ connecting rods . . . | Labor | 1.25 | net |
| Rebalancing 61″ flywheels for use with aluminum pistons . per set | Labor | 1.88 | net |
| Rebalancing 74″ flywheels for use with aluminum pistons . per set | Labor | 2.50 | net |
| *These prices apply only when flywheels without shafts are sent in.* | | | |
| Rebushing one set of inlet lifter arms and fitting rollers and pins | Mat'l | 1.00 | list |
| | Labor | .63 | net |
| Rebushing one set of exhaust lifter arms and fitting roller and pins | Mat'l | 1.04 | list |
| | Labor | .63 | net |
| Refacing exhaust valve . . . each | Labor | .31 | net |
| Fitting 1915 to 1922 type mechanical oiler with operating shaft and bushing . . . | Mat'l | 1.35 | list |
| | Labor | 1.25 | net |
| Fitting 1923 and 1924 type mechanical oiler with operating shaft | Mat'l | .95 | list |
| | Labor | .88 | net |
| Rebushing transmission main shaft . . . | Mat'l | .40 | list |
| | Labor | 1.25 | net |

## SPORT MODEL FRAME PARTS

| Part No. | Name | Models | Price |
|---|---|---|---|
| WGE31 | Front Bar Only | All Sport Models | $ .95 |
| WIE41 | Rear Bar Only | All Sport Models | 1.05 |
| AWGE20 | Upper Bar | All Sport Models | 2.30 |
| AWGE11 | Lower Bar | All Sport Models | 1.05 |
| WGE70R | Rear Fork (Upper) | All Sport Models | .75 |
| WGE71R | Rear Fork (Lower) | All Sport Models | .85 |
| WGE7 | Frame Head | All Sport Models | 3.00 |
| WGE32 | Front Motor Bracket | All Sport Models | 3.70 |
| WGE42 | Rear Motor Bracket | All Sport Models | 3.60 |
| WGE9 | Front Connection for Lower Bar | All Sport Models | .95 |
| WIE10A | Rear Connection for Lower Bar | All Sport Models | 1.00 |
| WGE8 | Seat Post Cluster | All Sport Models | 2.30 |
| WGE23 | Seat Bar Bracket | All Sport Models | .45 |
| WGE85 | Rear Mudguard Support | All Sport Models | .90 |
| WGE62 | Left Rear Axle Clip | All Sport Models | 2.20 |
| WGE52 | Right Rear Axle Clip | All Sport Models | 2.20 |

## SIDECAR FRAME PARTS—SINGLE PASSENGER—1915 TO 1924

| | | | |
|---|---|---|---|
| DQ33 | Main Bar (Next to Motorcycle) | 1915 to 1917 | $2.40 |
| GQ33 | Main Bar (Next to Motorcycle) | 1918 to 1923 | 3.50 |
| MQ33 | Main Bar (Next to Motorcycle) | 1924 | 5.20 |
| DQ6P | Axle Tube (Rear Bar Assembled) | 1915 to 1923 | 3.00 |
| MQ6A | Axle Tube (Rear Bar Assembled) | 1924 | 3.55 |
| EQ37 | Side Bar (Away from Motorcycle) | 1915 to 1924 | 1.00 |
| EQ36 | Front Bar | 1915 to 1916 | 1.00 |
| EQ36A | Front Bar | 1917 | 1.65 |
| GQ36A | Front Bar | 1918 to 1923 | 1.35 |
| MQ36A | Front Bar | 1924 | 1.55 |
| DQ7 | Truss Bar (Diagonal) | 1915 | 3.80 |
| EQ7 | Truss Bar (Diagonal) | 1916 to 1917 | 2.10 |
| JQ121R | Truss Bar Front (Diagonal) | 1918 to 1923 | 1.90 |
| MQ121R | Truss Bar Front (Diagonal) | 1924 | 2.15 |
| JQ7R | Truss Bar Rear (Diagonal) | 1918 to 1923 | 1.60 |
| MQ7R | Truss Bar Rear (Diagonal) | 1924 | 1.65 |
| DQ9 | Connection for Main Bar & Axle Tube | 1915 to 1924 | .75 |
| EQ76 | Connection for Side Bar & Axle Tube | 1916 to 1924 | 1.90 |
| DQ8 | Connection for Main Bar (Center & Front) (2) | 1915 to 1924 | .70 |
| DQ15 | Truss Bar Center Connection | 1915 | .35 |
| EQ15 | Truss Bar Center Connection | 1916 to 1917 | .20 |
| GQ15 | Truss Bar Center Connection | 1918 to 1924 | 1.65 |
| DQ16 | Truss Bar & Main Bar Connection | 1915 | .40 |
| EQ16 | Truss Bar & Main Bar Connection | 1916 to 1917 | .25 |
| IQ16 | Truss Bar & Main Bar Connection | 1918 to 1924 | .45 |
| EQ38 | Connection for Side & Front Bar | 1915 to 1916 | 1.00 |
| FQ38R | Connection for Side & Front Bar | 1917 | .80 |
| GQ38P | Connection for Side & Front Bar | 1918 to 1924 | 1.15 |
| DQ10A | Frame Brace Bracket | 1915 to 1917 | 1.10 |
| GQ10 | Frame Brace Bracket | 1918 to 1924 | .80 |
| DQ13 | Mudguard Support Rod Bracket | 1915 to 1917 | .60 |
| EQ48A | Mudguard Support Rod Bracket on Truss Bar | 1915 to 1917 | .30 |

# Mechanics' Bulletin

No. 99. Nov. 1, 1923. Harley-Davidson Motor Co., Milwaukee

The Service Department will from time to time issue bulletins to be mailed with the Weekly News Bulletins, covering mechanical suggestions and ideas of interest to the shop. These bulletins will cover the same ground as the Service bulletins issued in the past, excepting that they will be issued more frequently, or whenever we have live material, thereby keeping the repairmen informed with up-to-the-minute shop news. If the Weekly News Bulletin does not reach the shop, be sure to follow up the office from time to time and ask them if any mechanics' bulletins have been received.

## Adjustment and Repair of DCA and E Motors

### Fitting Piston Rings in DCA 74 cu. in. Motors

Because Harley-Davidson Aluminum pistons are specially designed for use with four rings, they are longer lived than cast iron pistons. The two lower rings act as a cushion between the piston and cylinder walls. A motor fitted with these pistons can therefore be kept in practically its original condition by fitting new rings when necessary.

The two top rings act as compression rings and hence are used for gas tightness only. The third ring (first ring above the piston pin) acts as a compression as well as a bearing ring.

The fourth or bottom ring acts as a combination bearing, oil, and tension ring.

When the piston rings are worn to such extent that the pistons are noisy, replace the two bottom rings with oversize thickness rings (as explained below.) *Do not confuse oversize thickness rings with rings oversize in outside diameter.* It is not necessary to replace the two top rings unless they are worn considerably, or burned due to lack of oil.

Notice: Step joint rings, such as used on cast iron pistons, are not designed for use with aluminum pistons. To use ordinary piston rings or step joint rings on aluminum pistons will cause the motor to stick or "seize" and in consequence damage the cylinders and pistons.

### Piston Rings for DCA Motors

On the next page is a list of DCA piston rings. Some of these are new rings. Insert the part numbers in your parts book until such time as we issue a new sheet for your parts book.

***NOTE: Be sure and read the following instruction before fitting any of these rings to DCA motor pistons.***

| Factory number | Description | Where Used | Tax Status | Price Each |
|---|---|---|---|---|
| LA11DK | Standard plain ring | Used in the two TOP grooves— DCA Motors | NT | 20c |
| MA11D | Standard bevel edge ring | Used in the two LOWER grooves— DCA Motors | NT | 25c |
| MA11DA | Oversize thickness ring (.001"+) with beveled edge. Marked in RED | Used in THIRD ring groove (first above pin) to take up wear— DCA Motors | NT | 25c |
| MA11DB | Oversize thickness ring (.0025"+) with beveled edge. Marked in YELLOW | Used in BOTTOM ring groove to take up wear DCA Motors | NT | 25c |
| MA11DD | Standard size assorted upper and lower | Used in new motors and on new standard pistons— DCA Motors | NT | Ea. 23c |
| MA11DE | Assorted oversize thickness rings for third and bottom grooves. Marked in RED and YELLOW | Used in THIRD and BOTTOM grooves— DCA Motors | NT | Ea. 25c |

### Fitting Rings to Piston Grooves

Try each ring in the piston groove, rolling it around the piston to ascertain the fit. If the ring does not fit just free in the groove, its flat side should be rubbed slightly over very fine emery cloth, preferably number 00, laid on a planed surface.

### Fitting Rings LA11DK

The two top rings have flat or plain faces, that is, their edges are not beveled.

These rings, being compression rings only, can be retained as long as they show no appreciable wear, side shake in the piston grooves, or discoloration due to lack of oil. If the clearance between the two top rings and the piston ring grooves is more than .002" (.05 m/m), new standard rings should be fitted. This can be determined with a feeler gauge.

Never under any circumstances fit oversize thickness rings in the two top ring grooves unless the cylinders have worn at least .004" or .005" (.10 or .12 m/m).

### Fitting Rings MA11D

The third ring, or first ring above the piston pin, should have one edge beveled and be fitted in the groove with the beveled edge down. The standard thickness bevel edge ring is MA11D and is used in the 3rd and 4th ring grooves in new motors and on new standard pistons.

The fourth or bottom ring groove should also be fitted with an MA11D beveled edge ring, (beveled edge down), except when the motor has developed a rattle at medium high speeds.

## Fitting Oversize Thickness Rings MA11DA and MA11DB

These rings are furnished only on Parts Orders. They are not included with standard rings but can either be ordered under the above part numbers or under assortment number MA11DE.

Fit oversize thickness ring MA11DA in the third groove, or groove just above the pin. This ring will be marked in RED and should be fitted in this groove only. The beveled edge must be fitted downward for proper lubrication.

Fit oversize thickness ring MA11DB in the fourth or bottom groove with the beveled edge down. This ring will be marked in YELLOW and should be fitted in this groove only.

Standard or oversize thickness rings must always be lapped in to insure perfect lubrication for the first few hundred miles, or during the "running in" period.

These oversize thickness rings should take care of motors having from 5,000 to 7,000 miles of service as well as motors that are noisy at medium high speeds.

AFTER FITTING STANDARD OR OVERSIZE THICKNESS RINGS DO NOT FORCE THE MOTOR OR DRIVE FASTER THAN 25 MILES PER HOUR FOR THE FIRST THREE OR FOUR HUNDRED MILES. THIS IS IMPORTANT.

## Fitting Rings to E Motor Pistons

The rings on the E motor aluminum pistons function the same as those on DCA pistons, that is, the two top rings are used for compression purposes, the third ring (first ring above the pin) is used for compression and bearing purposes and the bottom ring is used for lubrication and bearing purposes. The third and bottom rings have beveled edges and are fitted with the beveled edges downward.

When the piston rings are worn to such extent that the pistons are noisy, replace the bottom ring with an MA11B, .0025″ (.63 m/m) thicker than standard ring and the third ring, or first ring above the pin, with a standard beveled edge ring MA11. It is not necessary to replace the two top rings unless they are worn considerably, or burned due to lack of oil. When replacement is necessary, use standard size plain face rings EA11KB.

## E Motor Piston Rings

| Factory number | Description | Where Used | Tax Status | Price Each |
|---|---|---|---|---|
| EA11KB | Standard plain ring | Used in the two TOP grooves—E motors | NT | .20 |
| MA11 | Standard bevel edge ring | Used in the two LOWER grooves—E motors | NT | .25 |
| MA11B | Oversize thickness ring (.0025″+) with beveled edge. Marked in YELLOW | Used in bottom ring groove to take up wear—E motors | NT | .25 |

## Be Sure to Obtain Proper Ring Gaps

The beveled joint rings used in both 61 and 74 cu. in. aluminum piston motors must have from .008″ to .012″ (.2 to .3 m/m) gap at the ring ends when located in the TOP END of the cylinder. The bottom or fourth ring, however, may be fitted with a gap up to 3/64″ (1.1 m/m) without causing serious effect.

A very good way to get the correct gap of piston rings in the cylinder is to allow about .029″ (.73 m/m) gap when the ring is at the bottom end of the cylinder. As the rings are moved upward the gap will automatically close, because the cylinders are tapered. After the cylinders wear, that is, the taper reduced, the gap allowed at the bottom end of the cylinder can be reduced accordingly. If the taper in the cylinder is multiplied by 3 and .008″ is added to the product we will have the correct gap for the ring when it is in the bottom end of the cylinder. As an example: We have a cylinder with a taper of .007″ (.17 m/m); multiply this taper by 3, then add .008″ (.2 m/m) for the proper gap. The result will be .029″, (.73 m/m), or the proper gap for the ring when located in the lower end of the cylinder.

## Lapping Piston Rings in DCA and E Motors

Lapping is especially recommended when oversize thickness rings are fitted.

For the very best results it is advisable to lap the piston rings in the cylinders until they bear perfectly at all points against the cylinder walls. When rings are to be lapped in, do not allow as large a gap in the ends, because the lapping process will enlarge the gap from .005″ to .008″ (.12 to .2 m/m), depending on how long the lapping is continued and the kind of lapping abrasive used.

Oil the piston ring grooves and put the four piston rings in their proper places. Fit a slightly loose piston pin to the piston and use an old connecting rod with a piece of wood through the lower bearing to serve as a handle.

Apply a coating of lapping compound, grade 1-A Clover Leaf grinding compound is recommended, and enter the piston and rings into the cylinder. Give the piston with rings a to and fro motion, at the same time turning it from side to side. Lap the rings until they show effects of the abrasive over their entire surface.

When a cylinder is exceedingly rough, it is advisable to lap the rings on an old piston, using either grade A or B compound and finishing up on the piston to be used with grade 1-A compound.

After lapping the rings sufficiently, remove all traces of the abrasive thoroughly with gasoline before assembling the motor.

## Valve Grinding on DCA and E Motors

Valve grinding and the proper fitting of valves on DCA motors are most important operations if extreme high speed is to be maintained over long distances.

These large motors generate more heat than the 61 cu. in. type motors and consequently the valves are subjected to more abuse. If carbon deposits accumulate between the valve faces and cylinder seats, burning gases will blow by and cause the motor to become excessively hot. This additional heat will reduce speed and power, burn spark plugs and prevent proper lubrication.

It is, therefore, important that the valves be ground carefully and adjusted properly after scraping carbon and cleaning out the motor. Do not simply clean off the valve faces and seats and call it a good job, but lap the valves in on the seats with a good grade of grinding compound and test the results as follows: After grinding the valves in, clean the faces with gasoline and mark the valve face with a soft pencil, placing the marks vertically, every ¼ inch (6.3 m/m) around the face. Replace the valves and with a screw driver press firmly on the valve and give it several to and fro turns. Remove the valve and examine the pencil marks, noting whether or not they are erased equally about the face. If the pencil marks do not show the valve to be true, continue grinding until the valve and seat faces are true.

## Adjusting the Carburetor Air Valve on 74 cu. in. DCA Motors

In some localities and under certain conditions a long air valve spring such as fitted on some 1924 motors may cause an unsatisfactory fuel mixture between speeds of 30 and 40 miles per hour. This is a condition that can be remedied very easily and without expense to the rider.

If the motor does not respond to medium high speeds, or popping occurs at the carburetor, it is safe to assume that the air valve spring is too weak and should be tightened accordingly. Unscrew the air valve stem bushing three turns, or 3/32″ (2.3 m/m). This will give just enough clearance for the choke pin to clear the bushing when in the outward position.

A still better plan would be to cut ⅛″ (3.1 m/m) off the threaded end of the air valve adjusting screw. All machines shipped from the factory after September 20, 1923, have ⅛″ (3.1 m/m) shorter air valve adjusting screws.

After changing the air valve spring adjustment it will of course be necessary to readjust the needle valve and possibly the high speed cam as follows: Screw the needle valve inward or down until the proper mixture is obtained. Turn the high speed cam indicator to position 3. The carburetor will then be adjusted properly for all general service up to extremely high speed, when it may be necessary to open the shutter on the side of the carburetor to furnish additional air for high speed purposes.

Where high speed is more important than low or medium speed adjustments, we recommend that a long air valve spring be used, or if the shorter type spring is used, that a ported air sleeve be fitted to the carburetor.

## Care of Mica Core Spark Plugs

The mica core spark plug may after hard service show the effects of heat and in consequence cause premature ignition. If a large motor, such as the 74 cu. in., is held wide open for a distance of several miles at a stretch, the spark plug cores may suffer greatly, in fact they may flake or crack to such extent that the motor is caused to slow down to 20 or 30 miles per hour. If spark plugs cause such difficulties, remove them and after taking them apart scrape and sandpaper all the loose flakes from the core. The plugs should after being reassembled, render much better service.

Ordinarily mica core spark plugs will render excellent service and cause very little difficulty; however, when pushed at top motor speeds for long stretches, they are functioning under conditions similar to plugs in racing service and will therefore break down quicker than when used under ordinary conditions of service.

## High Speed Lubrication of Aluminum Piston Motors

The fact that DCA and E type motors are fitted with aluminum pistons does not make motor lubrication more difficult. The design of these motors allows for sufficient cylinder and piston clearance so that they will withstand high temperatures without excessive oil consumption.

The mechanical oil pump is adjusted, upon leaving the factory, to provide correct lubrication in ordinary service up to 40 or 45 miles per hour. This adjustment is obtained by using one thick and two thin washers under the head of the oiler adjusting screw. Above 45 miles per hour, the hand pump should be brought into service as follows:

At 45 to 55 miles per hour, give motor 1/3 pumpful of oil every 4 miles.

At 55 to 65 miles per hour, give motor ½ pumpful of oil every 1 mile.

At 65 to 75 miles per hour, give motor 1 pumpful of oil every ¾ to 1 mile.

Above 75 miles per hour, give motor 1 pumpful of oil every ½ mile.

## Gear Ratios—All 74 cu. in. Motors

The following sprocket combinations are now used on machines shipped from the factory.

### Sidecar Machines

FDS, JDS, FDCAS and JDCAS models are fitted with 15 tooth engine sprockets instead of 16 tooth engine sprockets. Gear ratio 4.91 to 1. Previous gear ratio was 4.61 to 1.

### Solo Machines

FD and JD models are fitted with 17 tooth engine sprockets instead of 18 tooth engine sprockets. Gear ratio 4.34 to 1. Previous gear ratio was 4.10 to 1.

FDCA and JDCA models are fitted with 16 tooth engine sprockets instead of 17 tooth engine sprockets. The 44 tooth rear wheel sprocket is retained. Gear ratio 4.22 to 1. Previous gear ratio was 3.97 to 1.

It is suggested that any 74 cu. in. motor not performing satisfactorily on hills or long runs be geared as above outlined.

## Compression of DCA Solo and Sidecar Motors

The compression on both solo and sidecar DCA motors is now as follows:

DCA solo machines have a 1/16″ (1.5 m/m) compression plate under each cylinder, and sidecar motors have the customary ⅛″ (3.1 m/m) plate, in addition to an extra 1/16″ (1.5 m/m) plate, under each cylinder.

If DCA solo or sidecar motor does not seem to give the desired results on hills or long high speed runs, or has a tendency to knock, we suggest that compression plates be fitted according to the above.

# Generator Repairs

| | | |
|---|---|---|
| Soldering and turning commutator | Labor | $1.25 |
| | List | Net |
| Fitting commutator to Remy 235 type armature GX1067 or GX1067C | $8.25 | 6.25 |

REMY 250 TYPE COMMUTATOR CANNOT BE REPLACED WITHOUT REWINDING ARMATURE.

| | |
|---|---|
| Rewinding Remy 250 type armature including new commutator | 12.00 |

> **NOTE**
>
> Harley-Davidson and Remy 235 type armatures are not rewound and Harley-Davidson armatures are not fitted with new commutators because the repair cost would exceed the price of new armatures. Spark coils with broken down windings or condensers, damaged cases or terminals, cannot be repaired.

| | List | Net |
|---|---|---|
| Repairing manual switch KK385 or MK385 | $1.40 | |
| Labor for overhauling generator or magneto | | $5.00 to 7.50 |

It is impossible to estimate the material required to repair a generator or magneto because of the wide difference between the condition of different units.

# Carburetor Exchange Prices

NOTE: Missing parts are charged for in addition to the exchange price. Carburetors with oversize throttle shafts, damaged bowls, or broken bodies are exchanged for new carburetors at quoted prices.

| | List | Net |
|---|---|---|
| Exchanging worn 74″, 61″ or Sport Model carburetor for rebuilt carburetor | $5.75 | $4.00 |
| Exchanging worn 74″, 61″ or Sport Model carburetor with oversize throttle shaft, damaged bowl or broken body for a new carburetor | 9.00 | 6.50 |
| Exchanging worn 1921 small bowl style 74″ carburetor for large bowl style carburetor | 9.00 | 6.00 |

# Motorcycle and Sidecar Frames, Forks and Tanks

Inspect Very Carefully Before Giving Estimate To Customer.
These Prices Include Re-Enameling, But No Material.

### MOTORCYCLE FRAMES

When luggage carrier studs are needed, add $1.00 net to the quoted labor charges.

| | Net |
|---|---|
| Labor for repairing slightly bent frame—no new brazed fittings furnished | $ 7.00 |
| Labor for repairing frame needing one or two cylinder or crank case clamps | 8.00 |
| Labor for repairing frame needing three or four cylinder or crank case clamps | 9.00 |
| Labor for repairing badly bent frame—no new brazed fittings furnished | 9.00 |
| Labor for repairing frame needing one, two or three brazed fittings, one or two of which are crank case or cylinder clamps | 10.00 |
| Labor for repairing a frame needing four brazed fittings, three of which are cylinder and crank case clamps | 10.50 |
| Labor for repairing frame needing four brazed fittings, two of which are cylinder or crank case clamps | 11.50 |
| Labor for repairing frame needing five brazed fittings, three of which are cylinder and crank case clamps | 12.50 |
| Labor for repairing frame needing six, seven or eight brazed fittings, three of which are cylinder and crank case clamps | 14.00 |

*When a lower bar or loop tube is furnished the cost includes cylinder brackets or crank case clamps.*

### RIGID AND SPRING FORKS

Always add lower head cone EE66P—32 cents list, to the rigid fork repair prices.

| | | Net |
|---|---|---|
| Labor for repairing rigid fork—no new fittings furnished | $2.50 | to $3.00 |
| Labor for repairing rigid fork with one broken side, center stem or crown plate | 4.25 | |

*It does not pay to repair a rigid fork having more than one broken fitting.*

| | | |
|---|---|---|
| Labor for repairing spring fork—no new fittings furnished | 1.75 | to 2.50 |
| Labor for repairing spring fork with one broken side, mudguard bracket or tip | 3.50 | |

*It does not pay to repair a spring fork having more than one broken fitting.*

### TANKS

| | | Net |
|---|---|---|
| Labor for repairing damaged tank, depending upon extent of damage | $3.00 | to $5.00 |

*It does not pay to repair a badly damaged 1917 to 1920 tank.*

### SIDECAR FRAMES

| | Net |
|---|---|
| Labor for repairing sidecar frame—no new fittings furnished | $ 9.50 |
| Labor for repairing sidecar frame needing one fitting | 10.50 |
| Labor for repairing sidecar frame needing two fittings | 12.00 |
| Labor for repairing sidecar frame needing three fittings | 13.00 |

## Re-enameling Motorcycle and Sidecar Parts in Olive Green, Brewster Green, or Harley-Davidson Gray

These prices include no labor for stripping, assembling and repairing. Always tell us in your instructions whether to re-enamel only or to re-enamel and repair. *Add about 20% to these prices to cover our labor for tagging, cleaning and getting parts ready for enameling.*

| | Net |
|---|---|
| Frame, motorcycle or sidecar | $ 1.50 |
| Set of forks | 1.50 |
| Single fork | .75 |
| Sport Model fork | 1.20 |
| Set of tanks | 2.25 |
| Sport Model tank | 1.50 |
| Mudguards, motorcycle or sidecar ... each | .75 |
| Sidecar body two passenger | 7.05 |
| Sidecar body one passenger | 6.00 |
| Tool box | .75 |
| Handlebars | .75 |
| Generator | .90 |
| Magneto | .75 |
| Set of Chainguards | 1.13 |
| Stand | .30 |
| Battery box | .75 |
| Wheels, motorcycle or sidecar ... each | .75 |
| Re-enameling all parts of a motorcycle after it is completely stripped and all fittings have been removed from parts | 12.00 |

## List of Spare Parts to be Used in Estimating Repair Costs

This list is made up for estimating repair costs only.

### SPRING FORK PARTS—1915 TO 1924

| Part No. | Name | Models | Price |
|---|---|---|---|
| BC19 | Spring Fork Side | 1915 | $1.50 |
| EC19R | Spring Fork Side | 1916 to 1919 | 1.15 |
| IC19R | Spring Fork Side | 1920 to 23—61″ | 1.15 |
| KC19DR | Spring Fork Side | 1922 & 23-74″ all 24 | 1.15 |
| AC13 | Spring Fork End | 1915 to 24 | .50 |
| DC20 | Front Mudguard Support | 1915 | .70 |
| EC20 | Front Mudguard Support | 1916 to 22—61″ | 1.00 |
| LC20 | Front Mudguard Support | 1923 —61″ | 1.00 |
| KC20D | Front Mudguard Support | 1922 & 23-74″ all 24 | 1.45 |

### RIGID FORK PARTS—1915 TO 1924

| Part No. | Name | Models | Price |
|---|---|---|---|
| BC100P | Rigid Fork Side | 1915 | $1.95 |
| EC100PR | Rigid Fork Side | 1916 to 1923—61″ | 3.25 |
| KC100DP | Rigid Fork Side | 1922 & 23-74″ all 24 | 3.65 |

| Part No. | Name | Models | Price |
|---|---|---|---|
| AC2C | Rigid Fork Stem | 1915 to 1924 | $1.00 |
| BC1B | Upper Crown Plate (1) | 1915 | .22 |
| BC1A | Lower Crown Plate (2) | 1915 | .20 |
| HC1 | Crown Plate Upper (2) | 1916 to 23—61″ | .16 |
| HC1A | Crown Plate Lower (1) | 1916 to 23—61″ | .16 |
| HC27 | Crown Plate Assembly | 1916 to 23—61″ | .80 |
| KC1D | Crown Plate (3) | 1922 & 23-74″ all 24 | .20 |
| KC27D | Crown Plate Assembly | 1922 & 23-74″ all 24 | .90 |
| HO388 | Crown Plate Spacer (4) | 1915 to 1924 | .04 |
| DC15 | Spring Fork Bracket | 1915 | 1.30 |
| EC15 | Spring Fork Bracket | 1916 to 23—61″ | 1.60 |
| KC15D | Spring Fork Bracket | 1922 & 23-74″ all 24 | 2.00 |
| DC32 | Rigid Fork Side Upper End | 1915 to 1924 | .35 |
| EC23 | Upper End Splice (inner) | 1915 to 1924 | .10 |
| KC23 | Upper End Splice (outer) | 1915 to 1924 | .10 |

### FRAME PARTS—THREE-SPEED FRAMES

| Part No. | Name | Models | Price |
|---|---|---|---|
| FE607 | Loop Tube (Head to Three-Speed Bracket) | 1915 to 1924 | $2.70 |
| FE171 | Front Loop (Head to Casing Clamp) | 1915 to 1924 | 1.20 |
| FQ86 | Front Loop Bar Reinforcement (2) for Splicing EE 171 to Frame | | .08 |
| FE608 | Rear Loop Tube | 1915 to 1924 | .75 |
| EE606A | Top Bar with Seat Bar Bracket | 1915 to 1924 | 2.10 |
| AE605 | Lower Bar Only | 1915 to 1924 | 1.10 |
| FE609 | Lower Bar with Motor Brackets | 1915 to 1924 | 2.00 |
| EE19R | Rear Fork Only (Upper) | 1915 to 1924 | .60 |
| DE85R | Rear Stay Only (Lower) | 1915 to 1916 | .90 |
| EE85R | Rear Stay Only (Lower) | 1917 to 1924 | 1.10 |
| IE72P | Frame Head | 1915 to 1924 | 3.75 |
| DE93 | Tank Strip Front | 1915 to 1916 | .12 |
| JE93 | Tank Strip Front | 1917 to 1924 | .10 |
| DE75 | Tank Strip Rear | 1915 to 1916 | .10 |
| JE75 | Tank Strip Rear | 1917 to 1924 | .05 |
| DE2 | Crank Case Clamp | 1915 to 1924 | .20 |
| CE24P | Foot Board Bracket | 1915 to 1924 | .45 |
| IE505 | Handle Bar Control Bracket | 1915 to 1924 | .10 |
| AE504A | Front Cylinder Clamp | 1915 to 1924 | .30 |
| FE706 | Rear Cylinder Clamp | 1915 to 1924 | .16 |
| FE735 | Gear Box Bracket | 1915 to 1923 | 5.10 |
| ME735 | Gear Box Bracket | 1924 | 5.10 |
| DE36P | Seat Bar Bracket & Bushing | 1915 to 1924 | .75 |
| EE1 | Seat Post Cluster | 1915 to 1916 | 1.55 |
| FE1 | Seat Post Cluster | 1917 to 1924 | 3.00 |
| AE5 | Rear Mudguard Support | 1915 to 1916 | .55 |
| FE5 | Rear Mudguard Support | 1917 to 1924 | 1.00 |
| DE7 | Left Rear Axle Clip | 1915 | 2.00 |
| EE7 | Left Rear Axle Clip | 1916 | 2.00 |
| FE7 | Left Rear Axle Clip | 1917 to 1924 | 2.10 |
| EE6 | Right Rear Axle Clip | 1915 to 1916 | 2.00 |
| FE6 | Right Rear Axle Clip | 1917 to 1924 | 2.10 |
| DE42 | Right Luggage Carrier Stud | 1915 to 1924 | .12 |
| DE41L | Left Luggage Carrier Stud | 1915 to 1924 | .12 |

# Service Dept. Bulletin

No. 97. Revised Nov. 20, 1923. Harley-Davidson Motor Co., Milwaukee

This bulletin replaces Service Department Bulletins No. 67, 78 and 93 and covers the care of the electrical equipment on 1918 to 1920 models besides general electrical instructions that apply to all models. Special attention is directed to the "Ignition Trouble Shooting Chart" on the last pages of the Bulletin because this information is invaluable when hunting down ignition troubles.

## To Inspect and Correct a Faulty Lighting Switch

(These Switches were used between 1918 and 1920)

Remove the two hexagon nuts which clamp the entire switch box assembly to the studs of the switch base. Take hold of the black switch box cover and remove the entire assembly from the switch base. If the cover sticks it can easily be forced off by placing a screw driver against the edge of the cover from the left side of the machine and then striking the screw driver with the palm of the hand. Remove the two round head screws which clamp the black switch box cover to the switch assembly and remove the cover. If an inspection proves that the wires are firmly and properly connected as per illustration No. 5 showing switch wiring diagram, the fibre switch base to which the wires are attached should be removed from the cover and spider assembly. These two assemblies can be taken apart after the three screws which pass through the side of the spider cover have been removed.

Inspect the four spider contacts inside of this cover. Make sure that they bear against the contact inserts in the fibre base with sufficient pressure to insure a closed circuit, and that they cannot slide beyond the insert contacts. To see whether the spider contacts slide beyond the insert contacts, turn them to the various positions and with a pencil, mark the exact location of the contacts on the metal cover of this assembly. Then put the fibre switch base assembly into the switch cover assembly and note whether each mark lines up with its respective clamp screw. If they do not line up properly, bend the spider contacts as necessary.

## To Adjust the Centrifugal Switch

(Used on 1918 to 1922 Models)

To get at the centrifugal switch it will, of course, be necessary to remove the left foot board, short chain guard and chain. Under the cover at the lower left end and of the generator is a set screw. With a screw driver loosen this about one turn. This cover which is held by a bayonet type connection, is then removed by turning it to the left as far as it will go and pulling it from the generator.

Be sure that the clearance "A" between thrust button "B" and cover "C" of the centrifugal switch does not amount to more than a few thousandths of an inch. If there is too much clearance at this point the ball action will be lost which will prevent a good contact if any, at the points "D". If the blades require adjusting, disconnect the ground wire from the battery box cover screw to prevent a short circuit, which in an instant would remove the temper in the switch blades making them useless. Never bend the switch blades as they are finely tempered and "set" on the switch blade support. Always bend the switch blade support when changing position of blade. Adjust the long blade support first.

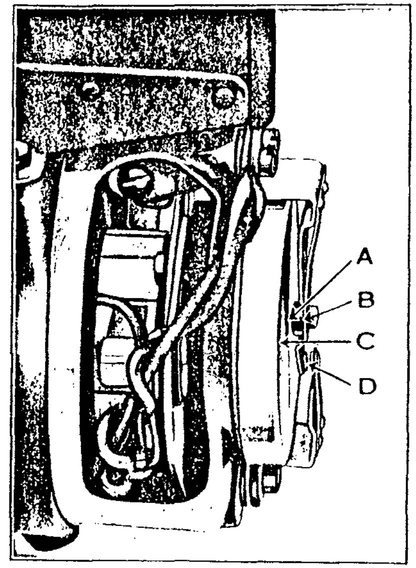



Illustration No. 1

When bending the long blade support, care must be taken to bend it so that the steel insert in the thrust button is in line with the thrust ball in the switch housing. This is very important, because, if the ball comes in contact with the bakelite of the button, it will wear a pit into the button in a short time. After the large blade is in the proper position, obtain the clearance at the contact points by bending the lower or short blade support. A definite clearance for these points cannot be given because of the variation in the stiffness in some of the blades. However, it is safe to assume, that 1/32" clearance is about right. Bend this blade support accordingly, being careful that the points line up, and make a good square contact.

The switch should be tested as follows to see whether or not the adjustment is correct. Replace the short chain and battery ground wire, raise the valves, press firmly on the handlebar horn button and give the starter crank a vigorous stroke. If the centrifugal switch blades are properly adjusted, and the circuit between the generator and battery, and the battery itself is O. K. the horn will sound for just a fraction of a second.

On rare occasions the cut-out weights may be found magnetized, thus sticking to the base proper and causing sluggish action of the switch. Magnetized weights should be replaced with weights free from magnetism. They may be tested for magnetism by trying to lift small particles or chips of iron or steel.

Watch the action of the centrifugal switch blades. See if they make contact. Then if the horn does not sound while pressing the horn button, check for the following possible troubles:

1.—Battery is discharged. 2.—Faulty manual switch. 3.—Loose wire connections. 4.—Faulty horn or the wire itself is broken at one or more places.

It is well to get into the habit of attempting to sound the horn after stopping the motor, to determine whether the centrifugal switch is functioning properly.

A centrifugal switch out of adjustment will cause the following:

Motor will be difficult to start.
Motor will misfire.
Battery will discharge prematurely.
Battery will not receive full charge.
Generator armature and commutator will be burned.
Brushes will be burned.

## To Adjust a Faulty Manual Ignition Switch

(Used on 1918 Models only)

If previous tests and inspections prove that the centrifugal switch, horn, battery, wiring and connections are O. K. and the horn cannot be sounded when the motor is cranked, the motor will be hard starting because the manual ignition switch is faulty.

Since the manual ignition switch is a part of the lighting switch, refer to instructions covering the removal of this switch on page 1, under "To Inspect and Correct a

Faulty Lighting Switch." Remove the three screws holding the fibre base and spider cover assembly together, and bend the end of the contact blade. This will be only very slightly, as may be found necessary. Be careful not to bend the contact blade too much because it will then be impossible to lock the ignition when the key is removed. This same blade grounds or short circuits the generator when the key is removed from the switch so the motor will stop when the key is removed.

When Motor Keeps on Running with Ignition Key Removed.

This trouble can be traced to two causes which are:

1.—Failure of entire switch assembly to make a ground connection to the frame.

2.—Contact blade failing to make contact or ground against the lug of the spider assembly cover when key is removed.

To determine whether entire assembly is grounded, start the motor and touch a screw driver to the switch and the frame work after removing the enamel at the points of contact. If a spark occurs, it will be necessary to remove the enamel so that switch clamp can make contact with the frame.

If no spark occurs, it will be necessary to remove cover and bend contact blade until it makes contact with the lug of the spider assembly cover. If the temper should be burned out of this blade, it should be replaced.

To Tell Whether Generator is Charging the Battery.

Start the motor in the usual way and disconnect the battery negative wire from the ground terminal. If the motor continues to run after the battery negative wire is removed (the battery out of circuit), the generator is charging or producing current. When making this test it is important that the motor be run at slow speed only, because if run at high speed serious damage may result.

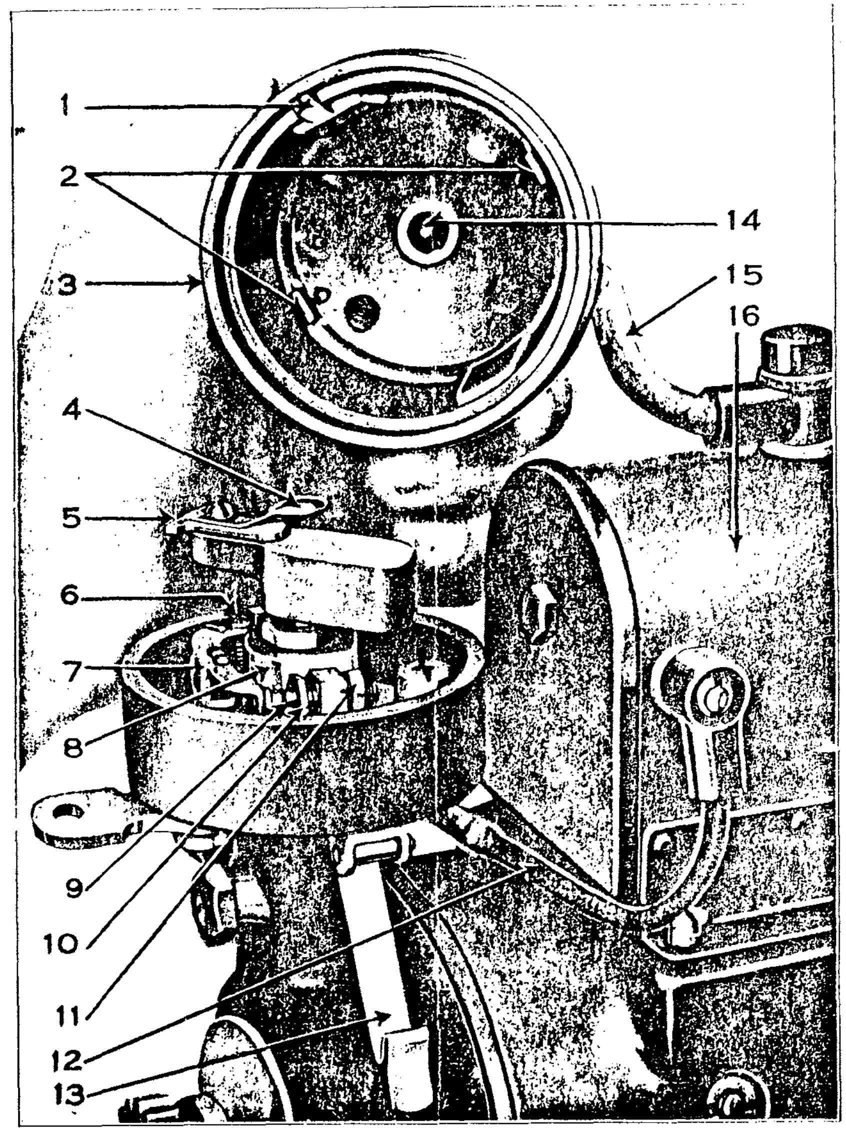
If the motor stops upon removing the battery negative wire, the generator is not charging or there is an open or broken connection between the generator and the manual switch. DO NOT REMOVE THE GENERATOR FROM THE ENGINE.

## Why the Battery Must Always be Kept in Circuit

The battery acts as an accumulator and governor holding the generator voltage down to 8 volts. The current produced by the generator at 30 miles per hour, with the battery out of circuit, is above 30 volts. This high voltage produces a serious overload on the generator and will burn and pit the breaker points in a short time. Other serious damage may result to the armature, spark coil, or condenser. Bulbs will burn out at any voltage higher than 6-8 volts. Therefore, even though the storage battery should be exhausted and not capable of giving off current, it must be left in its place, connected up.

## Ignition Unit of the Harley-Davidson and Remy Generator
### (All Models Between 1918 and 1920)

1—Distributor cap locating lug, or stop, should interlock with the slot at "6" whenever the distributor cap "3" is replaced. Failure to fit the distributor cap properly may mean a damaged generator; 2—High tension terminals which alternately collect the ignition current from segment "5" and carry it to the spark plug wires. These high tension terminals clear the segment by about 1/64" and should never be adjusted; 3—Distributor cap; keep it clean; 4—Distributor segment contact spring which carries the ignition current from carbon contact "14" to segment "5"; 5—Distributor segment distributes the ignition current from the distributor segment contact



# Sport Model Motors

## Sport Model Valve Timing Specifications

The sport model intake and exhaust cams are mounted on the same cam gear, similar to "V" twin cam design. The cam and pinion gears are marked so that the valves can be timed readily. When timing the motor according to gear marks, be sure to have the proper gear teeth in mesh, that is, a marked tooth must coincide with a mark that is between two teeth. Illustration No. 4 shows correct alignment of gear marks A and B for proper valve timing.

## Valve Timing Specifications for Sport Model Motor

To check valve operation against piston location, remove the front cylinder plug and with a scale measure the piston travel according to the following specifications.

The exact time of valve opening and closing can be determined easily by turning the push rod or lifter pin while the motor is being turned over. When the push rod or lifter pin begins to tighten or loosen, the valve is beginning to open or close.

## Inlet Valve Timing

Inlet valve should *open* when piston is 7/32" *before top dead center*. Inlet valve should *close* when piston is 9/16" *after bottom dead center.*

## Exhaust Valve Timing

Exhaust valve should *open* when piston is 15/32" *before bottom dead center*. Exhaust valve should *close* when piston is 1/16" *after top dead center.*

## Sport Model Breather Valve Timing

Crank case compression in the sport model motor is relieved through a port in the cam gear and stud when the valves are timed correctly (according to marks).

## Valve Tappet Adjustment for Sport Model Motors

Both inlet and exhaust valves on the sport model should have .006" clearance when the motor is cold. To insure correct valve timing, it is imperative that the tappets be adjusted to have .006" clearance.

## Timing Sport Model Motor with Generator for Ignition

Inspect circuit breaker points before starting to time the motor, to make sure they are separating .020". Use a thickness gauge or the gauge provided on the generator wrench for the purpose.

The generator drive gear is provided with three key ways, located to permit change of timing within 1/3, 2/3 and 1 tooth of the gear. In other words, the drive gear can be fitted to mesh properly with the other gears when the piston and timer points are set according to the following instructions.

Remove the front cylinder plug and set piston between 3/8" to 7/16" before top dead center on compression stroke. It will be necessary to remove the front footboard support in order to remove the cylinder plug. Compression stroke is the next up stroke of the piston after the inlet valve closes. The outside (nearest the manifold) valve lifter pin is for the inlet valve.

After locating the piston at the proper place for timing, set the generator timer shaft as follows: The timer lever (located between coil and timer housing) must be advanced or *shifted to the rear.*

Turn the timer shaft until the "flat side" is away from the coil. The cam must be set just ready to separate the breaker points. The drive gear can now be fitted to mesh with the intermediate gear as described previously. Hold the timer cam with one hand when fitting the drive gear to prevent it from turning and hence change the timing.

After generator is timed, make sure that the outside terminal wire (spark plug cable) of distributor cap leads to the front cylinder. Refer to illustration No. 5, showing proper disposition of spark plug cables.

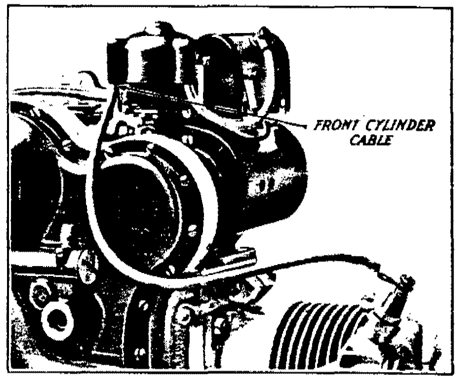



ILLUSTRATION NO. 5

## Timing Sport Model With Magneto for Ignition

The magneto on the sport model motor can be timed by merely aligning all gear marks after the drive gear is keyed to the armature shaft. To check the timing, remove the cylinder plug and measure the piston position before top dead center when the magneto breaker points are just ready to separate.

The correct piston position for ignition is between 3/8″ and 7/16″ before top dead center.

The front (forward) interrupter shoe on sport model magneto times the *front* cylinder.

The magneto interrupter lever is advanced when in a downward position.

Ignition, or the electric spark occurs at the time when the generator or magneto circuit breaker points are just separating. Since an interval of time is required for ignition to propagate a flame through the gasses and hence cause complete combustion, the timing of the spark's occurence is always set before the piston reaches top dead center on the compression stroke.

## How to Locate Compression Stroke of Piston for Ignition Timing (All Motors)

As the inlet valve opens, the piston descends, taking in a charge of fuel. The next up stroke of the piston will be the compression stroke. Both the inlet and exhaust valves on the same cylinder will be closed when the piston is coming up on the compression stroke.

## Setting the Piston for Ignition Timing (All Motors)

After locating the compression stroke, move the piston to top dead center; then back it down (turn motor backward) the required distance (see specifications for your motor) from the top of the stroke. By reading the graduations on the scale, the distance between the piston head and top center can be determind easily.

## Ignition Timing Specifications for "V" Twin Motors

The following specifications give the correct piston positions before top dead center for solo and sidecar motor ignition timing. The measurements are given so the piston can be set and the circuit breaker points timed on the proper cam, to just separate with the spark lever advanced fully.

### 74″ Sidecar or Low Compression DCA Motors

(Generator or Magneto Equipped)

Pistons must be set between 7/32″ and 1/4″ before top dead center.

### 74″ Solo or High Compression DCA Motors

(Generator or Magneto Equipped)

Pistons must be set between 13/32″ and 7/16″ before top dead center.

### 74″ Sidecar or Low Compression Motors Using Standard Cast Iron Pistons

(Generator or Magneto Equipped)

Pistons must be set between 7/32″ and 1/4″ before top dead center.

### 74″ Solo or High Compression Motors Using Standard Cast Iron Pistons

(Generator or Magneto Equipped)

Pistons must be set between 9/32″ and 5/16″ before top dead center.

### 61″ Sidecar or Low Compression Motors Using Standard Cast Iron Pistons

(Generator or Magneto Equipped)

Pistons must be set between 7/32″ and 1/4″ before top dead center.

### 61″ Solo or High Compression Motors Using Standard Cast Iron Pistons

(Generator or Magneto Equipped)

Pistons must be set between 9/32″ and 5/16″ before top dead center.

### 61″ Sidecar or Low Compression Motors Using Aluminium Pistons

(Generator or Magneto Equipped)

Pistons must be set between 7/32″ and 1/4″ before top dead center.

### 61″ Solo or High Compression Motors Using Aluminum Pistons

(Generator or Magneto Equipped)

Pistons must be set between 11/32″ and 3/8″ before top dead center.

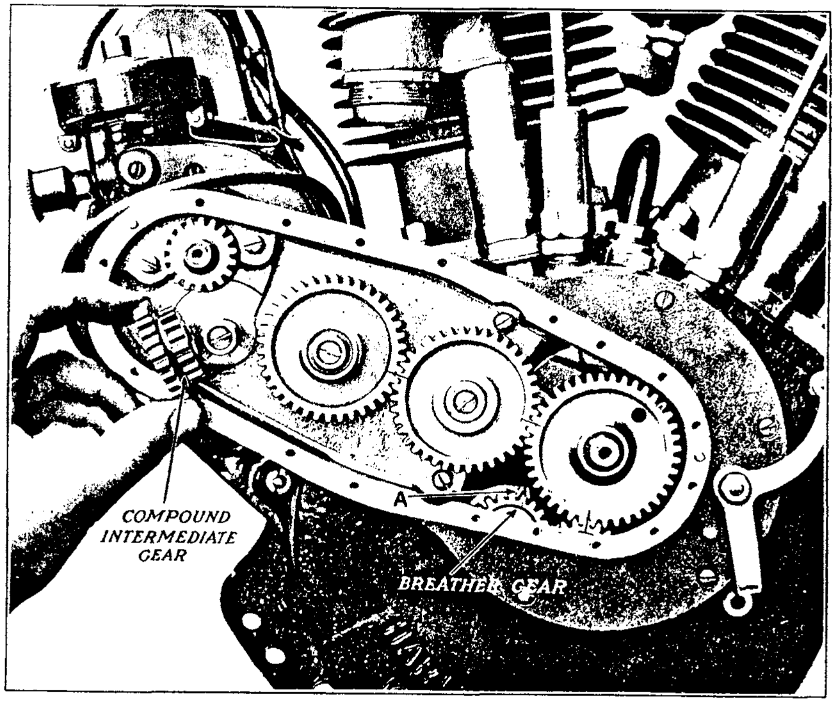



ILLUSTRATION NO. 3

## 61″ Special Fast Stock 500, M, A and E Type Motors

(Generator or Magneto Equipped)

Pistons must be set between 3/8″ and 7/16″ before top dead center.

## To Time Generator for Ignition on "V" Type Twins

Before attempting to time the generator, remove the gear case cover and compound intermediate gear. Refer to illustration No. 3.

The timer cam for "V" Twins is shaped to have a large and a small end, the *small* end being used for timing the *front* cylinder. Looking at the circuit breaker housing from above, the cam turns in a clockwise (right hand) direction.

The timer advance and retard lever must be all the way advanced (forward) when timing ignition. With the front cylinder piston set according to specifications for the particular model of motor, turn the timer cam clockwise, by means of the generator gear until the small cam is just starting to separate the circuit breaker or contact points. Now that the piston and timer cam are set, hold the generator gear with the thumb of the left hand to keep it from turning; then mesh the compound intermediate gear. The compound intermediate gear may not mesh with the generator and large intermediate gears on the first attempt. However, by turning the compound gear a tooth at a time, a place will be found where it will slide into mesh easily.

It is a good policy to check the timing after the piston has been located, the points set and the gears meshed. This can be done by turning the motor until the points are just separated; then pass a scale through the cylinder plug hole to the top of the piston, finally turning the motor forward until the piston reaches top dead center. Note the piston's upward travel in fractions of an inch and if it does not check with the specifications, retime the motor as may be necessary.

When timing ignition, the backlash of the gears and timer cam must be taken into consideration. Otherwise, the piston location and breaker points will not check according to the specifications.

## Magneto Ignition Timing for "V" Twin Motors

(Roadside or Temporary Timing)

The magneto can be timed by lining up all motor gear marks; then fitting the magneto gear to the armature shaft. The magneto drive key must, of course, be in place. This method of timing will be close enough for emergency or quick timing, however, it must not be taken as a factory standard. The best method is, of course, to remove the front cylinder plug, locate piston and set the interrupter according to the following instructions. Refer to illustration No. 2.

## Factory Method for Timing Magneto Ignition

The magneto drive key used between the gear and shaft should be filed thin so as to allow movement of the gear on the shaft if necessary, to obtain the correct interrupter and piston setting.

Locate the piston in the *front* cylinder according to specifications for solo or sidecar service. Loosen the magneto drive gear nut (do not remove the nut) and loosen the drive gear on the shaft. The gear should be loosened with gear puller FK831, or, if this tool is not at hand, by tapping it sharply with a small hammer, preferably a brass hammer.

Advance the magneto timer by shifting it downward. Turn the interrupter in an anti-clockwise (lefthand) direction, until the lever fibre block is just touching the *rear* housing interrupter shoe. Hold the interrupter in this position so it cannot turn, then force the drive gear on the shaft, tightening the lock nut to hold the gear in place.

Check the timing by observing the opening of the interrupter points and measuring the distance of the piston's upward travel before it reaches top dead center. If necessary, retime the motor until it does check with the specifications for that particular type of motor.

## Ignition Timing for Model 250 Remy Generator

The 250 model generator timing is similar to that of the magneto. The timer cam has a small and a large end. The small end is used to time the front cylinder.

The circuit breaker ring assembly is advanced when turned to the right or clockwise.

The timer should be advanced fully and the cam turned clockwise until the circuit breaker points are just ready to separate. After the proper piston position has been obtained, the generator gear can be fitted to the shaft and secured in place with the lock nut. As in the case of the magneto, the drive key should be filed thin in order to allow the gear to be shifted on the shaft if necessary.

## Valve Timing for 1913 & 1914 "V" Twin Motors

Since the cam gear used in these motors is not marked, it will be necessary to locate the pistons in the proper places in the cylinders and then set the cam to operate the valves accordingly.

It is probably easier to set the exhaust valve on its closing period because this takes place when the piston is just over top dead center. That is, the piston has reached top dead center and has just started on the next downward stroke.

Locate the front cylinder piston between 1/16″ and 3/8″ *after top dead center*, then mesh the cam gear with the pinion gear so the exhaust valve is *just closing*. The roller arm roller for the front cylinder will be just riding off the first or exhaust valve cam. Looking at the gears from the right side of the motor, the small pinion gear turns in a righthanded direction and the cam gear turns in a left handed direction. When timing valves according to this method, the exhaust valve tappets must, of course, be adjusted to have between .008″ and .010″ clearance.

Since the exhaust and inlet valve cams are mounted on the same timing gear (made integral) the inlet valves do not require independent timing.

## Valve Tappet Clearance for 1913 and 1914 "V" Twin Motors

On all Twin cylinder motors, prior to 1915, allow .004″ clearance between the exhaust lifter pins and the valve stems or caps. The caps used on the end of the exhaust valve stems on these motors are made in various thicknesses and if necessary, can be ground until the correct clearance is obtained.

The inlet levers and valve stems should be adjusted to have .004″ clearance.

# Sport Model Motors

## Sport Model Valve Timing Specifications

The sport model intake and exhaust cams are mounted on the same cam gear, similar to "V" twin cam design. The cam and pinion gears are marked so that the valves can be timed readily. When timing the motor according to gear marks, be sure to have the proper gear teeth in mesh, that is, a marked tooth must coincide with a mark that is between two teeth. Illustration No. 4 shows correct alignment of gear marks A and B for proper valve timing.

## Valve Timing Specifications for Sport Model Motor

To check valve operation against piston location, remove the front cylinder plug and with a scale measure the piston travel according to the following specifications.

The exact time of valve opening and closing can be determined easily by turning the push rod or lifter pin while the motor is being turned over. When the push rod or lifter pin begins to tighten or loosen, the valve is beginning to open or close.

### Inlet Valve Timing

Inlet valve should *open* when piston is 7/32" *before top dead center*. Inlet valve should *close* when piston is 9/16" *after bottom dead center.*

### Exhaust Valve Timing

Exhaust valve should *open* when piston is 15/32" *before bottom dead center*. Exhaust valve should *close* when piston is 1/16" *after top dead center.*

## Sport Model Breather Valve Timing

Crank case compression in the sport model motor is relieved through a port in the cam gear and stud when the valves are timed correctly (according to marks).

## Valve Tappet Adjustment for Sport Model Motors

Both inlet and exhaust valves on the sport model should have .006" clearance when the motor is cold. To insure correct valve timing, it is imperative that the tappets be adjusted to have .006" clearance.

## Timing Sport Model Motor with Generator for Ignition

Inspect circuit breaker points before starting to time the motor, to make sure they are separating .020". Use a thickness gauge or the gauge provided on the generator wrench for the purpose.

The generator drive gear is provided with three key ways, located to permit change of timing within 1/3, 2/3 and 1 tooth of the gear. In other words, the drive gear can be fitted to mesh properly with the other gears when the piston and timer points are set according to the following instructions.

Remove the front cylinder plug and set piston between 3/8" to 7/16" before top dead center on compression stroke. It will be necessary to remove the front footboard support in order to remove the cylinder plug. Compression stroke is the next up stroke of the piston after the inlet valve closes. The outside (nearest the manifold) valve lifter pin is for the inlet valve.

After locating the piston at the proper place for timing, set the generator timer shaft as follows: The timer lever (located between coil and timer housing) must be advanced or *shifted to the rear.*

Turn the timer shaft until the "flat side" is away from the coil. The cam must be set just ready to separate the breaker points. The drive gear can now be fitted to mesh with the intermediate gear as described previously. Hold the timer cam with one hand when fitting the drive gear to prevent it from turning and hence change the timing.

After generator is timed, make sure that the outside terminal wire (spark plug

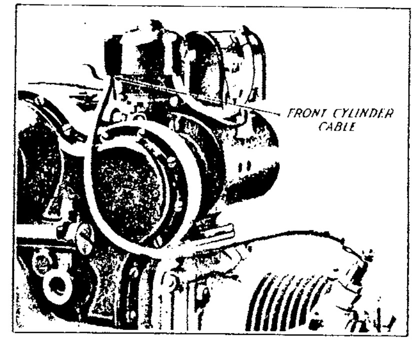



ILLUSTRATION NO. 5

cable) of distributor cap leads to the front cylinder. Refer to illustration No. 5, showing proper disposition of spark plug cables.

## Timing Sport Model With Magneto for Ignition

The magneto on the sport model motor can be timed by merely aligning all gear marks after the drive gear is keyed to the armature shaft. To check the timing, remove the cylinder plug and measure the piston position before top dead center when the magneto breaker points are just ready to separate.

The correct piston position for ignition is between 3/8" and 7/16" before top dead center.

The front (forward) interrupter shoe on sport model magneto times the *front* cylinder.

The magneto interrupter lever is advanced when in a downward position.

# Single Cylinder Motors

## Single Cylinder Valve Timing (All Models)

The exhaust valve timing in all single cylinder motors should be such as to cause the valve to open when the piston is between 3/4" and 9/16" before bottom dead center and close when the piston is between 1/16" and 1/8" after top dead center.

On most single cylinder models the pinion and cam timing gears are marked, thus making exhaust valve timing a simple matter. All that is necessary in this case is to line up the pinion and cam gear marks and the valve is timed.

## Exhaust Valve Tappet Clearance for All Single Cylinder Motors Except Model 21CD

Adjust the exhaust tappet to allow .004" clearance for all single motors except model- 21CD. On early model motors steel caps were placed over the end of the valve stems. These caps are furnished in various thicknesses, and can, therefore, be ground to give the correct clearance.

## Single Cylinder Motor Inlet Valve Timing

All 1913 to 1918 single cylinder motors require independent timing of the inlet valves, because the inlet cam is on one of the intermediate timing gears. The inlet valve should be timed to open when the piston is 3/16" before top dead center.

The inlet valve should be timed to close between 1/8" and 3/8" after bottom dead center. Allow .004" clearance between inlet lever and valve stem when motor is cold.

Single cylinder motors made prior to 1913 have automatic inlet valves, which therefore, do not require timing.

## 1921 CD Single Motor Inlet Valve Timing

The inlet valve in this motor is operated by the secondary or cam gear and does not, therefore require independent timing.

## Valve Tappet Clearance for 21CD Single Motor

When motor is cold, allow .004" clearance for the inlet valve stem and lever, and between .008" and .010" for the exhaust valve stem and tappet.

## Breather Valve Timing for Single Cylinder Motors

All single motors except model 21CD have automatic relief or breather valves, which, of course, requires no timing.

To time the breather valve on model 21CD single motors, align the pinion and cam gear marks, then mesh the breather gear so its marked tooth checks with the **Λ** stamped in the crank case. Refer to illustration No. 2 showing the proper setting for valves and breather according to marks.

## Single Cylinder Motor Ignition Timing
### (All models except 21CD)

All single cylinder motors should be timed for the spark to occur with the piston set between 3/16" and 1/4" before top dead center on compression stroke. The interrupter housing must be advanced fully (shifted downward) and the interrupter lever set just ready to break the points with the piston located as mentioned above.

## Model 21CD Single Ignition Timing

The 1921 CD model commercial single should be timed with the piston set 1/4" to 9/32" before top dead center.

## Timing Single Cylinder Motor Ignition According to Gear Marks

With the pinion gear and cam gear marks aligned, fit the magneto drive key and gear, then fit the intermediate gears so all marks are aligned.

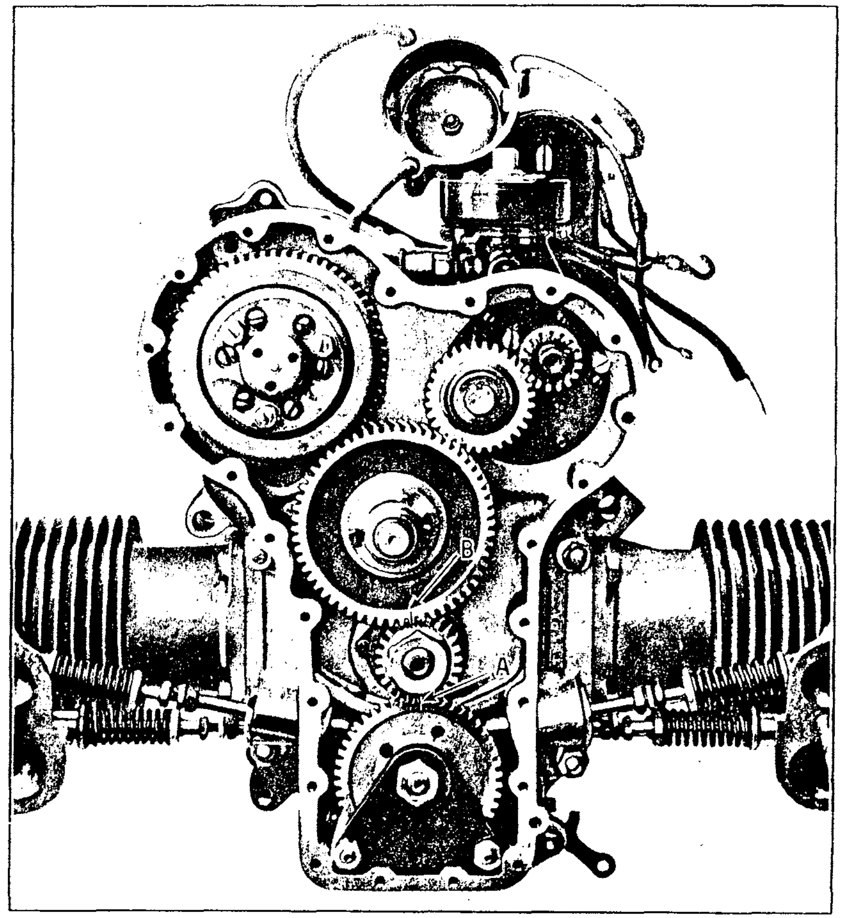



ILLUSTRATION NO. 4

# Mechanics' Bulletin

No. 101 July 15, 1924 Harley-Davidson Motor Co., Milwaukee

## Zenith Carburetor Instructions

The Zenith is a plain tube automatic type of carburetor, depending upon an arrangement of jets and air passages to provide a satisfactory fuel mixture for the various engine speeds. The operation of the carburetor is entirely automatic, with the exception of a low speed (idling) air adjusting screw, which is located on the top of the carburetor body and is readily accessible. Turning the idler adjusting screw 2 (Illus. No. 1) outward makes for a lean mixture, and turning it inward enriches the mixture.

Once the proper combination of jets has been obtained for a certain type of motor, no further adjustments should be necessary.

### Starting the Motor

When the motor is cold, place choker lever at P (Illus. No. 1, priming position) and with the switch off, operate the starter pedal two or three times. Then move choker lever to S (starting position), turn on switch, and start the motor in the usual manner. Run the machine a few blocks with the choker lever in S (starting position) until the motor is warm; then move choker lever toward R (running position).

An intermediate position is provided which will be found very convenient during the warming up stage. Choker lever should be moved to R position as soon as practicable; running in any other position continuously will cause misfiring and will consume excessive fuel. With a warm motor, it will seldom be necessary to use choker lever.

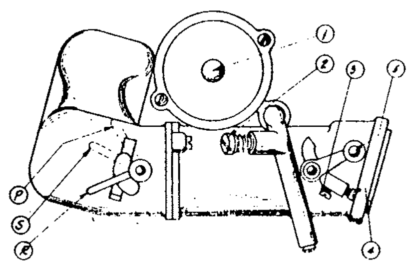


ILLUSTRATION NO. 1

P—Priming position;
S—Starting position;
R—Running position;
1—Float needle valve cap;
2—Idler adjusting knurled screw;
3—Throttle disc control screw;
4—Set screw;
5—Throttle lever.

If a motor is difficult to start, do not instantly condemn the carburetor but rather check over the spark plugs, valve tappets, and manifold joints and make certain that there is no water in the gasoline. Very often difficult starting is caused by improperly adjusted spark plugs, and poor carburetion is blamed. Sticky or gummy exhaust or intake valve stems and guides, improper valve tappet adjustments, water in the gasoline, a poor grade of gasoline or leaky manifold joints can also affect motor starting, much the same as poor carburetion.

### Carburetor Parts and Their Functions

In case it becomes necessary to take the carburetor apart for cleaning (which may be done without disturbing a single adjustment) it would be well to know the parts and their functions.

A float chamber, or bowl A, (Illus. No. 2), and a barrel, containing a system of fuel nozzles and air passages, B, are the principal parts. Fuel from the tank enters the Union Body D, and after being strained through the filter screen E, passes into the bowl through the float needle valve seat F. From the bowl to the motor fuel flows through different channels, in various quantities and proportions, depending on the size of the nozzles, the speed of the motor, and the degree of throttle opening.

To see if there is any gasoline in the carburetor, remove float needle valve cap G. If the needle valve can be depressed with the finger, there is no gasoline in the carburetor.

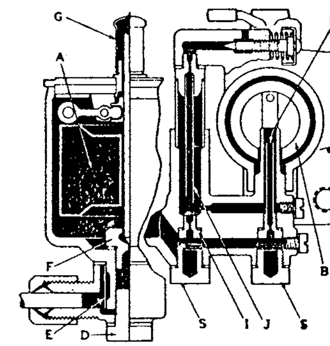



ILLUSTRATION NO. 2

A—Bowl;
B—Choke tube or venturi;
D—Gasoline union body;
E—Filter screen;
F—Float valve seat;
G—Float needle valve cap;
H—Main jet;
I—Compensating jet;
J—Atmospheric well;
S—Lower body plugs.

When the butterfly throttle valve is nearly closed and the motor is "turned over" there is a very strong suction at the edge of the butterfly where the idling hole is located. Under this condition of throttle opening little or no gasoline is supplied by the main and cap jets H. Gasoline from the bowl flows through the compensating jet I into the atmospheric well J, the suction then lifting it through the idling jet which has a calibrated opening at its upper end. At this point it meets a stream of air which is controlled by the knurled screw 2, (Illus. No. 1), the only adjustment which can be changed on the carburetor. The resulting mixture passes through the idling hole and on into the motor cylinders.

### Jet Combinations for Various Motors

| Description | JDCA JDCB | Factory No. | Price | JD JE | Factory No. | Price |
|---|---|---|---|---|---|---|
| Main jet, H, (Illus. No. 2) Standard .......... | 21 | MX1728D | .50 | 20 | MX1728C | .50 |
| Main jet, optional as explained below......... | 20 | MX1728C | .50 | 19 | MX1728B | .50 |
| Atmospheric well or idling jet, J, (Illus. No. 2).... | 45 | MX1724 | .45 | 45 | MX1724 | .45 |
| Compensating jet, I, (Illus. No. 2) Standard... | 22 | MX1729D | .35 | 20 | MX1729B | .35 |
| Compensating jet, optional, as explained below..... | 21 | MX1729C | .35 | 19 | MX1729A | .35 |
| Choke or venturi....... | 23 | MX1733A | 1.50 | 21 | MX1733 | 1.50 |
| Float needle valve seat, F, (Illus. No. 2)........ | 38 | MX1720 | .35 | 38 | MX1720 | .35 |
| Identification mark on carburetor ............. | CA | | | JD | | |

It will be noted that the two types of carburetors are not interchangeable without changing jets and venturi. Any of these parts can be ordered from us in the regular way.

For special occasions or to meet with the characteristics of certain motors, the jet combinations can be changed as follows:

If a motor tends to overload at moderate speeds or to consume too much gasoline, a No. 20 main jet can be fitted in the CA model, or a No. 19 main jet in the JD or JE model. If overloading is found at low speeds, it can in practically all cases, be eliminated by proper use of the idling adjustment.

The low speed (idling) adjusting screw 2 (Illus. No. 1) is to be used for varying the quality of the mixture; that is, turning it out makes the mixture leaner, while turning it in makes the mixture richer. If the screw is turned all the way in and the mixture is still too lean, the trouble undoubtedly is caused by air leaks in the manifold or inlet housings. This screw cannot be used to vary the idling speed of the motor.

The throttle valve or disc control screw 3 (Illus. No. 1) is used for this purpose. Turning it in makes the motor run faster; turning it out slows the motor down. This screw may be termed a quantity adjustment. These screws should be used in conjunction with each other. In an extreme case of loading at low speeds, a No. 21 compensating jet may also be tried for the CA model, or a No. 19 compensating jet for the JD or JE model. This jet makes for a smoother running motor at low speeds, but is not quite as good for acceleration or hill climbing. See that the idling jet is a 45. Some of the earlier carburetors were fitted with size 50 jets which had a slight tendency to overload.

All jets are plainly marked and through the aid of illustration No. 2 with the foregoing descriptive matter, the various jets and working members should be located without difficulty.

If you should happen to have a Zenith carburetor not functioning properly on one of your motors, we suggest that it be checked over. The jet sizes should correspond with the standard settings as mentioned above, for that particular model of carburetor.

## Care of the Carburetor

Keeping the carburetor free from dirt and water is the only care necessary. This should be done periodically by removing the Union Body D (Illus. No. 2), filter screen E, and lower plugs S, and cleaning the openings with gasoline, compressed air, or a straw. Do not use a wire or drill. It is very important that the filter screen be replaced and that it be in good condition. If it is dirty it will shut off the gasoline, and if it has holes, dirt can enter and stop up the jets. If necessary the entire carburetor can be taken apart and cleaned, without disturbing its adjustment; each part has its place and can go in no other. If, after a considerable period, the carburetor should not idle well, inspect and clear the atmospheric or idling well, which may be clogged from dust.

# Standard Factory Repair Prices

October 15th, 1924. Harley-Davidson Motor Co. Milwaukee, Wisconsin

WITH the help of this list, you can establish standard retail prices on factory repair jobs like cylinder regrinding, connecting rod rebushing and frame and fork exchanging. The chance of under- or over-charging the rider is eliminated.

You can exchange a damaged frame or other piece of equipment for a rider from your stock of repaired parts, and finish the transaction on the spot instead of having to wait until you learn the factory's charge.

If you supply a rider with a new part from stock in exchange for a damaged part, you can easily figure what allowance to make him.

In estimating the cost of repairs on frames and forks, remember that the prices quoted in the first part of this list are for labor only. To arrive at the repair cost, add the price of the needed new parts to the labor charge. You will find all frame and fork fittings listed herein. As an example, the cost of repairing a frame needing a new head and two casing clamps will be estimated as follows:

| | |
|---|---|
| Labor charge (as per this list) | $11.00 net |
| 1 — IE72P frame head | 3.75 |
| 2 — DE2 casing clamps @ .20 | .40 |
| | $15.15 |

Inspect carefully any part on which you quote a repair or exchange price. You may find, for example, that a frame which on first inspection seems to be out of line, has one or more cracked parts such as cylinder or casing clamps.

All prices on parts, except where otherwise noted, are list. Where list prices are not subject to the usual discount, net prices are shown. All labor prices are net. All quotations are subject to change without notice.

QUOTATIONS COVER ONLY SPECIFIED OPERATIONS

## Motor Repairs

***Pistons are always lapped in when cylinders are reground***

| | | | Retail Price |
|---|---|---|---|
| Regrinding 61″ cylinders and fitting over-size cast iron pistons, rings, piston pins and lock pins | Per set | Mat'l $ 6.44 list<br>Labor 5.63 net | .......... |
| Regrinding 74″ cylinders and fitting over-size cast iron pistons, rings, piston pins and lock pins | Per set | Mat'l 6.44 list<br>Labor 5.63 net | .......... |



**When cast iron piston motors are fitted with aluminum pistons, specify whether you want 1923 or 1924 type pistons because of the difference in piston pin sizes. To fit 1924 aluminum pistons or iron alloy pistons to an earlier than 1924, 1924 JD or FD, motor requires the fitting of 1924 connecting rods. Motors must be rebalanced when fitted with aluminum or iron alloy pistons. See prices below. Rebalancing instructions are furnished upon request.**

| | | | Retail Price |
|---|---|---|---|
| Regrinding 61″ cylinders, any model, and fitting 1923 over-size aluminum pistons (using 39/64″ piston pins), rings, piston pins and lock rings | Per set | Mat'l $11.60 list<br>Labor 7.25 net | .......... |
| Regrinding 61″ cylinders, any model, and fitting 1924 over-size aluminum pistons (using .790″ piston pins), rings, piston pins and lock rings | Per set | Mat'l $11.72 list<br>Labor 7.25 net | .......... |
| Regrinding 61″ cylinders, any model, and fitting over-size iron alloy pistons, rings, piston pins and lock pins | Per set | Mat'l $ 9.00 list<br>Labor 7.25 net | .......... |
| Regrinding 74″ cylinders, any model, and fitting 1923 oversize aluminum pistons (using 39/64″ piston pins), rings, piston pins and lock rings | Per set | Mat'l $11.60 list<br>Labor 7.25 net | .......... |
| Regrinding 74″ cylinders, any model, and fitting 1924 oversize aluminum pistons (using .790″ piston pins), rings, piston pins and lock rings | Per set | Mat'l $11.82 list<br>Labor 7.25 net | .......... |
| Regrinding 74″ cylinders, any model, and fitting oversize iron alloy pistons, rings, piston pins and lock pins | Per set | Mat'l $ 9.00 list<br>Labor 7.25 net | .......... |
| Reaming 61″ cylinders for 74″ exhaust valves | Each | Labor $ 1.00 net | .......... |
| Sandblasting and rewhitening cylinders | Per set | Labor 1.50 net | .......... |

***Cylinders are rewhitened only when specified.***

| | | | |
|---|---|---|---|
| Fitting oversize inlet housing clamp nut | | Mat'l $ .50 list<br>Labor 1.25 net | .......... |
| Rebushing 61″ or 74″ connecting rods at both ends and lapping steel bushings | Per set | Mat'l $ 2.16 list<br>Labor 1.56 net | .......... |
| Rebushing 61″ or 74″ connecting rods at both ends and fitting rollers, retainers and crank pin | Per set | Mat'l $ 5.36 list<br>Labor 2.19 net | .......... |
| Drilling 61″ or 74″ connecting rods | Per set | Labor 1.25 net | .......... |
| Rebalancing 61″ flywheels for use with aluminum or iron alloy pistons | Per set | Labor 1.88 net | .......... |
| Rebalancing 74″ flywheels for use with aluminum or iron alloy pistons | Per set | Labor 2.50 net | .......... |

***These prices apply only when flywheels without shafts are sent in.***

| | | | |
|---|---|---|---|
| Rebushing inlet lifter arms and fitting rollers and pins | Per set | Mat'l $ 1.00 list<br>Labor .63 net | .......... |
| Rebushing exhaust lifter arms and fitting rollers and pins | Per set | Mat'l $ 1.04 list<br>Labor .63 net | .......... |

## Motor Repairs — Continued

| | | | Retail Price |
|---|---|---|---|
| Refacing exhaust valve | Each | Labor .31 net | .......... |
| Fitting 1915 to 1922 type mechanical oiler with operating shaft and bushing | | Mat'l $ 1.35 list<br>Labor 1.25 net | .......... |
| Fitting 1923 to 1925 type mechanical oiler with operating shaft | | Mat'l $ .95 list<br>Labor .88 net | .......... |
| Rebushing transmission main shaft | | Mat'l $ .40 list<br>Labor .75 net | .......... |

# Generator Repairs

| | | Retail Price |
|---|---|---|
| Soldering and turning commutator | Labor $ 1.25 net | .......... |

> **NOTE**
>
> The price of a new armature is so low that it does not pay to rewind an old armature or replace a commutator. Spark coils with broken down windings or condensers, damaged cases or terminals, cannot be repaired. A charge will be made for testing and inspecting armatures and coils.

| | List |
|---|---|
| Repairing manual switch KK385 or MK385 | $1.20 |

# Carburetor Exchange Prices

*NOTE: We are now prepared to exchange worn Schebler H model carburetors for Schebler De Luxe carburetors. See prices below.*

| | Net | List |
|---|---|---|
| Exchanging worn 74″ or 61″ Schebler H model carburetor for a *rebuilt* H model carburetor | $4.00 | $ 5.75 |

*This exchange price does not include the cost of replacing missing parts like hot air connection or air valve casting.*

| | Net | List |
|---|---|---|
| Exchanging worn 74″ or 61″ Shebler H model carburetor with oversize throttle shaft, damaged bowl or broken body, for a *new* Schebler H model carburetor | 6.50 | 9.00 |
| Exchanging worn 1921 small bowl style 74″ Schebler H model carburetor for a *new* large bowl size carburetor | 6.00 | 9.00 |
| Exchanging worn Schebler H model carburetor, any model, for a *new* MK88A 1⅜″ Schebler DeLuxe carburetor, which fits all 1924 and 1925 motors and 1921 to 1923 74″ motors | 8.00 | 12.00 |
| Exchanging worn Schebler H model carburetor, any model, for a *new* LK744 1⅛″ Schebler DeLuxe carburetor, which fits 1917 to 1923 61″ motors | 7.50 | 11.25 |

# Motorcycle and Sidecar Frames, Forks and Tanks

Inspect Very Carefully Before Giving Estimate to Customer.

***These Prices Include Re-enameling, But No Material.***

## MOTORCYCLE FRAMES

***When luggage carrier studs are needed, add $1.00 net to the quoted labor charges.***

LABOR FOR REPAIRING FRAME REQUIRING

| | Net | Retail Price |
|---|---|---|
| Straightening only, no new parts | $6.00 to $ 8.00 | .......... |
| 2 casing clamps | 9.50 | .......... |
| 2 cylinder brackets | 9.50 | .......... |
| 1 axle clip | 9.50 | .......... |
| 1 rear fork | 9.50 | .......... |
| 1 rear stay | 9.50 | .......... |
| 2 casing clamps and 2 cylinder brackets | 10.00 | .......... |
| Head and 1 axle clip | 11.00 | .......... |
| Head and 1 rear fork | 11.00 | .......... |
| Head and 2 casing clamps | 11.00 | .......... |
| Top bar and 2 casing clamps | 11.00 | .......... |
| Lower bar and 2 casing clamps | 11.00 | .......... |
| Front loop bar and 2 casing clamps | 11.00 | .......... |
| Rear loop bar and 2 casing clamps | 11.00 | .......... |
| 2 rear stays | 11.00 | .......... |
| 2 rear forks | 11.00 | .......... |
| 1 rear stay and 1 rear fork | 11.00 | .......... |
| Seat Post Cluster | 12.00 | .......... |
| Gear Box Bracket | 12.00 | .......... |
| Head, seat post cluster and 2 casing clamps | 13.00 | .......... |
| Head, top bar and 2 casing clamps | 13.00 | .......... |
| Head, lower bar and 2 casing clamps | 13.00 | .......... |
| Head, front loop bar and 2 casing clamps | 13.00 | .......... |
| Head, rear loop bar and 2 casing clamps | 13.00 | .......... |
| Loop tube | 13.00 | .......... |
| Seat post cluster and upper bar | 13.00 | .......... |
| Seat post cluster and lower bar | 13.00 | .......... |
| Seat post cluster and rear loop tube | 13.00 | .......... |
| Head, top bar, lower bar and 2 casing clamps | 14.00 | .......... |
| Head, lower bar, front loop bar and 2 casing clamps | 14.00 | .......... |
| Head, top bar, front loop bar and 2 casing clamps | 14.00 | .......... |
| Head, top bar, rear loop bar and 2 casing clamps | 14.00 | .......... |
| Head, lower bar, rear loop bar and 2 casing clamps | 14.00 | .......... |
| Gear box bracket and rear stays | 14.00 | .......... |
| Gear box bracket and rear loop tube | 14.00 | .......... |
| Gear box bracket and loop tube | 14.00 | .......... |

***When a lower bar or loop tube is furnished the cost includes cylinder brackets or crank case clamps.***

## RIGID AND SPRING FORKS

***Always add lower head cone EE66P—32 cents list, to the rigid fork repair prices.***

| | Net | Retail Price |
|---|---|---|
| Labor for repairing rigid fork—no new fittings furnished | $2.50 to $3.00 | ........ |
| Labor for repairing rigid fork with one broken side, center stem or crown plate | 4.25 | ........ |

***It does not pay to repair a rigid fork having more than one broken fitting.***

| | Net | Retail Price |
|---|---|---|
| Labor for repairing spring fork—no new fittings furnished | 1.75 to 2.50 | ........ |
| Labor for repairing spring fork with one broken side, mud-guard bracket or tip | 3.50 | ........ |

***It does not pay to repair a spring fork having more than one broken fitting.***

## TANKS

| | Net | Retail Price |
|---|---|---|
| Labor for repairing damaged tank, depending upon extent of damage | $3.00 to $5.00 | ........ |

***It does not pay to repair a badly damaged 1917 to 1920 tank.***

## SIDECAR FRAMES

| | Net | Retail Price |
|---|---|---|
| Labor for repairing sidecar frame—no new fittings furnished | $ 9.50 | ........ |
| Labor for repairing sidecar frame needing one fitting | 10.50 | ........ |
| Labor for repairing sidecar frame needing two fittings | 12.00 | ........ |
| Labor for repairing sidecar frame needing three fittings | 13.00 | ........ |

# Re-enameling Motorcycle and Sidecar Parts in Olive Green, Brewster Green, or Harley-Davidson Gray

These prices include labor for cleaning and getting the parts ready for enameling. These prices do not include labor for stripping, assembling and repairing.

| | Net | Retail Price |
|---|---|---|
| Frame, motorcycle or sidecar | $ 1.80 | ........ |
| Set of forks | 1.80 | ........ |
| Single fork | .90 | ........ |
| Sport Model fork | 1.45 | ........ |
| Set of tanks | 2.50 | ........ |
| Sport Model tank | 1.80 | ........ |
| Mudguards, motorcycle or sidecar ....each | .90 | ........ |
| Sidecar body two passenger | 9.75 | ........ |
| Sidecar body one passenger | 9.00 | ........ |
| Tool box | .90 | ...... |
| Handlebars | .90 | ........ |
| Generator | 1.10 | ........ |
| Magneto | .90 | ........ |
| Set of Chainguards | 1.45 | ........ |
| Stand | .40 | ........ |
| Battery box | .90 | ........ |
| Wheels, motorcycle or sidecar ....each | .90 | ........ |
| Re-enameling all parts of a motorcycle after it is completely stripped and all fittings have been removed from parts | 15.00 | ........ |
| Re-enameling all parts of a single passenger sidecar after all fittings have been removed | 13.50 | ........ |

# List of Spare Parts to be Used in Estimating Repair Costs

This list is made up for estimating repair costs only.

## SPRING FORK PARTS

| | | | | |
|---|---|---|---|---|
| BC19 | Spring fork side | 1915 | T | $1.50 |
| EC19R | Spring fork side | 1916 to 1919 | T | 1.15 |
| IC19R | Spring fork side | All 1920 and 1921, 1922 and 1923 61″ models | T | 1.15 |
| KC19DR | Spring fork side | 1922 and 1923—74″ models all 1924 | T | 1.25 |
| NC19R | Spring fork side | 1925 | T | 1.15 |
| AC13 | Spring fork end | 1915 to 1925 | T | .50 |
| DC20 | Front mudguard support | 1915 | T | .70 |
| EC20 | Front mudguard support | 1916 to 1922—61″ models | T | 1.00 |
| LC20 | Front mudguard support | 1923—61″ models | T | 1.00 |
| KC20D | Front mudguard support | 1922 and 1923—74″ all 1924 and 1925 | T | 1.45 |

## RIGID FORK PARTS

| | | | | |
|---|---|---|---|---|
| BC100 | Rigid fork side | 1915 | T | $1.95 |
| EC100 | Rigid fork side | 1916 to 1923—61 models | T | 3.60 |
| KC100D | Rigid fork side | 1922 and 1923—74″ models all 1924 | T | 3.80 |
| NC100 | Rigid fork side | 1925 | T | 3.50 |
| AC2B | Rigid fork stem | 1915 to 1924 | T | .85 |
| NC2 | Rigid fork stem | 1925 | T | .95 |
| BC1B | Upper crown plate (1) | 1915 | T | .22 |
| BC1A | Lower crown plate (2) | 1915 | T | .20 |
| HC1 | Crown plate (2) | 1916 to 1923—61″ models | T | .16 |
| HC1A | Crown plate lower (1) | 1916 to 1923—61″ models | T | .16 |
| HC27 | Crown plate assembly | 1916 to 1923—61″ models | T | .80 |
| KC1D | Crown plate (3) | 1922 and 1923—74″ models, all 1924 and 1925 | T | .20 |
| KC27D | Crown plate assembly | 1922 and 1923—74″ models, all 1924 and 1925 | T | .95 |
| HO388 | Crown plate spacer (4) | 1915 to 1925 | | .04 |
| DC15 | Spring fork bracket | 1915 | T | 1.30 |
| EC15 | Spring fork bracket | 1916 to 1923—61″ models | T | 1.75 |
| KC15D | Spring fork bracket | 1922 and 1923—74″ models, all 1924 and 1925 | T | 2.00 |
| EC32 | Rigid fork side upper end | 1916 to 1924 | T | .35 |
| EC23 | Upper end splice | 1915 to 1924 | T | .10 |

## FRAME PARTS

(Three-Speed Frame)

| | | | | |
|---|---|---|---|---|
| IE72P | Frame head | 1915 to 1924 | T | $3.75 |
| NE35 | Frame head | 1925 | T | 4.25 |
| EE606A | Top bar with seat bar bracket | 1915 to 1924 | T | 2.10 |
| NE606A | Top bar with seat bar bracket | 1925 | T | 2.05 |
| FE609 | Lower bar with motor brackets | 1915 to 1924 | T | 2.09 |
| NE609 | Lower bar with motor blocks | 1925 | T | 1.85 |
| NE504 | Cylinder clamp block (2) | 1925 | T | .35 |
| DE93 | Tank strip (front) | 1915 and 1916 | T | .12 |
| DE75 | Tank strip (rear) | 1915 and 1916 | T | .10 |
| JE93 | Tank strip (front) | 1917 to 1924 | T | .10 |
| JE75 | Tank strip (rear) | 1917 to 1924 | T | .05 |
| NE622 | Tank screw block (5) | 1925 | T | .03 |
| EE1 | Seat post cluster | 1915 and 1916 | T | 1.55 |
| FE1 | Seat post cluster | 1917 to 1924 | T | 3.00 |
| NE1 | Seat post cluster | 1925 | T | 3.25 |
| FE607G | Loop tube (head to three-speed bracket) | 1915 to 1924 | T | 2.70 |
| EE171 | Front loop bar (head to casing clamp) | 1915 to 1924 | T | 1.20 |
| FQ86 | Front loop bar reinforcement (2) | For splicing EE171 to frame | T | .08 |
| NE618 | Front tube assembly (head to lower connection) | 1925 | T | 3.70 |
| IE505 | Handlebar control bracket | 1915 to 1924 | T | .10 |
| NE621 | Crank case and footboard bracket (1) | 1925 | T | .95 |
| NE620 | Lower frame connection | 1925 | T | 3.35 |
| FE608 | Rear loop tube | 1915 to 1924 | T | .75 |
| NE608 | Rear loop tube | 1925 | T | .85 |
| NE623 | Rear tube spring plug (at bottom) | 1925 | T | .06 |
| FE735 | Three-speed bracket | 1915 to 1924 | T | 5.10 |
| NE735 | Three-speed bracket | 1925 | T | 3.45 |
| EE19R | Rear fork only (lower) | 1915 to 1924 | T | .60 |
| NE19R | Rear fork only (lower) | 1925 | T | .55 |
| DE85R | Rear stay only (upper) | 1915 and 1916 | T | .90 |
| EE85R | Rear stay only (upper) | 1917 to 1924 | T | 1.10 |

| | | | | |
|---|---|---|---|---|
| NE85R | Rear stay only (upper) | 1925 | T | .95 |
| AE5 | Rear mudguard support | 1915 and 1916 | T | .55 |
| FE5 | Rear mudguard support | 1917 to 1924 | T | 1.00 |
| NE5 | Rear mudguard support | 1925 | T | .90 |
| DE2 | Crank case clamp | 1915 to 1924 | T | .20 |
| CE24P | Foot board support rod bracket | 1915 to 1924 | T | .45 |
| AE504A | Front cylinder clamp | 1915 to 1924 | T | .30 |
| FE706 | Rear cylinder clamp | 1915 to 1924 | T | .16 |
| DE36P | Seat bar bracket and bushing | 1915 to 1924 | T | .75 |
| NE36P | Seat bar bracket | 1925 | T | .35 |
| FE7 | Left side axle clip | 1915 to 1925 | T | 2.10 |
| FE6 | Right side axle clip | 1915 to 1925 | T | 2.10 |
| DE42 | Right luggage carrier stud | 1915 to 1925 | T | .12 |
| DE41L | Left luggage carrier stud | 1915 to 1925 | T | .12 |

## SPORT MODEL FRAME PARTS

| | | | | |
|---|---|---|---|---|
| WGE31 | Front bar only | All sport models | T | $ .95 |
| WIE41 | Rear bar only | All sport models | T | 1.05 |
| AWGE20 | Upper bar | All sport models | T | 2.30 |
| AWGE11 | Lower bar | All sport models | T | 1.05 |
| WGE70R | Rear fork (upper) | All sport models | T | .75 |
| WGE71R | Rear fork (lower) | All sport models | T | .85 |
| WGE7 | Frame head | All sport models | T | 3.00 |
| WGE32 | Front motor bracket | All sport models | T | 3.70 |
| WGE42 | Rear motor bracket | All sport models | T | 3.60 |
| WGE9 | Front connection for lower bar | All sport models | T | .95 |
| WIE10A | Rear connection for lower bar | All sport models | T | 1.00 |
| WGE8 | Seat post cluster | All sport models | T | 2.30 |
| AWGE23 | Seat bar bracket | All sport models | T | .45 |
| WGE85 | Rear mudguard support | All sport models | T | .90 |
| WGE62 | Left rear axle clip | All sport models | T | 2.20 |
| WGE52 | Right rear axle clip | All sport models | T | 2.20 |
| WGD15 | Handlebar cluster forging (where bar joins fork) | All sport models | T | 3.00 |

## SIDECAR FRAME PARTS, SINGLE PASSENGER

| | | | | |
|---|---|---|---|---|
| GQ33 | Main bar (next to motorcycle) | 1918 to 1923 | T | $3.50 |
| MQ33 | Main bar (next to motorcycle) | 1924 | T | 5.20 |
| NQ33 | Main bar (next to motorcycle) | 1925 | T | 5.90 |
| DQ6P | Axle tube (rear bar assembly) | 1915 to 1923 | T | 3.00 |
| MQ6RA | Axle tube (rear bar assembled) | 1924 and 1925 | T | 5.50 |
| EQ37 | Side bar (away from motorcycle) | 1915 to 1925 | T | 1.00 |
| GQ36A | Front bar | 1918 to 1923 | T | 1.35 |
| MQ36A | Front bar | 1924 and 1925 | T | 1.55 |
| JQ121R | Truss bar, front (diagonal) | 1918 to 1923 | T | 1.90 |
| MQ121R | Truss bar, front (diagonal) | 1924 and 1925 | T | 2.15 |
| JQ7R | Truss bar, rear (diagonal) | 1918 to 1923 | T | 1.60 |
| MQ7R | Truss bar, rear (diagonal) | 1924 and 1925 | T | 1.65 |
| DQ9 | Connection for main bar and axle tube | 1915 to 1925 | T | .75 |
| NQ933 | Connection for main bar and axle tube | 1925 | T | .65 |
| EQ76 | Connection for side bar and axle tube | 1916 to 1925 | T | 1.90 |
| DQ8 | Connection for main bar (center and front) (2) | 1915 to 1925 | T | .70 |
| GQ15 | Truss bar center connection | 1918 to 1925 | T | 1.65 |
| IQ16 | Truss bar and main bar connection | 1918 to 1925 | T | .45 |
| GQ38P | Connection for side and front bar | 1918 to 1925 | T | 1.15 |
| GQ10 | Frame brace bracket | 1918 to 1924 | T | .80 |
| NQ10 | Frame brace bracket | 1925 | T | 1.10 |

# Mechanics' Bulletin

No. 102 June 10, 1926 Harley-Davidson Motor Co., Milwaukee, Wis., U. S. A.

## Complete Timing Instructions for Harley-Davidson Motors

All models from 1915 to date—except 1918 and earlier single cylinder models and the opposed twin cylinder sport model. Instructions for these models furnished on request.

The arrangement of this bulletin is as follows:



## The Valves

### How They Operate in Relation to Piston

If the valve operating mechanism (cam gear, lift arms, etc.) is removed from the timing gear case of a motor, and the motor then turned, the valves will stand still and the piston will move up and down in the cylinder without any distinguishing strokes other than just up and down. But when the valve operating mechanism is assembled in gear case and the valves thereby made to operate in a fixed relation to piston travel when motor is turned, each stroke of piston has its particular function to perform in the series of events required for each power impulse, namely: Taking fresh gas into cylinder, compressing the gas, delivering the energy of the burning gas, and expelling the burned gas. The fresh gas is admitted and the burned gas expelled through ports in the cylinder head which are opened and closed by the action of the valves; therefore, the valves must open and close at just the right time in relation to piston travel.

Four strokes of the piston (two up and two down) are required for each power impulse. The purpose of each stroke and the action of the valves during the strokes are as follows:

No. 1 Intake stroke—Piston going down taking in fresh gas. The intake valve opened shortly before piston passed over top center and started down on this stroke. Valve remains open during full stroke and closes after piston has passed bottom center and traveled upward a short distance on next (compression) stroke.



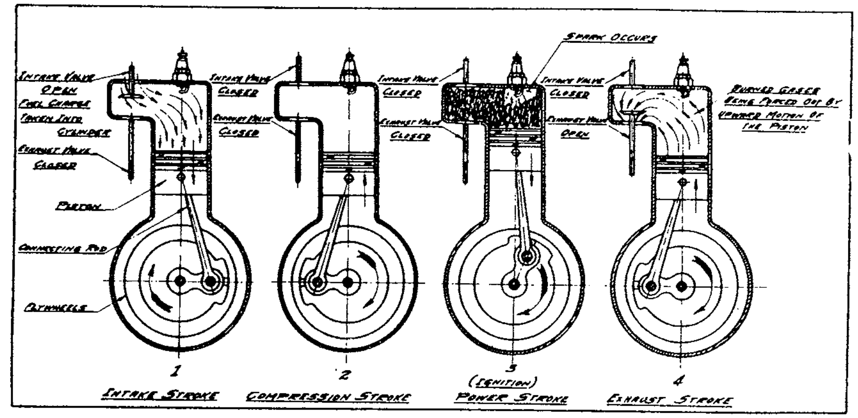



ILLUSTRATION NO. 1
**Graphically Explains the Four-Stroke-Cycle Principle**

No. 2 Compression stroke—Piston coming up and compressing gas in cylinder head. Both valves are closed. (Ignition should be timed to occur shortly before piston reaches top center on this stroke. The exact timing is given under "Ignition Timing").

No. 3 Power stroke—Piston going down under the pressure of the burning gas. Both valves are closed nearly the full stroke. (Exhaust valve opens shortly before piston reaches bottom center).

No. 4 Exhaust stroke—Piston coming up, forcing out burned gas. Exhaust valve opened shortly before piston reached bottom center on last (power) stroke. It remains open the full exhaust stroke and closes after piston has passed top center and traveled down a short distance on next (intake) stroke.

This explanation of the valve action applies to all Harley-Davidson motors, whether single or twin cylinder models. On twin motors, the two cylinders are timed in relation to each other, so that they deliver power impulses alternately; that is, when either cylinder is delivering a power impulse, the other cylinder has completed just half of the events required for its next power stroke (piston is going down on intake).

The exact valve timing in relation to piston, which varies for different motors, and correct method of obtaining valve timing for all stock models from 1915 to date (except 1918 and earlier single cylinder models and the opposed twin sport model, which are covered in separate bulletin) are explained hereafter under various headings which indicate the particular models the data may be applied to.

### Read These Cautions

Piston positions in motor timing are determined from either top (upper) or bottom (lower) dead centers. Dead center is point at extreme top or bottom end of piston travel—the point where piston is "dead." Be very careful that you do not become confused where the timing specifications indicate "before or after top or bottom center." In locating the piston in any of these positions, it must be understood that the motor is to be *turned in the direction in which it runs.*

When checking valve timing, valve tappets must be very accurately adjusted, as per instructions below; otherwise, timing will not check right even though cam gear is correctly meshed with pinion gear. Then, when turning motor to find point where valves start to open or are fully closed, be extremely careful that you turn motor to just the right point, because a little variation at tappets means a comparatively big difference in piston position. The exact time of valve opening and closing can be determined easily by turning push rod or tappet while motor is being turned slowly. When push rod or tappet begins to tighten or loosen, the valve is starting to open or just closing.

# Twin Motor Valve Timing

## Valve Tappet Adjustment

### Twin Motors

When making adjustments to valve tappets, motor must be cold in order to obtain accurate results. Compression release lever must be in running position. Turn motor to a position where you are sure that tappet to be adjusted is in its lowest position.

Adjust exhaust tappet and inlet push rod clearance as follows:

Exhaust tappets—1915-16 models

Front—.006″ (.15mm) clearance.

Rear—.004″ (.1 mm) clearance

Exhaust tappets—1917 and later models

Front and rear—.008″ (.2 mm) to .010″ (.25 mm) clearance.

Inlet push rods—All models 1915 to date —.002″ (.05 mm) to .004″ (.1 mm) clearance between inlet lever and end of valve stem.

## To Time Valves According to Gear Marks

### Twin Motors

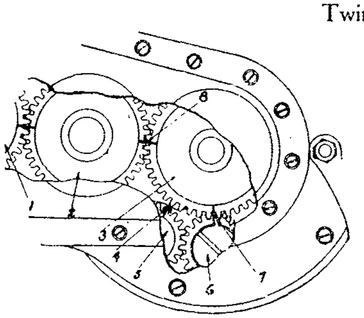


ILLUSTRATION 2

*Twin Motor Timing Gears*

1—Oiler and intermediate gear; 2—Intermediate gear; 3—Secondary or cam gear; 4—Breather valve "A" timing mark on case; 5—Breather valve gear; 6—Pinion or main shaft gear; 7—Pinion and secondary gear marks correctly aligned; 8—Secondary and intermediate gear marks correctly aligned.

In all twin motors since 1915, the cam gear (secondary gear) and pinion gear are marked so that if cam gear is removed, it can be replaced in correct time without going to the trouble of actually checking valve openings and closings against piston position.

Illustration 2 shows the gear marks correctly aligned.

Secondary gear 3 is marked in two places. Fit it to motor with one of marks registering with marked tooth on pinion gear 6 and other mark facing intermediate gear 2. The pistons and cams will then be in proper relation and the valves will open and close at the right time, *provided tappet and push rod adjustments are correct.*

## To Time Valves Without Aid of Gear Marks

### Twin Motors

If the gear marks have been removed, the valves can be timed as follows: In this case motor should be out of frame and cylinder plugs removed so that a 6″ scale can be inserted against the head of piston in order to determine exact piston position in relation to top and bottom centers. Also, timing gear case should be removed.

First, fit cam gear onto its stud, regardless of timing, and get both exhaust tappets accurately adjusted to correct clearance. Then remove gear. Set front piston 1/8″



(3.18 mm) *past top center* and insert gear back into place with exhaust cam lobe upward, midway between front and rear lift arms. Next, hold front exhaust lift arm up as far as tappet will permit, and at same time shift cam gear *to the right*, one gear tooth at a time, until the last position is found where gear can be inserted without overlapping and being blocked by the exhaust lifter arm roller. When this position is found, the gear should be in correct time and, at most, very likely isn't more than one gear tooth out of the way. To make sure, check the valve openings and closings in both cylinders, against piston positions, as per following specifications. After exhaust valve timing is found to be correct, timing gear case and inlet push rods can be assembled to motor and inlet valve timing then checked. However, as both cams are integral with the one gear, the inlet valves are bound to be in time, when the exhaust valves are correctly timed.

## Exact Piston Positions Where Valves Should Open and Close

### Twin Motors

### 1915-1916

Intake Valve opens when piston is 1/16″ (1.59 mm) to 3/32″ (2.38 mm) before top center (Piston coming up on exhaust stroke).

Intake Valve closes when piston is 1/8″ (3.18 mm) to 1/4″ (6.35 mm) after bottom center (Piston starting up on compression stroke).

Exhaust Valve opens when piston is 5/8″ (15.9 mm) to 3/4″ (19 mm) before bottom center (Piston going down on power stroke).

Exhaust Valve closes when piston is 1/32″ (.79 mm) to 1/16″ (1.59 mm) after top center (Piston starting down on intake stroke).

### 1917 to Date

Intake Valve opens when piston is 3/16″ (4.76 mm) to 5/16″ (7.94 mm) before top center (Piston coming up on exhaust stroke).

Intake Valve closes when piston is 3/4″ (19 mm) to 7/8″ (22.2 mm) after bottom center (Piston starting up on compression stroke).

Exhaust Valve opens when piston is 5/8″ (15.9 mm) to 3/4″ (19 mm) before bottom center (Piston going down on power stroke).

Exhaust Valve closes when piston is 1/16″ (1.59 mm) to 1/8″ (3.18 mm) after top center (Piston starting down on intake stroke).

## The Breather Valve and How to Time It According to Marks

### Twin Motors

The relief or breather valve is provided to allow the crank case compression to be expelled when the pistons descend. Besides relieving the crank case compression, the breather valve controls the lubricating system to a large degree. The importance of correct timing for this valve is therefore obvious.

When marks on pinion and cam gears are in perfect alignment, the breather valve gear must be meshed with pinion gear so that marked tooth on breather gear aligns with the "A" stamped in crank case just above breather bushing. Illustration 2 shows correct breather valve timing according to gear marks.

## To Time Breather Valve Without Aid of Gear Marks

### Twin Motors

The breather gear must be set so that port in sleeve of valve is open 1/16″ (1.59 mm) to 3/32″ (2.38 mm) *when front piston* is on exact top dead center. Opening must be on *forward* side of port in crank case. Valve continues to open as motor is turned in the direction in which it runs, and closes when piston is near bottom center.

# Valve Timing 21.09 Cu. In. (350 CC) Single Cylinder Side by Side and Overhead Valve Motors

## Valve Tappet Adjustment

Overhead and Side by Side Valve 21.09 cu. in. Singles

The important things to be remembered when adjusting tappets on the single cylinder motor are: Motor must be cold. Compression release lever (de-compressor lever on overhead valve motor) must be in downward position. Be sure that motor is turned so that tappet to be adjusted is in its lowest position. Adjust tappets to the following clearances:

Side by Side Valve Motor—
Intake and Exhaust—.004″ (.1 mm) to .005″ (.125 mm) clearance.

Overhead Valve Motor—
Intake and Exhaust—.002″ (.05 mm) to .003″ (.076 mm) clearance. (This clearance to be measured between end of valve stem and rocker arm).

## To Time Valves According to Gear Marks

Overhead and Side by Side Valve 21.09 cu. in. Singles

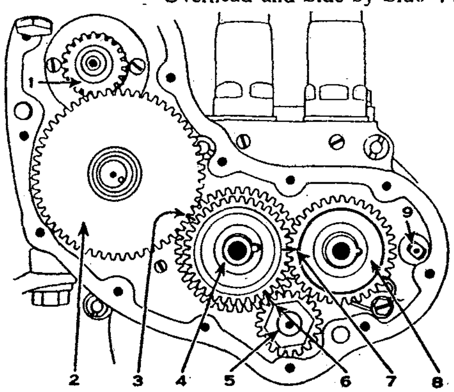


ILLUSTRATION 3
*Timing Gears—Single Cylinder Generator Equipped Motor*
1—Generator gear; 2—Intermediate gear; 3—Mark on inlet cam gear 4, with which, marks on gears 1 and 2 are lined up **in a magneto equipped motor.** (Gears 1 and 2 are not marked, in generator equipped motors); 4—Inlet cam gear; 5—Pinion gear; 6—Marks on pinion gear and inlet cam gear correctly aligned; 7—Marks on inlet and exhaust cam gears correctly aligned; 8—Exhaust cam gear; 9—Compression release lever stud.

The valve timing gears are marked so that if removed, they can be replaced in correct time as shown in Illustration 3. The inlet cam gear 4, which is a compound gear, is marked in three places 3-6-7. Assemble gears in case with one of marks on gear 4 in alignment with mark on pinion gear 5, another mark in alignment with mark on exhaust cam gear 8, and third mark facing gear 2. The cams will then be timed in proper relation to piston, and if tappets are correctly adjusted, valves will open and close at right time. Assemble the other two gears 1-2 as per instructions under "To Time Ignition."

## To Time Valves Without Aid of Gear Marks

Overhead and Side by Side Valve 21.09 cu. in. Singles

If the gear marks have been removed, the valves can be timed as follows: If a side by side valve motor, remove cylinder head so that piston position can be determined. If an overhead valve motor, the piston position can be determined by inserting a 6″ (150 mm) scale through spark plug opening.

First, fit cam gears 4-8 (Illus. 3) into case, regardless of timing, and get tappets accurately adjusted to correct clearance. Then remove both gears. Set piston ⅛″ (3.185 mm) before top center and then insert inlet cam gear 4 back into place with the cam lobe *forward* of intake tappet. Next, hold the tappet up snug against



valve and shift cam gear *to the left*, one gear tooth at a time, until last position is found where cam will still clear tappet and allow gear to be inserted. This is correct position for this gear.

Now turn motor in direction in which it runs until piston stands ⅛″ (3.185 mm) after top center. This requires only a slight movement of motor. Insert exhaust cam gear 8 with its cam lobe *forward* of exhaust tappet. Then, hold tappet up snug against valve and shift gear *to the left* one tooth at a time, until last position is found where cam will clear tappet and allow gear to be inserted. Both gears should now be in correct time, and, at most, will not be more than one tooth out of the way. To be sure that timing is correct, check the valve openings and closings against piston position, as per the following specifications. Before doing this checking, fit gear case cover so that gears will be supported and held in correct alignment.

## Exact Piston Positions Where Valves Should Open and Close

Side by Side Valve—21.09 cu. in Single

Intake Valve opens when piston is 1/8″ (3.18 mm) to 3/16″ (4.76 mm) before top center (Piston coming up on exhaust stroke).

Intake Valve closes when piston is 7/16″ (11 mm) to 9/16″ (14.3 mm) after bottom center (Piston starting up on compression stroke).

Exhaust Valve opens when piston is 7/16″ (11 mm) to 9/16″ (14.3 mm) before bottom center (Piston going down on power stroke).

Exhaust Valve closes when piston is 1/8″ (3.18 mm) to 3/16″ (4.76 mm) after top center (Piston starting down on intake stroke).

Overhead Valve—21.09 cu. in. Single

Intake Valve opens when piston is 3/32″ (2.38 mm) to 5/32″ (4 mm) before top center (Piston coming up on exhaust stroke).

Intake Valve closes when piston is 7/16″ (11 mm) to 9/16″ (14.3 mm) after bottom center (Piston starting up on compression stroke).

Exhaust Valve opens when piston is 7/16″ (11 mm) to 9/16″ (14.3 mm) before bottom center (Piston going down on power stroke).

Exhaust Valve closes when piston is 3/32″ (2.38 mm) to 5/32″ (4 mm) after top center (Piston starting down on intake stroke).

## To Time Breather Valve

Overhead and Side by Side Valve 21.09 cu. in Singles

Single motors are provided with two breather valves, which must be open during down stroke of piston to release crank case compression, and closed on up stroke of piston to cause a vacuum or suction in crank case, which is necessary for proper lubrication. These valves are simply ports in both cam gear shafts which at proper time register with ports in gear shaft bearings in gear case cover. These shafts are held in a fixed relation to the gear by means of pins in the shafts. So when cam gears are correctly fitted into gear case, according to gear mark or by other methods of timing, the breather ports are bound to be timed correctly.

# Ignition Timing

Theoretically, ignition should occur as the piston reaches top dead center on compression stroke, when the gas in cylinder head will be compressed to the limit. However, there is a short lapse of time after spark occurs before complete combustion; so in order to have the burning gas exert the maximum pressure on the piston just as it passes over top center, ignition is always timed to occur when the piston is a little distance before top center, on compression stroke. This distance varies for different types of motors, being governed by the compression of motor, whether it is for solo, sidecar or other heavy duty service, and various other things. To enable the operator of a machine to get the best motor performance under all service conditions, the circuit breaker of ignition unit is so constructed that it can be retarded or advanced a limited distance at the will of the operator, thereby changing the time of ignition in relation to piston position. Exact timing specifications for all models from 1915 to date are given below (except 1918 and earlier single cylinder models and the opposed twin sport model, which are covered in a separate bulletin).

## Time All Motors With Circuit Breaker in Fully Advanced Position

As the timing specifications below give the maximum distance that piston may be before top center when spark occurs, the circuit breaker (spark) lever must be in fully advanced position when timing a motor. The rider cannot then advance the spark too far for best motor performance, under normal service conditions.

## Circuit Breaker Points Must Be Accurately Adjusted

Be sure to adjust circuit breaker point gap to following specifications *before timing a motor*, because, if point gap is improperly adjusted when timing motor, and then later the gap is adjusted correctly, the timing will be affected to some extent.

Adjust point gap as follows:

| | | |
|---|---|---|
| All Generators | .....020″ | (.5 mm) |
| Bosch Magneto | .....016″ | (.41 mm) |
| Berling Magneto | .....018″ | (.46 mm) |
| Dixie Magneto | ......020″ | (.5 mm) |

## Spark Occurs as Circuit Breaker Points Just Start to Open

On a twin cylinder generator model, the front cylinder is timed with *narrow end* of circuit breaker cam.

21.09 cu. in. single cylinder generator model has a one cam circuit breaker.

On a twin cylinder magneto model, the front cylinder is timed with rear interrupter cam of a Bosch magneto, or the lower interrupter cam of a Berling magneto.

21.09 cu. in. single cylinder magneto model has only one interrupter cam.



## Locating Compression Stroke and Setting Piston for Ignition Timing

Twin and Single Cylinder Motors

When timing a twin motor, it makes no difference whether the timing is set with the front or rear cylinder piston, provided proper circuit breaker cam is used; however, it is customary to time with front piston. In order to locate piston just right distance before top center, a 6″ (150 mm) scale can be inserted through cylinder plug hole in cylinder head of a twin motor, through spark plug hole on an overhead valve single, while on the side by side valve single, cylinder head should be removed.

Directly after intake closes (turning motor in the direction in which it runs), the piston is coming up on compression stroke. Get the piston on exact top dead center of this stroke, and then back motor up until piston stands the correct distance before top center, as per following specifications.

## Ignition Timing Specifications

### "L" Model Motor

Valve timing — Same as Standard motor.

Ignition timing — 13/32″ to 7/16″.

### "H" Model Motor (2 cam)

Valve timing —

Inlet valve opens when piston is 1/4 to 3/8 before top center.
Inlet valve closes when piston is 13/16 to 15/16 after bottom center.
Exhaust valve opens when piston is 9/16 to 11/16 before bottom center.
Exhaust valve closes when piston is 1/4 to 5/16 after top center.
Ignition 11/32″ to 13/32″.

### Equipped Motor

As all timing gears, including the magneto drive gear, are marked in motors equipped with magneto, these motors can be timed close enough to correct timing so that they will run satisfactorily, by simply assembling the timing gears with all marks in alignment. First, set cam and pinion gears with their marks in alignment as shown in Illus. 2, if a twin motor, or Illus. 3, if a single motor, and then carry alignment of marks right through to magneto gear. The timing obtained by this method is likely to be very accurate and in every case will be close enough to accurate so that motor will perform satisfactorily. However, play in magneto gear keyway, and lash or play between the gear teeth due to wear, allows some variation, so this method should not be depended upon as accurate enough to be used in shop practice. To be sure of accurate timing, it is recommended that shop mechanic, after setting timing according to gear marks, check piston position against circuit breaker setting, and make adjustments as necessary to correct the timing to specifications given on page 8 for particular type of motor being timed.

The magneto gear keyway is cut considerably wider than key fitted in armature shaft. This allows the position of gear on shaft to be changed slightly. In case a motor, after being timed according to gear marks, doesn't check accurately according to piston position and circuit breaker point opening, simply loosen armature shaft nut and magneto gear slightly and shift armature shaft a trifle in gear. Then tighten shaft nut and check timing again. If necessary the shaft key may be filed thinner to allow more movement of shaft in gear, in order to obtain exact timing.

## To Time Ignition in a Harley-Davidson or Remy 235 Generator Equipped Twin Cylinder Motor—According to Gear Marks and Circuit Breaker Setting

The generator drive gear and small compound or double intermediate gear that meshes with it are not marked. However, a motor can be timed close enough to correct so that it will perform satisfactorily by setting circuit breaker in proper relation to pinion and cam gear marks and without reference to piston position. This method should not be considered accurate enough to be used exclusively in shop practice; however, it can be used in emergencies when necessary to make a quick job of ignition timing while motor is assembled in frame.

Assemble pinion, cam and breather gears 6-3-5 into gear case with their marks in perfect alignment as shown in Illus. 2. Intermediate gears 1-2 may also be fitted into case, disregarding their marks. (These marks are used when timing a magneto model). Fit generator gear to armature shaft and tighten shaft nut. Don't as yet fit the small compound, or double, intermediate gear that meshes with generator gear. Next, after accurately adjusting the circuit breaker point gap, set circuit breaker (spark) lever in full advanced (forward) position, and then turn generator in direction in which it operates (to left) until *narrow end* of circuit breaker cam has separated contact points about $\frac{1}{2}$ to $\frac{3}{4}''$ of their full opening. Steady the generator in this position and after noting that marks on pinion and cam gears are still in perfect alignment, fit the small compound or double gear into place. See Illus. 4.

This gear may not slip into mesh freely on first attempt due to its teeth not registering properly with teeth on the generator and intermediate gears, but as the teeth on this double gear are staggered, a position can always be found, by turning the gear a tooth at a time, where it will slip into mesh freely without changing position of either of the two gears with which it meshes.



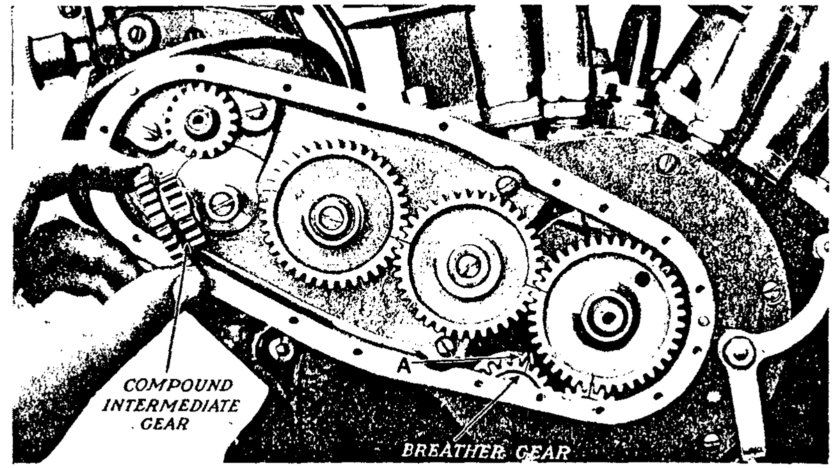



ILLUSTRATION NO. 4
**Timing Ignition According to Gear Marks and Circuit Breaker Setting**

## To Time Ignition in a Harley-Davidson or Remy 235 Generator Equipped Twin Cylinder Motor—Without the Aid of Any Marks

Use this more accurate method, when timing a motor that is out of frame and on bench where cylinder plug can be removed to allow a 6" scale to be inserted against piston in order to determine its exact position. This method is also sometimes applied when timing a motor while assembled in frame, a piece of wire being inserted through spark plug opening in order to locate piston. However, timing cannot be set as accurately with motor in frame.

Assemble pinion, cam, and breather gears 6-3-5 into gear case with their marks properly aligned as shown in Illus. 2, or, if gear marks have been removed, assemble the gears so that valves and breather are correctly timed as per valve timing instructions. Intermediate gears 1-2 may now be fitted into case, disregarding their marks. (These marks are used when timing a magneto model). Fit the generator gear to the armature shaft and tighten the shaft nut. Don't as yet fit the small compound, or double, intermediate gear that meshes with the generator gear. Now set the FRONT piston on compression stroke the correct distance before top center as per specification for the type of motor being timed. (Note—Timing may be set with either front or rear piston; however, it is customary to time by front piston). Remember that compression stroke occurs directly after the intake valve closes. Next, set circuit breaker (spark) lever in full advanced (forward) position, and then turn generator in the direction in which it operates (to left) until *narrow end* of circuit breaker cam is just starting to separate the contact points. Steady the generator in this position and after noting that piston has not been moved from setting just made, fit small compound or double gear into place. This gear may not slip into mesh on first attempt, due to its teeth not registering properly with teeth on generator and intermediate gears, but as teeth on double gear are staggered, a position can always be found, by turning gear a tooth at a time, where it will mesh freely without changing position of either of gears with which it meshes.

After timing has been completed, it is advisable to recheck it, by turning the motor back slightly, and then carefully turning it ahead until contact points just start to separate. Then check piston position to see if it is correct distance before top center. Due to lash or play in the gear train, it is sometimes necessary to go through the timing operation two or three times before timing will check just right.

## To Time Ignition in a Generator Equipped 21.09 Cu. In. Single Cylinder Motor—According to Gear Marks and Marks on Timer Base

### Side by Side and Overhead Valve Motors

The generator drive gear and intermediate gear that meshes with it are not marked; however, by means of cam and pinion gear marks and marks cut in top edge of timer base, a motor can be timed with a fair degree of accuracy without any reference to piston position, etc. This method should not be considered accurate enough for shop practice.

Assemble pinion and cam gears 5-4-8 in gear case with their marks in perfect alignment, as shown in Illus. 3. Fit generator gear 1 (Illus. 3) to armature shaft. This gear is located in position on armature shaft with a key, and is provided with three key ways, so that it can be located in a position that will allow accurate timing. Fit any one of keyways over key temporarily. Turn armature shaft nut (left hand nut) up lightly. Next, hold a 6 inch scale 3 (Illus. 5) or some small straightedge, tight and squarely against flat side of circuit breaker cam 2, and turn generator until scale or straightedge is in alignment with marks 1, cut in the top edge of timer base. Steady generator in this position, and after observing that marks on pinion and cam gears are still in alignment, as explained above, fit intermediate gear 2 (Illus. 3) into the case. Do not move either generator or cam gear in order to allow gear 2 to slip into mesh. If it will not slip into mesh freely on first attempt because of its teeth not registering properly with teeth on gears with which it must mesh, change position of generator gear on armature shaft by removing gear and turning it so that one of its other two keyways registers with key; then try again. After timing is complete, tighten armature shaft nut.

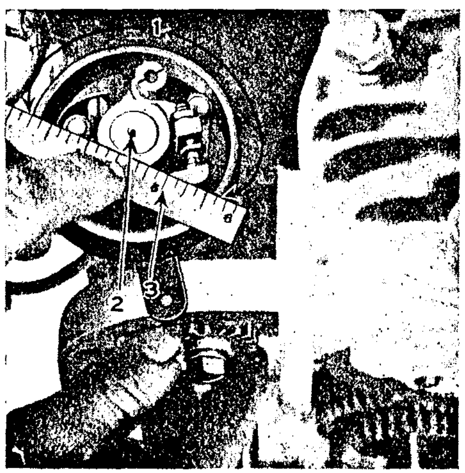



ILLUSTRATION 5

*Setting the Circuit Breaker to Time Ignition in Single Generator Model*

1—Timing marks cut in timer base; 2—Circuit breaker cam; 3—Six inch scale used as straightedge.



## To Time Ignition in a Generator Equipped 21.09 Cu. In. Single Cylinder Motor—Without the Aid of Any Marks

### Side by Side and Overhead Valve Motors

On the side by side valve model it will be necessary to remove the cylinder head so that exact piston position can be determined. On overhead valve model, piston can be located accurately by inserting a 6" scale through spark plug hole.

First assemble pinion and cam gears 5-4-8 into gear case according to their marks as shown in Illus. 3; or, if any or all marks have been removed, assemble gears so that valves are correctly timed, as already explained. Fit generator gear 1 to armature shaft. This gear is located in position on armature shaft with a key, and is provided with three keyways so that it can be located in a position that will allow exact timing. Fit any one of keyways over key temporarily. Turn armature shaft nut (left hand nut) up lightly. Now set piston on compression stroke, correct distance before top center, as per specifications for type of motor being timed. Remember that compression stroke occurs directly after intake valve closes. Next with circuit breaker (spark) lever in full advanced (forward) position, turn generator in direction in which it operates (to left) until circuit breaker cam has just started to separate contact points. Steady generator in this position, and, after noting that piston has not moved from setting just made, fit intermediate gear 2 into gear case and into mesh with generator and cam gears. If gear 2 will not slip into mesh freely on first attempt due to its teeth not registering properly with teeth on generator and cam gears as they are set, do not turn either motor or generator in order to line gears up so they will mesh, but change position of generator gear on armature shaft by removing gear and turning it so that one of its other keyways registers with key. Then go through the timing operation again. It may be necessary to shift generator gear to third keyway before accurate timing can be obtained. After timing is completed be sure to tighten armature shaft nut.

## Valve and Ignition Timing For 37 Cu. In. Single Cylinder C. D. Model Built in 1921-22

The valve tappet and push rod adjustments, valve timing specifications (including breather timing), and timing methods described for twin cylinder motor can be applied to this model, as it is simply a twin 74" motor with one cylinder removed.

Ignition should be timed to occur when piston is 1/4" (6.35 mm) to 9/32" (7.14 mm) before top center on compression stroke. Use the same methods for timing as described for twin cylinder models.

# SERVICE SHOP DOPE

October 10, 1927

## TWO RING PISTONS (74" AND SINGLE)

We no longer furnish three (3) ring iron alloy pistons for 74" and Single motors. The 61" iron alloy piston still has three rings.

We have found two ring pistons in the sizes mentioned to be more satisfactory, and they are now supplied on all parts orders.

The two and three ring pistons are interchangeable. For instance, it is all right to use one two ring and one three ring piston in servicing a Twin motor.

The same part numbers as applied to three ring pistons (74" — 253-24 — Single 251-26) now apply to the two ring pistons.

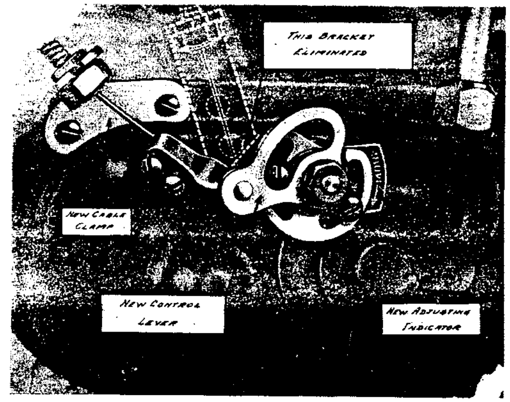
## THE AIR CLEANER MUST BE CORRECTLY FITTED

The air cleaner for maximum efficiency must be turned so that the dirt outlet at connection end is directly downward. If in any other position there will be some restriction to free escape of dirt sucked into cleaner, and as a result some will pass through into motor.

The air cleaner properly fitted means longer motor life, and we, therefore, suggest that you make it a point to see that this unit is correctly fitted in every case.

# SERVICE SHOP DOPE

Nov. 14, 1927




New Oiler Control Arrangement

## CHANGE IN TWIN OIL PUMP CONTROL

We now have an improved pump control arrangement, which will greatly lessen the possibility of the rider catching the control cable with his foot when cranking motor, resulting in a bent and unworkable control or other damage. It also eliminates entirely the pump body control clamp bracket, and thus the possibility of breakage at this point due to a strain on the cable as mentioned above, or some other accident. It not only brings the control cable closer to the gear case and out of the way of the rider's foot, but also leads it to the pump at a different and easier operating angle. The new control coil clamp bracket is an entirely separate fitting and in case of some strain on the cable, bending or damaging the bracket, the pump itself will not be harmed.

This new arrangement is easily and quickly adaptable to any of the earlier 1928 twin models now in service. In case of an accident with a machine equipped with the original control arrangement, resulting in the control clamp bracket being broken off the pump body, it is not necessary to replace the pump. Simply cut off and smooth up with a hacksaw or file the remaining stub of pump body bracket and then attach the new fittings.

You can obtain these new fittings on parts order. A complete combination necessary to make the change over, together with instructions for fitting, will be furnished, if you order part #711-28, price $ .80 list. Better order out a set or two and have them on hand.

SERVICE SHOP DOPE

November 21, 1927

## TO RENEW BUSHINGS IN SINGLE TRANSMISSION

Countershaft gear bushings can be removed with an old twin model pinion gear shaft. Place the large end of gear on an old Single piston turned bottom side up, and then drive the two bushings out. After pressing in new bushings, use reamer #4.

The bushing in low speed gear can be removed in the same manner, except that an old sprocket shaft is used to drive it out. This bushing has a shoulder on the dog side of gear and, therefore, has to be driven out from the opposite side. Size new bushing with reamer #4.

To remove clutch gear bushing, first, cut a few threads in bushing with a 3/4" tap, and after inserting a bolt of the same size, drive against inner end of bolt. Size new bushing with reamer #2.

The two countershaft bushings can be removed from gear box by driving or pressing them out with an old upper connecting rod bushing. When putting a new bushing in gear box cover (starter side), be sure that the flat side of bushing is facing main shaft bearing, so as to allow proper clearance for countershaft sprocket. After new bushings are pressed in, assemble the gear box and cover, and pull the screws up tight to be sure that cover is in proper location. Then, with line reamer #3, ream both bushings in one operation. This will insure perfect alignment of bearings.

The gear shifter shaft bushing has a shoulder on the outer end and, therefore, has to be pressed or driven out from the inside of case. This can be accomplished by working thru the inspection hole in top of case. Use reamer #1, to size new bushing.

### FRONT BRAKE COVER BEARING

When a new bushing is fitted in brake cover, it can be sized on the twin model with reamer #4 - on the single model with reamer #2.

SERVICE SHOP DOPE

December 27, 1927

## TO SPOKE FRONT WHEEL ( BRAKE TYPE )

### STARTING SPOKES IN HUB

First, mark a starting point on each side of hub as follows. Draw a line, radially true with hub center, from any one of the brake shell attaching rivets, to the rim of shell. This line will come between two of the spoke holes. Locate the rivet in right side spoke flange that is directly opposite brake side line rivet, and draw a similar line to rim of right flange. On this side the line will register exactly with one of the spoke holes

Insert spokes in brake side first. Holding hub with brake shell downward, and starting line toward you, insert the first spoke in the hole just to the left starting line. Then working from this point insert a spoke in every <u>second</u> hole all the way around the hub, leaving the holes between for the spokes to be inserted from other side of flange. The hub can now be turned over (brake shell upward) and spokes inserted in the remaining ten holes. We now have ten outer spokes (spokes inserted from inside of flange), and ten inner spokes (spokes inserted from outer side of flange). Do not as yet start spokes in right side of hub.

### STARTING SPOKES IN RIMS

With the hub standing upright on the bench, brake shell downward, place the rim over hub, WITH THE TIRE VALVE hole toward you. The hub must be turned SO THAT STARTING LINE POINTS TOWARD YOU. A hole in your bench in which to insert the axle, thus allowing the spoke flange to rest flat on bench makes the job of lacing easier. Be sure to place the rim with the proper side up. You can determine this by placing a spoke nipple in a hole on each side of rim and noting on which side the nipple sets at the greatest angle. The side that shows the greatest angle is the brake side and should go downward. Now, you are ready to start the spokes in the rim. Remember all spokes now in hub go to the lower row of rim holes. First, take inner spoke, makred "starting spoke No. 1" (3rd spoke right of starting line) to the hole in rim just to the right of tire valve hole. Start nipples on spokes as they are inserted through rim. The balance of the inner spokes can now be started easily. The INNER spoke next to starting spoke No. 1 will go to the second hole from it in the rim, and so on around the wheel, every other rim hole (bottom row) being left vacant for the outer spokes.

Next, note that the hub is still standing in proper relation to rim so that the spokes lead from the hub at an angle corresponding to the angle of the rim holes in which they are fitted. The outer spokes can now be laced into place. Start with outer spoke marked "starting spoke #2. (3rd spoke left of starting line) and insert it in the second tire rim hole (bottom row) to the right of tire valve hole. The wheel can now be turned other side up to make it more convenient to get at these outer spokes. The outer spoke next to starting spoke No. 2 will go in the first vacant hole from it in the rim and so on around the wheel. With this side of the wheel properly laced, every spoke crosses three.

### INSERTING SPOKES AND LACING RIGHT SIDE

With the wheel turned brake side downward, fill the right side flange with spokes,- inserting all twenty of them from the outside (upper side) of flange. The spoke heads will all be on the one side of flange.

To start the first spoke on this side in the rim, turn the wheel so that starting line on hub is toward you, and take spoke marked "starting spoke" No. 3 (1st spoke left of starting line - NOT THE SPOKE WITH WHICH THE LINE REGISTERS) to the fourth rim hole (top row) on the right of tire valve hole. Now take the second spoke from this starting spoke to the second hole from it in rim, and so on around the wheel, leaving every other spoke free and every other rim hole vacant. This leaves ten spokes to be crossed with those just laced in. Start this group with the spoke which registers with the starting line. "starting spoke No. 4", taking it to the fourth rim hole (top row) on the left of tire valve hole. The second spoke from this starting spoke will go to the next vacant hole from it in rim, etc. With this side of wheel properly laced every spoke crosses four.

The wheel can now be trued and the nipples tightened in the usual way. To determine that spokes are so tightened that rim is true sideways with center of hub, lay a straight-edge across brake end of axle sleeve and measure the distance from straight-edge to rim. On a singe wheel the correct measurement is 1.029" (approx. 1-1/32" - and on a twin wheel 1.756" (approx. 1-3/4"). If a wheel is laced with the rim off center any appreciable distance the machine in which it is used may have a tendency to pull to one side.

SERVICE SHOP DOPE

January 9, 1928

KEEP THE FRONT WHEEL BRAKE CONTROL PROPERLY CONNECTED

Three connection holes are provided in the front brake operating lever on twin models. At just which of these holes the control cable is connected makes a decided difference in the pressure that can be applied to brake bands, by operating the hand lever. The braking power is thus adjusted to load and traction.

In the case of a machine used with sidecar, the control should be connected in the end holes (makred SC) to give most positive braking.

For solo service the connection should be made at the hold marked (Solo) furthest from end of lever, so that rider cannot apply brake with enough pressure to lock wheel when driving on slippery or loose surfaced roads.

The center hole is provided as an intermediate for the sidecar driver who desires a less positive brake - or the solo rider who wishes more positive brake action.

When attaching or detaching sidecar, the brake control connection should at the same time be shifted accordingly - particularly when detaching sidecar, because using a machine solo with the brake connected up for sidecar service there is more possibility of applying brake with enough pressure to cause skidding. This holds particularly at this time of the year in localities where the roads are a lot of the time wet, icy, or covered with snow, and consequently traction uncertain.

We, therefore, suggest that you caution your riders - particularly your solo riders - regarding proper connection of the brake control, and thus lessen the possibilities of skidding and spills.

SERVICE SHOP DOPE

No. 416 February 20, 1928

HERE ARE SOME SERVICING TIPS ON THE FRONT WHEEL BRAKE

A free working control is one of the first essentials to smooth and effective braking. A sticky, hard working control means that considerable of the pressure applied at the hand lever is lost in control friction. Frequent lubrication of every part of the control arrangement will keep it working freely.

Should you have any complaint of the brake chattering at times, examine the controls and see if the cable is sticking in the control coil, or the brake operating shaft sticking and binding in its bearing in the brake cover, preventing the brake shoes from returning to their normal positions when hand lever is released. Such condition is only the natural result of neglected lubrication. A liberal application of oil the full length of control and also a few drops at the hand lever and operating shaft bearings (the operating shaft on the latest machines is provided with alemite fitting) will free the control action, and very likely the chattering will be entirely eliminated. On the latest machines two brake shoe springs, instead of one as on early machines, are provided to give more positive action in returning shoes to full released position.

In some cases of chattering, it may be found that, while the control is free in action, it is adjusted so tight as to hold the shoes continually expanded to the point where the bands are almost touching the drum, even with the hand lever in full released position. With control so adjusted, if the wheel bearings happen to have a little more than the normal amount of play, or the brake assembly has some play in its center bearing, the brake bands and drum will come in contact occasionally, and a chatter is the likely result. The control should be so adjusted that the hand lever can be compressed about 1/4 to 1/3 of its full movement before the brake begins to take effect.

Of course, as the brake center bearing becomes worn to the extent that the brake assembly has considerable play or shake, there will be an increased tendency toward chattering. This also hold true in case of excessive play in the wheel hub bearings. With everything perfect, the bands have only a few thousandths inch clearance from drum, so you can readily see what happens if there is too much shake in the hub or brake. Check the adjustment of wheel hub bearings now and then, and keep the brake bearing in good condition, by renewing the cover bushing when worn. A temporary repair to take up play is sometimes made by simply fitting a thin shim washer between the brake assembly and its thrust washer. When this method is used, care must be taken that the shim washer is not thick enough to bind the assembly.

After a new brake center bushing has been pressed into place, it must be reamed to correct size. The twin model requires a 7/8" reamer, and the single a 11/16" reamer. Both of these sizes are incorporated in the set of four reamers furnished for servicing the single transmission (part #12660-26)

The brake shackle bushings will not ordinarily need to be renewed very often. These bushings on the twin model require a 5/8" reamer to size them on the single, a .4915" reamer.

PART NUMBERS ON BRAKE AND SHACKLE BUSHINGS

| | | |
|---|---|---|
| 4115-28 | -- Center Bushing - Twin | $ .40 List |
| 4116-28 | -- Center Bushing - Single | .35 " |
| 4131-28 | -- Shackle Bushing - Twin (2) | .35 " |
| 4132-28 | -- Shackle Bushing - Single (2) | .30 " |

Now as to the control cable and coil, and the various lengths used on different models - you have no doubt noticed that on the first few machines equipped with front brake, the control was passed down between the frame head and fork, and thence down along the outside of fork. On later machines, the control is shortened and leads from the handlebar directly down the fork side. The latter arrangement has less bends and gives a freer operating control. When it becomes necessary to service the control on one of the early machines, it is adviseable to shorten and arrange it as on the late machines.

The correct lengths are as follows:

| | | |
|---|---|---|
| Twin models with Standard Bars | Control Cable 52¼"<br>Control Coil 48½" | (Includes end fittings) |
| Twin Models with Short Bars | Control Cable 49¼"<br>Control Coil 45¼" | (Includes end fittings) |
| Single Models with Standard Bars | Control Cable 43¼"<br>Control Coil 40 " | (Includes end fittings) |
| Single Models with Short Bars | Control Cable 40 3/4"<br>Control Coil 37½" | (Includes end fittings) |

On early machines where the control was passed through the forks, the lengths of the coil and cable were in each case 3" more than the lengths given above. Remember this, if you retain the original arrangement of control, when servicing an early machine.

Control cable and coil are furnished on parts order in only one length - cable 56" with one end fitting attached - coil 48½". Both must be cut to correct length for the particular model on which they are to be used. Before cutting cable, apply a light coating of solder at the point where cutting is to be done. This will prevent the ends of cable from fraying out, making it difficult to insert it thru coil. After cable has been inserted, the other end fitting must be attached. This is quite a particular job because the end must stand considerable strain, and unless very securely attached, it may pull off. We suggest doing the job as follows:

After placing the end fitting on cable, but before soldering it fast, spread the end of cable as much as possible by driving a small tack between the strands and leaving it there. A brass tack or brad about 1/2" long is best for this job. The end can now be soldered fast. The best job can be done by dipping it in a pot of molten solder. If, however, such facilities for soldering are not available, a satisfactory job can be accomplished with an ordinary soldering iron. The iron should be very hot so that the solder will flow freely between the cable strands. Use a 50-50 grade of solder. The ordinary wire solder is not hard enough for this job.

# SERVICE SHOP DOPE

No. 422 April 2, 1928

## FITTING GEAR STUD PLATE TO "H" MOTORS

Before placing gear stud plate in crank case, see that the ends of the gear studs fit in the holes provided from them in the gear case cover.

Always place an old piston, bottom end up, under the crank case in such a position that the gear stud plate hole rests directly over the piston. This prevents the crank case from becoming knocked out of shape. Pean over the dowel pin hole in the crank case because it is necessary that the pin be a press fit, and variation in manufacture may prevent the hole in the gear stud plate from lining up exactly with the original hole.

Allow the ends of the gear studs to remain in the gear case cover. Start the gear stud plate in the crank case. Place a block of wood on the outside of the gear case cover and tap lightly with a hammer, driving the gear stud plate in the crank case far enough to start the gear stud plate bolts and a few timing gear case cover screws. Alternate driving the gear stud plate, and drawing the screws and bolts up lightly until the gear stud plate in in position and the screws and bolts have been tightened. The timing gear case cover and now be removed and the ends of the gear stud plate bolts riveted over to prevent loosening.

Ream (use 1/2" reamer) or file out the dowel pin hole and drive the dowel pin into place, peaning over the edge of the dowel pin hole in the gear stud plate to prevent it from coming out.

Before timing the motor, make sure the gears have the proper amount (.003") of backlash and do not bind on the studs.

## REMOVING & FITTING TAPPET GUID BLOCKS & ROLLER TAPPETS

(Read carefully before attempting to remove or fit guide block or roller tappets)

Tappet guide blocks can be removed from "H" motors without disassembling the motor by removing only the inlet housings and the exhaust valves. This can be done while the motor is in the frame.

Remove the timing gear case cover and the cam gears. Remove the inlet and exhaust valve tappet adjusting screws, so that when driving the guide blocks out, the roller tappets will remain in the case. If the tappets are allowed to come out with the guide blocks, one corner of the lower, or forked part, will cut a groove in the aluminum and cause an oil leak. This also applies when replacing the guide blocks, but it is necessary to reverse the above directions, starting the stems of the tappets in the guide blocks from the inside of the case.

When removing or replacing the guide block, use a light hammer and a block of wood, tapping on the block of wood. When replacing the guide block, place a block of wood at an angle on the edge of the uppermost part of the guide block. Placing the block of wood directly across the top of guide block will dent the top and ruin it.



Before fitting lower part of the tappets in the guide blocks, see that the roller tappet stems are a free fit in the holes machined for them in the guide blocks. If the lower part of the tappets bind in the guide blocks, file tappets until they fit freely with no noticeable clearance.

Before fitting a new tappet guide block, pean over the edge of the dowel pin hole in the timing gear case to compensate for any difference there may be in the position of the dowel pin hole in the guide block. Use machinist's blue to determine if the rollers ride squarely on the cam lobes. Shift the guide block to make the rollers run squarely on the cams, then drill or ream out the dowel pin hole so the dowel pin is a drive fit.

Time the ignition so the spark occurs 11/32" to 13/32" before top center on compression stroke.

# SERVICE SHOP DOPE

No. 423

April 9, 1928

## NEW ENAMELING PRICES

The following is an up-to-date list of prices for re-enameling motorcycles, sidecars, package trucks and parts; also a list of extra charges for new parts enameled in the standard optional colors. These prices cover enameling charges only. They do not include the cost of any necessary repairs. KEEP THIS LIST AS A PERMANENT RECORDS. ALL PRICES ARE NET AND SUBJECT TO CHANGE WITHOUT NOTICE.

| Parts | STANDARD COLORS Single Olive Green | STANDARD COLORS Twin H-D Grey; Brewster Green; Olive Green | STANDARD OPTIONAL COLORS Single Coach Green; Police Blue; Maroon; Azure Blue | STANDARD OPTIONAL COLORS Twin | Add to cost of new parts |
|---|---|---|---|---|---|
| Complete Motorcycle | $13.00 | $15.00 | $15.60 | $18.00 | - |
| Complete Sidecar (LT or LX) | - | 12.50 | - | 15.00 | - |
| Complete Sidecar (QT) | - | 15.00 | - | 18.00 | - |
| Sidecar Body (LT OR LX) | - | 8.50 | - | 10.20 | - |
| Sidecar Body (QT) | - | 10.00 | - | 12.00 | - |
| Truck Body (MWP) | - | 15.00 | - | 18.00 | - |
| Truck Body (MXP) | - | 12.50 | - | 15.00 | - |
| Truck Body (MW) | - | 10.00 | - | 12.00 | - |
| Frame (Motorcycle) | 1.80 | 1.80 | 2.15 | 2.15 | $.70 |
| Frame (Sidecar/Truck-Narrow Tread) | - | 2.00 | - | - | - |
| Frame(Sidecar/Truck-Wide Tread) | - | 2.25 | - | - | - |
| Spring Fork | .75 | .90 | .90 | 1.10 | .40 |
| Rigid Fork | .90 | .90 | 1.10 | 1.10 | .50 |
| Set of Tanks | 2.00 | 2.25 | 2.40 | 2.70 | 1.20 |
| Mudguards (each) | .90 | 1.00 | 1.10 | 1.20 | .50 |
| Tool Box | - | .75 | - | .90 | .40 |
| Handlebars | .60 | .60 | - | - | - |
| Generator | .50 | .50 | - | - | - |
| Magneto | .25 | .25 | - | - | - |
| Headlamp | .60 | .60 | - | - | - |
| Tail Lamp | .25 | .25 | - | | |
| Horn | .50 | .50 | - | - | - |
| Set of Chainguards | 1.25 | 1.25 | 1.50 | 1.50 | .60 |
| Stand | .60 | .60 | .70 | .70 | .20 |
| Battery Box | .75 | .80 | .90 | .95 | .70 |
| Wheels-Each (including spokes) | 1.25 | 1.25 | - | - | - |
| Motorcycle Luggage Carrier | 1.00 | 1.00 | 1.20 | 1.20 | .35 |
| Set of Sidecar Springs | - | .80 | - | - | - |
| Sidecar Tire Rack and Luggage Carrier | - | 1.50 | - | 1.80 | - |

FOR ALL OTHER COLORS EXCEPT CREAM OR WHITE, ADD 60% TO STANDARD COLOR PRICES.
FOR CREAM OR WHITE, ADD 80% TO STANDARD COLOR PRICES

# SERVICE SHOP DOPE

No. 425

April 23, 1928

## EXTRA SPRING FOR FRONT WHEEL BRAKE

TO INSTALL EXTRA SPRING IN FRONT WHEEL BRAKE SHOE DRILL 3/16" HOLE MIDWAY AND ON INSIDE LINE OF ELONGATED HOLES ALREADY IN SHOE.

The front wheel brakes on all machines now leaving the factory are equipped with two springs. The new spring (part no. 4125-28A for twin and 4126-28A for single) is connected across the two brake shoes on the same side as the brake operating stud.

This additional spring insures positive action the moment the pressure on the hand lever is released.

# SERVICE SHOP DOPE

July 26, 1928

## THE CLUTCH PULL ROD AND BEARING

Should you experience any clutch pull rod or pull rod bearing trouble, see if the three studs in the actuating plate on that particular machine aren't fitting too tightly in their holes in the clutch outer disc, preventing the actuating plate from acting freely.

The actuating plate must fit freely enough so that when the clutch is fully engaged (pedal all the way forward), the actuating plate will be forced outward by its spring to the full limit of pull rod adjustment, thus keeping a light tension on the pull rod bearing and holding the balls and races in alignment.

With the actuating plate studs fitted too tightly, the plate is not forced outward by its spring to the limit of the pull rod adjustment, when clutch is fully engaged, and the balls and races of the pull rod bearing are then free to wobble and run out of alignment. This condition is likely to damage the bearing, and in some cases the head of the pull rod may be badly worn or even twisted off.

If you will watch this point, and also see that pull rod is properly adjusted and its bearing greased occasionally, you will have no pull rod trouble.

When you find a tight fitting actuating plate, its studs can easily be aligned with a hammer to give the desired free fit.

# SERVICE SHOP DOPE

No. 444

September 3, 1928

## KEEP MUFFLER SLOTS CLEAN

The slots of the new 4 tube mufflers are narrower than those on earlier mufflers. This construction is highly efficient in promoting quietness of operation, provided the slots are kept open and free of soot and dirt.

With all muffler slots clean there is sufficient room for the exhaust gases to escape freely without appreciable back-pressure. Inspect the muffler frequently to be sure all the slots are kept clean. If they're clogged, clean them thoroughly with a stiff piece of wire or a hack-saw blade.

A clean muffler will go a long way toward insuring good motor performance - a dirty, clogged muffler will almost certainly result in overheating, loss of power, and a sluggish running job.

Instruct your men in the shop and have them pass the tip along to the riders - TO KEEP THE MUFFLER SLOTS CLEAN -- BUT DON'T WIDEN THE SLOTS BECAUSE DOING SO WILL DEFEAT THE PURPOSE OF THE 4 TUBE PRINCIPLE.

# SERVICE SHOP DOPE

## THE 45" MODEL

Here are some recent 45 motor improvements that can be worked into the early motors already in service. We are all "up on our toes" to keep this new model performing satisfactorily right from the start, and very likely you will want to go as far as practical in installing any improvements in the earlier machines, without waiting for possible difficulties to turn up. We will cooperate to the limit in helping you do this.

### GENERATOR DRIVE SHAFT

To overcome some generator drive shaft key shearing difficulties which showed up in the first machines assembled, we have made the gear a tighter press fit at each end and are using much stronger keys. These changes were made before many machines were shipped, and you are not likely to run into difficulties along this line, except with the very first machines put in service. The key shearing occurred largely at the left, or bevel gear end of the shaft.

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Lately we have found that in many cases the bevel gear shaft has a tendency to slowly but gradually work out of the gear, even though it still remains a tight press fit. As this shaft works out, it butts against the right side shaft and forces the right side generator drive gear against the thrust boss on the cam gear case cover, sometimes with such force as to cut and wear the thrust boss quite badly. A squeaking noise in the gear case is an indication of this condition. To overcome this we are now fitting a pin or rivet through one of the breather holes in the bevel gear and shaft. This not only prevents the shaft from working out, but also gives double assurance of no further key shearing trouble at this end. This pin is fitted in all new motors with numbers above 29D3403.

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The generator drive shaft bearing in the right side crank case was originally an unbushed bearing just a reamed hole in the aluminum case. A few cases have been found where for some reason or other this bearing has become badly cut and enlarged, allowing the right side drive shaft a great deal of play. This condition is evidenced by a bad clatter or noise in the gear case, particularly when accelerating from slow speeds. As soon as we learned of this trouble we immediately installed a bronze bushing. This bushing has been fitted in all motors with numbers above 29D3404, as in the case of the bevel gear pin mentioned above.

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If you should run into any of these difficulties, here's what you should do: if you find either a right or left side generator drive shaft with its key sheared, and the shaft quite loose in its gear rather than a press fit as it should be, you had better replace that particular part of the assembly (gear and shaft) and send the original parts in to us for replacement. Of course, if it happens to be a bevel gear key that shears, and you find the shaft still a fairly good fit in the gear, it will not be necessary to replace the assembly because fitting a new key and also the pin or rivet described before will secure the assembly so that there is no further danger of key shearing.



As for the rivet and bushing, it will take you only a short time to install these in your own shop. It is not necessary to remove motor from frame for either job. A special line reamer is required to ream out the case for the bronze bushing. We will loan you this reamer for the asking. We haven't had enough of these reamers made up so that we can loan them out to all dealers at the same time, but we have quite a number on hand and it is our idea to circulate them among the dealers as needed. We suggest the advisability of fitting both the pin and bushing, but particularly the pin, on all the machines you have in service (below 29D3404), rather than taking a chance on everything going along all right, or in other words waiting for trouble to develop. If you wish to do this, just advise us accordingly and we will send you the special reamer together with the necessary bushings and rivets -- also detailed instructions for fitting.

Don't in any case be satisfied to make a "patch job" of servicing this generator drive shaft. We would much rather replace a few drive shaft assemblies than to gamble on the satisfaction of the early purchasers.

### THE COUNTERSHAFT SPROCKET

In connection with the very first machines assembled we found a few cases of key shearing at the countershaft sprocket. Naturally the keyways, particularly the sprocket keyways, were sometimes damaged as a result. This trouble was discovered quickly and the necessary changes were immediately made. The sprocket keyway was cut enough deeper to allow fitting key 2279-26, which is the same key used to secure the inner clutch disc, and a much stronger key than the one originally used in the sprocket. Since these changes were made there has been no further key shearing. Should you experience any difficulties along this line with the first machines sold, we suggest that you install this later combination. Only latest style sprockets will be supplied on parts orders.

Although no such trouble has been experienced on the single cylinder model, the change has been applied to this model as well. Any countershaft sprockets with the shallow keyway that you may have in stock can be used up on the Single.

Incidentally, we will soon announce some new tools for the 45 model, and among these is a proper wrench for the engine and countershaft sprocket nut. This will make it possible to more securely tighten these sprockets, than has been possible in the past with the wrenches available.

### INNER FRONT CHAIN GUARD SCREWS

If one of the two screws which attach the inner chain guard to crank case happens to loosen and work out, it may drop into the chain and do some damage to chain or sprockets, or possibly both. You don't need to worry about anything like this happening on the later machines because for some time a shake-proof lock washer has been fitted under the head of each screw. Only the first few hundred machines were assembled without these lock washers, and if you happen to have any of these machines in your territory, they are the ones where you might find the screws loosened. We would suggest that as you have the opportunity to inspect the first machines sold you note whether or not these lock washers are fitted, and if not, put them in. With the lock washers fitted and the screws pulled up tight there is no danger of their coming out. The part number of this shake-proof lock washer is RO-2730.

## CHAIN LUBRICATION

There has been some comment that the front chain does not receive sufficient lubrication from the motor through the oiling arrangements provided. As a matter of fact we have made no particular claims that it would. In designing the 45 motor we went as far as practical in providing for chain lubrication through the engine sprocket and breather, but you are very likely to find that as a general thing additional lubrication is required. A removable plate is provided on the chain guard to allow for chain greasing and inspection

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It might be possible in some odd cases that the chain does not get normal lubrication from the motor, because of lubricating bushing 421-26 having turned from its original position, thus putting oil ways out of alignment. Unlike any of our other models, the 45 motor has an oil hole drilled inside the left crank case, directly above the sprocket shaft bushing, and when lubricating bushing 421-26 is properly fitted, a groove in its face registers with this oil hole. Oil feeds down to the groove in the bushing face, outward into the sprocket, and then works through the sprocket on to the chain. Naturally if the groove in bushing face does not line up with oil hole, the oil supply will be cut off or at least reduced considerably. On the later machines this lubricating bushing is locked in position by means of a short dowel pin through its face and projecting a little distance into the aluminum case

In the earlier motors even though this dowel pin was not fitted, there is only a slight chance of the bushing shifting its position: however, we ran into two or three cases where it had and this is what prompted fitting the dowel pin. Although this is rather an important point, it is not of such importance that you will need to pull down motors simply to check oil-way alignment. We are calling the matter to your attention, and when you do have a motor apart for any reason, you can check the alignment and if the bushing has shifted, locate it properly and secure it with a dowel pin.

This duplex chain, if properly lubricated will give surprisingly good mileage. On the other hand if run dry, big mileage can hardly be expected. Instruct your riders to remove the inspection plate and apply some grease to the chain occasionally.

## HIGH COMPRESSION HEADS

Here is some dope on something you have very likely been wondering about. Last week the Weekly New Bulletin carried an announcement of the DL model 45. You were told that this new model is a higher compression solo machine, with increased pep and speed. Possibly when you get a few of these jobs in service some of the fellows who bought early 45's will raise a howl because the other fellows have more speed. We can furnish you with special heads and other parts to "soup-up" any of the machines you already have in service. Here's what you'll need and what it will cost:

| | | |
|---|---|---|
| 1-RA78TD | High Compression Front Head | $5.00 List |
| 1-RA78TE | High Compression Read Head | 5.00 List |
| 1-RK90T | 7/8" Venturi | .96 List |
| 1-RF33TB | 28T Rear Sprocket | 3.00 List |

SERVICE SHOP DOPE

October 22, 1928

TO INSTALL RIGHT SIDE GENERATOR SHAFT BRONZE BUSHING WHERE NONE WAS ORIGINALLY FITTED

This job does not require removing motor from frame. Simply remove footboards, bevel gear cover (#1537-29) and cam gear case cover, and take out the complete cross drive assembly with center coupling. It will also be well to remove front exhaust cam gear to allow more room to work.

Now with the special reamer furnished for this job at hand, fit the reamer pilot bushing in left side bevel gear shaft bronze bushing and insert reamer from right side of case. After stuffing some rags or waste in the forward end of cam gear case to catch the chips, proceed to ream out hole. Ream a trifle more than 1-1/16" deep or, in other words, deep enough so that bushing will drive in flush with outside of case. It will be necessary to remove the reamer and clean the chips from it several times before the required depth is accomplished. When reaming is complete, thoroughly clean the hole before installing bushing.

Now slip the new bushing on to generator drive shaft (#633-29) WITH THE NOTCHED END OF BUSHING NEXT TO GEAR, and start shaft and bushing into case. Following this method of installing will insure getting the bushing started straight. This is important because the aluminum box is now rather thin on one side of hole, and starting the bushing out of alignment with hole in case might result in a crack at this point. The reamer furnished is of a size to allow the bushing about a .0025" press fit, and this is not tight enough so that there is any danger of damaging case if bushing is kept in alignment.

Before driving the bushing further into case, note that bushing is so turned that the hole near inner (starting) end is in just the right alignment to meet the oil hole originating on upper side of bearing boss, not far from the end, and drilled at an inward angle through the aluminum. Incidentally, this oil hole must be thoroughly cleaned out after reaming because it sometimes becomes completely plugged with chips. Unless this oil hole is open and registers with the hole in bushing, this end of the drive shaft will not get sufficient lubrication and trouble is likely to result.

After carefully following instructions this far, force the bushing into case by driving against the gear with a hammer and soft blunt punch or block of hard wood. Bushing must be driven in flush with case to maintain original end clearance for gear.

Next, pull out the gear and shaft or if by any chance bushing has closed up enough to pinch shaft, drive shaft and gear out from left side of motor, using a small diameter rod. An oil groove must now be cut in face of bearing boss to register with notch in end of bushing. This can be done easily with a small round nosed chisel.



The next operation is to smooth up the inside of bushing. If the reamer pilot bushing has not already been removed from bevel gear shaft bushing, take it out and lay it aside. Then, inserting the reamer from this side of case, turn the short reamer on end of pilot through the newly installed bushing. This bushing is already reamed to correct size as furnished, but when driving it in the ends may be burred and of course it might possibly in some cases close up a trifle. The short reamer on end of pilot is provided for smoothing up and to safeguard against a change in size. Our specifications call for fitting this bearing .001" to .0015" loose.

This completes the job and all parts can now be re-assembled, after carefully cleaning all chips from gear case. If the original drive shaft bearing was found in bad condition and as a result the shaft itself is cut and worn considerably it had better be renewed. Apply oil liberally to all bearings as parts are reassembled. Since some of the oil which ordinarily remains in gear case with cover removed has been wiped out while cleaning out chips, it will be well to pour a small initial supply of fresh oil over gears just before replacing cover. If the front exhaust cam gear and possibly other gears were removed, they must be replaced according to markings, however the generator drive gear requires no timing. Timing the cam gears according to marks, also automatically times the ignition, provided the circuit breaker and timer assembly as a unit has not been taken apart. Simply removing this assembly does not affect timing.

Before replacing the cam gear case cover on a motor in which trouble has been experienced with the generator bevel drive gear shaft working out of gear, as explained fully elsewhere, always note the condition of the cover thrust boss which takes the end thrust of generator drive gear. If it is cut and grooved considerably smooth with a file.

# SERVICE SHOP DOPE

October 22, 1928

## TO INSTALL PIN IN BEVEL GEAR AND SHAFT

Remove left footboard front stud nut. Footboard can now be pushed down out of the way. After removing gear cover (#1537-29) bevel gear and shaft can be pulled out. Note whether shaft has worked part way out of gear and if so drive it back. The breather holes in gear and shaft will align when gear is all the way on.

Drive pin through the breather hole opposite keyway. Note that it is started with its head in proper alignment with the channel into which it must fit. Driving it in a cocked relation to channel may result in some damage to face flange of gear. It is advisable when fitting this rivet to support the gear at the bottom of channel on the edge of a flat wrench of proper thickness, clamped in a vise, and also use a punch ground to proper thickness rather than an ordinary taper punch or chisel to drive the rivet into place.

Upset the end of rivet extending through into hollow end of shaft, with a round punch just slightly smalled in diameter than the inside diameter of shaft end.

In any instance where this rivet is not installed until such time as the shaft has worked out to the extent of causing a binding and squeaking in gear case, the cam gear case cover should also be removed and the right side generator drive shaft bearing inspected.

HARLEY-DAVIDSON MOTOR CO.

# SERVICE SHOP DOPE

No. 33

December 5, 1928

## THE "45" TWIN CLUTCH

Should you experience any trouble with this clutch slipping, even with the spring tension increased as much as it can be and still allow enough spring action for releasing, it is probably because of oil discs; more often the back discs. There is not usually any trouble with slippage as long as the clutch is thoroughly dry. However, once the discs become oily, it takes very strong spring tension to hold the clutch.

You may be inclined to believe that any oil getting into the clutch comes from the front chain, but this is not often the case. We have found in nearly every case we have investigated that the oil comes from the transmission. You know there is bound to be a little leakage through the clutch gear bearing (main left side bearing) and by the cork oil retaining washer. While most of this oil drips away, there are two possible routes by which some of it may get into the clutch. One route is through the back clutch disc keyway, and then by the washer and nut that secure this disc - the other route is along the surface of the back disc and over its rim.

Since the beginning of the 1929 season, several improvements have been made in this clutch. It is not likely that you will find many complaints of slippage with the later clutches. For your guidance in servicing clutches, we are going to give you a list of the more important improvement made to date.

1. The flat washer between back clutch disc and its lock nut is shellaked in assembly to insure a tight seal against oil leakage through the keyway.
2. The later clutch discs, that is the metal discs, are carefully ground to a smooth and true surface to insure maximum friction area.
3. The two asbestos friction discs are now riveted to the clutch sprocket. This alone makes the clutch action much more positive. This sprocket with discs attached is furnished on all parts orders.
4. Stronger springs of better material are being assembled in the latest clutches. They allow obtaining enough pressure to hold the clutch even though the discs are somewhat oily. These springs in the initial adjustment should be compressed to 1-3/32" and then if the clutch doesn't hold satisfactorily, increase the tension a little bit at a time. Don't set the tension stronger than necessary becuase this only puts unnecessary strain on the control parts. These stronger springs are furnished on all models.

If you run into any complaints of slippage in connection with the early clutches, we suggest that you first inspect the discs and if found in an oily condition, wash them in gasoline and thoroughly dry them. Then re-assemble the clutch fitting a new cork oil retaining washer if the original is somewhat worn, and incorporating improvements numbers 1 and 4 described above.

This attention will most likely make the clutch hold satisfactorily. If, however, there is still excessive slippage, the next step will be to fit the later clutch sprocket. At the same time inspect the outer steel discs to make sure that their surfaces where they bear against the asbestos discs are smooth and true. A true disc surface is indicated by an unbroken, polished ring the width of asbestos disc all the way around the rim of steel disc. If either steel disc is found uneven and not bearing all the way around, it should be replaced with one of the later discs with ground surface.

HARLEY-DAVIDSON MOTOR CO.

Here is some real good news - We can now furnish you that alemite connection adapter you have wanting so long to enable you to use a large capacity or auto type gun for greasing. Once you have this adapter you can purchase locally the size of gun that suits you best. A list of Alemite Lubricator Co. branch stores is attached.

Don't fail to take advantage of this equipment. Not only will you be able to give your customers better greasing service, but you will also be able to make "flat rate" job #6 a more profitable service operation.

Adapter part number is 11660-X, price $1.50 list.

# SERVICE SHOP DOPE

INSTRUCTIONS ON "DLD" MOTORS

This job requires special fuel and spark plugs. Use Ethyl gas, or a 50/50 mixture of Benzol and Gasoline; the latter is really the best. These fuels work well in this motor.

The special spark plugs shipped with this motor have been tested with the motor and are o.k. If they foul, you can easily clean them, which is not the case with other high compression plugs, for instance the Lodge mica plug.

Oiling Motor: When running wide open for any distance give motor extra oil with hand pump and learn from your own experience how much oil you can use at high speed and not foul the plugs or slow up the motor. The mechanical pump can be readjusted, if necessary, to give proper oiling without plug fouling at low speed.

Gearing: Use a 28-tooth sprocket on rear hub, as this motor has not more turn-over than the standard "DL", but it will pull a higher gear.

Handling Spark: You may find, in starting out, that you can retard the spark and have a better running motor than when using full advance. Operate the spark control at the point where the motor runs best.

It is advisable for a dealer or rider to run this motor a few hundred miles before expecting the best possible speed out of same. After this motor has been run a few hundred miles and the valves then touched up and the motor tuned up generally it should be a better motor than when new.

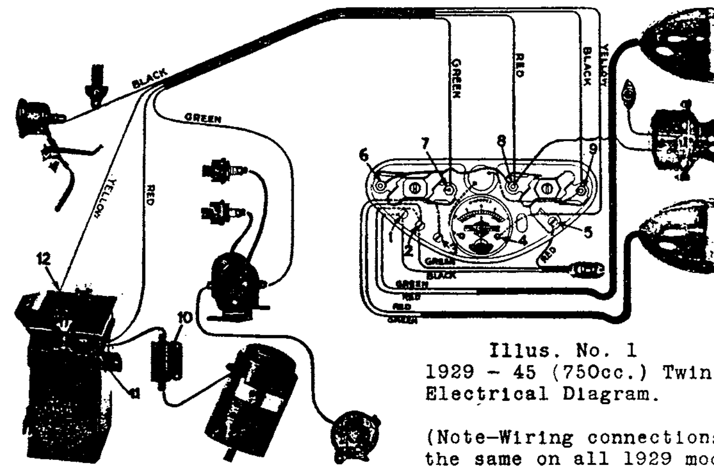
HARLEY-DAVIDSON MOTOR CO.

# SERVICE SHOP DOPE

No. 34

**THE 1929 LIGHTING SYSTEM and GENERATOR CONTROL**

December 8, 1928




Illus. No. 1
1929 - 45 (750cc.) Twin Electrical Diagram.

(Note—Wiring connections are the same on all 1929 models)

The current consumption of the 1929 lighting system varies with the lamps actually lighted for night driving, from 3 up to a maximum of about 7 amperes. One headlamp and tail lamp draw 3 amperes - both headlamps, tail lamp and switch panel lamp draw 6 amperes - sidecar and speedometer lamps add 1/2 ampere each. The generator is provided with a regulating lever by means of which the maximum output can be conveniently adjusted to charge the battery according to the amount of current being consumed for lighting. While the lights are in use and at any time the battery is in a low state of charge the regulating lever can be set for maximum output; however, when driving mostly in daylight and especially when making any long daylight trip the output should be reduced to avoid overcharging battery and rapidly evaporating the solution.

Don't infer from the above that you should be able to regulate the generator output high enough to carry the entire light load at all speeds. This cannot be done. While the output when regulated to its maximum should be more than enough to carry all lights when driving at the speeds where the generator charges at its best, it cannot be regulated to carry all lights at other speeds, particularly at low speed. When the generator output is not enough, the additional current needed is, of course, being drawn from the battery. At around 20 miles per hour the discharge with all lamps lighted may be as much as three or four amperes. Such a discharge must not be allowed to continue for any length of time because this would completely discharge a fully charged battery in approximately four or five hours.

Here are the things you can do in case you run into any instances where the battery will not stay in a satisfactory state of charge without frequent charging from an outside source, even though the generator output is regulated to its maximum as adjusted at the factory:

First of all you will, of course, make sure that the battery is in good condition and will hold a charge. If it happens that the battery is in bad order nothing can be accomplished by giving attention elsewhere.

The movement of the generator output regulator is limited by stops secured under the main brush holders. On the earliest 1929 models these stops were cut to the required length to give a maximum of approximately 7 amperes on the Single and Big Twin generators - and about 6 amperes on the 45 Twin generator. On the later generators the stops have been shortened to allow further advance and thus increase the maximum output to 8 to 9½ amperes on the Single and Big Twin - and 7 to 8 amperes on the 45 Twin. On all generators a still further advance is possible by making the stops still shorter. This should be done if there is trouble in keeping the battery in a good state of charge. Don't, however, in any case shorten the stops enough to allow the regulating brush holder to actually come in contact with ground brush holder. With the regulator advanced to the limit there must be at least a few thousandths of an inch clearance between brush holders.

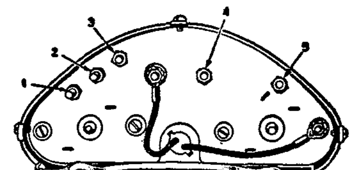
When testing a generator and readjusting output regulation it is advisable to use an accurate test ammeter rather than rely on the equipment ammeter. Bear in mind, too, that the maximum output to which a generator can be adjusted depends to a great extent on the state of charge of the battery in circuit. With a fully charged battery in circuit the generator maximum output will be about 2½ amperes more than with an almost completely discharged battery. Therefore, if you attempt to adjust the maximum output with a discharged battery in circuit, the results obtained might wrongly indicate to you that the generator is not performing up to standard.

You should caution your riders of 1929 models that even though the generator output has been increased to its limit, they still cannot expect the battery to stay in a good state of charge if they insist on using both headlamps when driving a great deal of the time at lower speeds. Of course, if a machine is driven a lot during the daytime, the battery will be in condition at night to supply lighting current needed in addition to output of generator for



quite a long time. However, the machine in average service is not run enough in daytime to offset any heavy discharge from battery at night. The riders have got to learn that in order to keep the battery in a good state of charge the lights must be used with judgement. When driving at low speed only the left headlamp should be lighted. This one lamp gives ample light for any speed up to 25 or more miles an hour, depending of course on road conditions. When a bad stretch of road is encountered the second lamp can be turned on. Switching off the right lamp reduces current consumption about 2½ amperes.

Operating the handlebar switch to turn off the right lamp also directs the current through a second filament in the left lamp - thus tilting the beam, or as commonly expressed dimming the light. Some riders may object to driving with only the one light simply because of the fact that the beam is tilted when the other light is off. In this case you can quickly change the wiring hookup at the switch box so that the beam no longer tilts, although the light control will remain the same as before. Illustration 2 with its description explains just how to do this.




Regular hookup — Illus. No. 2 — Optional hookup

| Regular hookup | Optional hookup |
|---|---|
| 1-Green wire from left headlamp—also black wire from handlebar light switch. | 1-Black wire from handlebar light switch. |
| 2-Red wires from both headlamps - also green wire from handlebar light switch. | 2-Red wire from right headlamp - also green wire from handlebar light switch. |
| 3-Green wire from right headlamp. | 3-Green wire from both headlamps. |
| 4-Yellow wire from battery. | 4-Same as regular. |
| 5-Red wire from handlebar light switch. | 5-Red wires from handlebar light switch, and left headlamp. |

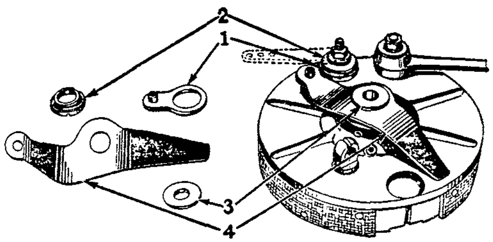
The above information will most likely answer any questions you may have in mind regarding the 1929 electrical equipment. Of the suggestions we have made, we point out the one with reference to educating your riders as most important. Setting them straight in the matter will not only leave them with the satisfaction that comes with clear understanding, but will also result in better service from their batteries. A battery, continually in a discharged condition, is short lived.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wisconsin

# SERVICE SHOP DOPE

No. 39 January 28, 1929

## A NON-CHATTERING DEVICE FOR 1928 TWIN FRONT BRAKE




Here is an attachment that overcomes any tendency of the 1928 Twin front brake assembly to chatter when play develops due to a worn cover bushing. It can be installed in a few minutes.

Part No. 4107-28 List Price $1.00

## NEW CROSS DRIVE SHAFT FOR 45 GENERATOR

A one piece generator drive shaft, with right side gear fitted to a taper and secured with a key and nut is now being furnished instead of the two piece drive shaft with center coupling as originally installed. These assemblies are interchangeable. On all parts orders specifying any part of the two piece assembly, with exception of the bevel gear, the later type shaft together with right side gear, key and nut will be furnished under part No. 1532-29A – Price $4.50 list.

## NEW PART NUMBERS

You may have calls for some of these parts so suggest you make a note of the numbers.

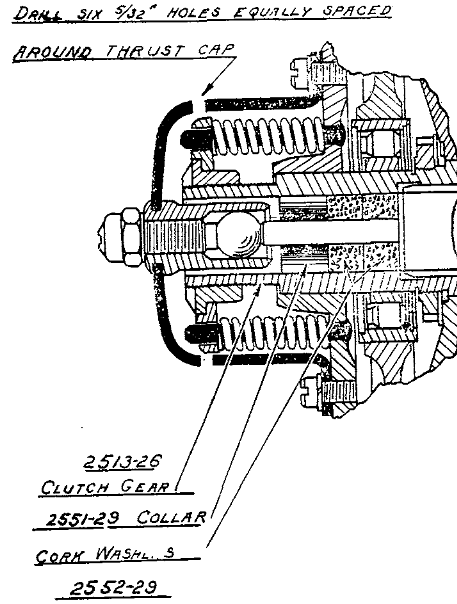
| Part No. | Name | List Price |
|---|---|---|
| 4171-29 | Clamp nut for front brake control wire clevis | .20 |
| 253-29 | Tappet guide bushing for H motor | 1.00 |
| 2505-29 | New type actuating plate | .90 |
| 1536-29A | Bevel gear pin (for 1536-29) | .05 |
| 1536-29B | Bevel gear shim | .05 |
| 1535-29 | Left side bushing for drive shaft | .40 |
| 134-29 | Push rod end felt washer | .05 |
| 2076-26A | Starter crank & pedal assembly | 3.00 |
| 2546-29A | Clutch spring (7/16"X1¼") Heavy, for 12 spring clutch | .05 |

HARLEY-DAVIDSON MOTOR CO.

# SERVICE SHOP DOPE

No. 41 March 11, 1929

## SINGLE AND 45 CLUTCH PUSHROD




This illustration shows the two cork washers (2552-29) and the steel collar (2551-29), fitted over the clutch push rod inside the clutch gear sleeve. The cork washers keep any oil that may work out through the clutch gear and main shaft bearing from getting into the thrust cap and working inside the clutch. The steel collar serves as a guide for the end of push rod and prevents it from running off to one side, and thus possibly becoming damaged when releasing load is applied.

This improvement went into effect early in the 1929 season, and applies to both Singles and 45 Twins. However at the start a steel collar only 3/16 thick, installed between the cork washers, was used. The present steel collar is 3/8" thick. It is important that it be fitted as per illustration. We suggest that whenever it is convenient to do so, you inspect all early 1929 Singles and 45 Twins, also earlier Singles, and install these washers where they haven't already been fitted, correcting the arrangement when not according to the illustration.

In addition to the above improvement, six 5/32" holes, equally spaced are drilled on the outside of the clutch thrust cap as indicated. These holes serve as a drain to prevent any oil that may possibly leak out by the cork washers from eventually working inside the clutch.

## TWIN LAPPING ARBOR

The lapping arbor wrench (11950-X) listed in the accessory catalog fits only the lapping arbors as furnished at the present time. The present lapping arbor is fitted with nuts small enough in diameter so that an be used for either Twin or Single laps, whereas the older lappi or was fitted with larger diameter nuts.

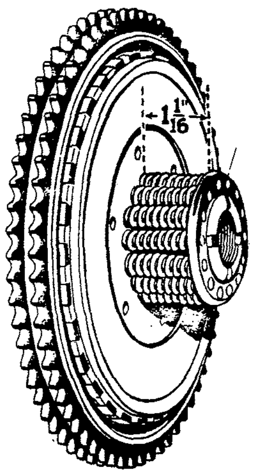
If you have an old style Twin lapping arbor that is in good condition, and you want to adapt it so that you can use one of these wrenches, you'll have to order out the following parts to bring it up-to-date.

| Part No. | Name | List Price |
|---|---|---|
| GK830D | Main Nut | $ .40 |
| FK830C | Adjusting Collar | .40 |
| GK830B | Lock Nut | .40 |

NOTE No. 1 - The original disc 1 does not need to be replaced because it has not been changed. Should any change in the disc be made in the future, it will then be included. When a replacement is made, be sure to shellac the disc washer before fitting the lock nut as explained in "Shop Dope" No. 33. This prevents oil leakage.

The splineways on steel disc 6 must be matched with splines on outer steel disc 8 so that disc 6 works back and forth freely. This is necessary for proper releasing action. Adjust spring tension as explained farther on.

Complete clutch furnished under part No. RG555TAP,
List Price.............$16.00.



Illus. 3. - Assembled Clutch with Thrust Cap Removed.

ADJUSTING CLUTCH - This clutch will hold with considerably less spring tension than the former clutch. In the initial adjustment set the spring tension adjusting nut so that springs are compressed to 1-1/16 inch as shown in Illus. 3. If a tryout proves this adjustment not entirely satisfactory re-adjust as necessary, changing the adjustment only a little at a time.

This new clutch assembly is thicker and the thrust cap protrudes farther into chain guard. When clutch is released, the thrust cap may rub against chainguard. In that case, remove chainguard and support it (inside up) on two blocks of wood a little thicker than thrust cap housing, placed near housing. Then, drive the housing outward, or in other words, deepen it by striking the metal with a hammer at the point where the housing joins the guard proper.

The increased thickness of the new clutch also explains the need of a new push rod and spring adjusting nut both of slightly greater length.

See "Shop Dope" #41 - (Single and 45 Clutch Push Rod.)

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wisconsin

Note - Until such time as new clutch parts are listed in parts catalog, you may order any individual new parts needed according to numbers in Illus. 1. In connection with each order be sure to mention: "As shown in Shop Dope #42."

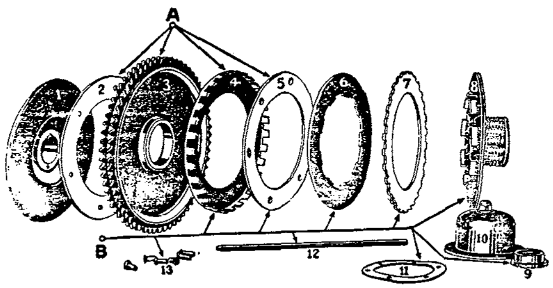
# SERVICE SHOP DOPE

No. 42 March 21, 1929

## A NEW CLUTCH FOR THE 45 TWIN AND 30.50 SINGLE

A new clutch has just gone into production on the 45 Twin and the 30.50 Single. This clutch has two more friction discs than the former clutch, and with its increased friction area, it has much greater efficiency than actually required to hold any load that may be applied with either of these two models. This means that clutch performance will not be at all sensitive to unfavorable conditions sometimes encountered that normally tend to decrease efficiency, such as uneven new discs that do not contact fully, oil getting onto discs, etc. This clutch requires less spring tension to hold, which means, of course, less strain and wear in connection with push rod, push rod bearings, and other clutch control parts.

We suggest that when difficulty is experienced in servicing one of the earlier clutches, you incorporate the necessary parts to convert the clutch to the late type, or if desirable, install a complete new assembly.



1 - Inner steel disc (See "Note #1"); 2 - Asbestos disc; 3 - Clutch sprocket; 4 - Key ring; 5 - Asbestos disc; 6 - Steel disc; 7 - Driving disc; 8 - Outer steel disc; 9 - Adjusting nut; 10 - Thrust Cap; 11 - Thrust cap gasket; 12 - Push rod; 13 - Rivets with which group "A" is assembled.

Illus. 1 - Complete Clutch In Order of Assembly.

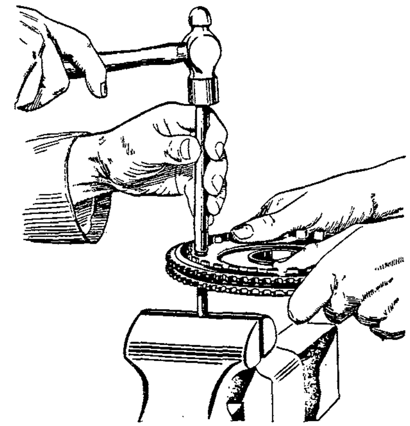
## CHANGING OVER EARLIER CLUTCHES, USING ORIGINAL PARTS AS FAR AS POSSIBLE

The combination of parts under group "B" (Illus. 1) permits a complete change-over of any of the earlier clutches fitted with 14 springs.

If clutch to be changed over happens to be a 12 spring clutch, it will be necessary to add to the above, fourteen clutch springs, one spring collar, and one thrust cap and gasket, as listed on next page.

One of the two original asbestos discs, if in good condition, can be used as disc 2, (Illus. 1) but disc 5 must be a new one because of its smaller outside diameter. It is furnished with parts under group B.





Illus. 2 - Riveting Group "A"

In changing over clutches, it will be found that in the very earliest clutch the asbestos discs are not attached to other parts, but in later clutches they are riveted to the sprocket. In changing over the former, it will be necessary to drill six holes with a No. 9 drill (.196 inch) through sprocket and the original asbestos disc to be used, locating holes to match the holes already drilled in key ring 4. The holes in asbestos disc must also be countersunk to accommodate rivet heads. (It is really advisable to use a new disc 2 when the original is not drilled.) In getting the later sprocket with riveted discs ready for change-over, it is only necessary to drill off rivet heads so that rivets can be punched out.

Next, arrange parts in group "A" (Illus. 1) in their proper order as shown, and insert rivets through assembly from back or inner side (heads in disc 2). When riveting, rest head of rivet squarely on end of a drift or punch held in a vise and spread hollow ends of rivets with a blunt center punch as shown in Illus. 2. It is best to insert all rivets and spread them just enough to hold them in place before riveting any permanently, otherwise after one is spread and securely tightened, trouble may be experienced in getting holes lined up so the remainder can be inserted. Be extremely careful when riveting that you do not damage asbestos discs 2 and 5.

Change-Over Parts for Early 14 Spring Clutch (Group B)

Part No.-RG555TP—List Price ~~$4.75~~
This Special Price Applies
for Only a Short Time.

To complete above combination for early 12 spring clutch, include the following:

| | | | |
|---|---|---|---|
| 2546-29 | (14) | Clutch Springs | $ .05 each |
| RG730TA | (1) | Spring Collar | .40 |
| 2550-26 | (1) | Thrust Cap | 1.00 |
| RG729T | (1) | Thrust Cap Gasket | .05 |

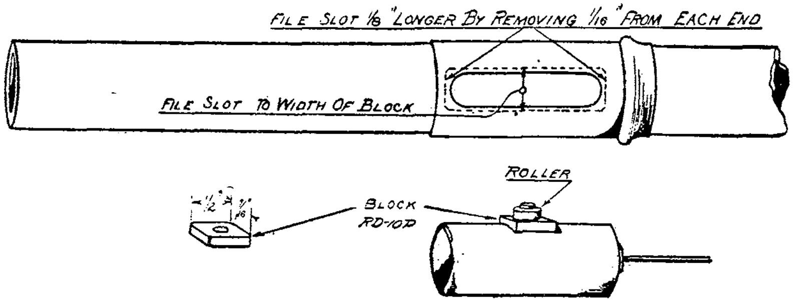
## INSTALLING A COMPLETE NEW CLUTCH ASSEMBLY

When a complete new clutch assembly is ordered, all parts shown in Illus. 1, except inner clutch disc 1, are included. Group "A" is furnished assembled. Key ring is electric welded to sprocket 3 and asbestos discs 2 and 5 are riveted in place.

# SERVICE SHOP DOPE

No. 43 April 6, 1929

## SERVICING HANDLEBARS WITH WORN SLOTS




Here's how you can service handlebars that become worn in the plunger control slot to the extent of unsatisfactory grip operation. Repair is accomplished by the use of a new plunger block which replaces the lower one of the original plunger rollers.

This new block is 1/2 inch long and 7/16 inch wide and slot can be widened for either dimension. First file slot to meet the 7/16 inch dimension and if it does not smooth up at this width use the 1/2 inch dimension. File same amount of metal from both sides of slot, which was originally about 3/8 inch wide.

Plunger control slot will also need to be lengthened so that control has the proper amount of movement to fully operate throttle or spark lever. Lengthen slot about 1/8 inch - 1/16 inch at each end.

A recess will also have to be filed in plunger to accommodate the new block. File recess about as deep as the original counterbore around roller pin hole, and at right angles to hole.

Part No. RD10P - - - - List Price $ .10

# SERVICE SHOP DOPE

No. 44 May 20, 1929

## HEAVIER SPOKES IN COMMERCIAL FRONT WHEEL

The front wheels of all 61" and 74" Twin machines intended for commercial service are now being built up using heavier spokes.

If you have occasion to rebuild the front wheel of any earlier commercial jobs, you can install these heavier spokes after drilling spoke holes in the hub and brake flanges and also holes in rim to a larger size. When drilling flanges, it's advisable to remove all insides from the hub. Use a No. 2 drill to drill hub and brake flanges. Use a 19/64" drill, or a letter "N" drill (preferably a letter "N" drill) to drill holes in tire rim.

| PART NO. | NAME OF PART | LIST PRICE |
|---|---|---|
| 3943-29 | Extra heavy front hub shell spoke (9-9/16" | $ .07 |
| 3945-29 | Extra heavy front brake sheel spoke(8-19/32) | .07 |
| 3947-29 | Spoke Nipple | .04 |

## NOT PRACTICABLE TO FIT EARLIER THAN 1928 RIGID FORKS WITH BRAKE BRACKETS

It isn't advisable to install brake brackets on rigid forks not originally intended for use with a front brake when forks are returned for repairs. The front brake subjects rigid forks to certain stresses and strains for which the 1928 and later forks are reinforced throughout. It is impossible to incorporate these reinforcements on earlier than 1928 front forks; consequently, if these earlier forks were fitted with brake brackets and used for servicing 1928 or later machines with damaged forks, they wouldn't give satisfactory service.

# SERVICE SHOP DOPE

No. 45 June 18, 1929

## BATTERY FILLER PLUGS

Do not confuse battery filler plugs used in the 1929 Single and 45 Twin battery with those used in the late 61 and 74 Twin battery. The 61 and 74 Twin battery is vented through holes in the top of cover and is fitted with solid filler plugs. The Single and 45 Twin Battery is vented through a hole in each filler plug. Do not use a filler plug intended for a 61 and 74 Twin battery in a Single and 45 Twin battery because the gases that form while the battery is charging will have no way of escaping and the jar is liable to burst.

## "45" (750 cc) TWIN IMPROVEMENTS

During the 1929 season, several improvements have been made in the design of the "45" (750cc) Twin model. All of the later parts involved in these changes, except the gear case cover listed below, are listed in the Parts Book "Supplement" of Marchl, 1929. The principal parts affected are forks, front mudguard, tanks, and the timing gear case cover and right crank case. When ordering these parts for the "45" (750 cc) Twin, first determine whether early or late parts are needed, and if later parts are required refer to the Parts Book "Supplement" for the correct part numbers.

Front forks were made one inch longer. If you have occasion to order a complete set of forks, it is, of course, advisable to order the latest set; however, if only a spring fork or rigid fork is needed, be sure to measure the old fork so that the proper part number can be determined. Measure the rigid fork from the lower crown plate to the tip of the fork side. Early fork measures 14-9/16 inches, later fork 15-9/16 inches.

The change in front forks also affected the dimensions of the front mudguard braces. When ordering a front mudguard, determine whether early or late forks are fitted and order accordingly, using the proper part number.

Whether a machine has early or late tanks is easily determined by the outstanding difference in width.

The right crank case and the gear case cover of the 45 Twin motor is now fitted with four dowel pins instead of two, as heretofore. If you have any occasion to order a gear case cover for a 45 Twin motor, note how many dowel pins the right crank case is fitted with and order accordingly, per the following part numbers:

584--29 Two dowel pin hole gear case cover
584-29A Four dowel pin hole gear case cover.

NOTE: Right crank case with provisions for four dowel pins is being furnished on all parts orders, however, only two dowel pins are pressed into place. The two extra dowel pins are furnished in a separate package with each crank case and should be used only in the event the latest gear case cover (with four dowel pin holes) is used.

# SERVICE SHOP DOPE

No. 46 August 12, 1929

## TO ATTACH 1929 OR EARLIER SIDECAR OR PACKAGE TRUCK TO 1930 BIG TWIN MOTORCYCLE

A 1929 or earlier sidecar or package truck can be attached to a 1930 Big Twin motorcycle by using the 1930 connection fittings as listed below; however, you cannot incorporate the added advantages of the interchangeable wheel and side-car brake

| QUANTITY | PART NO. | DESCRIPTION | LIST PRICE |
|---|---|---|---|
| 1 | 6009-30 | Frame Brace | $3.50 |
| 1 | 6023-30 | Frame Brace Clevis Pin | .20 |
| 1 | 6025-30 | Frame Brace Tie Bolt | .90 |
| 1 | 6026-30 | Frame Brace Tie Bolt Nut | .20 |
| 1 | 6029-30 | Front Connection | 2.00 |
| 2 | 6031-30 | Front Connection Clamp | .50 ea. |
| 4 | 6033-30 | Front Connection Clamp Bolt | .15 ea. |
| 1 | 6035-30 | Rear Frame Bracket | 1.00 |
| 2 | 6036-30 | Rear Frame Bracket Bolt | .15 ea. |
| 2 | 6037-30 | Rear Frame Bracket Bolt Nut | .10 ea. |

Fit the rear bracket to rear axle clip of motorcycle, with outer curve of bracket towards the front of machine. Fit bracket bolts with nuts inside of axle clip. (With left hand sidecar/package truck fit bracket bolts with nuts outside)

Fit the front bracket to front frame tube of motorcycle with the lower clamp of bracket slightly above the highest point of frame tube reinforcement (near motor support). Do not, as yet, tighten clamp screws.

Insert frame brace tie bolt into hole provided in seat post cluster forging. Do not, as yet, tighten tie bolt nut. Remove and discard the original frame brace on sidecar chassis and attach the new brace.

Pack a little grease in each ball sprocket; then make front and rear sidecar connections. Front connection may need to be shifted slightly to make rear connection line up properly. Connect frame brace with frame brace clevis pin. Tighten front and rear brackets and frame brace tie bolt sevurely; then tighten ball joints in the usual way.

Adjust frame brace so that motorcycle leans slightly outward. This adjustment is made by disconnecting frame brace from frame brace tie bolt and turning it further into or out of lower clevis on sidecar chassis.

## TO ADAPT 1929 LIGHT SIDECAR TO 1930 - 45 CU. IN MOTORCYCLE

The only part required to adapt a 1929 light sidecar to a 1930 45 cu. in (750 cc) twin model, is a new frame brace. When ordering, specify "Frame Brace to fit 1929 Light Sidecar to 1930 45 cu. in. (750 cc) Twin:.

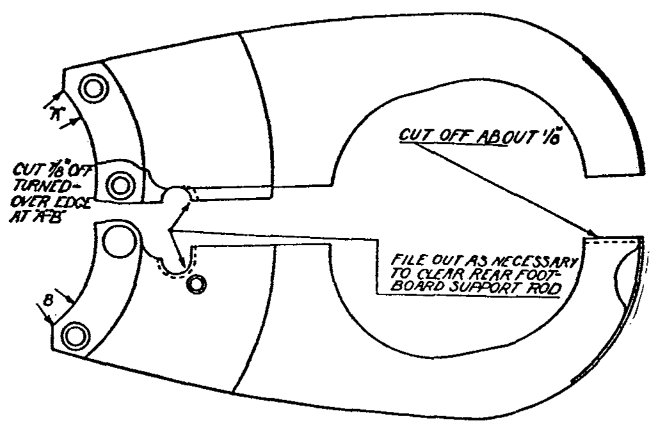
The list price of this frame brace is $6.00.

The frame brace connection as attached to motorcycle frame underneath saddle on 1929 model is not required on the 1930 model because the connection socket is incorporated in frame.

# SERVICE SHOP DOPE

Special Bulletin October 31, 1929

INSTRUCTIONS FOR FITTING LATE UNITS AND PARTS TO EARLY 1930
74 TWIN MODELS (below 3000)




INNER CHAIN GUARDS

Fit the new rear support rod extension nut.
Alter inner chain guards as illustrated
Attach the new breather pipe.
The new clutch assembly is adapted to the original clutch shell and sprocket. However, some fitting of disc splines may be necessary.
Remove transmission starter cover and fit the new starter gear and starter clutch.
To be sure of proper motor lubrication, it is of first importance that the throttle oil pump control be properly adjusted. THIS CONTROL MUST BE ADJUSTED SO THAT THE CARBURETOR THROTTLE LEVER AND THE OIL PUMP CONTROL LEVER STRIKE THEIR FULL OPEN STOPS AT THE SAME TIME.
Until such time as a motor has been run-in for at least 2000 to 3000 miles, it is advisable to recommend that when running at top speed 1/3 pumpful of oil be injected into motor with hand pump about every 2 miles.
Drain crank case and inject a supply of fresh oil (3 pumpfuls) every 750 miles or oftener.

DO NOT EXCEED A TOP SPEED OF 40 MILES AN HOUR FOR THE FIRST 500 MILES.

# SERVICE SHOP DOPE

No. 49 November 4, 1929

## SPARK PLUGS

When Harley-Davidson spark plugs become shorted due to fouling, they can easily be taken apart, cleaned, and put back in good condition, if the proper procedure is followed in dis-assembling and assembling.

Difficulties have been experienced by some in getting rather old plugs apart without damaging some of the parts. In most cases, this was because a monkey wrench or ordinary end wrench was used to remove the core clamp nut, which is not strong enough for this type of wrench. Then, too, with plugs that have seen a considerable amount of service, the threaded parts become somewhat set together, and the nut doesn't turn readily.

If plugs to be taken apart have seen considerable service, they should be soaked in gasoline or kerosene to free the threads before attempting to remove the core clamp nut. Hold base of plug in vice while turning out core nut with closed end wrench (11805-29) furnished with tool kit. Don't squeeze the base tight enough to distort it. Using this method, you will find that plugs can easily be taken apart and re-assembled.

Clean the core by scraping it and finishing with fine sandpaper. If there is any questions about the good condition of any parts, renew them. Pay particular attention to the condition of the bottom gasket for procelain (38-09C) and spring washer (38-09D).

## THE 1930 TWIN IGNITION COIL

The ignition coil used on 1930 Twin models differ from that used on former Twin models in that it does not incorporate the condensor. The condensor on 1930 Twin models is mounted on the circuit breaker assembly. No provisions have been made for adapting the new coil to earlier Big Twin models. If desired, the new ignition coil and the complete new style circuit breaker assembly with condensor can be fitted to the 1929-45 (750 cc) Twin Model; however, the new coil cannot be used without the new circuit breaker.

The ignition coil on the 30.50 (500 cc.) Single model is the same as on the former Single models.

# SERVICE SHOP DOPE

No. 50 November 11, 1929

## NEW PARTS IN 1930 BIG TWIN MOTORS

As a result of numerous changes made in 1930 Big Twins starting with motor number 3000, many parts are now not the same as listed in the Parts Book. The parts affected are as follows:

Valve Springs
Upper Valve Spring Covers
Valve Guides
Right Crank Case
Left Crank Case
Crank Case Studs (take the place of 443-30 and 447-30)
Breather Pipe
Drain Lever Catch
Right Flywheel for Iron Alloy Piston Motors
Left Flywheel for Iron Alloy Piston Motors
Right Flywheel for Dow Metal Piston Motors
Left Flywheel for Dow Metal Piston Motors
Beveled Lower Piston Ring for Iron Alloy Pistons
Beveled Cushion Ring for Dow Metal Pistons
Iron Alloy Piston for V - VS Models
Inner Front Chainguard Screws
Rear Footboard Support Rod Extension Nut
Lined Clutch Friction Disc (Same as 1929)
Clutch Springs
Clutch Spring Sector Nut
Starter Clutch
Starter Mainshaft Gear
Frame (Late frame furnished on all parts orders)

At this time, many of the early motors are being converted and fitted with the late parts.

A Parts Book "Supplement" covering all changes will soon be printed. In the meantime, when any of the above parts are needed, do not order by Part number, but simply give name of part, and specify "Latest Part", or "Early Part" on the order.

# SERVICE SHOP DOPE

No. 51 November 14, 1929

## FITTING SPECIFICATIONS FOR ALL DOW METAL PISTON SINGLE MOTORS

PISTONS: -30.50 cu. in. Single - .011" to .012" loose in cylinder
-21.09 cu. in. Side by Side Valve Single - .012" to .013" loose in cylinder.
-21.09 cu. in. Overhead Valve Single - .011" to .012" loose in cylinder
(Measure all pistons just below the top group of rings, and cylinders about 1/2" from top of bore.)

PISTON-CYLINDER HEAD CLEARANCE -- 3/64" to 5/64"

PISTON PINS IN PISTONS -- Plug or snug slip fit in both sides.

PISTON PINS IN UPPER END OF CONNECTING RODS --Free to .0005" loose.

LOWER CONNECTING ROD BEARING --.0003" to .0004" loose on rollers.

CONNECTING ROD -- .010" to .020" end play between flywheels --roller and retainer assembly should be narrower, but not more than .010" narrower than rod.

PINION GEAR SHAFT -- .0035" loose at inner end of bushing -- .0025" loose at outer end of bushing. Bushing is taper reamed with special reamer.

SPROCKET SHAFT -- .0005" to .001" loose in roller bearing - .006" to .007" loose in chain lubricating bushing.

FLYWHEEL ASSEMBLY -- .002" to .006" end play in crank case.

CAM GEARS -- .001" to .0015" loose in crank case and cover bushings - free to .005" end play.

INTERMEDIATE AND OILER GEARS - .0015" to .002" loose on studs.

# SERVICE SHOP DOPE

No. 51A November 14, 1929

FITTING SPECIFICATIONS FOR 45 CU. IN. TWIN MOTORS

(NOTE: These supercede all previous specifications, and apply to 1929 and 1930 models.)

PISTONS -- .015" to .016" loose in cylinders. Measure pistons just below the top group of rings, and cylinders about 1/2" from the top of bore.

PISTON-CYLINDER HEAD CLEARANCE -- 3/64" to 5/64".

PISTON PINS IN PISTONS -- Plug or snug slip fit in both sides.

PISTON PINS IN UPPER END OF CONNECTING RODS -- .00025" to .00075" loose.

LOWER CONNECTING ROD BEARING -- .0004" to .0006" loose on rollers

CONNECTING RODS -- .006" to .010" end play between flywheels -- roller and and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT -- .0045" loose at inner end of bushing - .002" at outer end of bushing. Bushing is taper reamed with special reamer.

SPROCKET SHAFT -- .0005" to .001" loose in roller bearing - .006" to .007" loose in chain lubricating bushing.

FLYWHEEL ASSEMBLY -- .002" to .006" end play in crank case.

CAM GEARS -- .0005" to .001" loose in crank case and cover bushings - free to .005" end play

GENERATOR DRIVE SHAFT -- .001" to .0015" loose in bushings - .002" to .004" end play.

GENERATOR ARMATURE SHAFT BEVEL GEAR -- .002" to .003" loose in bushings - shimmed to give necessary clearance between bevel gears

TAPPET GUIDES -- .0005" to .001" press fit in crank case.

# SERVICE SHOP DOPE

No. 51B November 14, 1929

FITTING SPECIFICATIONS FOR 1930 BIG TWIN MOTORS

IRON ALLOY PISTONS -- .004" to .005" loose in cylinders.

DOW-METAL PISTONS -- .018" to .019" loose in cylinders (measure all pistons just below the top group of rings, and cylinders about 1/2" from top of bore)

PISTON-CYLINDER HEAD CLEARANCE -- V-VL 3/64" to 5/64". VC(Commercial) - 7/64" to 9/64"

PISTON PIN IN IRON ALLOY PISTON -- .0005" to .001" press fit in lock pin hole side - plug or slip fit in opposite side.

PISTON PIN IN DOW-METAL PISTON -- .00025" (tight hand) to .0005" press fit in both sides

PISTON PIN IN UPPER CONNECTING ROD END -- .00075" to .00125" Loose

LOWER CONNECTING ROD BEARING --.001" to .0015" loose on rollers

CONNECTING RODS - .006" to .010" end play between flywheels - roller and retained assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT - .0045" loose at inner end of bushing - .002" loose at outer end of bushing. Bushing is reamed with taper reamer.

SPROCKET SHAFT - .0005" to .001" loose in roller bearing -- .006" to .007" loose in chain lubricating bushing.

FLYWHEEL ASSEMBLY - .002" to .006" end play in crank case.

CAM GEARS -- .0005" to .001" loose in crank case and cover bushings - free to .005" end play

INTERMEDIATE GEAR - .0015" to .002" loose on stud

TAPPET GUIDES -- .0005" to .001" press fit in crank case

VALVE TAPPETS -- .0005" to .0015" loose in tappet guides.

# SERVICE SHOP DOPE

No. 51C November 14, 1929

VALVE AND IGNITION TIMING SPECIFICATION FOR ALL 1930 MOTORS

21.09 CU. IN. SIDE BY SIDE VALVE SINGLE

INTAKE VALVE -- OPENS when piston is -- 1/8" to 3/16" before top dead center
CLOSES when piston is --7/16" to 9/16" after bottom dead center

IGNITION -- OCCURS when piston is -- 7/32" to 9/32" before top dead center on the compression stroke.

EXHAUST VALVE -- OPENS when piston is 7/16" to 9/16" before bottom dead center
CLOSES when piston is --1/8" to 3/16" after top dead center

21.09 CU. IN. OVERHEAD VALVE SINGLE

INTAKE VALVE -- OPENS when piston is 3/32" to 5/32" before top dead center
CLOSES when piston is 7/16" to 9/16" after bottom dead center

IGNITION -- OCCURS when piston is - 11/32" to 13/32" before top dead center on the compression stroke.

EXHAUST VALVE -- OPENS when piston is 7/16" to 9/16" before bottom dead center
CLOSES when piston is - 3/32" to 5/32" after top dead center

30.50 CU IN SINGLE

INTAKE VALVE -- OPENS when piston is 5/16" to 9/16" before top dead center
CLOSES when piston is 11/16" to 15/16" after bottom dead center

IGNITION -- OCCURS when piston is 1/4" to 5/16" before top dead center on the compression stroke.

EXHAUST VALVE -- OPENS when piston is 1/2" to 3/4" before bottom dead center
CLOSES when piston is 1/4" to 1/2" after top dead center

45 CU. IN TWIN

INTAKE VALVE -- OPENS when piston is 5/32" to 7/32" before top dead center
CLOSES when piston is 37/64" to 45/64" after bottom dead center

IGNITION -- OCCURS when piston is 1/4" to 9/32" before top dead center on the compression stroke.

EXHAUST VALVE - OPENS when piston is 37/64" to 45/64" before bottom dead center
CLOSES when pist is 5/32" to 7/32" after top dead center

STANDARD 74 CU. IN TWIN

INTAKE VALVE - OPENS when piston is 9/64" to 21/64" before top dead center
CLOSES when piston is 9/16" to 13/16" after bottom dead center

IGNITION - OCCURS when piston is 5/16" to 3/8" (Comm. 1/4" to 5/16") before top dead center on the compression stroke.

EXHAUST VALVE - OPENS when piston is 9/16" to 13/16" before bottom dead center
CLOSES when piston is 9/64" to 21/64" after top dead center

NOTE: When checking valve timing according to the position of the pistons, bear in mind that the tappets must first be adjusted to the correct clearance.

# SERVICE SHOP DOPE

No. 51E November 14, 1929

FITTING SPECIFICATIONS FOR ALL DOW METAL PISTON SINGLE MOTORS

PISTONS - 500 c.c. Single - .28mm to .305mm loose in cylinder
350 c.c. Side by Side Valve Single - .305mm to .33mm loose in cylinder
350 c.c. Overhead Valve Single - .28mm to .31mm loose in cylinder
(Measure all pistons just below the top group of rings, and cylinders about 12.70 mm from top of bore)

PISTON-CYLINDER HEAD CLEARANCE - 1.19mm to 1.98 mm.

PISTONS PINS IN PISTONS - Plug or snug slip fit in both sides

PISTON PINS IN UPPER END OF CONNECTING RODS - Free to .013mm

LOWER CONNECTING ROD BEARING - .0075mm to .01mm loose on rollers

CONNECTING ROD - .255mm to .51mm end play between flywheels -- roller and retainer assembly should be narrower, but not more than .255mm narrower than rod.

PINION GEAR SHAFT - .09mm loose at inner end of bushing -- .065mm loose at outer end of bushing. Bushing is taper reamed with special reamer.

SPROCKET SHAFT - .013mm to .025mm loose in roller bearing -- .15mm to .18mm loose in chain lubricating bushing.

FLYWHEEL ASSEMBLY - .05mm to .15mm end play in crank case.

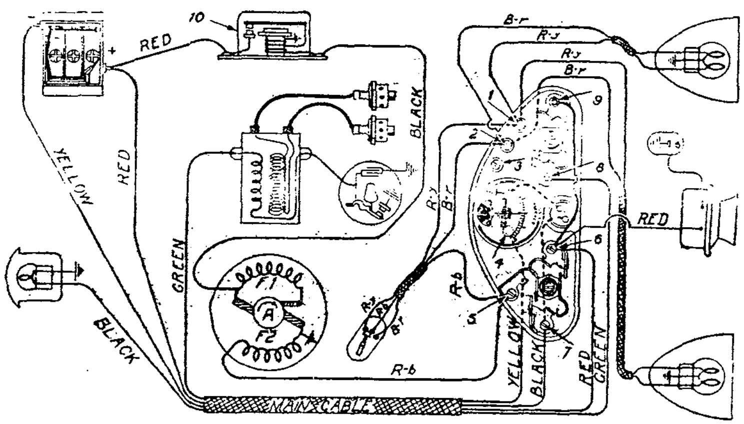
CAM GEARS - .025mm to .04mm loose in crank case and cover bushings - free to .13mm end play

INTERMEDIATE AND OILER GEARS - .04mm to .05mm loose on studs.

# SERVICE SHOP DOPE

No. 52 November 18, 1929

## THE 1930 HARLEY-DAVIDSON ELECTRICAL SYSTEM




### KEY TO WIRING DIAGRAM

1 - Red wires with yellow tracer - one from handlebar light switch and one from each headlamp; 2 - Black wires with red tracer - one from handlebar light switch and one from each headlamp; 3 - No connection; 4 - Yellow wire from battery; 5 - Red wires with black tracer - one from handlebar light switch and one from generator; 6 - Red wire from battery, red wire to horn, also wire from No. 9; 7 - Black wire from tail lamp, also wire from switch panel lamp; 8 - Green wire from ignition coil; 9 - Ignition wire from No. 6, also serves as a terminal for extra lighting equipment; 10 - Relay cutout switch.

B-r - Black wires with red tracer; R-y - Red wires with yellow tracer; R-b - Red wires with black tracer; A - Generator armature; F1 - Regulating field coil; F2 - Shunt (auxiliary) field coil.

The 1930 Harley-Davidson electrical system incorporates several new features, foremost of which is a new generator that, at normal driving speeds, supplies about the same amount of current to the battery with all lamps lighted, as it does with no lamps lighted. This new generator embodies two independent field coils. One field coil (F1) maintains a magnetic field strong enough to enable the generator to supply ample current for ignition and to keep the



battery charged. The other field coil (F2) comes into play only when the main lighting switch is turned ON. This intensifies the magnetic field and results in enough increase in the current output of the generator to amply care for lights at average driving speeds.

The battery-generator and ignition circuits are the same as with previous models; however, to get a complete working knowledge of the new system, trace it out on the wiring diagram according to the following outline.

When the ignition switch is turned ON preparatory to starting the motor, current flows from the positive (+) post of battery, through the RED wire of main cable to post No. 6 in switch box. From post No. 6, current flows through wire to post No. 9 (which is one side of ignition switch), through the ignition switch, and then through the GREEN wire of main cable to the primary winding of the ignition coil. From the primary winding of coil, the current flows through the circuit breaker points to ground. The circuit is finally completed through ammeter and YELLOW wire of main cable to the negative (-) post of battery.

With the motor started, the armature (A) builds up current from the magnetism retained permanently by the fields. Until the generator voltage becomes higher than the battery voltage, the circuit is open at relay switch, and the current that is generated and picked up by the brushes simply builds up within the generator. A small amount of current completes an external circuit through the grounded winding of relay switch with the result that the switch core becomes magnetized. The spring tension of the relay cutout switch is so adjusted that when the generator voltage has built up higher than the battery voltage, the cutout core becomes sufficiently magnetized to close the contact points; thus completing the circuit between the generator and the battery. (The cutout contact points ordinarily close at a speed of about 15 miles per hour in high gear.) When the motor is stopped, or is running so slowly that generator voltage is lower than the battery voltage, the cutout core becomes de-magnetized, allowing the points to open; thus preventing the battery from discharging through the generator.

At the positive (+) post of battery, the current coming from generator divides, the required amount going to the ignition unit, and the balance to battery, keeping it charged. When the generator is charging, the ignition circuit is not completed through the ammeter and YELLOW wire of main cable, as it was when starting, but directly through ground to the source of current, the generator.

The current that flows through the battery, flows from the negative (-) post, through the YELLOW wire of main cable to one side of ammeter; through the ammeter, and then through ground to the generator. The amount of current going through the battery is registered on the ammeter, and is known as the generator charging rate.

When the main lighting switch is turned ON, the current required by lamps flows from the positive (+) post of battery, through the RED wire of main cable to post No. 6, which is a terminal of the main lighting switch. In this switch, current divides, and part of it goes from post No. 7 through the BLACK wire of main cable to the taillamp; and part of it goes from post No. 5 to the toggle switch and to the generator field winding. Both, the toggle switch wire, and the generator wire, are RED wires with a black tracer.

The toggle switch wire from post No. 5, is connected with the center prong in toggle switch. The position of the contact plunger in toggle switch determines whether current is going to the upper or to the lower filaments of headlamps.

The generator wire from post No. 5 connects with field coil F2. The current in going through field coil F2, intensifies the magnetic field, and the result is enough increase in the current generated to take care of lamp load.

## A FEW POINTERS IN DIS-ASSEMBLING AND ASSEMBLING 1930 TWIN GENERATORS

IF A BIG TWIN GENERATOR, the first thing to do is pull the drive gear off the end of the armature shaft. Your combination gear and bearing puller (11849-X) will be suitable for this job after the unthreaded end of screw is ground to a diameter of 3/8 inch. This change is now effective on new pullers. Pulling the drive gear off the armature shaft shears the dowel pin. Of course, a new dowel pin will need to be used when re-assembling.

Before removing the aluminum frame end, mark it and the frame at a point near the two frame screws which are closest to the negative (grounded) brush. The shunt (auxiliary) field coil (F2) is then located directly under the mark on frame. THIS APPLIES TO ALL 1930 TWIN GENERATORS.

THE 45 (750 c.c.) TWIN GENERATOR is fitted with outside terminals marked to indicate the proper connections. On the inside of this generator, connections are made as follows: The uninsulated wire of shunt (auxiliary) field coil (F2) is grounded to the copper strip, which is secured beneath the terminal clamp on the inside of the generator frame. The other wire of shunt (auxiliary) field coil (F2), which is insulated with enameled cloth, is attached to the terminal marked "Switch". A short wire from the positive brush is connected to the terminal marked "Relay". These last mentioned connections are made by inserting the wires through the hollow terminal rivets and soldering on the outside.

The wire of regulating field coil (F1) that extends farthest through the aluminum frame end, is connected to the regulating brush. The other wire is connected to the positive brush. THIS APPLIES TO ALL 1930 TWIN GENERATORS.



IN THE BIG TWIN GENERATOR, the black wire of shunt (auxiliary) field coil (F2) is grounded to the copper strip, which also grounds the negative brush. The red wire with black tracer is connected to an insulated terminal located on positive brush holder insulator. The red wire with black tracer from post No. 5 in switch box also connects onto this terminal. The BLACK wire from relay cutout switch connects onto the positive brush.

## SPARK PLUG HOODS

If you experience any trouble with the spark jumping between the lower edge of spark plug hood and spark plug base, you can correct it by changing the form of the hood slightly. This can be accomplished by pressing in the top of hood (boss that fits onto plug) with a vise. Support base of hood on piece of flat metal larger than the hood diameter to avoid distortion when pressing it. Press the boss down until it is about flush with hood body.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis. U.S.A.

# SERVICE SHOP DOPE

No. 54E ROLLER BEARING ROLLERS January 13, 1930

Here is a handy chart, giving information about roller bearing rollers. The length of each roller is given, along with the part number, where each roller is used, and the number of rollers in each bearing. It is suggested that this data be kept in a prominent place so that it can be referred to on a moments notice. The standard diameter is the same for all types of rollers. Rollers are furnished in diameters varing from .001" undersize to .001" oversize in steps of .0001".

This Shop Dope Bulletin is prompted by the fact that in many instances, mechanics lose considerable time in determining just what type roller is needed for certain bearings they may be servicing. Then, too, part numbers on boxes containing rollers very often become unreadable through handling, causing inconvenience in locating the proper place for them.

| PART # | WHERE USED | # USED | LENGTH |
|---|---|---|---|
| 304-15 | Big Twin Front Connecting Rod | 24 | 9.12 mm |
| " " | 1929 and earlier Big Twin Sprocket Shaft | 24 | " " |
| " " | 45" Twin Sprocket Shaft | 24 | " " |
| " " | 1930 Big Twin Front Brake Hub | 24 | " " |
| " " | 1930 Big Twin Sidecar Brake Hub | 24 | " " |
| 305-15 | Big Twin Rear Connecting Rod | 12 | 18.65 mm |
| " " | 30.50" Single Connecting Rod | 12 | " " |
| " " | Big Twin Clutch Sprocket | 12 | " " |
| 305-29 | 45" Twin Rear Connecting Rod | 12 | 14.28 mm |
| 306-26 | 21.09" Single Connecting Rod | 12 | 15.08 mm |
| " " | 21.09" and 30.50" Single Sprocket Shaft | 12 | " " |
| 2289-17 | 45" Twin Front Connecting Rod | 24 | 7.14 mm |
| " " | 45" Twin and Single Clutch Sprocket | 16 | " " |
| " " | Big Twin Transmission Countershaft Gear | 24 | " " |
| " " | 1924 and earlier transmission main drive gear | 20 | " " |
| 2289-25 | 1930 Big Twin Sprocket Shaft | 24 | 12.30 mm |
| " " | 1929 and later Big Twin Transmission main drive gear | 24 | " " |
| " " | 45" Twin and Single Transmission Clutch Gear (Left Side) | 16 | " " |
| " " | 45" Twin and Single Transmission mainshaft (right Side) | 12 | " " |
| " " | 1930 Big Twin Interchangeable Wheel Hub | 14 | " " |
| " " | 1930 Big Twin Rear Brake Hub | 14 | " " |

# SERVICE SHOP DOPE

No. 57 April 14, 1930

IMPORTANT NOTICE ON

CYLINDER HEAD BOLTS

Cylinder heads on some of the 1930 Big Twins are clamped with twelve 7/16" x 1-5/8", and two 7/16" X 1-13/16" bolts threaded with 20 threads to the inch; and some are clamped with fourteen 7/16" x 1-7/8" bolts threaded with 16 threads to the inch.

It is advisable to arrange your supply of cylinder head bolts accordingly, and call this to the attention of your parts and service men.

When necessary to renew a cylinder head bolt, first determine which size is needed. A mistake is likely to result in stripped cylinder threads. For reference purposes, the various sizes and part numbers are listed below.

| PART NO. | SIZE | THREAD | LIST PRICE |
|---|---|---|---|
| 14-29A | 7/16" x 1-5/8" | 20 | 0.10 |
| 14-30 | 7/16" x 1-13/16" | 20 | .10 |
| 14-30B | 7/16" x 1-7/8" | 16 | .10 |

Incidently, cylinder heads on all 30.50 cu. in. (500 c.c.) Singles are retained with bolt No. 14-29A.

SERVICE SHOP DOPE

No. 58 June 30, 1930

## CARBURETOR BACK FIRE DEFLECTOR

Latest VL and DLD model carburetors are fitted with an air intake cap in place of the air cleaner furnished as original equipment on all models. In connection with this air intake cap on latest machines, a deflector plate is fitted between cap and carburetor so that in case of motor back firing any flame blown out will be directed away from the carburetor body and adjoining parts that may be wet with gasoline.

Some of the first machines equipped with carburetor air cap did not have the deflector plate and it would be well to so equip these machines, as a precaution against possible damage from back firing. You can check up the number of machines you have in service with air caps but without the deflector plate and order the required number of deflectors under part No. SA-1110. We will furnish deflector plates no charge for machines that did not originally have this equipment in connection with the air cap, provided you will make this request on your order blank along with motor numbers of the machines involved.

HARLEY-DAVIDSON MOTOR CO.

SERVICE SHOP DOPE

No. 59 August 4, 1930

## IMPROVED SEAT POST SPRINGS

A new seat post cushion spring combination has recently been developed that is much improved over the spring combination used in the past. The new combination is now being furnished in all new machines, and it is also being supplied on parts orders. It can be applied to any LATER 1929 and 1930 MODEL, and since it is a much more satisfactory and dependable spring combination that has been available previously, we intend to furnish it complete on all parts orders calling for any of the cushion springs applying to later models, as mentioned. This means that the new combination, which has been given the part No. 3128-29, will not only take the place of the spring furnished in the past on that number, but will also take the place of the springs furnished heretofore on part Nos. 3128-30; 3129-29; and 3129-30. Please bear in mind that the last three part numbers mentioned have now become obsolete, and when any one of them is found on a parts order it will be changed to 3128-29 calling for the new spring combination.

The new spring arrangement involves three springs, two five inches long and a shorter spring that is to be assembled at the extreme lower end. An extra guide collar is included which is to be fitted between the short spring and the one above. The guide collar that is found with original seat post combination is to be fitted between the two longer cushion springs.

In connection with the 1930 SEAT POST ASSEMBLY, which is not quite as long overall as the 1929 assembly, the recoil spring used in combination with the new cushion spring arrangement should be only one inch long. The recoil spring is the one in the lower end of the plunger or guide tube, which checks or cushions the upward movement of the saddle. The early 1930 seat post assembly was fitted with a recoil spring about two inches long, and it was not until well along in the season that this spring was shortened. When you install a new cushion spring combination in a 1930 seat post, pay particular attention to the recoil spring found in the assembly and if it is a long one, cut it off as necessary or replace it with a proper one. With all springs properly assembled on the seat post the initial spring tension can then be adjusted as desired by means of the adjusting nuts at the lower end of the seat post rod.

We suggest that you order out a good supply of the new springs, and have them on hand for your service requirements. Order as follows:

| | | | |
|---|---|---|---|
| 3128-29 | New Saddle Cushion Spring Combination | - | Price $1.00 List |
| 3133-30 | Seat Post Recoil Spring One Inch Long | - | Price .10 List |

# SERVICE SHOP DOPE

No. 60 August 25, 1930

## GEAR SHIFTER LOCK FOR THE "45" AND SINGLE TRANSMISSION

The gear shifter lock as applied to 1931 "45" and Single Models can also be applied to 1929 and 1930 models of both the "45" and Single. The necessary parts to make this change can be ordered under the following number:

| PART NUMBER | LIST PRICE |
|---|---|
| TG-750-TP Unit Complete | $2.50 |

The transmission must be removed from the frame in order to make the installation as the new shifter shaft cannot be placed in the gear box due to lack of clearance between the front of the gear box and the seat mast tube. After the new parts are installed, observe through the inspection hole in the top of the transmission that the shifter lock plunger in the bottom of case is so adjusted that when the sliding gear is shifted to either high or low position, its dogs mesh completely at the same time that the plunger registers fully with the corresponding locating notch the gear gear shifter plate.

The plunger can be re-adjusted as necessary with regard to both spring tension and position by turning the eccentric plunger bushing either to the right or left.

Next replace the inspection hole plate, using two of the original screws to fasten it on the right side and on the left side (side nearest clutch); fasten both the inspection plate and the release lever stop with the two long screws sent with the assembly. The clutch release lever stop should be installed with its straight side toward the rear of the transmission.

With the clutch lever against the stop, the lockfinger on the clutch release lever should enter about half way through the slots in the locking quadrant, but no further. This adjustment can be obtained by bending the stop as needed.

Finally the clutch push rod should be so adjusted that the clutch release lever will have 1/16" free movement before it acts on the clutch.

# SERVICE SHOP DOPE

No. 61 September 15, 1930

## NEW METHOD OF TIMING IGNITION ON 1931 - 74 CU. IN. TWIN

On all 1931 - 74 cu. in. Twins, on the left side of the crank case and just above the motor number, you will find a plug which screws into the crank case ignition timing hole.

The proper procedure in order to check timing or re-time a motor using the new timing hole is as follows:

1. Remove spark plugs, to permit turning motor freely.
2. Set breaker points at .020" to .024"
3. Remove plug from timer hole.
4. Rotate motor counter-clockwise (the direction in which motor runs) until mark which is cut into flywheel starts to show through timing hole. Continue to rotate motor until mark is in the correct position, in relation to timing hole opening, for the type of motor being timed. (see 5.)

NOTE: MAKE SURE THAT NARROW END OF CIRCUIT BREAKER CAM is about to open points when flywheel mark appears. (Mark will appear twice while circuit breaker cam rotates once, but location of mark on flywheel is only in relation to front cylinder and front cylinder is timed by narrow end of circuit breaker cam. Therefore, if mark appears when wide end of cam is about to open points, continue to rotate motor until mark comes around again. Came will then be right).

5. The correct position of flywheel mark in timing hole for setting ignition on 3 types of 1931 motors is as follows:

VC COMMERCIAL: Flywheel mark should be just starting to disappear at front edge of timing hole when you look straight down at timing hole and motor is being turned counter-clockwise. With the mark in this position and circuit breaker properly adjusted (see 6.) spark will occur 1/4" before top center.

V AND VS: Flywheel mark should be squarely in center of timing hole. With mark in this position and circuit breaker properly adjusted (see 6.) spark will occur 5/16" before top center.

VL: Flywheel mark should be just starting to appear at rear edge of timing hole. With mark in this position and circuit breaker properly adjusted (see 6.) spark will occur 3/8" before top center.

6. If you find that with SPARK IN FULLY ADVANCED POSITION, the circuit breaker just starts to open when the flywheel mark appears at the correct position for the type of motor being timed, then timing is correct. If, however, the points are not just starting to open, loosen the two screws that hold the circuit breaker and the advance and retard plate assembly together (not the two screws that secure adjustable contact points) and reset the circuit breaker as necessary. With the motor in frame, the position at which points are just starting to open can be found exactly by turning ignition switch on. When points open, ammeter will go from discharge to zero. On the bench a light and battery can be hooked up to circuit breaker low tension wire and grounded to motor to serve the same purpose.

# SERVICE SHOP DOPE

No. 62 October 6, 1930

## USE 1931 TYPE CUSHION AND GUIDE RINGS WHEN SERVICING 1930 MOTORS

1931 type cushion and guide rings can be fitted to 1930 74 cu. in. engines provided both are used together. The new guide and cushion rings must be used with each other due to the new cushion ring being thicker than the 1930 type, therefore, the new guide rings must be thinner to match.

The new custion rings are more dependable and longer-lived than 1930 style rings.

1931 guide and cushion rings can be ordered on the following part numbers:

| NUMBER NEEDED | PART NUMBER | NAME | LIST PRICE |
|---|---|---|---|
| 8 | 267-31 | Piston Guide Ring | 15¢ each |
| 4 | 268-31 | Inner Cushion Ring | 15¢ each |

## CARBON AND ITS EFFECT

Carbon cannot be allowed to accumulate in late type Ricardo Head motors, particularly the 74 cu. in. twin to the same degree as in 1929 and earlier slope head cylinder motors.

The Ricardo principle allows only about 1/16" clearance between pistons and flat area of heads. When this space becomes filled with carbon deposited on heads and pistons to the extent of striking as pistons pass over top center, a loud rattle that may be mistaken for a piston rattle, a connecting rod roller bearing knock, or a valve noise, will set up in the motor and is particularly noticeable if the throttle is suddenly closed when slowing down from average touring speed.

Any machines which develop the above characteristics can be taken care of by cleaning out carbon.

# SERVICE SHOP DOPE

No. 63 November 1, 1930

## NEW "45" MODEL GENERATOR DRIVE

A new and stronger "45" model generator bevel gear drive has been in production for several weeks. It has been assembled in new motors, starting with #31D1786 - and it is also being supplied on parts orders, WHEN SPECIFIED.

This new drive combination can also be applied to all 1930 motors, as well as early 1931 motors assembled before the new parts were available. The only requirement is that the complete combination be installed (armature bevel gear - drive shaft - and drive shaft bevel gear), because otherwise the individual parts are not interchangeable.

The new combination cannot be applied to the 1929 model. The reason for this is that the small bevel gear will not fit the armature shaft in the generator of this model.

We recommend that the new drive combination be used altogether in giving required service to the generator drive of 1930 and early 1931 motors, originally fitted with the lighter gears. The new gears have fewer, but larger teeth; also the drive shaft has been made stronger, with the result that the whole combination is much sturdier and more reliable.

In fitting the new gears, the same as with earlier gears, spacing shims (1639-29 and 1536-29B) must be applied as needed to adjust to just the right fit, as follows: Gears should match almost exactly; or in other words, the outer edge of one should not extend beyond the other -- allow but little noticeable play or lash in gears - gears must turn freely all the way around without any binding whatever at any point (with generator installed).

The parts of the new drive are listed in the parts catalog supplement of October 1, 1930 as follows:

#1649-31 - Armature Bevel Gear ................$1.50 List
#1536-31 - Drive Shaft Bevel Gear ............ 1.50 "
#1532-31 - Generator Drive Shaft ............. 2.00 "
#1536-31A- Bevel Gear Pin ..................... .05 "

When you wish to order the new drive combination completely assembled and ready to install, use the following part numbers:

TA-3298-T - Drive Shaft Assembly .............$3.50 List
#1649-31 - Armature Bevel Gear ............. 1.50 "

# SERVICE SHOP DOPE

No. 64 December 15, 1930

## TUNING MOTORS FOR SPEED AND POWER

The following tips are intended particularly for 1930 and later motors, but can be applied to any motor. When you have complaint that a motor is sluggish, slow or poor on pulling, apply the following tuning ideas. DO NOT EXPECT ANY ONE OF THESE SUGGESTIONS ALONE TO DO THE TRICK - YOU MAY HAVE TO APPLY ALL OF THEM BEFORE A MOTOR WILL REALLY DEVELOP ITS MAXIMUM PERFORMANCE.

1. BREAKER POINTS - Should have a full .022" (.020" to .024") opening. In a new motor, due to wearing off of high spots on the fibre block of the breaker lever in the first few hundred miles of running, the points close up a little and as as result timing is retarded to some extent and the motor may be "flat". Check the points and reset them.

2. SPARK TIMING - If with points properly reset a motor is still sluggish, check ignition timing by actual measurement of piston position. (V motors should be timed 5/16" before top center; VL motors 3/8" before top center. All timing to be done on front cylinder on compression stroke. On 1931 motors retime using crankcase timing hole) See that spark control is adjusted for full advance.

3. CARBURETOR AIR INTAKE - Some motors are equipped with air cleaner, some with air cap, and some with air intake pipe. The air cleaner keeps dirt and grit out of the motor, but slows down top speed. The air cap gives good carburetion, but exposes the motor to the danger of fire should the motor backfire with the carburetor flooded. The air intake pipe is the latest equipment.

   On motors equipped with air cleaner, where top speed is most important, remove the cleaner and replace with an air intake cap, or preferably with the new air intake pipe assembly (part nos. 1406-31, 1410-31 and 644030).

4. MUFFLERS - A partly closed or dirty muffler develops back pressure and back pressure means overheating, loss of speed, pick-up and power. Make sure muffler is well open on the end and is not clogged on the inside. The new "straight thru" muffler on 1931 - 74 cu. in. motors cannot clog on the inside, but the fish tail end should be kept clean and open. The early 1930 muffler, two tube type, was quiet, but developed some back pressure at high speed particularly when dirty. The procedure here for best speed development is to first further open the V slot ends of the two pipes. Then disassemble the muffler and remove the baffle plate spot welded in the lower tube between the two transfer pipes. This baffle plate will come out, but must be pounded hard with a long iron rod. It is very often found that this operation makes a machine anywhere from 3 to 5 miles per hour faster if everything else is in good shape, but of course, it is understood that there is some increase in exhaust noise.

5. COMPRESSION - No motor can be expected to show good performance if valves and rings are leaking. When tuning up a motor, be very sure that compression is good. Touch up the valves; check the rings; clean out the carbon.



6. VALVES SPRINGS - In tuning up a motor always check valve spring. Motor performance cannot be good with springs in bad order -- replace any that are found broken, or even weakened to any appreciable extent. On the 1930 74 cu. in. Twin pay particular attention to the early type of small diameter spring. If any of these original springs are found broken or weakened replace all with "service spring No. 168-30". This spring is entirely reliable and is distinguished from other 1930 small diameter springs by being marked with blue paint.

MISCELLANEOUS - It may be only small things which are causing a motor to lack speed, power and pull. Make sure of these details.

Check the carburetor for wear, air leaks, and adjustments.

See that valve tappets are properly adjusted.

Do not expect a high compression motor to run good on a poor grade of low test or on an extremely high test gasoline - use a good blend of Benzol, Ethyl, or other anti-knock fuel.

If your motor lacks turnover when using the recommended gearing, and when tuned according to the suggestions given here you might try a larger venturi in the carburetor. Very often this will help greatly, particularly in regard to speed. The late model VL is equipped with 1-1/16" venturi.

Use good oil if you expect a motor to perform. Poor oil creates friction which results in heat, loss of power and speed. Harley-Davidson oil of the right grade will give best results.

Finally check spark plugs. An old, badly burned set of plugs will hold a motor back -- fit a set of good new plugs -- play safe by using only Harley-Davidson plugs.

# SERVICE SHOP DOPE

No. 65 December 22, 1930

## NEW PISTON PIN LOCK RING

A newly developed piston pin lock ring recently went into production. It is now being assembled in all Lynite (aluminum) and Dow-metal piston motors. It is also being supplied exclusively on parts orders. It can be applied to all motors in service with the types of pistons mentioned. TEMPORARILY a set of these new rings will be supplied with each parts order piston, however, this will be discontinued when sufficient time has elapsed to allow everyone to obrain a supply of the new rings.

Since the new ring is of much better quality and more dependable than rings available up to now, we strongly recommend that you obtain a supply at once and then discard any earlier type rings you may have on hand.

This new ring is readily distinguished from rings supplied previously by its greater width due to a thin section extending from one side of the ring proper. It has much greater tension than earlier rings and will hold tightly under the hardest service. With proper installation, troubles resulting from lock ring failures will be reduced to an absolute minimum.

### IMPORTANT

For dependable service, lock rings must seat in their grooves with considerable tension. Take no changes with loose fitting rings and possible trouble as a result. DO NOT USE LOCK RINGS A SECOND TIME. JUNK THOSE REMOVED IMMEDIATELY. Use only the latest, re-designed installing tool described below, and thus avoid loss of tension through over-compressing and consequent "setting", also bending or twisting, which are likely to be the result of hap-hazard methods of installing.

The part number and price of the new ring is as follows: Part #280-24 - List Price 10¢.

## NEW TOOL FOR INSTALLING LATEST TYPE PISTON PIN LOCK RING

A NEW TOOL is required for satisfactory and safe installation of the new style piston pin lock ring described above. The new ring will be used exclusively in all new motors equipped with Lynite (aluminum) and Dow-metal pistons in the future, and temporarily, as already mentioned, they will be sent out with parts order pistons. For these reasons together with the fact that the old lock ring is discontinued from our parts list, the tool furnished in the past, one of which no doubt you have in your shop, becomes obsolete. We suggest that you do not attempt to use the old tool with the new ring, because in doing so there is too much chance of ring damage and faulty installation.

The required new tool which is especially adapted to the new ring is now available. Order one and use it exactly according to instructions given below. You will then be assured of good and dependable lock ring performance.

Part No. 12052-30 Price - $1.00 list



## INSTRUCTIONS

The lock ring tool involves three pieces, namely, a transfer collar (the smaller collar); a compressing collar (the larger collar with tapered inside); and a drift. Note the reference below to these names.

1. Place transfer collar on bench, either end up, and set recessed end of compressing collar on top of it.

2. After applying oil to lock ring, insert it, thin section downward, into compressing collar. Press ring squarely down into collar far enough so that it will stay.

3. With large end of drift, push ring on through compressing collar until the thin section transfers into small collar. It may happen that ring binds to some extent and will not transfer easily. In this case apply more pressure to drift. DO NOT USE A HAMMER, as a hammer blow may "set" ring, reducing its tension greatly.

4. Remove compressing collar and place it to one side as it is not needed further until ready for the next ring.

5. Slip the transfer collar in which ring is now held, over small end of drift with lock ring outward, and after noting that ring groove is clean insert drift into piston pin. Turn ring and collar so that ring gap is approximately 1/8 turn below removal slot at side of pin hole. (NOTE: Earlier than 1931 pistons were not provided with removal slot mentioned.) Do not place a new style lock ring in a 1930 piston without first filing a removal slot in the piston. If this is not done, the ring will be extremely hard to take out.)

6. Transfer lock ring into groove in piston boss by striking drift a quick, but light blow with hand or hammer. Make sure that ring seats well into groove.

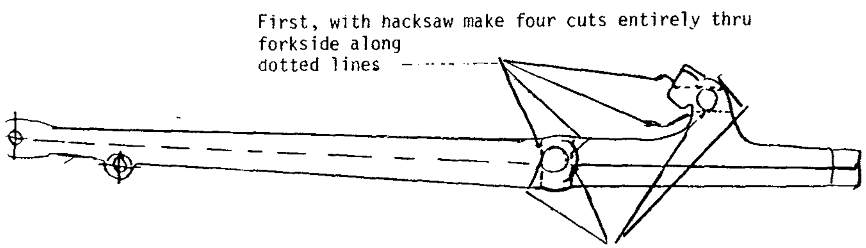
7. To remove ring, work a pointed tool under it at removal slot and pry ring out.

NOTE: You will observe that the pin hole in late pistons is slightly larger at the points where the lock rings register. In earlier pistons the pinhole is reamed one size straight through. The new construction is to allow for fitting of oversize pins without affecting the lock ring fit. However, only one size of lock ring is furnished and it applies equally well with either size of hole. It is simply a matter of a slightly tighter fit with the smaller hole, and naturally the lock ring does not drift into place quite as readily as in the larger hole in late pistons.

SERVICE SHOP DOPE

No. 67 January 6, 1931

## TO FIT NEW RIGID FORK SIDE




To fit new rigid fork side proceed in the following manner:

If lower cross member has lug riveted to fork side, first remove rivet. Then with a hack saw, or preferably a power saw if such equipment is available, make four cuts entirely through the fork side (per illustration). Start the cuts about 1/32" away from ends of cross members that extend through fork side, being careful not to cut into them.

After necessary saw-cuts have been made, take a half-round chisel and cut (at points indicated in illustration) four grooves, one on each side of cross members, the full depth of fork side to permit breaking the remaining stock away.

Then with a hammer straighten peaned-over ends of cross members (do not file off, or stock may not be sufficiently long for a good re-peaning job), so a new fork side may be driven or pressed on. Do not heat ends of cross members to straighten peaned over ends because they are heat treated and might be somewhat weakened.

When driving or pressing on a new fork side, extreme care should be exercised that it is driven or pressed on both the cross members evenly. If this precaution is not taken the new fork side may jam when part way on and it will be difficult to either remove it or drive it on the remaining distance. To further insure that the new fork side will go on reasonably easily, polish ends of cross members with emery cloth and use a small quantity of white lead for a lubricant.

After fork side has been driven or pressed snugly against shoulders of cross members, pean over ends of members, being careful to pean the metal firmly into countersunk holes of fork side. It is not necessary to replace rivet where one was originally fitted thru lower cross member lug and fork side, as rivet is not essential and has been discontinued on later machines.

Finally check fork for alignment.

SERVICE SHOP DOPE

No. 68 January 12, 1931

## FIT DOUBLE FILAMENT HEADLIGHT BULBS CORRECTLY

Originally the 1931 headlight was equipped with a 32-32 candle power bult, but this has recently been changed to 32-21 candle power bulb. With the 32-21 candle power bulb care must be exercised to install it correctly so that the 32 candle power filament will burn when the "bright" (higher beam) is lighted, and the 21 candle power when the "dimmer" (tilted beam) is lighted.

Most bulbs are marked "TOP" on the base, and if the side so marked is placed upward in the lamp the filaments will be in correct positions. Bulbs not marked are installed correctly if the filament of smaller diameter wire is placed toward the top of the lamp.

## INCREASE BULB LIFE BY REDUCING GENERATOR CHARGING RATE

Reduce the generator charging rate if you are experiencing trouble with bulbs burning out. A high charge rate means overloaded bulbs and the life of bulbs under that condition is greatly decreased.

## RUBBER SPEEDOMETER DRIVE GEAR

### ADJUSTMENT

The rubber speedometer drive gear operating on the rear sprocket of the 74 cu. in. Twin should mesh fully with the sprocket teeth. Allow just enough clearance so that the gear does not bottom and bind at any point. If the gear is not meshed this way, it may wear out prematurely. When rear wheel is shifted to adjust the drive chain, remember to move speedometer gear back accordingly.

### INSTALLATION

When fitting a rubber speedometer drive gear to the shaft, be extremely careful to insert the raised hub section of the two piece hub accurately and squarely into the hole molded in the rubber gear. Make sure that the hub and the gear are matched perfectly in this regard before putting the retaining washer and screws in place. Failure to install the gear in this manner will result in serious damage due to the gear running eccentric.

Rubber gears damaged obviously from mis-adjustment or improper installation cannot be considered faulty and subject to replacement regardless of length of time or number of miles in service.

# SERVICE SHOP DOPE

No. 69 January 19, 1931

## NEW CONSTANT MESH STARTER GEARS

A new starter arrangment of a constant mesh design for the Big Twin transmission recently went into production. All 74 cu. in twin models built lately are equipped with this new started assembly. It can be fitted to any Big Twin transmission from 1926 up. The advantage of the new starter are - first, elimination of all danger of gears jamming when starting, thus removing all posibility of damage through motor backfiring; second, easier motor turnover and starting because of the smoother operation of the constant mesh gears. The new starter assembly complete may be ordered on the following part number:

Part No. 2125-26 List Price - $9.00

### FITTING INSTRUCTIONS

To fit this new constant mesh starter to any Big Twin transmission from 1926 models to early 1931 models the instruction below should be carefully followed:

1. Remove the following original parts: starter cover cap, clutch pull rod, and pull rod thrust bearings.
2. Take out clevis pin in clutch release lever (chain guard side) and shift release lever to one side.
3. Remove starter cover and crank
4. Take off main shaft nut and remove starter clutch, keys, starter main shaft gear, starter clutch spring and starter clutch spring disc.

   (A puller for the starter clutch can be easily made from a sprocket puller, part no. 11920X, by grinding off the backs of the jaws so that they will slip under the starter clutch, and fitting pull rod lock nut, part no. BO-680B on puller screw. The threads on puller screw and nut do not match, therefore, nut will not go on puller screw very far and will act as a surface to pull up against end of main shaft when removing starter clutch. Tapping starter clutch with a brass rod will help loosen it.)
5. Install the four long studs supplied with the new assembly in place of the four original studs located toward the front of the transmission (two on bottom, one at top, and one between). The original studs are too short for the new starter cover.
6. Install new starter clutch spring disc with recess for starter clutch spring facing outward. Fit new starter clutch spring, starter main shaft gear, starter keys and starter clutch. Replace main shaft washer and nut. Fit starter crank in new sector gear in new cover.
7. Install new starter cover and TIME starter gears. TIMING IS CORRECT IF THE LOWEST TOOTH ON STARTER SECTOR GEAR (WITH STARTER CRANK UP) MESHES BETWEEN THE TWO MARKED TEETH ON STARTER MAIN SHAFT GEAR. THIS IS IMPORTANT.
8. Replace and connect release lever, pull rod, and thrust bearings.
9. Pack new starter cover cap with grease and install.



10. Starter gear adjuster plunger is not necessary with new assembly, but it must be left in gear box or replaced with a suitable plug. (At some time later gear boxes will not have a hole at this point.)

### IMPORTANT PRICE CHANGE

Effective January 15, 1931, the price for exchanging worn two cam tappet guide blocks and tappets was increased to $7.50 net, $11.50 list, per set. This figure includes the cost of new tappet guide bushings and tappets.

Some of these guide blocks have been in service so long that they have been repaired several times and are now getting to the point where we have to scrap quite a number of those returned. Usually it is a matter of the square lower section in which the tappet slides, being worn to such an extent that even oversized tappets will not make a satisfactory fit.

# SERVICE SHOP DOPE

No. 71 March 31, 1931


## 74 CU. IN. TWIN MOTOR FITTING SPECIFICATIONS

(NOTE: These supersede all previous specification and apply to all 1930 and later Big Twin Motors.)

PISTON CLEARANCE:
IRON ALLOY PISTONS - (V & VC). . . . . . . . . . . . . . . . .004" to .005"
ALUMINUM & DOW METAL PISTONS - (V & VL) . . . . . . . . . .016" to .018"
(Measure all pistons just below the top group of rings and cylinders about 1/2" from top of bore)

PISTON-CYLINDER HEAD CLEARANCE ( V & VL) .................... 1/16" to 3/32"
(VC Commercial) ............. 7/64" to 9/64"

PISTON PIN IN IRON ALLOY PISTON - .0005" to .001" press fit in lock pin side - plug or slip fit in opposite side.

PISTON PIN IN DOW-METAL & ALUMINUM PISTONS - Snug press fit - not over .0005" tight.

PISTON PIN IN UPPER CONNECTING ROD END (All models) - .001" loose

LOWER CONNECTING ROD BEARING (All models) - .001" to .00125" loose

CONNECTING RODS (All models) - .006" to .010" clearance between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT (All Models) - .0045" loose at inner end of bushing - .002" loose at outer end of bushing. Bushing is taped reamed with special reamer)

SPROCKET SHAFT (All models) - .0005" to .001" loose in roller bearing - .006" to .007" loose in chain lubricating bushing.

FLYWHEEL ASSEMBLY (All models) - .004" to .008" end play in crank case

CAM GEARS (All models) - .0005" to .001" loose in crank case and cover bushings free to .005" end play.

INTERMEDIATE GEAR (All Models) - .001" to .0015" loose on stud

TAPPET GUIDES (All Models - .0005" to .001" press fit in crank case

VALVE TAPPETS (All Models) - .001" to .0015" loose in tappet guides


# SERVICE SHOP DOPE

No. 71A March 30, 1931


## 45 CU. IN. TWIN MOTOR FITTING SPECIFICATIONS - (ALL MODELS)

NOTE: These supersede all previous specifications

PISTON CLEARANCE -- .015" to .017" (Measure pistons just below the top group of rings, and cylinders about 1/2" from the top of bore)

PISTON-CYLINDER HEAD CLEARANCE -- 3/64" to 5/64"

PISTON PIN IN PISTON -- Snug press fit -- not over .0005" tight

PISTON PIN IN UPPER END OF CONNECTING ROD -- .00075" loose

LOWER CONNECTING ROD BEARING -- .0006" to .0008" loose

CONNECTING RODS -- .006" to .010" end play between flywheels -- roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT -- .0045" loose at inner end of bushing -- .002" at outer end of bushing. (Bushing is taper reamed with special reamer.)

SPROCKET SHAFT - .0005" to .001" loose in roller bearing -- .006" to .007" loose in chain lubricating bushing.

FLYWHEEL ASSEMBLY -- .002" to .006" end play in crank case.

CAM GEARS -- .0005" to .001" loose in crank case and cover bushings -- free to .005" end play.

GENERATOR DRIVE GEARS AND SHAFT -- Shaft must be free running fit; have .002" to .004" end play, and .001" to .0015" cldarance in bearings. Small bevel gear should be .002" to .003" loose in bushing assembly, and shimmed to allow .002" to .004" clearance between bevel gears.

TAPPET GUIDES -- .0005" to .001" press fit in crank case.

VALVE TAPPETS -- .001" to .0015" loose in tappet guides


HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wisconsin U.S.A.

# SERVICE SHOP DOPE

No. 71B

March 30, 1931

## SINGLE MOTOR FITTING SPECIFICATIONS - (ALL MODELS)

( NOTE: These supersede all previous specifications)

PISTON CLEARANCE -- Dow metal and aluminum -- .011" to .013". (Measure all pistons just below the top group of rings, and cylinders about 1/2" from top of bore)

PISTON-CYLINDER HEAD CLEARANCE -- 3/64" to 5/64"

PISTON PIN IN PISTON -- Snug press fit - not over .0005" tight

PISTON PIN IN UPPER END OF CONNECTING ROD -- .0005" loose

LOWER CONNECTING ROD BEARING --.0004" to .0006" loose

CONNECTING RODS -- .010" to .020" end play between flywheels -- roller and retainer assembly should be narrower, but not more than .010" narrower than rod.

PINION GEAR SHAFT -- .0035" loose at inner end of bushing -- .0025" loose at outer end of bushing (Bushing is taper reamed with special reamer)

SPROCKET SHAFT -- .0005" to .001" loose in roller bearing -- .006" to .007" loose in chain lubricating bushing.

FLYWHEEL ASSEMBLY -- .002" to .006" end play in crank case

CAM GEARS -- .0005" to .001" loose in crank case and cover bushings -- free to .005" end play

INTERMEDIATE AND OILER GEARS -- .0015" to .002" loose on studs

TAPPET GUIDES -- .0005" to .001" press fit in crank case

VALVE TAPPETS -- Free to .00075" loose in tappet guides.

# SERVICE SHOP DOPE

No. 71C

March 30, 1931

## TIMING SPECIFICATIONS

NOTE: These supersede all previous specifications.

### 1930 AND LATER 74 CU. IN. TWIN ( V AND VC MODELS)

INTAKE VALVE - Opens when piston is 11/64" to 19/64" before top dead center
Closes when piston is 9/16" to 13/16" after bottom center

EXHAUST VALVE - Opens when piston is 9/16 to 13/16" before bottom dead center
Closes when piston is 11/64" to 19/64" after top dead center

IGNITION - OCCURS when piston is 1/4" to 5/16" before top dead center on the compression stroke.

### 1930 AND LATER 74 CU. IN TWIN (VL MODEL)

INTAKE VALVE - OPENS 9/32" to 13/32" before top dead center
CLOSES 1/4" to 1-1/8" after bottom dead center

EXHAUST VALVE - OPENS 5/8" to 7/8" before bottom dead center
CLOSES - 1/4" to 3/8" after top dead center

IGNITION - OCCURS when piston is 5/16" to 3/8" before top dead center on the compression stroke.

### 45 CU. IN TWIN ( ALL MODELS)

INTAKE VALVE - OPENS when piston is 5/32" to 7/32" before top dead center
CLOSES when piston is 37/64" to 45/64" after bottom dead center

EXHAUST VALVE - OPENS when piston is 37/64" to 45/64" before bottom dead center
CLOSES when piston is 5/32" to 7/32" after top dead center

IGNITION - OCCURS when piston is 1/4" to 9/32" before top dead center on the compression stroke.

### 30.50 CU. IN SINGLE (ALL MODELS)

INTAKE VALVE - OPENS when piston is 5/16" to 9/16" before top dead center
CLOSES - when piston is 11/16" to 15/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 1/2" to 3/4" before bottom dead center
CLOSES when piston is 1/4" to 1/2" after top dead center

IGNITION - OCCURS when piston is 1/4" to 5/16" before top dead center on the compression stroke.

21 CU. IN. SIDE BY SIDE VALVE SINGLE (ALL MODELS)

INTAKE VALVE - OPENS when piston is 1/8" to 3/16" before top dead center
CLOSES when piston is 7/16" to 9/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 7/16" to 9/16" before bottom dead center
CLOSES when piston is 1/8" to 3/16" after top dead center

IGNITION - OCCURS when piston is 7/32" to 9/32" before top dead center on the compression stroke

21 CU. IN OVERHEAD VALVE SINGLE (ALL MODELS)

INTAKE VALVE - OPENS when piston is 3/32" to 5/32" before top dead center
CLOSES when piston is 7/16" to 9/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 7/16" to 9/16" before bottom dead center
CLOSES when piston is 3/32" to 5/32" after top dead center

IGNITION - OCCURS when piston is 11/32" to 13/32" before top dead center on the compression stroke.

TAPPET CLEARANCES

NOTE: When checking valve timing according to piston position, bear in mind that tappets must first be adjusted to the correct clearances.

ALL SIDE BY SIDE VALVE MODES ( SINGLES AND TWINS) --- INTAKE - .004" to .005"
EXHAUST - .006" to .007"

OVERHEAD VALVE SINGLE __ INTAKE AND EXHAUST - .002" to .003"

# SERVICE SHOP DOPE

No. 73S April 13, 1931

## RE-ENAMELING PRICES

The following is a list of prices for re-enameling motorcycles, sidecars, package trucks and parts. These prices cover re-enameling charges only. They do not include the cost of any necessary repairs, not labor for stripping and assembling. ALL PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

| PARTS | STANDARD COLOR List Price | STANDARD OPTIONAL & ALL OTHER COLORS List Price |
|---|---|---|
| Motorcycle Cpt. (all models) | $18.50 | $23.00 |
| Sidecar Body (all models) | 15.50 | 18.50 |
| Package Truck Body (M-MO-MW) | 14.00 | 17.00 |
| Package Truck Body (MT-MXP-MWP-MDC-MNO) | 18.50 | 23.00 |
| Frame (Motorcycle) | 2.30 | 2.85 |
| Frame (sidecar/package truck)-Black | 2.30 | * |
| Spring Fork | .90 | 1.15 |
| Rigid Fork | 1.15 | 1.45 |
| Tanks (set) | 3.40 | 4.25 |
| Mudguards (each) | 1.50 | 1.90 |
| Tool Box | 1.00 | 1.25 |
| Handlebars (Black) | .90 | * |
| Generator (Black) | .40 | * |
| Headlamp (Black) | .75 | * |
| Tail Lamp (Black) | .40 | * |
| Horn (Black) | .60 | * |
| Front Chainguard | 1.25 | 1.50 |
| Front Chainguard Inner plate (Each) | .30 | * |
| Rear Chainguard | .40 | .45 |
| Stand (Rear or Front) | .60 | .75 |
| Battery Box Cpt. | 1.00 | 1.25 |
| Wheels (Each including Spokes-Black) | 1.90 | * |
| Sidecar or Package Truck Springs (set) | 1.40 | * |
| Luggage Carrier (Motorcycle) | 1.50 | 1.90 |
| Tire Rack and Luggage Carrier (Sidecar) | 2.30 | * |



| PARTS | STANDARD COLOR List Price | STANDARD OPTIONAL & ALL OTHER COLORS List Price |
|---|---|---|
| Spare Wheel Carrier (Black) | $ .75 | * |
| SirenProjector or Guard | .40 | .45 |
| Panel Switch Cover | .25 | * |
| First Aid Box | 1.30 | 1.50 |
| Pyrene Brackets (Each - Black) | .75 | * |
| Legshields (Set - Black) | 2.00 | |
| Name Plate (Black) | .25 | |

The parts indicated by an asterisk (*) are enameled BLACK on all standard as well as special colored machines.

For paneling tanks and mudguards any color panel add $1.00 net - $1.50 list extra per panel

For special shaped panels on tanks any color add $3.50 list extra per panel

For two-tone sidecar bodies or package truck bodies add $2.30 list to charge for single color enameling.

Add transportation charge to List Prices

# SERVICE SHOP DOPE

No. 74 April 20, 1931

## FOLLOW THESE SUGGESTIONS FOR BEST MOTOR LUBRICATION

You wonder perhaps, why again this spring, we bring up the old story of lubrication here are the reasons. First of all, late type motors are higher compression then ever before, resulting in more power, higher operating temperatures, and call for closer attention to lubrication. Second, in recent years, more and more riders are using their machines throughout winter, regardless of how severe weather conditions may be. In almost every locality, winter service usually means machines must be equipped with handlebar windshields and possibly sidecars. It means, too, motors are often primed and choked when starting, which likely results in considerable dilution of crankcase oil.

You probably haven't worried much about the matter of lubrication during winter as you have felt machines are necessarily operated so slowly, that less effective motor cooling due to windshield equipment, additional load of sidcar, diluted crank case oil, and the hard going of winter service generally, should result in no harm worth mentioning. We fully agree that slow winter riding does not lead to any great danger of motor damage, even though lubrication may not be at its best. However, danger comes in with the first warm spring days. Immediately a rider gets "rip-twisting fever", or in other words, a desire to try his machine out: whereupon, without changing oil in the crank case, without removing the handlebar windshield, without tuning up his motor in any way, he travels out to his favorite speed course and turns on the gas. What are the results" His motor, not at the peak of its efficiency after a winter of plugging around, fails to cool or lubricate properly, and heats up badly possibly to the extent of seizing.

The solution to this problem is to warn your riders against the practice of rushing out to the open highway on the first fine day and riding their machines wide open WITHOUT FIRST DRAINING THE CRANK CASE AND PUMPING IN THREE GUNFULS OF FRESH OIL. Remind them further, not to push their machines to the limit, with sidecars attached on warm spring days - especially when windshields are fitted and motor are in need of some tuning up.

Another thing, in connection with lubrication, which seems to have more or less disappeared, is the good old-fasioned practice of using the hand oil pump when riding at top speed or under conditions of high motor turnover. Since motors have been fitted with throttle controlled oilers, use of the hand oil pump has been almost completely forgotten except as a means of injecting fresh oil after draining, but with the increased horse-power, speed and heat developed by late motors, it is more important now than ever before that the hand pump be used under certain conditions. As a safety factor, advise your riders to use their hand oil pumps when running at high speeds. Tell them to supply about 1/3 to 1/2 pumpfuls, at least every two miles.

Another mightly important lubrication suggestion, which is entirely overlooked too frequently, IS THE SIMPLE STUNT OF OCCASIONALLY CLOSING THE THROTTLE, FOR AN INSTANT, WHEN TRAVELING AT EXTREME SPEEDS. Closing the throttle shuts off the air supply from the air intake of the carburetor almost completely, setting up a vacuum in the cylinders which draws oil up from crank case past the pistons thus more effectively lubricating cylinder walls, upper connecting rod ends,



and pistons. It is not necessary to keep the throttle closed for more than a second or two, as pistons are moving so fact that a considerable quantity of oil is drawn up instantly.

### SUMMARY

1. Drain, flush and replace crank case oil supply regularly.

2. Use the hand oil pump when motor is running at, or near, its top limit.

3. Develop the habit of occasionally snapping the throttle shut, for an instant, when traveling at high speed.

4. Do not ride a machine, particularly a sidecar outfit, equipped with handlebar windshield, wide open for long distances without giving close attention to lubrication, and overheating conditions possibly brought about through bad spark plugs or need of general tuning-up.

5. Always use good oil. Our recommendation is that Harley-Davidson oil be used exclusively.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wisconsin,
U.S.A.

# SERVICE SHOP DOPE

No. 76 May 4, 1931

## ROLLER BEARING ROLLERS

(Supersedes all previous lists)

Here is a handy chart, giving information on roller bearing rollers. It is suggested that this data be kept in a prominent place so that it can be referred to on a monents notice.

The standar diameter is the same for all types of rollers. They are furnished in diameters varying from .001" undersize to .001" oversize, in steps of .0001".

| PART NO. | WHERE USED | NO. USED | LENGTH |
|---|---|---|---|
| 304-15 | Big Twin front connecting Rod | 24 | 23/64" |
| " " | 1929 and earlier Big Twin Sprocket Shaft | 24 | " " |
| " " | 45" Twin Sprocket Shaft | 24 | " " |
| " " | 1930 and later Big Twin Front Brake Hub | 24 | " " |
| " " | 1930 and later Big Twin Sidecar Brake Hub | 28 | " " |
| 305-15 | Big Twin Rear Connecting Rod | 12 | 47/64" |
| " " | 30.50" Single Connecting Rod | 12 | " " |
| " " | Big Twin Clutch Sprocket | 12 | " " |
| 305-29 | 45" Twin Rear Connecting Rod | 12 | 9/16" |
| 306-26 | 21.09" Single Connecting Rod | 12 | 19/32" |
| " " | 21.09" and 30.50" Single Sprocket Shaft | 12 | " " |
| 2289-17 | 45" Twin Front Connecting Rod | 24 | 9/32" |
| " " | 45" Twin and Single Clutch Sprocket | 16 | " " |
| " " | Big Twin Transmission Countershaft Gear | 24 | " " |
| " " | 1924 and earlier Transmission Main Drive Gear | 20 | " " |
| 2289-25 | 1930 and later Big Twin Sprocket Shaft | 24 | 31/64" |
| " " | 1923 to 1929 Big Twin Rear Wheel Hub | 32 | " " |
| " " | 1925 and later Big Twin Transmission main drive gear | 20 | " " |
| " " | 45" Twin & Single Transmission Clutch Gear (Left side) | 16 | " " |
| " " | 45" Twin & Single Transmission Mainshaft(right side) | 12 | " " |
| " " | 1930 and later Big Twin interchangeable wheel hub | 14 | " " |
| " " | 1930 and later Big Twin Rear Brake Hub | 28 | " " |

# SERVICE SHOP DOPE

No. 77 May 11, 1931

## CYLINDER HEAD BOLT SIZES

(Supersedes all previous information)

Cylinder heads on some of the 1930 Big Twins are clamped with twelve 7/16" x 1-5/8", and two 7/16" x 1-13/16" bolts threaded with 20 threads to the inch; and some are clamped with fourteen 7/16" x 1-7/8" bolts threaded with 16 threads to the inch. (See chart below)

It is advisable to arrange your supply of cylinder head bolts accordingly, and call this to the attention of your parts and service men.

When necessary to renew a cylinder head bolt, first determine which size is needed. A mistake is likely to result in stripped cylinder threads. To repair a cylinder in which threads are stripped, remove cylinder head, and with a 33/64" drill, enlarge the hole in head that corresponds with stripped hole in cylinder. Replace cylinder head (without gasket) and fasten with two or three bolts; then, using head as a guide to keep tap straight, re-thread stripped hole, using a 1/2" x 20 U.S.F. tap. Remove cylinder head again, and after cleaning all chips away, reassemble completely.

| PART NO. | SIZE | THREAD | LIST PRICE | NO & WHERE USED |
|---|---|---|---|---|
| 14-29A | 7/16" x 1-5/8" | 20 U.S.F. | $ .10 | 7 on all 30.50s, 12 on early 1930 74s. |
| 14-30 | 7/16"x 1-13/16" | 20 U.S.F. | .10 | 2 on early 1930 74s |
| 14-30B | 7/16"x 1-7/8" | 16 U.S.F. | .10 | 14 on later 1930 and 1931 74s |
| 14-30S | * 1/2" x 1-5/8" | 20 U.S.F. | .10 | Repair on all 30.50s and 1930 and 1931 74s |

# SERVICE SHOP DOPE

No. 78 May 15, 1931

## TO USE NEW CLUTCH FIXTURE

TO DIS-ASSEMBLE CLUTCH - Remove clutch spring nut sector locating pins and compressing screw from fixture. Place clutch assembly in fixture. Insert compressing screw through clutch assembly into threaded plate. Tighten compressing screw until clutch spring tension is relieved sufficiently to permit readily removing clutch spring screws. Then take out fixture compressing screw, and clutch assembly is then free to come apart.

TO ASSEMBLE CLUTCH - First try each lined friction disc separately in the clutch shell. As there is slight irregularity in the spacing of splines and splineways, it will be found that the discs fit better in one position than in another. This applies particularly to new or only slightly used discs. Brand new discs often require slight filing or grinding of the splines before fitting properly. Make a mark on the clutch shell and when the position is found where each disc fits freely, mark the discs accordingly. The flat steel discs and the releasing disc should also be fitted together and marked. After the discs are marked, proceed as explained below to place them in proper order in the clutch fixture with marks in alignment, and then after the assembly is removed from the fixture, insert it into the clutch shell according to markings. Unless this procedure is followed, there is a possibility of one or more of the discs binding in the splineways with the result that clutch will not engage and release properly.

With nut sector locating pins and compressing screw removed from fixture, place nut sectors on pads, and insert sector locating pins thru nut sectors into holes in fixture pads. (NOTE: Use outer row of holes for 1929 and earlier model clutches --- inner row of holes for 1930 and later models)

On 1929 and earlier models, place clutch springs only over nut sector locating pins: on 1930 and later models spring guide collars are first placed over nut sector locating pins, then springs and next the upper set of spring guide collars.

Place releasing disc guide pin in hole between pads. (NOTE: outer hole 1929 and earlier -- inner hole 1930 and later.) Next drop releasing disc into position so that disc guide pin enters any one of the three large holes in disc. Assemble inner clutch discs, remove guide pin, and place outer drive disc in position.

Insert fixture compressing screw through clutch assembly into threaded plate and compress springs. Remove nut sector locating pins and insert clutch spring screws. Turn screws in until 1½ threads extend through nut sectors.

After removing assembly from fixture, turn screws to right or left as necessary to allow keys on screw heads to drop into locking notches in outer drive disc; then assemble clutch in shell.

# SERVICE SHOP DOPE

No. 79 July 6, 1931

## 1932 45 and 74 CU. IN. TWIN PISTON PIN LOCK RINGS

All 1932 45 and 74 cu. in. motors equipped with Lynite (aluminum) or Dow metal pistons are fitted with a new type of piston pin lock ring. This ring fits on to the steel piston pin rather than into the aluminum or Dow metal piston as did the old style ring. This construction insures against lock ring failure providing rings are correctly and carefully installed.

At the start of the 1932 season, we are going to discontinue shipping the present type of aluminum and Dow metal pistons and send out only the improved 1932 pistons for the "45" and "74" models. However, the present lock rings and piston pins may be obtained for servicing earlier motors in which a change of pistons is unnecessary.

The new arrangement necessitated a change in the piston and piston pin design, therefore, the new parts are not interchangeable with older pistons, pins and lock rings. For this reason, on all orders for pistons, we will temporarily supply a complete combination of new style piston, piston pin, and lock rings. (The piston rings are not included.) You will find one of the lock rings fitted to the piston pin and we recommend you observe it carefully, particularly in regard to the tightness with which it fits on the pin. The ring you install on the opposite end of the pin should fit equally tight.

### IMPORTANT

THESE NEW RINGS CANNOT BE USED A SECOND TIME AS THEY BECOME BEND AND "SPRUNG" WHEN REMOVED. ANY ATTEMPT TO STRAIGHTEN AND RE-USE RINGS WILL VERY LIKELY RESULT IN SERIOUS DAMAGE TO THE MOTOR BECAUSE OF LOCK RING FAILURE.

THESE RINGS CANNOT BE SUCCESSFULLY INSTALLED EXCEPT WITH A NEW TOOL DESIGNED FOR THEM. OTHER METHODS OF INSTALLATION WILL EVENTUALLY CAUSE TROUBLE. (Complete instructions covering the use of this installing toll are packed with it).

IN ORDER TO PROPERLY SERVICE MOTORS, WE SUGGEST YOU ORDER ONE OF THESE TOOLS AND A SUPPLY OF THE NEW LOCK RINGS AT ONCE.

| 1932 LOCK RING | NEW INSTALLING TOOL |
|---|---|
| Part No. 280-32 | Part No. 12052-32 |
| List Price - 15¢ | List Price - $1.00 |

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

# SERVICE SHOP DOPE

No. 79A July 6, 1931

## INSTRUCTIONS FOR USING LOCK RING INSTALLING TOOL

The lock ring installing tool consists of three pieces, namely; 1. A TAPERED EXPANDING ARBOR (the longest piece); 2. A SHORT COLLAR (used only as a spacer when removing rings from "45" twin pistons); 3. A LONG COLLAR (for pushing rings over expander onto piston pins). NOTE THE REFERENCE TO THESE NAMES AND GO THRU EACH OPERATION IN THE ORDER GIVEN HERE.

### ORDER OF OPERATIONS WHEN INSTALLING RINGS

1. After piston and pin with one ring already in place, are assembled on connecting rod, carefully clean out groove in piston pin into which other ring is to be fitted.

2. Insert straight end of expander into piston pin starting it into pin on side where ring is to be installed.

3. Dip lock ring in oil and slide over tapered end of expander, with flat side of ring facing inward.

4. With long collar push lock ring over the expander into position on piston pin. Be sure gap in lock ring is at least 1/8" away from either removal slot in piston pin. Tap long collar lightly with a hammer, if necessary, to drive ring on.

### ORDER OF OPERATION WHEN REMOVING RINGS

NOTE: Remove only the ring on slotted end of piston pin. The other ring remains on pin permanently unless it becomes damaged or loose thru unusual service.

1. Insert straight end of expander into piston pin, starting it into the pin on the side which is not slotted. When doing this operation on 45 cu. in. motor, place small spacer collar over straight end of expander before inserting into piston pin. This small collar is not used on 74 cu. in. motors.

2. Place the edge of a screw driver blade under the lock ring at one of the slots in the piston pin. Rest screw driver on flat area of the expander and pry one side of ring out of groove.

3. Turn expander so that opposite side of ring can be pried out. Finally, work ring off of piston pin. Scrap ring removed, as it cannot be reused safely.

# SERVICE SHOP DOPE

No. 80 July 13, 1931

## ADJUSTING THE OIL PUMP

In addition to the regular oil pump adjustment described in the Rider's Hand Book, further regulation of the pump can be made by adding or removing washers from under the screw located in the end of the pump body. To change the amount of oil pumped, by means of this screw and washer adjustment, it is only necessary to add washers to increase the supply, or remove washers to decrease it. These washers are made in two thicknesses - 1/64" (part No. 674-22) and 1/16" (Part No. 0202). It is advisable to make all changes with thin washers, whether increasing or decreasing the oil supply, in order to prevent an extreme change which might result in a heavy oversupply, or an undersupply which would cause serious damage.

WARNING: - If the particular pump you are working on is one equipped with the short oiler screw (19/32" overall, part No. 672-22), do not under any conditions, fit more than a total of one thick washer or four thin washers. If the pump is fitted with the long adjusting screw (43/64" overall, part No. 672-29), do not fit more than a total of two thick or eight thin washers. Fitting more washers than the numbers mentioned, will very likely injure the pump.

## REAR WHEEL SPROCKETS FOR 45 CU. IN TWINS

A number of dealers have recently requested information in regard to the rear wheel sprockets available for 45 Twins. Here is a complete list of sprockets in stock. (These sprockets fit all "45" and "30.50s").

| | | | | |
|---|---|---|---|---|
| Part No. | 2046-29 | - | 28 | Tooth Sprocket |
| " " | 2042-29 | - | 30 | " " |
| " " | 2047-29 | - | 32 | " " |
| " " | 2048-29 | - | 36 | " " |
| " " | 2045-29 | - | 38 | " " |
| " " | 2043-29 | - | 40 | " " |

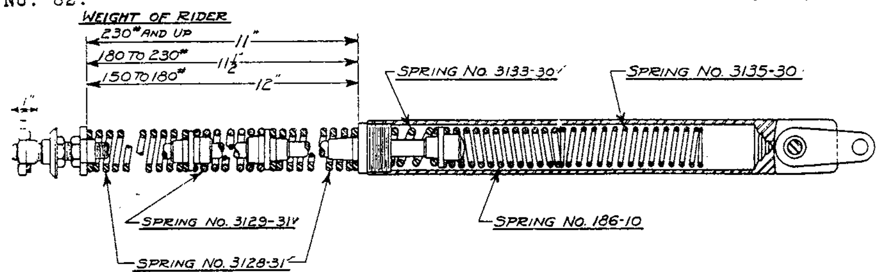
## SEND YOUR CRANKCASE HALVES TO THE FACTORY FOR MATCHING

To insure perfect matching of crank cases the factory method is to bolt crank case halves together and machine them in pairs. This procedure provides a perfectly square area for the cylinders to rest upon.

Crank case halves poorly matched may result in broken cylinder bases, oil leakage, or possibly both. To avoid difficulty of this kind, we advise you to send your crank cases to the factory for accurate matching.

# SERVICE SHOP DOPE

No. 82. July 27, 1931




## Correct Seat Post Adjustment

The above drawing shows the standard seat post as used on 74 and 45 cu. in. twins, and 30.50 cu. in. singles. The 21 cu. in. single seat post is the same as the above except spring No. 3133-30 is used instead of spring No. 186-10 in the upper group, and 186-10 is used in place of 3129-31 in the lower group.

To set the standard seat post for riders of different weights, adjust the lower springs to the required length, depending on weight of rider. (See drawing.)

If the standard seat post is too stiff even at its lowest adjustment, fit the regular 21 cu. in. single spring combination as this assembly is designed primarily for lighter riders.

## Horn Service

The manufacturer of Remy and Klaxon horns has asked us to request dealers to take all service questions concerning this equipment up with their local or nearby United Motors Service Station rather than to send these horns to the horn factory or to us directly. They maintain no service organization themselves and have promised good service on either adjustment or repair work through authorized United Motors Service Stations.

If you haven't a United Motor Service directory or if yours is not up to date we will be glad to mail you the latest revised list. Address your request to the Service Department.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U. S. A.

# SERVICE SHOP DOPE

No. 83 August 3, 1931

## BRONZE BUSHINGS NOT FITTED IN ALL 45 CU. IN TWIN CONNECTING RODS

All 45 cu. in. twin connecting rods now have bronze bushings in the upper ends. This applies to rods as assembled in new motors and also to those supplied on parts orders.

As the weights of the bushed and the unbushed rods are approximately the same, they are interchangeable and motor performance will not be affected in any way if a bushed and an unbushed rod are used together. The bushed rods can be used in any model 45 cu. in. twin.

## 1932 45 CU. IN TWIN CRANK PINS

The 1932 45 twin has a crank pin similar to the type used on the Big Twin. This design provides a hole drilled on an angle in the pin, which leads the oil from the drilled oil hole in the flywheel to the center of the connecting rod roller bearings, thus insuring an adequate supply of oil at this point. This new crank pin is now being supplied on all parts orders, and can be used satisfactorily in all 45 twin motors regardless of model. However, it is not advisable to use the old style (not drilled) crank pin in the 1932 flywheels as this combination may not allow sufficient oil to get thru to the lower end roller bearings.

## ALL 1932 45 CU. IN. TWINS HAVE HEAVIER CUSHION RINGS

The 1932 45 twin is equipped with a heavy type inner cushion ring which is considerable more reliable than the lighter style formerly supplied. When using these new rings to service an early 45 twin motor, bear in mind that the 1932 style guide rings must be used with them as the old guide rings are too thick; the new guide rings are made thinner to compensate for the increased thickness of the new style inner cushion rings.

In addition to the cushion and guide rings just described, the 1932 45 twin is also equipped with a new inner cushion ring (expander ring) fitted under the bottom compression ring. This upper cushion ring cannot be applied to earlier type pistons as the ring groove is not deep enough to allow sufficient room for it. However, this cushion ring can be fitted to all 45 twin pistons now being shipped on parts orders.

| NUMBER NEEDED | PART NO. | NAME | LIST PRICE |
|---|---|---|---|
| 4 | 262-32 | Guide Ring | 15¢ each |
| 2 | 263-32 | Cushion Ring, Lower | 15¢ each |
| 2 | 263-32A | Cushion Ring, Upper | 15¢ each |

# SERVICE SHOP DOPE

No. 84 August 10, 1931

## LUBRICATE SPARK AND THROTTLE CONTROLS REGULARLY

Spark and throttle controls should be oiled and greased at regular intervals. To lubricate grips remove them and apply grease, or a graphite and grease misture on handlebar ends, particularly around the spiral grooves cut in bars. Uncovered control coils (on models prior to 1932) can easily be lubricated by using a very thin, good oil applied directly to the control coil. The oil will quickly work through to the wire. THIS LUBRICATION IS PARTICULARLY NECESSARY ON THE OIL PUMP CONTROL COIL, AS THIS COIL IS LOCATED SO CLOSE TO REAR CYLINDER AND EXHAUST PIPE THAT IT DRIES OUT MORE QUICKLY THAN THE OTHER CONTROLS. When this control coil becomes dry, the throttle is extremely hard to operate, but becomes loose as soon as oil works through to control wire.

The spark and throttle control coils on 1932 models are covered (excepting oil pump control coil) and require lubrication only at points where wires come out of coils.

## CORRECTING CARBURETOR LEAKAGE

To correct a leaky carburetor, check float level to make sure that float is no higher than 3/8" (twins), 1/4" (singles), from upper edge of bowl. Re-set if necessary.

In connection with 1930 and 1931 carburetors (45" and 74") of the die-cast type, the float valve arrangement should also be given attention. See that the latest, guided, float valve (three sided valve) is installed. This newest valve comes nearer to being leak proof than any arrangement used previously. It can be applied to any 45" or 74" model die-cast bowl. The guided float valve (round valve) went into production with 1931 models, and the new three sided float valve which uses the same guide, went into production about the middle of the 1931 season. On die-cast carburetors supplied prior to the 1931 season it is necessary to fit a new float lever and float valve seat before the new three sided float valve can be fitted.

A gasoline strainer, which will keep dirt, etc., out of carburetor, should also be added to effectively stop gasoline leakage. The strainer can be fitted to old as well as late models, although it is necessary to bend the gasoline line when fitting it to older machines. A gasoline line adaptor is attached to strainer as it leaves the factory. When replacing a strainer on a 1932 - 45" or 74" model, this adaptor has to be removed, but on all other models it must be used.

| NAME | PART NO. | LIST PRICE |
|---|---|---|
| Three sided Float Valve | 1273-31 | $ .35 |
| Float Lever | 1272-31 | .25 |
| Float Valve Seat | 1284-31 | .60 |
| Gasoline Strainer | 3623-32 | 1.50 |

# SERVICE SHOP DOPE

No. 85 September 21, 1931

## HOW TO FIT THE LATEST INNER CHAIN GUARD SLIDING PLATE

On all 1930 and 1931 "74" cubic inch Twins, the inner chain guard sliding plate, part No. 3812-30, is attached to the transmission by means of two aluminum lugs cast integral with the transmission box. On 1932 model "74" cubic inch twins, this construction has been altered so that the chain guard sliding plate is now held to the transmission by means of the same cast aluminum lug at the rear of the transmission, andby a new stamped metal bracket attaching to the top of the transmission in the front. The object of this change is to prevent possible chain jamming and gear box breakage in the event the rear chain happens to break.

Gear boxes on 1930 and 1931 models can be converted to the later construction quite easily by sawing off the lug at the front end of the gear box flush with the box itself. Next, the two studs located directly above the point where the lug has been sawed off, must be removed and replaced with the two studs, part number 2134-31. Place the new sliding plate bracket over the special studs just installed, first placing spacer 3813-32 over each of the studs for the new bracket to rest upon. Tighten up the stud nuts, attach the inner chain guard sliding plate to the rear transmission lug and the job is complete.

This change is particularly recommended for motorcycles in commercial service, on which chains are run until worn to the breaking point and usually with very little attention.

The parts necessary to make this conversion are listed as follows:

| NAME | PART NO. | LIST PRICE EACH | NUMBER NEEDED |
|---|---|---|---|
| Studs | 2134-31 | .05 | 2 |
| Spacer | 3813-32 | .10 | 1 |
| Sliding Plate | 3812-32 | .75 | 1 |

# SERVICE SHOP DOPE

No. 87 October 12, 1931

## ADJUSTMENT OF REVERSE TRANSMISSION

In the event it becomes necessary to replace any parts which disturb the setting in a reverse transmission, particular attention should be given to the proper re-adjustment of the eccentric studs in the ends of the sliding-gear-fork shifter arms. These studs must be set so the sliding gears engage properly, and have sufficient clearance from adjoining gears when shifted to various positions.

The proper way to adjust, and to determine when adjustment is right, is to temporarily fit the gear box cover to the box and, after shifting to a certain position, carefully lift the cover straight upward and note the location of the sliding gears. As a matter of checking, repeat this test in each shift position and then turn the eccentric studs until the best possible general adjustment is obtained.

When a satisfactory adjustment has been reached, the main drive gear and its sliding gear will interlock completely in "High" position, and all gears will have ample clearance when in "Neutral" positions. With the studs turned to a point where the gears are in a position as just described, lock the adjusting studs with the special washers provided.

In addition to properly adjusting the eccentric studs, it may also be necessary to do a slight amount of fitting when new sliding gear shifter forks are installed. However, this will not be required except in isolated cases where a certain amount of grinding will be needed to compensate for unavoidable irregularities of the forks in order to provide all-around clearance. Whether or not grinding is necessary can only be determined by fitting the parts and trying them.

It should be remembered that reverse transmissions have more moving parts in their shifting mechanism than a standard gear box, and it is, therefore, extremely important to keep the gear shifting levers well lubricated in order to insure easy gear shifting. It is also important to keep the transmission FILLED with oil if easy shifting is to be maintained.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

# SERVICE SHOP DOPE

No. 88 October 19, 1931

## SERVICING INTERCHANGEABLE WHEELS

After considerable service, and, of course, depending to a great extent on the kind of service in which a machine is used, interchangeable wheels may become worn to some extent, causing end play in the wheel hubs, and looseness in the drive splines.

In case of excessive end play in a wheel hub, correction can be made by using a thicker thrust plate spacer than the one originally fitted in the hub. These spacers are regularly supplied in sizes from .345" to .380" in steps of .005", and we can supply a .390" spacer for unusual cases.

Drive spline looseness can be taken care of by fitting an oversize brake shell hub, which we can supply in sizes of .001", .002", or .003" oversize. A .001" oversize hub will take care of splines which have an average amount of wear; a .002" oversize will fix up a badly worn assembly; and a .003" oversize should not be necessary except in an extreme case where there is excessive wear.

AN OVERSIZE HUB SHOULD NOT BE FITTED UNTIL WHEELS HAVE BEEN INTERCHANGED A SUFFICIENT NUMBER OF TIMES SO THAT ALL WHEEL HUBS ARE WORN ABOUT EQUALLY. Otherwise fitting an oversize hub to correct a badly worn rear wheel will upset the interchangeable wheel system because the front, sidecar, or spare wheel will not fit on the oversize hub.

OVERSIZE REAR WHEEL SPOKE SHELL HUB

| Part No. | List Price each |
|---|---|
| 0.30S | $4.50 |
| 0.32S | $4.50 |

Specify oversize wanted

THRUST PLATE SPACER

| Part No. | List price each |
|---|---|
| 3927-30 | $ .25 |

Specify size wanted to order a quantity assorted

# SERVICE SHOP DOPE

No. 90

November 23, 1931

EXTRA HEAVY SEAT POST SPRING COMBINATION
NOW AVAILABLE

For some time back, we have been receiving occasional requests for a heavier seat post spring combination suitable for very heavy riders. We are now prepared to supply a stiffer spring assembly which is only a slight variation from the standard layout.

In order to change the standard seat post on 1931 or later models to the extra heavy arrangement, substitute the new heavy spring for the middle spring in the lower group of springs on the seat post rod. In addition to changing the spring, it is also necessary to exchange the two original spring guide collars for the two new collars supplied with the heavy spring.

To fit the extra heavy spring to a late 1929 or any 1930 model, the entire assembly of lower springs must be exchanged for the complete set listed below. This is necessary because the lower group of springs on late 1929 and 1930 models are entirely different from those now supplied.

In the event you wish new machines equipped with the heavy seat post spring combination when assembled at the factory, specify on your order -- "Supply extra heavy seat post spring combination." We strongly advise you against using the heavy combination on machines ridden by riders weighing under 200 pounds. The standard seat post satisfactorily takes care of riders weighing up to about 200 pounds.

COMPLETE SET OF LOWER SPRINGS - HEAVY - 3128-29A - $1.00 list
(Apply to all models from late 1929 upward)

CUSHION SPRING ONLY WITH COLLARS - HEAVY - 3129-31A -- $ .65 List
(For converting 1931 and later model standard combinations)

# SERVICE SHOP DOPE

No. 92

December 14, 1931

MECHANICS' SCHOOL DOPE

"All right boys -- park your Sunday clothes, ditch your smokes, jump into your overall, and we'll proceed during the next three weeks to discuss, explain, demonstrate, and put into practice everything that goes with the servicing of Harley-Davidson motorcycles." -- That will be the word passed around Monday morning, January 11th, 1932, when the mechanics' school opens. The instructors will be servicemen who have been through the mill of experience and who know the best and quickest ways to do things. There will be plenty of action and no time to even think about "depression". Three weeks chock-full of things every mechanic should know.

In view of the number of returns from our recent mechanics' school inquiry, only one class with a limit of twenty-four men will be instructed this winter. If you are interested, fill out and return the attached application blank at once. Applications received from those who previously returned inquiry forms, will, of course, be given first consideration. Other applications will be considered on the basis of first come - first served.

DON'T FORGET -- THE SCHOOL DATES ARE JANUARY 11TH, 1932 TO JANUARY 30TH, 1932. ONE CLASS -- LIMIT 24 MEN.

---

APPLICATION FOR MECHANICS' SCHOOL
( January 11, 1932 to January 30, 1932 )

Desk H-5
Harley-Davidson Motor Co.
Milwaukee, Wisconsin

Date______________________

Reserve a place for (ME______________) (MY MECHANIC______________)

Do you intend to come in a few days earlier to attend the Sales Conference on January 8th? (______________)

If sending employee (Name)______________________
(How long employed)______________________
(Is he continuing in your employ)______________________

Dealer's signature______________________

Address______________________

Shall we arrange for room and board? (About $9.00 per week)______________

# SERVICE SHOP DOPE

No. 95 August 22, 1932

IMPORTANT --- NOTICE --- IMPORTANT

THIS IS TO ADVISE THAT FOR SOME TIME TO COME WE WILL NOT RE-ENAMEL TANKS OF EARLIER MODELS WITH THE 1933 EAGLE HEAD SCROLL PANELS

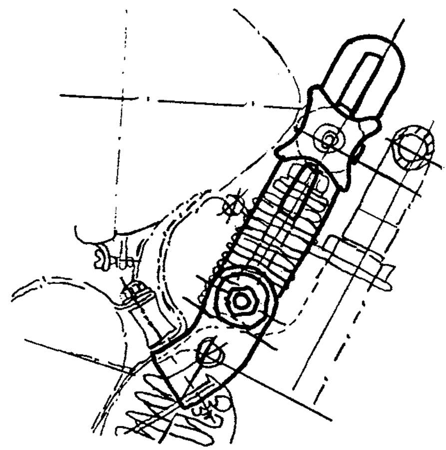
WE ALSO ADVISE THAT WE WILL NOT SUPPLY VLD MODEL CYLINDERS AND OTHER PARTS FOR CONVERTING OTHER MODELS TO VLD MOTORS.

WHEN THERE IS A CHANGE OF POLICY IN THIS RESPECT, YOU WILL BE NOTIFIED.

# SERVICE SHOP DOPE

No. 96 THE NEW RIDE CONTROL October 5, 1932

( FORK SNUBBER)



The new Ride Control recently announced is without any question the outstanding accessory development of the year, because it contributes to better motorcycle control and safer riding at high speeds. With it attached, a rider has complete control over fork action. It can quickly be adjusted at any speed to meet road conditions and eliminate any tendency toward front end bouncing and hopping.

While it is particularly effective in connection with a solo motorcycle, especially a fast driven one, it adds to the good riding qualities and control of any motorcycle in any sort of service. Push this attachment with your riders, expecially your fast solo riders. It is something they will need and appreciate.

Ride Control fits 1931 and later Twin models. It can also be applied to any 1930 Twin model that has been changed over to 1931 headlamp arrangement.

Part #11250-30 Price - $4.75 List Code Word -Biwxa

ATTACHING INSTRUCTIONS

After noting just how snubber is put together, diassemble cross member from side members. Remove spring fork rod lock nuts - also tool box and lamp bracket bolt nuts. Fit snubber cross member to spring fork rods and secure with lock nuts.

Remove tool box and lamp bracket bolts, one at a time, and fit snubber side members. Note that side members are right and left. Discard plain washer found between lamp and tool box brackets. Lower end of side member fits over both lower tool box brackets but, underneath lamp bracket, as per sketch.

When tightening bolts that secure lamp bracket- tool box bracket, and snubber side members, see that side members are adjusted so they bear lightly against cross member friction washers.

Loosen nut at joint in side member and adjust upper end so that slot lines up exactly with hole in cross member. Snubber control nut can be assembled on right or left side as desired. It is usually assembled on left side.

SERVICE SHOP DOPE

SPECIAL February 23, 1932

## MOTOR FITTING SPECIFICATIONS

### 1925 to 1929 61 cu. in., and 74 cu. in. Motors

PISTON CLEARANCE:

| | | | |
|---|---|---|---|
| Iron Alloy Pistons | 1925 to 1929 | 61 cu. in | - .002" -----.00275" |
| " " " | " " " | 74 " " | - .003" -----.004" |
| Aluminum & Dow Metal Pistons | " " " | 61 " " | - .0115" ----.0135" |
| Aluminum & Dow Metal Pistons | " " " | 74 " " | - .0135" ----.0155" |

(Measure all pistons just below the top group of rings and cylinders about 1/2" from top of bore)

PISTON PIN IN IRON ALLOY PISTON -- .0005" to .001" press fit in lock pin side -- plug or slip fit in opposite side.

PISTON PIN IN ALUMINUM & DOW METAL PISTONS -- Snug press fit -- not over .0005" tight.

PISTON PIN IN UPPER CONNECTING ROD END (all models) -- .001" loose

LOWER CONNECTING ROD BEARING:
Motors fitted with Iron Alloy pistons ------------ .0002" to .0003" loose
" " " Aluminum or Dow Metal Pistons --- .0004" to .0006" loose

CONNECTING RODS (All models) -- .006" to .010" clearance between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT
Motors fitted with Iron Alloy Pistons. .0035" loose at inner end of bushing -- .002" loose at outer end of bushing
Motors fitted with Aluminum or Dow Metal Pistons -- .004" loose at inner end of bushing -- .0025" loose at outer end of bushing.
(Bushing is taper reamed with special reamer.)

SPROCKET SHAFT (all models) -- .0005" to .001" loose in roller bearing.

FLYWHEEL ASSEMBLY (all models) -- .003" end play in crankcase

OILER GEAR, INTERMEDIATE GEAR, & GENERATOR DRIVE GEAR (all models) -- .001" to .0015" loose on studs

SERVICE SHOP DOPE

No. 92 March 28, 1932

## EXCHANGE EARLY SERVI-CAR CROSS SHAFTS FOR LATER TYPE WITH LOCK PIN

Any Servi-Car shipped from the factory prior to February 8, 1932, is equipped with a tow-bar cross shaft which has no lock-pin (cotter-pin). These early shafts are too short to allow fitting a lock-pin, and in order to fit one the cross shaft must be replaced with one of the later type.

To remove old shaft, support tow bar on a solid surface and knock shaft out with a raw hide mallet. Install new shaft so cotter pin hole is at right angles to tow-bar.

A lock pin is important because under certain unusual conditions, such as an extremely sharp dip in a driveway, or an exceptionally steep garage ramp, the old type tow-bar may become unlocked. Even more important is the fact that with a lock-pin the tow-bar shaft must be correctly inserted so the retaining lip on the tow-bar is inside the anchoring projection on tow-bar connection, before the lock-pin can be fitted. With the old arrangement, it was possible to insert the tow-bar incorrectly and not lock it in position.

The parts necessary to make the changeover are as follows:

| QUANTITY | NAME | PART NO. |
|---|---|---|
| 1 | Tow-bar Shaft | 7009-32 |
| 1 | Lock-pin and Chain | UC-824 |

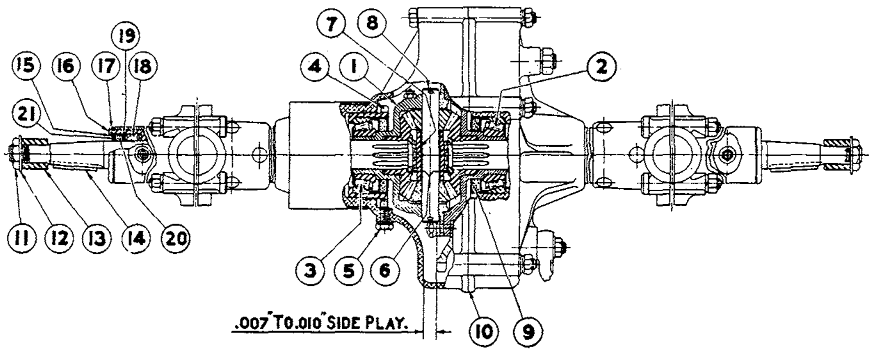
We will allow full credit for original shafts returned and received at the factory prior to June 1, 1932. After that date this offer is void.

Remember to give your Servi-Car owners good service. Arrange for regular inspections so you can keep all adjustments in order. Always keep in mind your Servi-Car customers are service specialists and they judge your service by their standards.

# SERVICE SHOP DOPE

No. 98 October 24, 1932

## Servi-Car Rear Axle Assembly




1. Differential unit

2. Right side differential bearing (not adjustable).

3. Left side differential bearing (adjustable).

4. Bearing housing (right thread) for left side differential bearing, by means of which side play of differential unit 1 is adjusted. To determine amount of side play insert screw driver, or other suitable tool, through chain opening in axle housing 10 and shift differential unit from side to side by applying pressure to sprocket. There should be .007" to .010" side play. To adjust side play loosen lock screw 5 sufficiently to disengage from slot in bearing housing 4. Insert screw driver, or other suitable tool in small opening provided in axle housing 10 (opposite lock screw 5) and turn bearing housing 4 to left for less -- to right for more side play.

5. Bearing housing lock screw.

6. Axle lock rings (half rings - four used) secure axles in large differential gears, and adjust axle end play in differential unit. End play can be determined by holding differential unit and checking from end of axle. End play can be readjusted by disassembling differential unit and fitting thicker lock rings which can be obtained (.125"Std)-.130"-.135" thick. Axles must not be pinched against spacer 7 and they should not have more than .005" end play.



(Do not confuse axle end play with differential side play as described under No. 4.) Occasionally it may be necessary to fit thicker lock rings on one axle than on the other to obtain proper adjustment.

7. Spacer for small differential gears.

8. Shaft for small differential gears.

9. Felt washer and retainer (both sides).

10. Axle housing.

11. Axle nut.

12. Axle nut lock washer.

13. Axle spacer.

14. Wheel key.

15. Outer end bearing spring ring.

16. Left end bearing cup, (left thread). The right end bearing cup is right thread.

17. Outer end bearing cup lock washer. After bearing cup is securely tightened, upset lock washer in notches in axle tube and bearing cup.

18. Outer end axle roller bearing.

19. Roller bearing thrust bushing - slip fit in bearing cup.

20. End bearing felt washer.

21. End bearing plain washer.

### IMPORTANT

Servi-Car rear chain should be checked up frequently for adjustment, lubrication and wear. A chain that finally breaks in service due to lack of attention may jam between rear sprocket and axle housing with the result that housing is broken or damaged, beyond further use.

Keep chain well adjusted and lubricated, and also inspect occasionally for damaged links and badly worn condition. Do not try to get the last possible mile out of chain, or in other words run it to the critical point before installing a new chain. It


(over)

is an easy enough matter to give this attention to Servi-Cars that come to your shop regularly for check-up. Owners who do not send their Servi-Cars to your shop regularly should be advised or warned of what may result from neglect of chain.

PART NUMBERS ACCORDING TO ILLUSTRATION NUMBERS.
(Note: Order parts by part numbers only.)

| Illus. No. | | Part No. |
|---|---|---|
| 2 & 3 | - | 7157-32 |
| 4 | - | 7148-32 |
| 5 | - | 7150-32 |
| 6 | - | 7129-32 |
| 7 | - | 7116-32 |
| 8 | - | 7114-32 |
| 9 | - | 7160-32 |
| 10 | - | 7135-32 left, 7140-32 right |
| 11 | - | 2050-12 |
| 12 | - | 7270-32 |
| 13 | - | 7266-32 |
| 14 | - | 7263-32 |
| 15 | - | 7180-32 |
| 16 | - | 7165-32 left, 7166-32 right |
| 17 | - | 7169-32 |
| 18 | - | 417-30 retainer; 2289-25 roller |
| 19 | - | 7173-32 |
| 20 | - | 7176-32 |
| 21 | - | 7178-32 |

## 1933 Scroll Tank Design Obtainable.

Effective November 1st the factory order (Shop Dope #95)against re-enameling early model repaired tanks 1933 style is rescinded. After that date the eagle head scroll, if specified, and any 1933 color combination desired will be applied to any tanks returned for repair and re-enameling.

The order prohibiting shipment of VLD motor parts for converting standard motors is still in effect.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis.
U.S.A.

# SERVICE SHOP DOPE

No. 97

November 7, 1932

## 1929 - "45" AND SINGLE MODEL TRANSMISSION REAR CHAIN SPROCKET

1929 type, 16 tooth rear chain sprocket, part #2035-29 is no longer supplied.

Covered by the same part number, the later type rear chain sprocket as applied to 1930 and later "45" and Single models, it is now furnished with all necessary fittings to adapt it. In other words, when you order sprocket #2035-29, you will receive the latest sprocket along with bearing race #2290-26 and felt washer #2294-28. Price $2.00 list.

In applying the later sprocket and fittings, it is necessary to remove transmission side cover. Cover has to be taken off because original bearing race behind sprocket must be pressed or driven out and new race put in. It will be found much easier to remove old bearing race and install new one if aluminum cover is heated and expanded before going through the operation. To avoid damaging cover, rest it squarely on the bottom of an old piston, or on the end of a piece of pipe of larger diameter than bearing race, while driving race out and in. Be sure to start new bearing race straight in relation to hole in cover, and drive it all the way in so that its flange is tight against cover all the way around.

After new bearing race has been installed, smooth and polish the outer face of cover around race, where sprocket felt washer will take bearing. Unless cover is perfectly smooth at this point, the felt washer is naturally likely to be damaged and worn out rapidly.

When refitting cover to gear box, be careful that holes in flange of three-step gear bronze bushing register with pins in cover.

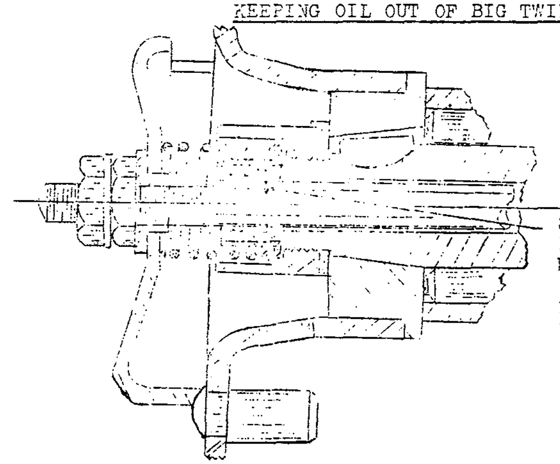
This later sprocket with parts to adapt it is being furnished because it is stronger, much more dependable and more satisfactory in every respect than the discontinued earlier type sprocket.

# SERVICE SHOP DOPE

No. 101

December 12, 1932

## KEEPING OIL OUT OF BIG TWIN CLUTCH



Sketch Showing New Clutch Pull Rod Oil Washer and Retaining Cap

Assembled in 1930 and later "74" Model Clutch

When the discs in a Big Twin model clutch accumulate oil to the extent that clutch finally doesn't release well and gears clash when shifting, particularly in getting into low gear when starting out in the morning, it is usually taken for granted that the oil came from the front chain and chain guard. More likely the oil comes from the starter side of transmission through the mainshaft. From the clutch end of mainshaft it follows along the actuating plate legs to the inside of clutch. As far as the oil on chain and in chain guard is concerned tests have proven that very little of this oil gets into clutch even though chain may be oiling quite freely. In odd cases some oil may get in the clutch directly from transmission through main gear and clutch bearings but as mentioned before we have found that in most cases the oil comes through the mainshaft along the pull rod.

The above sketch shows the new cork oil washer and retaining cap now assembled in latest transmission to prevent oil from coming through the mainshaft. This oil retaining arrangement can be readily installed in any Big Twin transmission from 1930 up.

When you find a 1930 or later Big Twin model clutch that drags after machine has been left standing, indicating that probably discs are oily, if you will take clutch apart, thoroughly wash and clean discs to remove accumulated oil, and reassemble installing the new washer, it is not likely that any further difficulty will be experienced.

| | | | |
|---|---|---|---|
| Cork Washer | #2460-33 | - | .10 list |
| Retainer | #2461-33 | - | .05 " |

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

# SERVICE SHOP DOPE

No. 106 December 11, 1933

## SERVICING EARLY LINKERT CARBURETORS

Linkert carburetors supplied on 1933 and first 1934 VLD and RLD motors have given some trouble with a lean or flat spot just off closed throttle, with carburetor needles adjusted just right for idling (closed throttle running) and also top speed. This flat spot ties up with complaint of uneven motor running and popping back through carburetor when running with only slightly open throttle, also when accelerating from low speed.

This flat spot has been corrected in later Linkert carburetors by enlarging, with a No. 55 drill, the larger idling hole in side of carburetor at throttle disc. Late carburetors corrected in this manner are identified with a center punch mark following the model number stamped in top of carburetor. It is a simple matter for anyone to correct an earlier carburetor in this manner. Simply remove idle pocket screw from back side of carburetor and carefully run a No. 55 drill through the larger idling hole.

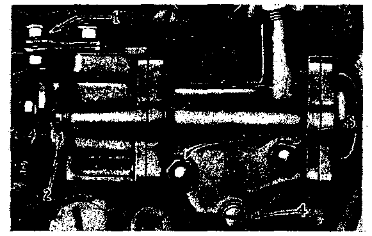
Thorough tests have proven that this change make carburetion O.K. in connection with any motor reasonably well tuned up otherwise. We refer particularly to circuit breaker point gap, ignition timing and condition of spark plugs. If ignition is a little late, which is very often found to be the case after a new motor has run considerable mileage, or if plugs are partially fouled or in bad order otherwise, naturally carburetion is likely to be poor even though the carburetor itself is O.K. in every respect. Always check all these things when correcting an early carburetor as explained aobve, or in any case when adjusting difficulty is experienced, because the carburetor can't be expected to have broad enough range of adjustment to overcome other faults about the motor.

Here's another thing about the Linkert carburetor. It will take a somewhat leaner adjustment of high speed needle than other carburetors we have used, without developing a complete dead spot at throttle opening where fuel supply switches over from low to high speed jet. Therefore, be careful you don't adjust high speed needle just barely rich enough to avoid a decided dead spot, but still so lean that mixture is very weak. A moderately rich adjustment of high speed needle is required for best all around results.

# SERVICE SHOP DOPE

No. 107 December 11, 1933

## THE 1934 OIL PUMP (All Twin Models)



1. Control lever.
2. Adjusting screw for low and moderate speeds.
3. Adjusting plate for high speed.
4. Adjusting screw for front chain oiling.
5. Pump fastening nuts (secure pump to gear case cover).

### ADJUSTMENTS

1. The adjustment of control lever No. 1 is of first importance because it determines the stroke of pump plunger and thereby regulates the output of pump in due relation to carburetor throttle lever and working load of engine. Without this control accurately adjusted, pump will not respond as it should to other adjustments described below:
CORRECT ADJUSTMENT - Set control wire between carburetor and oil pump so that when throttle is opened until carburetor lever strikes its full open stop, oil pump lever lacks just a trifle, not more than 1/64", of striking its full open stop. Disregard closed position of pump lever because this is determined by movement of carburetor lever. NOTE - As a safety, pump control lever is provided with a spring that throws it wide open in case of control wire breakage.

2. Screw No. 2 with washers under its head is the adjusting screw for low and moderate speeds. (Four to eight .002" washers as required - and four .012" washers on early pumps, or one 1/16" washer on later pumps, is the factory setting). Add washers for more oil - take off washers for less oil. When re-adjusting, add or take off only one or two thin washers at a time, and do not remove the four .012" washers or the 1/16" washer, as doing so will shut off this adjustment too far for safety. NOTE - Applying to pump on 74 cu. in. engine, the group of washers under head of screw 2 includes in addition to the usual number of washers, a .015" brass washer. This washer should be removed if engine is put in steady sidecar service. Also this brass washer will be found on pump only ordered for replacement. It should be removed if pump is installed on any 45 cu. in. engine or a 74 cu. in. engine in sidecar service.

3. Adjusting plate No. 3 regulates oil supply for high speed. It shifts a cam inside control housing and thus affects the stroke of pump plunger. TO RE-ADJUST - Loosen clamp nut and shift adjusting plate as per marking on plate. Don't re-adjust more than 1/16" at a setting. The original factory setting is indicated by a mark cut in pump body. NOTE - Inasmuch as the same pump with different setting applies to both 45 and 74 cu. in. models, a new pump only ordered for replacement will be found with proper setting marked for both models. Set the adjusting plate accordingly when pump is installed.

4. Screw No. 4 with washers under its head is the adjusting screw for front chain oiling. Add thin washers for more oil - take off thin washers for less oil. This adjustment has nothing to do with oil supplied to motor. NOTE - This chain oiling adjustment does not give complete control of oil supplied to chain, because some motors exhaust considerable oil spray directly from crank case through breather

system. This varies with service conditions, driving speed, supply of oil to crank case, etc. Because of some irregularity in this respect, the chain oiling adjusting screw will need to be re-adjusted to meet individual requirements.

## TRACING OUTPUT IRREGULARITIES

In a case of unquestionable over-supply that isn't corrected to a marked extent by setting adjustments back for less oil, check as follows:

1. Maybe control No. 1 is not accurately adjusted. Check this first.
2. Possibly there is a leak through hand pump due to dirt that prevents check ball from seating perfectly, or maybe ball check spring is so weak that crank case suction pulls ball away from its seat. Remove hand pump body and examine and clean it thoroughly. Make sure that spring tension is strong enough so ball is held firmly against its seat, and that ball seats perfectly without even the slightest indication of leakage. Where continued over-supply may leave some doubt about hand pump being free from leakage, even after pump has been examined and given the attention described, a good way to double check is by running a few days with oil pipe disconnected at hand pump and end of pipe plugged.
3. If an engine is in bad condition or poorly tuned up and adjusted, with regard to poorly seating valves, weak compression, circuit breaker point gap, ignition timing, carburetor adjustment, etc., the oil pump, even though in perfect order, will feed more than the normal amount of oil. This is because a weak engine requires opening the throttle further than normal to hold any desired speed, and oil pump is regulated by throttle.
4. Take pump apart and examine it for some fault, or return it to the factory for test and needed repair.

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Where there is apparent under-supply that is not corrected by setting up adjustments for more oil, check as follows:

1. Maybe control No. 1 is not accurately adjusted and as a result it shuts off too far. Check this first.
2. See that tank cap vent is open.
3. Disconnect pipe from pump and see that oil runs freely from pipe.
4. See if pump nipple is possibly clogged with chips, waste, or some foreign matter that has gotten into oil tank.
5. Take pump apart for inspection, or return it to the factory for attention.

## REMARKS

To remove pump it is not necessary to disturb gear case cover. After disconnecting oil pipe and control, and taking off the two pump fastening nuts No. 5, pump can be pulled off its mounting studs.

When there is occasion to take pump apart for examination, be careful that rotary valve and front end of pump body against which valve seats, are not scratched or damaged in some manner. This valve must seat perfectly for proper pump regulation. It is not advisable to use shellac on gasket when re-installing end cover that houses valve, because of the chance of some shellac working under the valve and causing a leak at least temporarily. Better use a new gasket every time but no shellac. If you find an early 1934 pump that leaks at the end cover joint, even though gasket is apparently in good order, and screws have been re-tightened, install a new end cover (695-34) and new gasket (680-34). The later cover is made heavier to better reinforce the joint surface.

# SERVICE SHOP DOPE

No. 107 January 5, 1934

## CYLINDER HEAD INFORMATION

(Big Twin Models Only)

We have three different cylinder heads for the Big Twin model and the following is to straighten out considerable confusion as to their application to various 1934 and earlier models.

The different heads are stamped on their ground joint surface 9.3 - 10.5 - and 12.5. This marking indicates cubic inch combustion space with the respective heads.

The 9.3 head, which is called our high compression head, always has and still applies to all VL and VLD motors.

The 10.5 head became the standard compression head at the beginning of the 1934 season and it regularly applies to all except the VLD model, and also the VFDS model since January 1, 1934.

The 12.5 head applied to all except VL and VLD models up to and including 1933. This head, over the period mentioned, was called our standard head, but now it is known as our low compression head. It is now used as regular equipment only on the VFDS motor (since January 1, 1934) but will be furnished as optional equipment on the VDS model if specified on order. (The models to which this head originally applied included the VC commercial model which had iron alloy pistons and small carburetor and manifold, however, this model had extra low compression due to being fitted with piston (part #256-30A) 1/6" shorter than our standard iron alloy piston. The VC model was discontinued at the end of the 1933 season.)

Since the VC model has been discontinued as our heavy dut commercial machine, its place is taken by the VFDS model, however, some prefer the VDS model for this service. These models are alike with the exception of pistons and cylinder heads. Both have standard cylinders, manifold and carburetor, the same as the VLD model. The VFDS model is fitted with 12.5 heads (since January 1, 1934) and iron alloy pistons No. 253-30 (pistons are not 1/16" short as in the old VC model). The VDS model is fitted with 10.5 heads and standard aluminum pistons.

NOTE: - In ordering a VDS model for commercial or other heavy dut service, where low compression is desirable, we recommend that you specify 12.5 heads. Be sure to mark your order plainly when this equipment is desired.

# SERVICE SHOP DOPE

SPECIAL April 27, 1934

## CARBURETION TIPS

To overcome apparent faulty carburetion that shows up in engine sluffing and popping back through carburetor at lower speeds, or missing and muffler explosions when engine is accelerating to high speed, especially in low and second gear, the following procedure is recommended:

1. See that spark control fully advances, also that circuit breaker points open to correct gap (.022") and then check time of ignition according to flywheel mark. Do this job very accurately and re-set, if necessary, as proper ignition advance (3/8" before top center-solo) is the first essential for good carburetion and good all around engine performance. The later Rider's Hand Book gives a very good description of best procedure in checking timing.
2. Try a new set of spark plugs. Even though original plugs appear O.K., maybe they are partially gouled, or there is a leaky procelain. It frequently proves out that apparently o.k. plugs are faulty to the extent of causing irregular performance.

ATTENTION TO LINKERT CARBURETOR.

3. Take carburetor apart and clean out.
4. Set float lever 5/16", taking this measurement directly opposite float needle, holding bowl up-side-down.
5. Measure over all length of main nozzle. If you find this length approximately 2-1/8" (early Linkert nozzle was this length) shorten it to 2-1/16" by turning 1/16" off bottom end. This should be done in a lathe and the original 45 degree chamfer maintained so that nozzle retaining spring will locate centrally.
6. See Shop Doep #106 about re-sizing larger idling hole with #55 drill. (This applies only to early Linkert Carburetor).
7. Thorougly clean gas strainer and its screen.
8. Re-assemble and attach carburetor and gas strainer. Before attaching gas line to strainer connection "turn on" tank gas cock and allow gas to flow for an instant to force all air from line.
9. In adjusting carburetor, set low speed needle for smooth motor idling as you always have done. Set high speed needle about 1-1/2 turns open and make further readjustment from this point, if necessary. 1½ turns is the average adjustment for solo service with a slightly richer adjustment for sidecar service. Bear in mind that the general tendency is to adjust the high speed needle too lean. With such adjustment, motor may hit evenly at top speed, but run lean when accelerating.
10. See that intake tappets are not set with less than specified clearance, as too little clearance increases over-lap of intake opening and exhaust closing and affects carburetion to some extent.
11. In an obstinate case of apparent bad carburetion, it is well to try a new ignition coil and condenser. Also note that battery had the proper level of solution over its plates and that it is in a fairly good state of charge. If battery is questionable, try another. The mistake of diagnosing ignition faults as bad carburetion and vice versa, is often made even by the most experienced trouble-shooter.

# SERVICE SHOP DOPE

SPECIAL — TUNING MOTORS FOR BEST TOP SPEED — May 1, 1934

First of all it must be remembered a standard motor is not a racing type motor fitted up loose for best top speed. Since motors have to be fitted up tight to satisfy with regard to quietness of operation when new, they require considerable running-in. The faster a motor is rated as to normal top speed that can be expected, the more running-in it requires, because it must turn up higher rpm. Too many riders expect too much at the start whereas the truth of the matter is, running-in wear that loosens up a motor so it rolls its best is very slow. Of course running-in affects other things besides the motor. Wheel hubs, transmission, chains, and brakes also have to be considered. Even at 3000 miles or more some machines are not run-in. It is a waste of time to attempt to tune it up to compete with other well tuned-up machines that have seen a lot of mileage.

After a motor has gone through a fair running-in period, the next requirement is a thorough tuning-up. Don't expect mileage alone to develop its best performance. At the end of the running-in period, even though motor is then well loosened up for free rolling it is not in favorable condition in other respects. Invariably there is a heavy accumulation of carbon, valve seats are in bad shape, valve stems and guides are gummy and sticky, muffler outlet may be partially clogged up with soot and possibly ignition timing has retarded somewhat due to wear and seating at various points in connection with timing arrangement.

FOLLOWING ARE THE SUGGESTED STEPS IN TUNING-UP:

1. Remove cylinder heads and valve and thoroughly clean all carbon from cylinder and piston heads and from around valve seats and ports. Clean the valves and run a reamer through valve guides to take out carbon and gummy deposits. Turn motor until pistons are at bottom center and carefully examine the cylinder walls with inspection lamp. If any marks or scores other than a few slight dark streaks are found, cylinders should be removed and piston rings inspected for tension, gap and freeness side-ways in grooves. Valves should be refaced with grinder and then ground-in to perfect seating in cylinders. If cylinder seats are pitted, burned, or warped so valves do not readily grind-in to a good, complete seat, the cylinders should be removed and seats re-cut.

   In the matter of piston rings, the compression rings, or, the two top rings, should be renewed if they show any damage, loss of tension, or wear to the extent that gap is quite wide. However, in connection with cushion rings, it is not advisable to change change these rings too frequently if best top speed is the thing most desired. A little piston slap usually goes along with a fast motor. As cushion rings wear and the spring rings take a set, cylinder wall pressure is naturally relieved and not so much power is required to move the pistons. With new cushion rings, cylinder pressure is brought back to the point where it was when motor was new and motor performance is affected somewhat until new rings have had time to seat and relieve their tension to some extent.

2. The next step in tuning-up is checking ignition timing. Fully advance ignition timing, according to specifications. This is particularly important, and should be given very close attention. Don't just guess that timing is somewhere near right and let it go at that. If ignition is even 1/16" late in relation to piston position, it may be enought to knock two to five miles per hour off top speed. The first step in checking ignition timing is making sure of proper circuit breaker point gap. .022" is the proper gap. Also make sure that spark control fully advances circuit breaker assembly.

   After giving circuit breaker the attention just described, turn motor until front piston is on compression stroke and then remove inspection plug from left crank case and check with flywheel mark. With ignition switch turned on, turn motor slowly and watch ammeter. As



the ammeter needle jumps to zero, they flywheel makr should be just appearing at the rear sideof inspection hole. Be sure circuit breaker is fully advanced during this operation. If timing does not check correct, it will have to be reset by shifting the circuit breaker assembly.

   Bear this in mind, while it is not good to have timing set further advanced than specifications call for, neither is there any advantage in the way of motor performance in extremely fast timing. If there is variation either way, it is better to have timing slightly fast than a little late. Timing specification for solo 74 model are 3/8" and for 45 model 9/32" before top center. This is according to flywheel mark.

3. Check valve tappets and be careful about setting with too little clearance. It is best to have them set with exact clearance, but if not exact, it is better to have them a trifle loose rather than with less clearance than specified. After valves have been freshly ground-in, the initial tappet adjustment should be rechecked and readjusted, if necessary.

4. The best spark plug for high speed service is our Hot-Stuff plug with R7 core. Our regular standard equipment plug is best suited to normal service conditions involving the average amount of low and moderate speed driving, but the Hot-Stuff plug is the better plug and more dependable for high speed operation. Where a motor may show loss of performance for no apparent good reason, it is a good idea to try a new set of plugs, even though the plugs to be taken out seem to be all right. Quite often loss of performance as a result of overheating is traced down to bad spark plugs even though a plugs looks to be in good shape.

5. All standard 1¼ model carburetors are fitted with 1-1/6" venturi for best all-around performance. Some motors show slightly better top performance with ventrui turned out to 1-1/8". Nothing is gained by going over 1-1/8". We do not supply a 1-1/8" venturi. However it is not a big job to enlarge the standard venturi when the larger opening is desired. Remember advantage through this change applies only where a motor is tuned up to its best in every other respect. A motor not tuned up does its best with 1-1/16" and nothing will be gained by simply changing to a larger size.

6. Standard gear ratios are determined as best suited for all around service. Good acceleration as well as top speed are taken into consideration. In a case where best possible top speed is desired above everything, usually something can be gained through slightly higher gearing provided motor is tuned up. Higher gear can be affected by fitting larger engine sprocket or smaller rear wheel sprocket. Engine performance and power output come first and gear ratio comes last. In other words, attempting to improve speed through changing gear ratio without first giving motor attention is working backwards and nothing will be gained.

A motor run-in and carefully tuned-up should turn up average or better than average top speed for the model involved. If it does not, there is questions as to what may be at fault. It may be something minor like a dragging brake or it may be more serious. Where a motor shows way below average performance, it should be torn completely down and the entire base assembly inspected for a damaged or seized bearing.

## 1934 STANDARD GEAR RATIOS

| MODELS | SPROCKETS E. | C. | C.S. | R. | HIGH GEAR RATIO | APPLIES TO |
|---|---|---|---|---|---|---|
| | 26 | 63 | 16 | 40 | 1 to 6.06 | 21" Side Valve Single |
| C & CB | 31 | 63 | 16 | 45 | 1 to 5.71 | 30.50 Side Valve Single |
| G,GA,GD/T | 26 | 63 | 16 | 37 | 1 to 5.6 | Servi-Cars - 45" Twin |
| R/RL | 26 | 63 | 16 | 30 | 1 to 4.54 | 45" Twin - Solo |
| RLD | 31 | 63 | 16 | 34 | 1 to 4.32 | 45" Twin-Solo (High Compression) |
| RS | 26 | 63 | 16 | 34 | 1 to 5.15 | 45" Twin - Sidecar |
| VD/VFD | 22 | 51 | 28 | 51 | 1 to 4.22 | 74" Twin - Solo |
| VDS/VFDS | 19 | 51 | 28 | 51 | 1 to 4.89 | 74" Twin - Sidecar |
| VLD | 22 | 51 | 28 | 51 | 1 to 4.22 | 74" Twin - Solo - Standard |
| VLD | 25 | 51 | 28 | 51 | 1 to 3.71 | OPTIONAL - 74" Twin - For speed purposes |

# SERVICE SHOP DOPE

No. 111 May 15, 1934

74 CU. IN. TWIN MOTOR FITTING SPECIFICATION (ALL MODELS)

NOTE: These supersede all previous specification and apply to all 1930 and later Big Twin Motors.

PISTON CLEARANCE -
IRON ALLOY PISTONS ........................................ .004" to .005"
ALUMINUM & DOW METAL PISTONS ................................ .016" to .018"
(Measure all pistons just below top group of rings and cylinders about 1/2" from top of bore)

PISTON-CYLINDER HEAD CLEARANCE -(All models except VC Commerical.... 1/16" to 3/32"
(VC Commercial - dis-continued 1934) .............. 7/64" to 9/64"

PISTON PIN IN IRON ALLOY PISTON - .0005: to .001" press fit in lock pin side - plug or slip fit in opposite side.

PISTON PIN IN DOW-METAL & ALUMINUM PISTONS - ...................... .0005" to .001" (Press fit in piston)

PISTON PIN IN UPPER CONNECTING ROD END - .001" loose

LOWER CONNECTING ROD BEARING - .001" to .00125" loose

CONNECTING RODS - .006" to .010" clearance between fly-wheels - roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT - .0045" loose at inner end of bushing -- .002" loose at outer end of bushing. (Bushing is taper reamed with special reamer).

SPROCKET SHAFT - .0005" to .001" loose in roller bearing -- .006" to .007" loose in chain lubricating bushing.

FLYWHEEL ASSEMBLY - .004" to .008" end play in crank case

CAM GEAR - .0005" to .001" loose in crank case and cover bushings - free to .005" end play.

INTERMEDIATE GEAR - .001" to .0015" loose on stud.

TAPPET GUIDES - .0005" to .001" press fit in crank case

VALVE TAPPETS - .0005" to .001" loose in tappet guides.

# SERVICE SHOP DOPE

No. 111A May 15, 1934

45 CU. IN. TWIN MOTOR FITTING SPECIFICATIONS (ALL MODELS

( NOTE: These supersede all previous specifications)

PISTON CLEARANCE -- .014" to .016" (Measure pistons just below the top group of rings, and cylinders about 1/2" from top of bore)

PISTON-CYLINDER HEAD CLEARANCE -- 3/64" to 5/64"

PISTON PIN IN PISTON -- .0005" to .001" press fit in piston.

PISTON PIN IN UPPER END OF CONNECTING ROD -- .001" loose

LOWER CONNECTING ROD BEARING -- .0005" to .0008" loose

CONNECTING RODS -- .006" to .010" end play between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT -- .0045" loose at inner end of bushing -- .002" at outer end of bushing. (Bushing is taper reamed with a special reamer).

SPROCKET SHAFT -- .0005" to .001" loose in roller bearing - .006" to .007" loose in chain lubricating bushing.

FLYWHEEL ASSEMBLY -- .004" to .008" end play in crank case.

CAM GEARS -- .0005" to .001" loose in crank case and cover bushings -- free to .005" end play.

GENERATOR DRIVE GEARS AND SHAFT (1931 and earlier models) -- Shaft must be free running fit; have .002" to .004" end play, and .001" to .0015" clearance in bearings. Small bevel gear should be .002" to .003" loose in bushing assembly, and shimmed to allow .002" to .004" clearance between bevel gears.

TAPPET GUIDES -- .0005" to .001" press fit in crank case.

VALVE TAPPETS -- .0005" to .001" loose in tappet guides.

# SERVICE SHOP DOPE

No. 111B May 15, 1934

## SINGLE MOTOR FITTING SPECIFICATION - (ALL MODELS)

PISTON CLEARANCE - Dow metal and aluminum -- .011" to .013" (Measure all pistons just below the top group of rings, and cylinders about 1/2" from top of bore)

PISTON - CLYINDER HEAD CLEARANCE -- 3/64" to 5/64"

PISTON PIN IN PISTON -- Snug press fit - not over .0005" tight

PISTON PIN IN UPPER END OF CONNECTING ROD -- .0005" loose

LOWER CONNECTING ROD BEARING -- .0003" to .0004" loose

CONNECTING RODS -- .010" to .020" end play between flywheels -- roller and retainer assembly should be narrower, but not more than .010" narrower than rod.

PINION GEAR SHAFT -- .0035" loose at inner end of bushing -- .0025" loose at outer end of bushing (Bushing is taper reamed with special reamer)

SPROCKET SHAFT -- .0005" to .001" loose in roller bearing -- .006" to .007" loose in chain lubricating bushing.

FLYWHEEL ASSEMBLY -- .002" to .006" end play in crank case

CAM GEARS - .0005" to .001" loose in crank case and cover bushings - free to .005" end play

INTERMEDIATE AND OILER GEARS -- .0015" to .002" loose on studs

TAPPET GUIDES -- .0005" to .001" press fit in crank case

VALVE TAPPETS -- Free to .00075" loose in tappet guides.

# SERVICE SHOP DOPE

No. 111C May 15, 1934

## TIMING SPECIFICATIONS

### 1930 AND LATER 74 CU. IN. TWIN - ALL MODELS EXCEPT 1930 and 1931 V AND VC MODELS

INTAKE VALVE -- Opens 9/32" to 13/32" before top dead center
Closes 7/8" to 1-1/8" after bottom dead center

EXHAUST VALVE - Opens 5/8" to 7/8" before bottom dead center
Closes 1/4" to 3/8" after top dead center

IGNITION -- OCCURS when piston is 5/16" to 3/8" before top dead center on the compression stroke.

### 1930 AND 1931 74 CU. IN. TWIN V AND VC MODELS

INTAKE VALVE -- OPENS when piston is --11/64" to 19/64" before top dead center
Closes when piston is -9/16" to 13/16" after bottom dead center

EXHAUST VALVE -- OPENS when piston is -- 9/16" to 13/16" before bottom dead center
Closes when piston is -- 11/64" to 19/64" after top dead center

IGNITION -- OCCURS when piston is 1/4" to 5/16" before top dead center on the compression stroke.

### 45 CU. IN. TWIN ( ALL MODELS)

INTAKE VALVE -- OPENS When piston is 5/32" to 7/32" before top dead center
Closes when piston is 37/64" to 45/64" after bottom dead center

EXHAUST VALVE - OPENS when piston is 37/64" to 45/64" before bottom dead center
Closes when piston is 5/32" to 7/32" after top dead center

IGNITION -- OCCURS when piston is 1/4" to 9/32" before top dead center on the compression stroke.

### 30.50 CU. IN SINGLE (ALL MODELS)

INTAKE VALVE -- OPENS when piston is 5/16" to 9/16" before top dead center
CLOSES when piston is 11/16" to 15/16" after bottom dead center

EXHAUST VALVE -- OPENS when piston is 1/2" to 3/4" before bottom dead center
CLOSES when piston is 1/4" to 1/2" after top dead center

IGNITION -- OCCURS when piston is 1/4" to 5/16" before top dead center on the compression stroke.

21 CU. IN. SIDE BY SIDE VALVE SINGLE ( ALL MODELS)

INTAKE VALVE -- OPENS when piston is 1/8" to 3/16" before top dead center
CLOSES when piston is 7/16" to 9/16" after bottom dead center

EXHAUST VALVE -- OPENS when piston is -- 7/16" to 9/16" before bottom dead center
CLOSES when piston is 1/8" to 3/16" after top dead center

IGNITION -- OCCURS when piston is 7/32" to 9/32" before top dead center on the compression stroke.

21 CU. IN. OVERHEAD VALVE SINGLE ( ALL MODELS )

INTAKE VALVE -- OPENS when piston is -- 3/32" to 5/32" before top dead center
CLOSES when piston is 7/16" to 9/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 7/16" to 9/16" before bottom dead center
CLOSES when piston is 3/32" to 5/32" after top dead center

IGNITION -- OCCURS when piston is 11/32" to 13/32" before top dead center on the compression stroke.

TAPPET CLEARANCES

NOTE: When checking valve timing according to piston position, bear in mind that tappets must first be adjusted to the correct clearances.

ALL SIDE BY SIDE VALVE MODELS (SINGLES AND TWINS) -- INTAKE -- .004" to .005"
EXHAUST -- .006" to .007"

OVERHEAD VALVE SINGE -- INTAKE AND EXHAUST -- .002" to .003"

CIRCUIT BREAKER OPENING - (ALL MODELS)

GENERATOR -- .020" to .024"

MAGNETO -- .014" to .018"

SERVICE SHOP DOPE

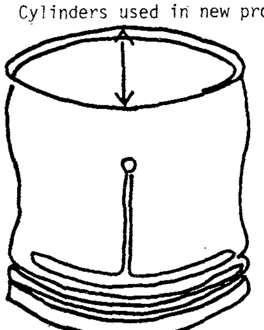
No. 112 December 17, 1934

## T-SLOT ALUMINUM PISTON

1935 Twin model motors are fitted with T-slot piston. 1934 Twin models are also fitted with this type piston starting with motors numbered 34-R-4000 and 34-VLD-9000. T-slot piston has not been used in Single models, neither has it been used in the VFD model motor in which iron alloy piston has been standard equipment.

T-slot pistons are now available for service in standard size, and oversizes up to .050". This piston in available sizes supersedes earlier type Dow-metal and aluminum pistons applying to side by side valve Twin motors. For a time the new piston will not be available in oversizes above .050", but eventually it will be.

Cylinders used in new production with T-slot piston are straight bore. T-slot piston can, however, be fitted with satisfactory results in taper bored cylinder as used in the past, when there is occasion to do so in connection with earlier motors in service, or taper bored cylinders in stock. In fitting this type piston to straight or taper finished cylinder it must be remembered that different fitting applies, because a new straight bore cylinder is the same diameter in full length that a new taper bore cylinder is at the top end. A taper bore cylinder is .005" to .007" larger at the bottom end. Fitting instructions follow:



ARROW INDICATES POINT AT WHICH PISTON CLEARANCE IN CYLINDER IS DETERMINED

The T-slot piston is a cam shaped piston and the point at which it is checked for cylinder fit is directly at the bottom of skirt, front and rear, exactly midway between pin bosses, (see illustration) Side clearance can be disregarded.

Piston fitting specifications applying to straight bore cylinder, call for a size to size fit with little if any drag, to .002" clearance. This, of course, applies to new cylinder and new piston, of matched size. In checking T-slot piston fit when overhauling and refitting a motor that has been in service for some time, up to .006" to .007" clearance can be allowed before worth mentioning piston slap should be noticeable. The best method of determining clearance is to use a feeler gauge between cylinder wall and fitting point on piston. Select feeler that just fills the space between piston and cylinder without requiring force to insert it. Using force to insert feeler will result in clearance being determined incorrectly as piston is quite flexible at skirt and it will simply be pushed out of shape. A closer job of checking piston clearance can be done with no rings on piston.

A .005" oversize T-slot piston is a proper fit in a new standard size taper bore cylinder. This oversize is also a satisfactory fit in a standard tapered cylinder that has seen some service and is possibly worn as much as .002 to .003 inch. Where there is more wear cylinder should be returned for reboring and refitting. Piston clearance in a taper bore cylinder cannot be checked very accurately with a feeler gauge because of cylinder tapering to larger diameter at bottom. If this is attempted, piston head should be about flush with top of cylinder when gauging.



It is o.k. to use T-slot piston in servicing a motor originally fitted with earlier type Dow metal or aluminum piston, where only one replacement piston is needed. It is not necessary to rebalance flywheels whether new piston is fitted in one or both cylinders.

T-Slot piston can also be used in servicing a motor originally fitted with iron alloy piston, but in this case, both iron pistons should be replaced. Piston pin bushings will also have to be shortened or replaced as explained below. With this combination it is not altogether necessary that flywheels be rebalanced for good motor performance, as the lighter piston affects smoother motor performance without this attention. Rebalancing will of course reduce motor vibration to the minimum.

74 model piston furnished on parts order differs slightly from piston used in new motor production in that the latter piston has about 1/8" less space between pin bosses for piston pin bushing. This is to gain the maximum pin bearing in piston bosses. In other words, the latest Big Twin piston pin bushing (1-1/8" long) is 1/8" shorter than bushing used in the past. However, piston furnished on parts order has enough space between pin bosses to permit installing in earlier Dow metal and aluminum piston equipped motors without changing, because of length, the original bushing (1-1/4"). This makes parts order piston adaptable, without bushing change, to either early or late motors, excepting motor originally fitted with iron alloy piston which has piston pin bushing 1-9/16" long. It will simply be a matter of a little extra clearance between pin bushing and piston bosses when a parts order piston is fitted to a motor originally equipped with T-slot pistons. This is o.k. The 45 model T-slot piston does not involve any change in piston pin bushing as used in the past.

Piston pin in T-slot piston is fitted a light hand press fit. Pin cannot be made a tighter press fit, because piston is cam ground and must be free to work on pin so that it shapes to cylinder as expansion takes place. Since the factory job of sizing pin holes in piston is done with a high speed boring tool which makes a more perfect job than can be done with a reamer, and piston pin of exact fit is matched to every piston, it is advisable to install new piston using standard pin furnished with it. If rod bushing is in bad order, requiring either reaming oversize and fitting oversize pin or a new bushing, it is advisable to renew bushing and ream standard. In reconditioning motors that have seen considerable service, an oversize pin will of course have to be fitted now and then where original pin has loosened and developed play in piston bosses. In this case a reamer should be used to resize piston hole. A good, smooth cutting reamer should be used and a little kerosene applied as a cutting lubricant. With piston hole sized with reamer, new pin can be fitted slightly tighter than the fit specified for factory fitted pin, inasmuch as a reamed fit will very soom free itself to some extent. In reamed hole, pin can be made a tight hand press fit.

Size piston pin bushing to give pin .001" clearance.

Piston ring gap for taper bored cylinder has always been about .006" near top of cylinder. In a straight bored cylinder, rings should be fitted with .010" gap. Note that straight bore cylinder requires wider gap. It is important that this be observed, because in straight bore cylinder there is more chance of rings expanding to the extent of tightening in cylinder if fitted with too little gap. Specified ring clearance side way in groove is .0015 to .002". 74 model T-slot piston uses the same compression ring used on earlier type pistons. 45 model T-slot piston uses new narrow rings(3/32" wide).

Install piston in either front or rear cylinder with T-slot forward. This puts power thrust load on unslotted side of piston.

When fitting T-slot piston to rod, do not use piston pin pusher tool as piston skirt is easily pushed out of shape if pin is fitted too tight or starts cocked and becomes jammed. If pin is properly fitted to piston, it can be pushed into place without the aid of pusher tool. Use tool #12052-32 for installing pinton pin lock ring. This will assure getting lock ring on in good shape with a snug fit which is important to avoid any chance of ring coming off and damaging both cylinder and piston.

After fitting piston to rod, check for alignment with piston squaring plate in the same manner as with earlier type piston. It is even more important with T-slot piston that this operation be carefully done.

It is not necessary to reshape or "round" piston after installing on rod because first of all piston is cam ground and, therefore, not round to begin with, and furthermore if pin is properly fitted, piston will not be pushed out of shape through forcing pin into place.

## MISCELLANEOUS THINGS TO BE REMEMBERED

Straight bored cylinders, new and rebored, (excepting cylinders on about the first 150 motors equipped with T-slot pistons) are identified with letter S stamped in base flange, left side, near rear corner.

1930 and later Twin model cylinders, also 1929 45" model cylinders returned for reboring in the future will be finished straight and fitted with T-slot piston, except cases where T-slot piston may not be available in oversize required. In this case, reboring will be taper as in the past and earlier type piston with cushion rings will be fitted. Cylinders returned to be refitted with iron alloy piston will also have to be rebored taper as in the past. In finishing cylinder to be fitted with T-slot piston, a smooth surface pretty much free from grinder marks is important, because piston skirt bears directly on cylinder wall instead of being carried on cushion rings as with earlier pistons. Unless cylinder bore is very smooth, piston skirt is likely to be owrn prematurely.

Oversize pistons to be furnished as regular stock oversizes, start with .005" oversize and go up in steps of .005". Pistons will be furnished in any odd size specified on order. For the present the top oversize is .050" but later it will be .070". There is a charge of 40¢ list, extra for regular oversize above 035" and any odd oversize.

When ordering oversize use standard piston part number and indicate oversize desired. Size stamped in oversize piston head indicates exact thousandths of an inch above standard size.

BEAR IN MIND - when fitting T-slot piston in straight bore cylinder, standard or oversize, piston must be of size to match cylinder size. EXample:

Standard straight cylinder - standard piston
.010" oversize cylinder - .010" oversize piston

In fitting taper borecylinder, piston should be .005" above cylinder size. Example:

Standard taper cylinder - .005" oversize piston
.010" oversize cylinder - .015" oversize piston

Remember this when ordering pistons.

In the future 74 model connecting rods, 285-30 front and 286-30 rear, returned to the factory for rebushing will be refitted with short (1-1/8") upper end bushing. Rods can then be used without bushing change with either T-slot or earlier type Dow-metal or aluminum pistons.

Following are number and prices applying to T-slot pistons and other new parts that go with them:

| | | |
|---|---|---|
| 256-30B | T-slot piston complete with rings and pin (74 Model) | $5.75, List |
| 253-29A | T-slot piston complete with rings and pin (45 model) | 5.50, List |
| 293-34 | Piston pin bushing 1-1/8" long, used with 74 model T-slot piston | .40, list |
| 260-34 | Piston ring, used with 45 model T-slot piston | .25, List |

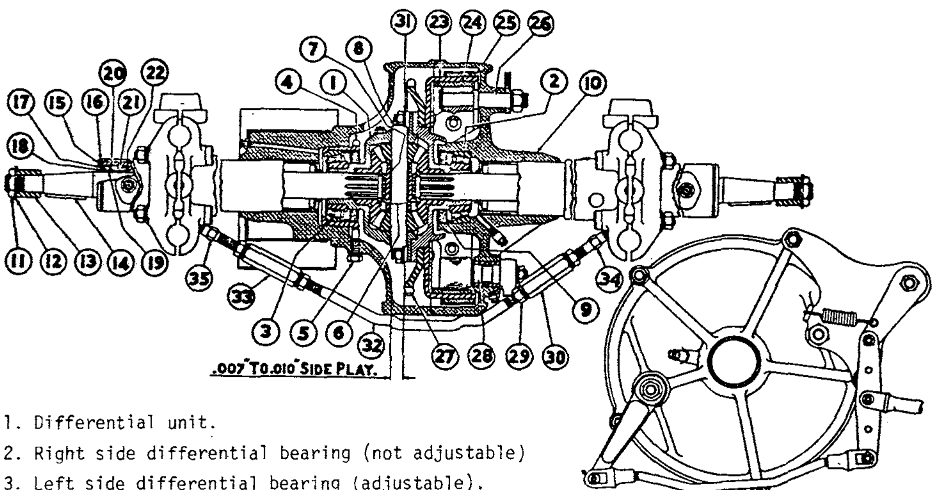
When there is occassion to order a replacement cylinder for a motor originally fitted with T-slot piston, use catalog part number of cylinder desired and specify for T-slot piston"

SERVICE SHOP DOPE

No. 118 January 16, 1935

## Servi-Car Rear Axle Assembly

**(Note: This Supersedes Shop Dope Sheet No. 98)**




1. Differential unit.

2. Right side differential bearing (not adjustable)

3. Left side differential bearing (adjustable).

4. Bearing housing (right thread) for left side differential bearing, by means of which side play of differential unit 1 is adjusted. To determine amount of side play insert screw driver, or other suitable tool, through chain opening in axle housing 10 and shift differential unit from side to side by applying pressure to sprocket. There should be .007" to .010 side play. To adjust side play loosen lock screw 5 sufficiently to disengage from slot in bearing housing 4. Insert screw driver, or other tool in small opening provided in axle housing 10 (opposite lock screw 5) and turn bearing housing 4 to left for less - to right for more side play.

5. Bearing housing lock screw.

6. Axle lock rings - (half rings - four used) secure axles in large differential gears, and adjust axle end play in differential unit. End play can be determined by holding differential unit and checking from end of axle. (Do not confuse axle end play with differential side play as described under No. 4) Axle end play can be readjusted by disassembling differential unit and fitting thicker or thinner lock rings which can be obtained .125" - .130"-.135" thick. Care must be taken that neither axle is pinched against spacer 7, nor should either axle have more than .005" end play. Occasionally it may be necessary to fit thicker lock rings on one axle than on the other to obtain proper adjustments.

7. Spacer for small differential gears.

8. Shaft for small differential gears.

9. Felt washer and retainer (both sides).



10. Axle Housing

11. Axle Nut

12. Axle nut lock washer. To lock nut after tightening, bend over edge of lock washer against nut at one point.

13. Axle spacer.

14. Wheel Key

15. Left end bearing cup (left thread). Right end bearing cup is right thread.

16. End bearing cup lock washer. After bearing cup is securely tightened, upset lock washer in notches in axle tube and bearing cup.

17. End bearing spring ring.

18. End bearing plain washer

19. End bearing felt washer

20. Roller bearing thrust bushing - slip fit in bearing cup.

21. Roller bearing. Axle to have .002" clearance in bearing.

22. Roller retainer.

23. Brake Shell

24. Inside brake shoe and lining.

25. Outside brake band and lining.

26. Outside brake operating shaft.

27. Sprocket. Differential unit, sprocket and brake shell are all fastened together with eight bolts. A wire is run through ends of bolts to prevent nuts coming off if they loosen.

28. Inside brake operating shaft.

29. Turnbuckle lock nut - (two to each turnbuckle) left thread for truss rod and right thread for turnbuckle studs.

30 & 33 - Turnbuckles - (Truss rod end left thread - stud end right thread).

31. Differential gear shaft lock plate - (two used).

32. Truss rod, stiffens axle assembly. After assembly has been in service awhile, truss rod should be checked and tigtened if needed to take up any slack that may have developed. To tighten truss rod, first loosen lock nuts at end of turnbuckles 30 and 33 and readjust turnbuckles just enough to take up slack and tighten truss rod so it will bear snufly against bottom of axle housing. CAUTION: If turnbuckles are tightened too tight, axle assembly will be spring out of line.

34 & 35. Turnbuckle coupling studs.

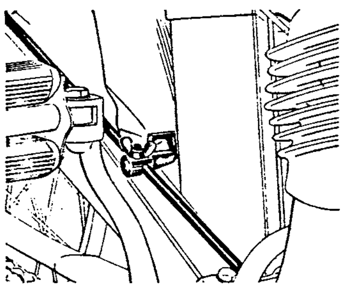
IMPORTANT

Servi-car rear chain should be checked often for adjustment, lubrication and wear. A chain that finally breaks in service due to lack of attention may jam between rear sprocket and axle housing with result that housing is broken or damaged beyond further use. Keep chain well adjusted and lubricated and inspect occasionally for damaged links and badly worn condition. Do not try to get last possible mile out of chain, or run it to the critical point before installing new chain. Rear brake shoes and linings are attached to right axle housing and before brakes can be relined, axle truss rod must be removed and housing taken apart. To remove truss rod 32, loosen turnbuckle lock nuts and turn studs 34 and 35 into turnbuckles far enough to free truss rod.

# SERVICE SHOP DOPE

No. 119 January 29, 1935

1935 - 45 CU. IN. (750 cc) MODEL BRAKE LOCK



When removing demountable rear wheel of 1935 - 45" model, it is necessary to apply and lock brake to hold brake drum and sprocket assembly while pulling wheel off. This applies to all 45" models except Servi-Cars.

To lock, apply brake with foot pedal, and shift lock back against battery box bracket as shown in illustration. When not in use, tighten securely on brake rod a little forward of battery box bracket.

Explain to your riders that lock is to be used when removing wheel, and that it can also be used to lock brake when machine is parked.

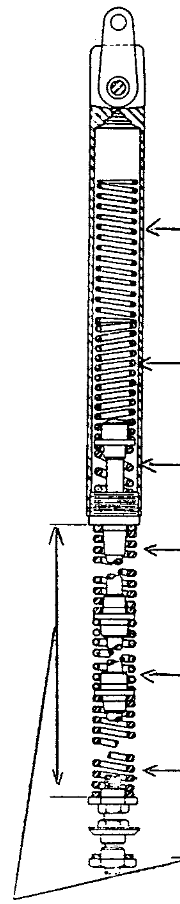
# SERVICE SHOP DOPE

No. 120 February 15, 1935

## SEAT POST

Spring combinations with part numbers that make up seat post assemblies (3121-30) (3122-30) (3123-30) (3124-30).

New machines furnished with standard seat post unless other than standard specified on order.



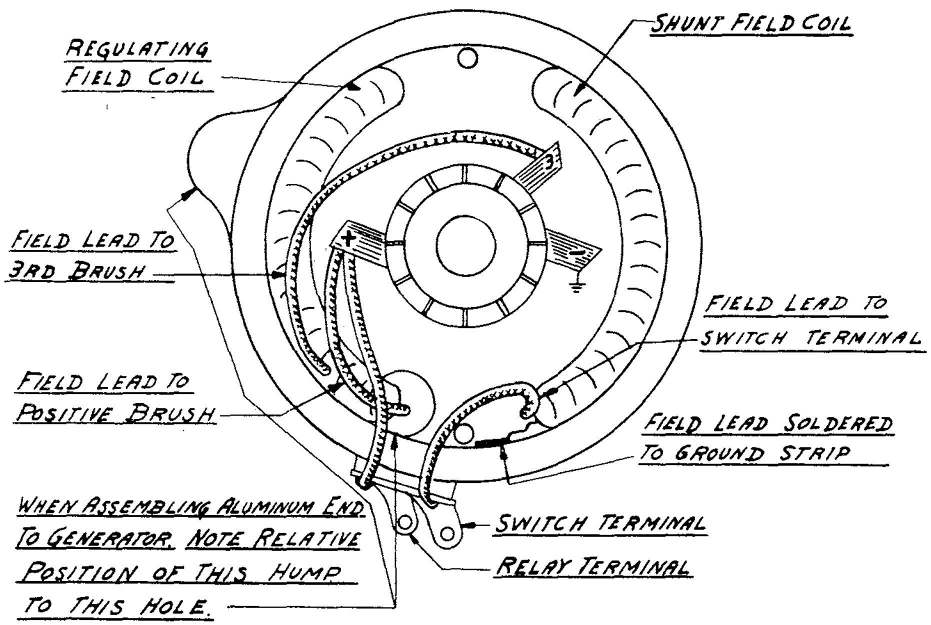
| Standard 130#-150# Pt.No.3123-30 | Light Under 130# Pt.No.3122-30 | Heavy 150#-230# Pt.No.3121-30 | Extra Heavy 230# and up Pt.No.3124-30 |
|---|---|---|---|
| | (This assembly was standard for 1932-1934 B Single) | | |
| 3135-30 | ← | ← | ← |
| 3133-30 | 3133-30 | 186-10 | 186-10 |
| 3133-30 | ← | ← | ← |
| 3128-31 | ← | ← | ← |
| 3129-31 | 186-10 | 3129-31 | 3129-31A |
| 3128-31 | ← | ← | ← |

Adjust 12" under 160 lbs. - 11½" over 160 lbs.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

SHOP DOPE No. 121C

SKETCH 305C — HARLEY DAVIDSON MOTOR CO. — 2-14-35



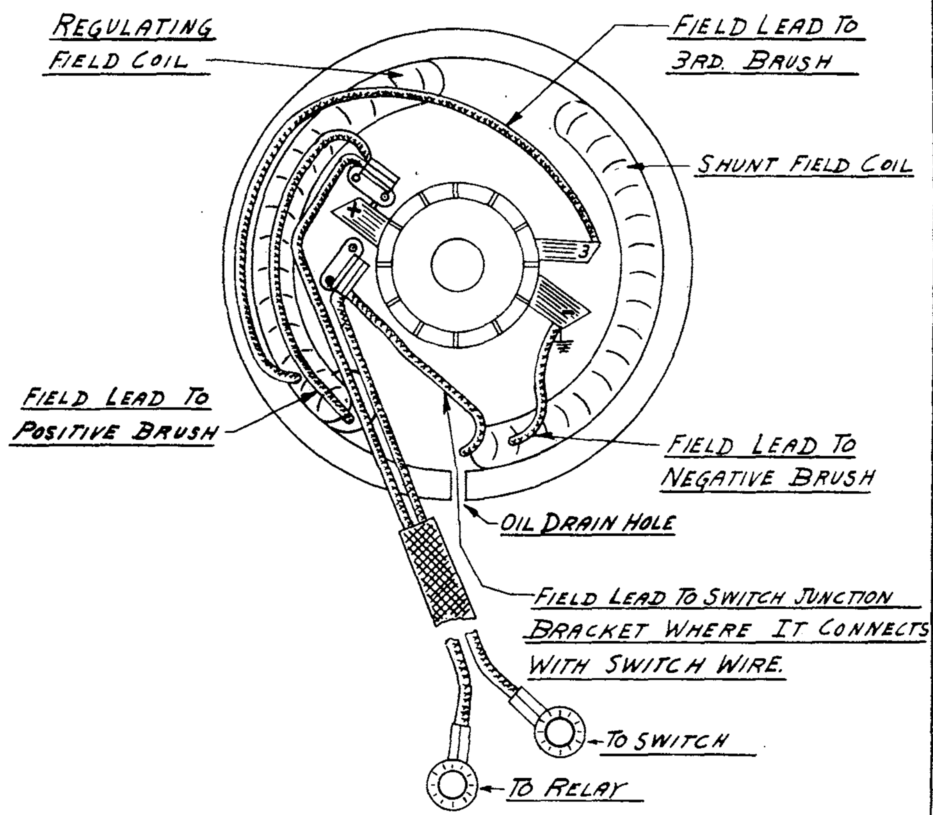

MODEL 30D · 1930 & 1931 - 45"
GENERATOR

SHOP DOPE No. 121D

SKETCH 305D — HARLEY·DAVIDSON MOTOR CO. — 2-14-35

NOTE:

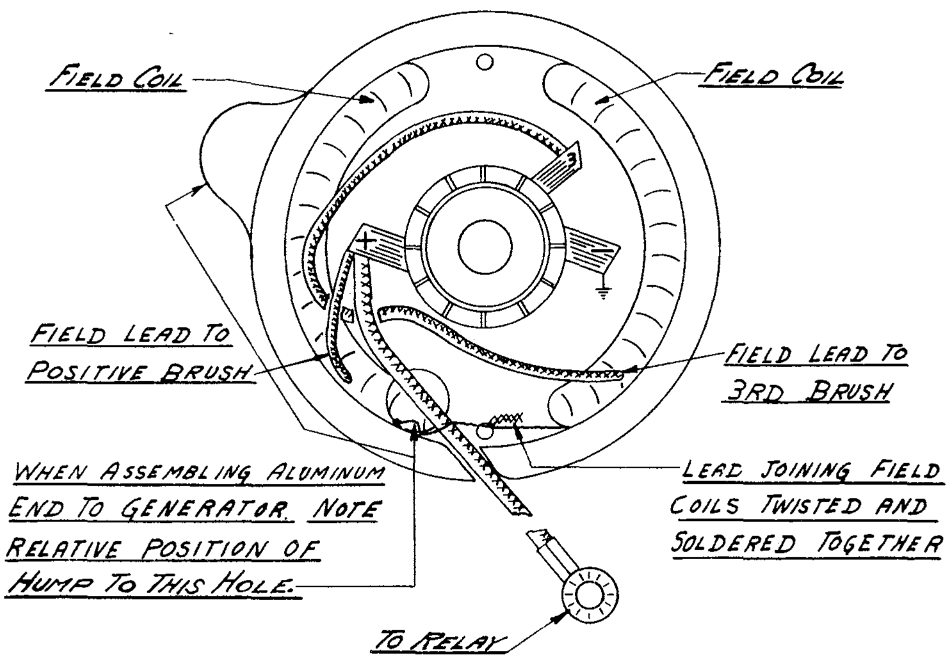
OIL DRAIN·HOLE IN FRAME IS AT BOTTOM SIDE OF GENERATOR.
FIELD COILS HAVE ALL LEADS NEAR BOTTOM SIDE OF GENERATOR.
ALUMINUM END WITH LEAD OUTLET HOLE BOTTOM SIDE OF GENERATOR.




1930 & 1931 - 74" GENERATOR

SHOP DOPE NO. 121

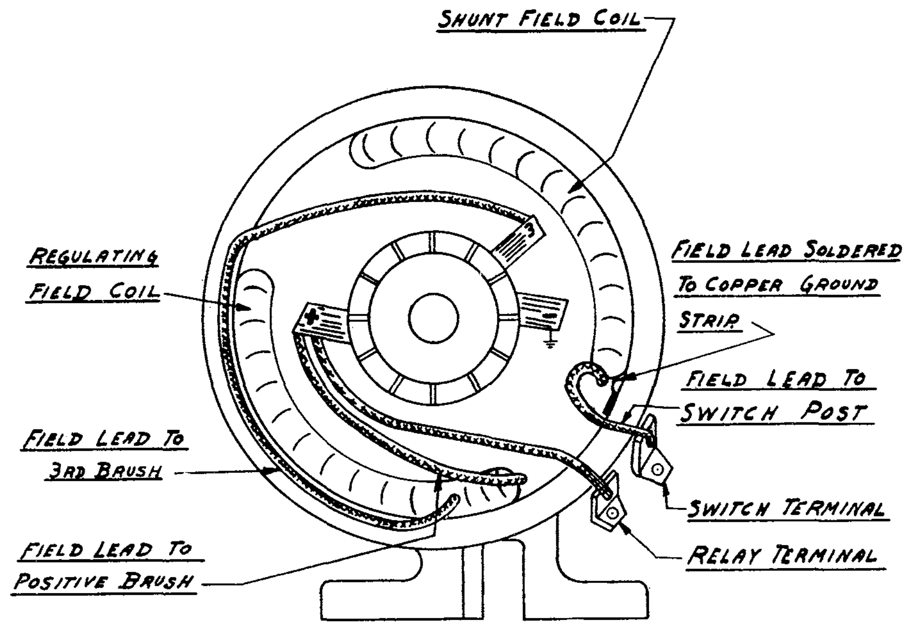
SKETCH 305 HARLEY DAVIDSON MOTOR CO. 2-14-35




1929-45" GENERATOR

SHOP DOPE NO. 121A

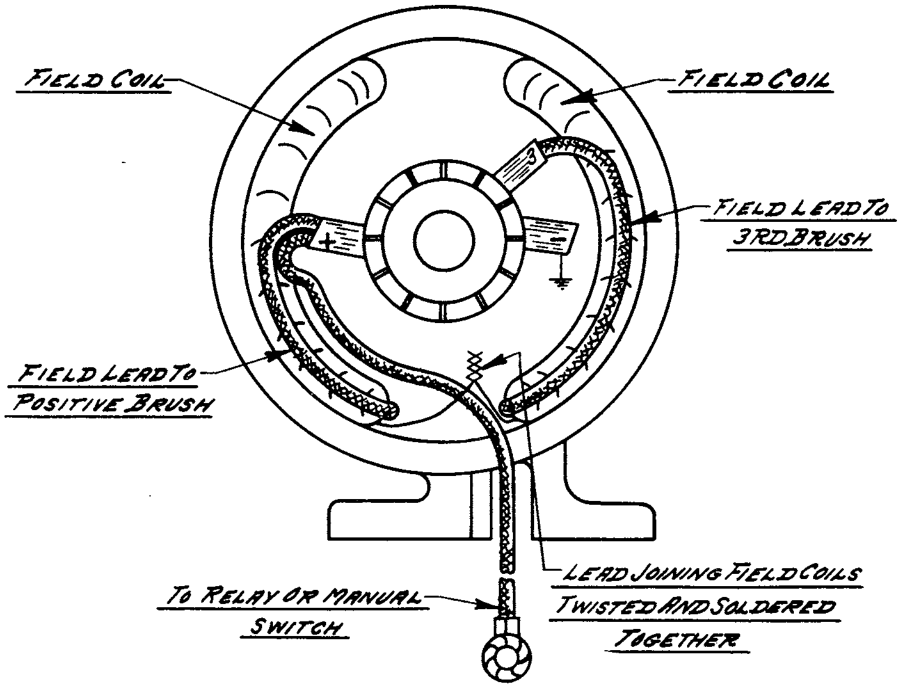
SKETCH-305A HARLEY DAVIDSON MOTOR CO. 2-14-35




1930 & LATER SINGLE GENERATOR

SHOP DOPE No. 121 E

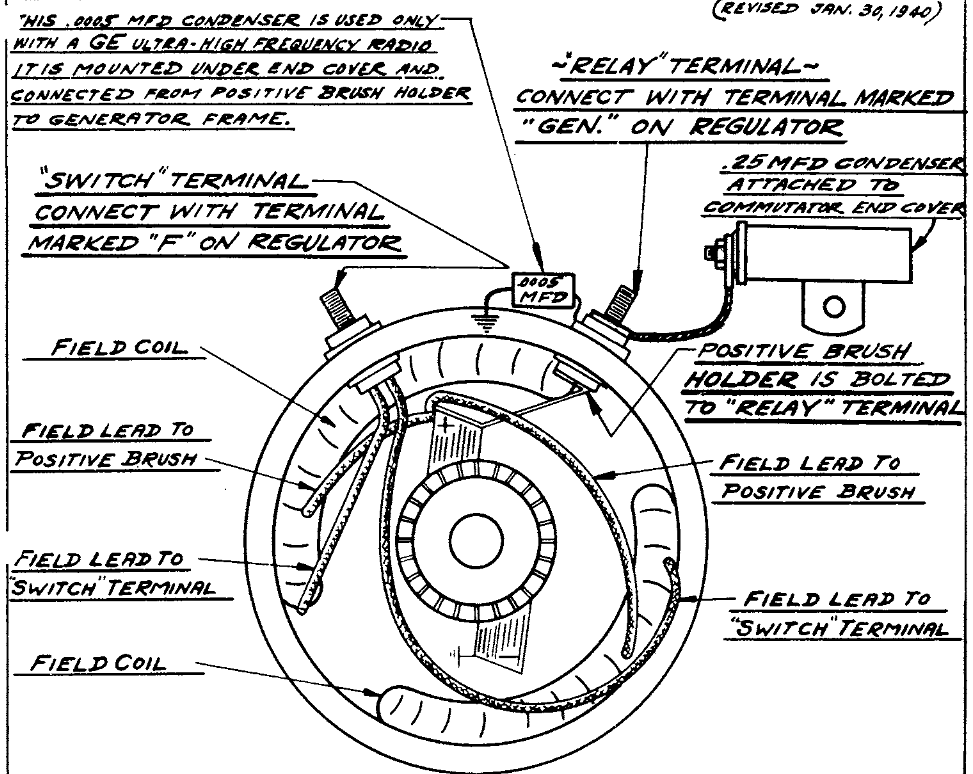
SKETCH-305E HARLEY DAVIDSON MOTOR Co. 2-14-35




1929 & EARLIER SINGLE'S; 61 & 74 GENERATOR

SHOP DOPE No. 121 G

SKETCH-305 G HARLEY-DAVIDSON MOTOR CO. (REVISED JAN. 30, 1940)




MODEL 32E 2R RADIO GENERATOR

USED ONLY WITH CURRENT AND VOLTAGE REGULATOR

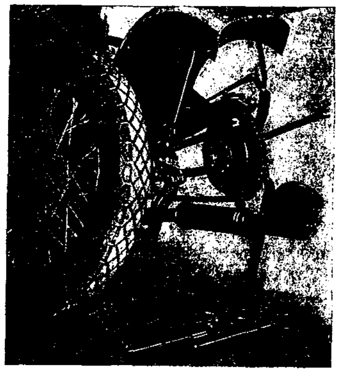
NOTE:- THIRD BRUSH IS DISCARDED.

SERVICE SHOP DOPE

No. 123

March 15, 1935

## 45 (750 C. C.) DEMOUNTABLE REAR WHEEL



Demountable rear wheel clamp screws must be securely re-tightened two or three times within the first few hundred miles after a new machine goes in service. In other words, the connection between brake assembly and wheel must not be allowed to work loose and develop play, because if this happens and wheel is allowed to run loose for some time, the mounting holes in hub flange will become badly elongated and then it will not be possible to keep a tight connection. In new assembly, wheel clamp screws are pulled very tight but a certain amount of give and setting takes place in service and re-tightening is necessary. After everything about the connection becomes thoroughly seated, clamp screws will no longer require frequent re-tightening, although they should be inspected occasionally.

Advise all your 45 model riders that when there is occasion to remove and replace wheel in making roadside tire repair, it is very important that all five clamp screws be pulled very tight.

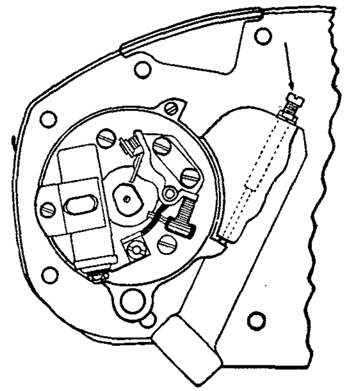
HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

SERVICE SHOP DOPE

No. 124

March 22, 1935

## 1935 - 74 MODEL TIMER ADJUSTING SCREW



When you have occasion to check and re-adjust ignition timing in connection with a 1935, 74 cu. in. model, you will observe that the circuit breaker full advance stop is now provided with an adjusting screw similar to the carburetor throttle stop screw. This might properly be called a micrometer adjustment for very accurate re-setting of ignition. With earlier models, to re-set timing, it is necessary to loosen the circuit breaker assembly and shift the advance and retard plate. Re-setting in this manner, it is not such a simple matter to get altogether accurate setting.

Proper procedure in checking and re-setting with the new adjusting arrangement is as follows: First adjust circuit breaker point gap to exactly .022". Next remove timing plug from left crankcase, and check timing with flywheel mark as illustrated and described on page 16 of 74 model Rider's Hand Book. If timing is found not correct, re-adjust circuit breaker stop screw a little at a time and re-check flywheel position, until flywheel mark comes to just the right point when ammeter indicator drops back to zero indicating that points have separated.

A lot is expected of motors these days in the way of performance and speed. The first essential for good all around performance and best possible top speed is accurate ignition timing. New motors are accurately timed in new assembly, but due to running-in and normal wear, timing changes to some extent. Encourage your riders to have timing of their motors checked periodically - be a "specialist" with this tuning up operation as concerns accuracy, and you will find yourself hearing less performance complaints.

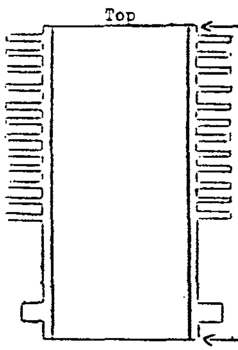
HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

SERVICE SHOP DOPE

No. 126 April 3, 1935

## CYLINDER REBORING AND PISTON FITTING INFORMATION

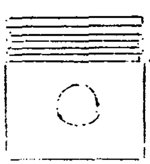
Taper Bore Cylinder And Solid Skirt Type Piston
(Note: Dimensions given are standard size.)




| Model | Size |
|---|---|
| 21" | 2.870" |
| 30.50" | 3.0885" |
| 45" | 2.745" |
| 61" (1923 & earlier) | 3.307" |
| 61" (1924 to 1929) | 3.305" |
| 74" | 3.422" |

| | |
|---|---|
| 21" | 2.875" |
| 30.50" | 3.0935" |
| 45" | 2.750" |
| 61" (1923 & earlier) | 3.310" |
| 61" (1924 to 1929) | 3.312" |
| 74" | 3.429" |

Note: Take cylinder measurement about ½" from top of bore, rather than at extreme top, when determining piston clearance given below.



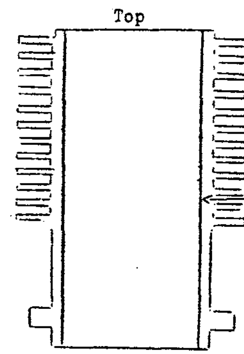
| Solid Skirt type piston. Model | Piston size at measuring point - just below top group of rings | Piston Clearance |
|---|---|---|
| 21" (all models) Dow metal & Lynite | 2.8585" | .011" to .013" |
| 30.50" Dow metal | 3.0767" | .011" to .013" |
| 45" Dow metal | 2.730" | .014" to .016" |
| 45" Lynite | 2.731" | .014" to .016" |
| 61" Iron Alloy (1924 to 1929) | 3.3035" | .002" to .003" |
| 61" Dow metal (1924 to 1929) | 3.293" | .0115" to .0135" |
| 74" Iron Alloy (1929 & earlier) | 3.419" | .003" to .004" |
| 74" Dow metal (1929 & earlier) | 3.406" | .0135" to .0155" |
| 74" Iron Alloy (1930 & later) | 3.419" | .004" to .005" |
| 74" Dow metal (1930 & later) | 3.405" | .015" to .016" |
| 74" Lynite (1930 & later) | 3.407" | .016" to .018" |

(over)



## CYLINDER REBORING AND PISTON FITTING INFORMATION

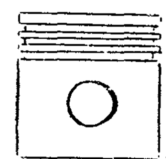
Straight Bore Cylinder and T-Slot type Piston
(NOTE: Dimensions given are standard size)




Standard bore dimension of straight bore cylinder for T-Slot piston

| | |
|---|---|
| 45" | 2.745" |
| 74" | 3.422" |

Note: When checking fit of T-slot piston in straight bore cylinder, insert piston part way in cylinder bore.



T-Slot piston should be fitted size to size,-to .002" clearance in straight bore cylinder, checking fit at bottom of skirt, front & rear, with feeler inserted between piston and cylinder bore.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

# SERVICE SHOP DOPE

No. 127 April 9, 1935

## SERVICING 1936, AND EARLIER INTERCHANGEABLE WHEELS

After considerable service, and, of course, depending to a great extent on the kind of service in which a machine is used, interchangeable wheels may become worn to some extent, causing end play in the wheel hubs, and looseness in the drive splines.

Excessive end play in a wheel hub (end play should be .004" to .008") can in most cases be corrected by simply fitting new bakelite thrust washers. In a case where new bakelite thrust washers will not readjust end play, fit narrower thrust plate spacer than the one originally fitted in hub. These spacers are regularly supplied in sizes from .345" to .380" in steps of .005", and we can supply a .390" spacer for unusual cases.

Drive spline looseness can be taken care of by fitting an oversize brake shell hub, which we can supply in sizes of .001", .002" or .003" oversize. A .001" oversize hub will take care of splines that apparently have considerable play when checked at rim of wheel; a .002" oversize will fix up a badly worn assembly; and a .003" oversize should not be necessary except in an extreme case.

AN OVERSIZE HUB SHOULD NOT BE FITTED UNTIL WHEELS HAVE BEEN INTERCHANGED A SUFFICIENT NUMBER OF TIMES SO THAT ALL WHEEL HUBS ARE WORN ABOUT EQUALLY. Otherwise fitting an oversize hub to correct a badly worn rear wheel will upset the interchangeable wheel system because the front, sidecar, or spare wheel will not fit on the oversize hub.

OVERSIZE REAR WHEEL BRAKE SHELL HUB

| Part No. | List Price |
|---|---|
| 4030-30S | $4.50 |
| 4030-32S | 4.50 |

Specify oversize wanted

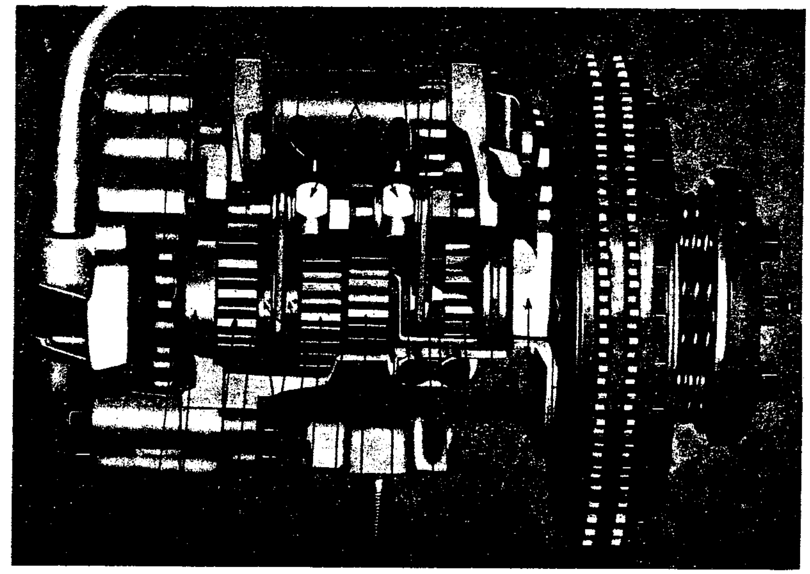
THRUST PLATE SPACER

| Part No. | List Price |
|---|---|
| 3927-30 | $ .25 each |

Specify size wanted or order a quantity assorted.

# SERVICE SHOP DOPE

No. 128 1935 45 MODEL TRANSMISSION April 10, 1935



(Illustration of Reverse Transmission)

| | | Part Number |
|---|---|---|
| 1. | Sprocket cover.................................................. | 2345-33 |
| 2. | Sprocket........................................................ | 2035-33 |
| 3. | Shifter fork shaft (held in place by sprocket cover)............. | 2245-33 |
| 4. | Shifter fork (low and reverse).................................. | 2247-33 |
| 5. | Spacing washer (same as No. 9).................................. | 2253-33 |
| 6. | Adjusting shims (same as No. 10) with which shifter fork No. 4 is adjusted to fully engage shifting clutch No. 25 in low and reverse positions. Shims are .007" and .014" - one to six required for correct adjustment in new assembly......................Shim .007" | 2253-33B |
| | Shim .014" | 2253-33A |
| 7. | Shifter fingers................................................. | 2248-33 |
| 8. | Shifter cam - must be free, but should not have more than .005" end play................................................... | 2243-33 |

## TAKING APART, RE-ADJUSTING, AND RE-ASSEMBLING

Transmission should be removed from motorcycle, drained and flushed out with gasoline, and given attention at the bench.

To dis-assemble transmission as necessary to only re-adjust shifter forks and shifting clutches, proceed as follows: First, remove inspection plate from transmission top, and use gauges to determine what re-adjustment is required as described in paragraphs No. 17 and No. 23. Next, remove shifter cam No. 8 as described in paragraph No. 29. Remove sprocket cover No. 1 and drift out shifter fork shaft No. 3. This shaft comes out through transmission side cover. With shaft out, shifter fork assemblies are free to be lifted out and re-adjusted. Bear in mind that the shifter fork assemblies are not interchangeable, and before taking them apart for re-adjustment, the exact arrangement of parts in each assembly should be carefully noted so they will be put back together the same way. It is also well to note the number of shims used in original factory setting, as the original adjustment will not be found far off, and losing track of it may mean re-assembling, gauging, and re-adjusting two or three times before correct new adjustment is accomplished. When re-adjustment of shifter fork assemblies has been completed, reverse the order of dis-assembly to put transmission back together.

To take transmission all the way apart for complete inspection, re-adjustment and renewal of parts, proceed as described above for only re-adjusting shifter forks, and then remove sprocket No. 2 and take off transmission side cover. All remaining internal parts can then be taken out through the side.

The first step in re-assembling and re-adjusting is assembling roller bearing No. 13, thrust bearing No. 14, and clutch gear No. 15 in case. Next, install mainshaft with only adjusting spacer No. 16, thrust washer No. 24, and reverse gear No. 26 (or standard transmission spacer bushing assembled on shaft). Now install transmission side cover with roller bearing No. 27, tighten cover securely, and check mainshaft for end play as described in paragraph No. 16. It is important that mainshaft be adjusted with the least possible end play and still have it turn freely. After mainshaft adjustment has been completed, remove transmission side cover and take shaft out, but be careful the adjusting spacer with which correct adjustment was obtained is not misplaced or mixed up with other washers that may be lying around. In other words, be sure you use this same washer in final assembly.

Now assemble just the following parts on mainshaft: Both thrust washers No. 24, reverse gear No. 26 (or standard transmission spacer bushing), low gear No. 22, adjusting spacer No. 21, and second gear No. 20, also have mainshaft adjusting spacer No. 16 in place. With this assembly together, install it in case, fit side cover with roller bearing No. 27, and tighten cover securely. Now see how much side play low and second gears have between washer No. 24 at end of shaft splines, and second gear retaining bracket No. 19. They must have enough clearance to turn freely, but should not have more than .003" side play. Re-adjustment as needed can be made by fitting thicker or thinner adjusting spacer No. 21. With this adjustment completed, transmission is ready to go together in complete assembly.

See that shifting clutches No. 18 and No. 25 are a good free fit without binding on shaft splines. Also observe that engaging dogs on clutches are in good condition without chipped corners and damage as results from shifting without clutch fully disengaged. Shifting clutches with chipped and battered engaging dogs creep out of engagement under steady driving load, and the tremendous side pressure brought about through this condition eventually results in serious damage to the shifting mechanism and all thrust points along the mainshaft assembly.



Assemble countershaft gear and starter parts in case first, then mainshaft assembly, and side cover, then go ahead with the assembly of shifter mechanism and other parts, in the reverse order of dis-assembly.

Before assembling clutch on clutch gear, give attention to thrust washer and cork oil retainer No. 12. Steel thrust washer is usually a rather snug fit on clutch gear sleeve. Just start it and let clutch inner disc push it to its proper position as disc is tightened. Inspect cork in recess in clutch disc, and if it appears to be at all worn, renew it.

See that shifter cam lock plunger seats with sufficient tension so that a fair amount of effort is required to move cam from one position to another. This is important to stop cam in just the right positions and thus be sure of shifting clutch driving dogs being fully engaged. Plunger spring tension adjusting screw is in the front of transmission case. Adjusting spring tension too strong will, of course, make shifting difficult so don't overdo it.

See that shifter controls from transmission to tank lever are well oiled and free working. Observe that at no point in the shifting range is there binding or interference with shifter rods. This is something that may be found now and then due to rods becoming bent. Be sure shifter rod is correctly adjusted so that when tank shifter lever is shifted from one position to another, transmission lever moves to just the right position for full engagement of lock plunger in cam notch, and thus full engagement of shifting clutch. Recommended adjusting procedure is to disconnect shifter rod from tank lever, set transmission lever in "neutral" position, and then re-adjust shifter rod so that tank lever has correct gate position. Bear in mind that wrong adjustment of control, or in other words, wrong relation between tank lever and transmission lever, may mean running with shifting clutches only partially engaged which soon leads to trouble.

To convert a standard three-speed transmission to a reverse unit, it is only necessary to fit gear No. 26 in place of original spacer bushing, and install reverse idler gear No. 32. No other changes are required in the transmission itself, but new shifter controls are required, namely, tank shifter gate, shifter lever, and shifter rod. The complete combination of parts required for changeover are covered by part number 2203-35, price $9.75 list.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wisconsin
U. S. A.

### Conversion Table

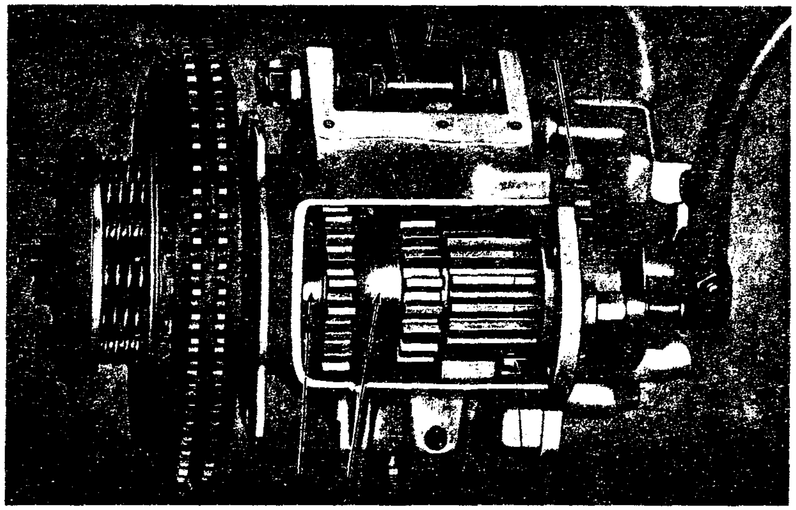
Inches to Millimeters

| | | |
|---|---|---|
| .003" | = | .08 mm. |
| .005" | = | .13 mm. |
| .007" | = | .18 mm. |
| .014" | = | .36 mm. |
| .030" | = | .76 mm. |
| .032" | = | .81 mm. |
| .037" | = | .94 mm. |
| .041" | = | 1.04 mm. |
| .090" | = | 2.29 mm. |
| .140" | = | 3.56 mm. |
| 1/16" | = | 1.59 mm. |
| 1/8" | = | 3.18 mm. |
| 1/4" | = | 6.35 mm. |

| | | Part Number |
|---|---|---|
| 9. | Spacing washer (same as No. 5).................................. | 2253-33 |
| 10. | Adjusting shims (same as No. 6) with which shifter fork No. 11 is adjusted to fully engage shifting clutch No. 18 in second and high positions.................................................... | 2253-33A & 33B |
| 11. | Shifter fork (second and high).................................. | 2246-33 |
| 12. | Roller bearing steel thrust washer, and cork oil retainer behind clutch inner disc ..................................Steel washer | 2520-33 |
| | Cork retainer | 2524-33 |
| 13. | Clutch gear roller bearing. (Thirty-one needle rollers, no retainer. Rollers furnished undersize and oversize in steps of .0001".. | See "Shop Dope" on Rollers |
| 14. | Thrust bearing................................Retainer and balls | 2521-33 |
| | Thrust race | 2522-33 |
| 15. | Clutch gear.................................................... | 2513-33 |
| 16. | Mainshaft end play adjusting spacer – between end of splines on shaft and end of clutch gear. This spacer furnished .090" to .140" thick, in steps of .005". Use thickness required to adjust mainshaft, free running to not more than .005" end play.............. | 2516-26 |
| 17. | Clearance between shifting clutch and clutch gear with shifter cam in <u>neutral position.</u> With clutch gear turned so that <u>highest points</u> of driving dogs on shifting clutch and clutch gear overlap about 1/16" to 1/8", insert narrow feeler gauge down through inspection opening in transmission top and between the ends of dogs. Gap should be not less than .030" and not more than .037". Re-adjust as necessary with shims No. 10. | |
| 18. | Shifting clutch (second and high)............................... | 2298-33A |
| 19. | Second gear retaining bracket................................... | 2299-33 |
| 20. | Second gear..................................................... | 2295-33 |
| 21. | Adjusting spacer – for adjusting side play of second and low gears, between washer No. 24 at end of shaft splines, and retaining bracket No. 19. This spacer furnished .032" to .041" thick, in steps of .003". Correct adjustment of this gear assembly, free running to .003" side play...................................... | 2294-33A |
| 22. | Low gear........................................................ | 2294-33 |
| 23. | Clearance between shifter fork and low and reverse gears, with shifter cam in <u>high position,</u> should be 1/4" either side of fork. Check this adjustment with a 1/4" thick gauge or feeler inserted through inspection opening in transmission top. Insert end of gauge all the way against shifting clutch so that spacing will be determined from raised thrust face on side of low gear rather than near ends of teeth. Re-adjust as necessary with shims No. 6. This adjustment applies also to a standard transmission without reverse gear, but in the standard transmission it is only necessary to gauge clearance between shifter fork and low gear. | |
| 24. | Thrust washers (two) on mainshaft at ends of splines............. | 2292-33 |



| | | Part Number |
|---|---|---|
| 25. | Shifting clutch (low and reverse)............................... | 2298-33 |
| 26. | Reverse gear (In the standard transmission a spacer bushing is used instead of this gear.) Install spacer with flange side outward...............................................Reverse gear | 2296-33 |
| | Standard transmission spacer | 2296-33A |
| 27. | Mainshaft roller bearing. (Twenty-one needle rollers, no retainer. Rollers furnished undersize and oversize in steps of .0001".) | See "Shop Dope" on Rollers |
| 28. | Roller bearing steel thrust washer and felt oil retainer on mainshaft behind sprocket................................Steel washer | 2291-33 |
| | Felt retainer | 2293-33 |



| | | |
|---|---|---|
| 29. | Shifter cam shaft. To take out shaft and cam No. 8, it is first necessary to remove complete clutch. Then, unlock shaft inner nut washer, turn inner nut completely off its thread, and pull out shaft from clutch side.......................................... | 2235-33 |
| 30. | Starter clutch.................................................. | 2165-32 |
| 31. | Countershaft gear. Floating bronze bushing at right end. Roller bearing at left end (nineteen needle rollers with steel thrust washer at each end of rollers, no retainer. Rollers furnished in undersizes and oversizes in steps of .0001").....Countershaft gear | 2303-33 |
| | Bronze bushing | 2304-33 |
| | Rollers | See "Shop Dope" on Rollers |
| | Inner washer | 2305-33 |
| | Outer washer | 2308-33 |
| 32. | Reverse idler gear. (This gear left out in standard transmissions and nothing takes its place).................................... | 2365-33 |

# SERVICE SHOP DOPE

No. 129 May 2, 1935

## A NEW AIR CLEANER

(Part No. 1401-35 - List Price $4.50)

A new and very effective Harley-Davidson carburetor air cleaner is now available. It is of the oiled screen type and does a very thorough job of cathcing any dust in the air that goes through it. When the screen has accumulated considerable dirt it can be easily removed, washed in gasoline, and re-oiled. The cleaner has exactly the same appearance as the regular 1935 carburetor air intake, but the end is closed and screen pack is fitted in the back side.

We strongly urge the immediate installation of cleaner on any motorcycles operated under conditions that are at all dusty. This applies to motorcycles driven all or part of the time on dirt roads, and particularly to motorcycles running in the sections affected by the unusual dust storms being experienced this year.

Bear in mind that considerable road dust or abrasive dust from any source, taken into motor through carburetor can bring about as much cylinder, piston and ring wear in 3000 miles as normally should occur in 15,000 miles or more. The result is loss of compression and piston slap at low mileage. Several cases of such premature wear have been called to our attention during the past few weeks from the dust storm sections.

While the air cleaner is not considered altogether necessary equipment on motorcycles driven on hard surface roads in localities not affected by dust storms, there is nothing against this equipment for general use. It does not restrict intake to the extent of any appreciable loss in motor performance.

NOTE: Air cleaner as equipped on new motorcycle is oiled when it leaves the factory. When shipped on parts order, air cleaner is not oiled to avoid possible oil damage to other parts packed with it. To place in service, remove metal mesh pack, dip in oil, hang where hot to drain until there is no further drippage, then re-assemble and attach.

# SERVICE SHOP DOPE

No. 130 May 8, 1935

## A MORE POSITIVE GROUND FOR ELECTRIC SYSTEM

In the past the grounded side of generator-battery circuit (from ammeter to generator) was completed through fork fittings and frame head bearings. Difficulties reported now and then such as repeated burning of lamp bulbs, excessive burning of circuit breaker points, missing, etc., have indicated the probabilities of an occasional motorcycle with faulty ground through head fittings.

To be sure of every motorcycle having positive ground hereafter, we are now shunting the frame head fittings out of the ground circuit by running a separate ground wire directly from grounded terminal of ammeter (left side terminal) to motorcycle frame. Ground wire is attached to frame with the screw that secures control coil clamp on left side of frame head. Completing the circuit in this manner eliminates any chance of faulty ground as a source of trouble.

The new ground wire can be attached to any motorcycle now in service, with switch panel and ammeter attached to fork triple clamp. We suggest you order out a supply of these ground wires and encourage installation on all motorcycles not so equipped originally, particularly early 1935 models. The cost is small and it is a safeguard against electrical difficulties.

Part number of ground wire - 4706-29. List price - $ .20

SERVICE SHOP DOPE

No. 131 May 18, 1935

## ADJUSTING PRE-FOCUSED HEADLAMP

Comparing the pre-focused type headlamp with earlier lamps, the pre-focused lamp projects a smaller but much more intense beam of light. In other words, it does not spread so much light to the roadside, but projects a high candlepower, clear vision beam a considerably greater distance ahead, where it is needed for fast night driving.

This being the case, it is necessary that the pre-focused lamp be adjusted or aimed with greater accuracy. It's like the difference between shooting with a shotgun or a rifle. If lamp is aimed too high or a little to one side, the main light beam simply won't hit the road directly ahead as it should for good vision.

Make provisions in your shop for very accurate adjustment of headlamp when assembling on new motorcycle or when re-adjusting. Don't just go by apparent correct setting of lamp body in relation to fork and handlebars. Adjust according to light beam. At a distance of 25 feet, with handlebar switch in upward (bright) position, top of main beam of light should be no higher than the center of lamp. Some moderate speed drivers are better satisfied with the light beam a trifle lower. See Rider's Handbook for further lamp adjusting suggestions.

SERVICE SHOP DOPE

No. 132 May 22, 1935

## ADJUSTABLE BRAKE SHOE PIVOT STUD

Starting with late 1934 models, all brakes are provided with adjustable shoe pivot stud. Previously this was a fixed stud.

When re-lining brake with adjustable pivot, attach new liners in the usual way, but before re-assembling brake in motorcycle, loosen pivot stud nut.

After re-lined brake and wheel have been completely re-assembled in motorcycle and axle tightened, apply brake with the maximum pressure ordinarily applied in braking, and while brake is applied, tighten pivot stud nut.

This adjustment offsets irregularities about new or relined shoe assemblies, and allows shoes to find position where liners have full contact with drum when brake is applied. The result is maximum brake efficiency.

After pivot stud adjustment has been made, brake control can then be correctly re-adjusted.

# SERVICE SHOP DOPE

No. 137 November 18, 1935

## NEW OIL WASHERS FOR TRANSMISSION - 1935 45 MODEL

A new type oil washer is now used behind clutch in the 45 model transmission. This change went into production starting with motor #35R3466 and including a few lower motor numbers, listed at foot of this bulletin. The original oil retainer behind clutch was a cork washer. The new washer is leather with rubber expander, in a metal retainer.

The new oil washer is not interchangeable with earlier cork washer, but can be applied to earlier transmissions (all 1935 45's, including Servi-Car, and 1934 45 reverse) by installing new inner clutch disc, part#2528-33. Latest inner disc under this part No. furnished on parts order is complete with the improved washer. Part No. of the new washer only (complete with retainer) is 2524-36. The original cork washer used with earlier disc can also still be obtained under part #2524-33.

If you have any early 1935 45 models that have been giving you considerable trouble with transmission oil leakage behind clutch, which you haven't been able to correct satisfactorily by installing new cork washer, we suggest you change the inner clutch disc for one with the improved washer. For machines that need this service, you can order in the regular way the required number of new discs, exchange them, and then if original discs are returned with no damage other than normal wear and tear, we will give you full credit.

When you order discs for this no charge exchange, please order only a reasonable number at a time, and be sure to mark your order plainly "for exchange" because for this service, we may furnish slightly used discs that have been returned and corrected to adapt the new washer. When you return for credit original discs that you have exchanged, see that each one is tagged with motor number so we can keep our records straight at the factory.

Remember, the name and part number are: Inner Clutch Disc #2528-33. Bear in mind also that this disc fits only the later 45 transmission (all 1935's and 1934 reverse). Models only with motor # below 35R3466 are to be considered for disc exchanges.

This inner disc no charge exchange offer is good only til February 1, 1936. After that date there will be a service charge of 85¢ net, per disc.

There is also a new oil washer behing the countershaft sprocket in later 45 transmission, but as the original felt washer at this point has done a good job, we are not suggesting that this washer be replaced with the new type until the original sprocket becomes worn out and has to be renewed. All new sprockets furnished on part order will be furnished with new type washer installed. The new washer cannot be fitted to earlier sprocket. The following part numbers apply to this sprocket and oil washers:

| | |
|---|---|
| 16 tooth sprocket compete with new oil washer | #2035-33 |
| New leather oil washer only with retainer | #2293-36 |
| Original felt washer | #2293-33 |

The transmissions in following machines below #35R3466 are fitted with latest oil washers:

| | | | | |
|---|---|---|---|---|
| 35RL 3222 | 35RL 3225 | 35RLD 3391 | 35R 3456 | 35R 3463 |
| RL 3223 | 35RL 3226 | 35R 3452 | 35R 3459 | R 3464 |
| RL 3224 | 35RLD 3381 | 35R 3453 | 35R 3461 | R 3465 |

# SERVICE SHOP DOPE

No. 137-E December 9, 1935

## INSTALLING LATEST (1936) OIL RETAINING WASHERS IN 1935 TRANSMISSION 45" MODEL ONLY

The latest oil retaining washer behind clutch is a much more dependable oil seal than the original washer used in 1935, which was a cork washer. The new washer is leather with a rubber expander and metal retainer. It has applied to all 1936 45" models, and a few later 1935 models starting with motor 35R-3466.

This new oil washer behind clutch is not interchangeable with earlier cork washer, but can be applied to earlier transmissions (all 1935 45"s, including Servi-Car and 1934 45" reverse). By exchanging clutch inner disc for a later one, or by enlarging somewhat in a lathe, the retainer recess in back side of original inner clutch disc.

Part numbers and prices applying to inner disc complete, and old and new oil washers are:

| Part No. | | List Price |
|---|---|---|
| 2528-33 | Inner clutch disc, complete with latest oil washer | $ 4.80 |
| 2524-36 | New Oil washer only (complete with metal retainer) | .50 |
| 2524-33 | Cork Washer (as originally equipped 1935) | .10 |

There is also an improved oil washer behind the 1936 countershaft sprocket. This new washer cannot be fitted to countershaft sprocket equipped on 1935 models. However, all new countershaft sprockets supplied on parts orders will be furnished with new type washer installed, and therefore as original 1935 sprockets become worn and have to be replaced, this oil washer change will take care of itself. The following part numbers and prices apply to new sprocket and old and new style oil washers:

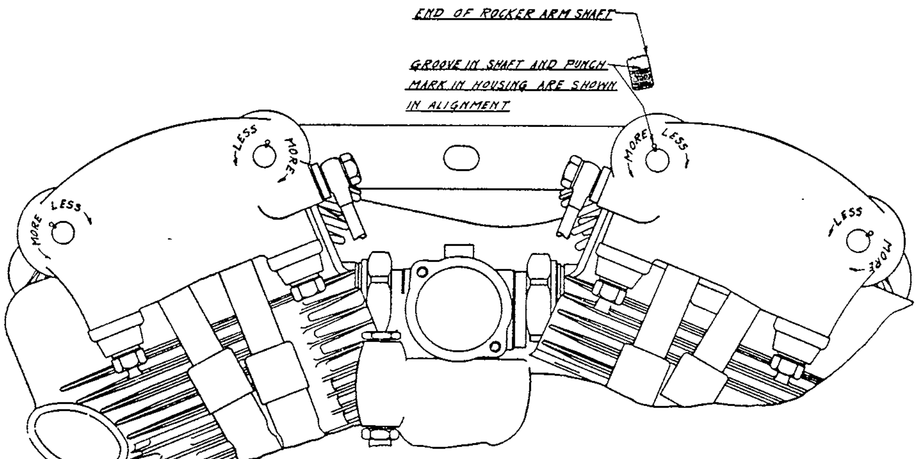
| Part No. | | List Price |
|---|---|---|
| 2035-33 | 16 tooth sprocket complete, with new oil washer | $ 1.50 |
| 2293-36 | New leather oil washer only (with metal retainer) | .25 |
| 2293-33 | Felt Washer as used with 1935 sprocket | .05 |

In removing and replacing clutch inner disc, you will need a new wrench to take off and replace disc nut. If you already have 45 clutch wrench 12745-26, all you will need to order is adapter 12745-36, which completes this wrench for the later type clutch disc nut. If you don't have this wrench, you should order it with your next parts order. Part numbers and prices follow:

| Part No. | | List Price |
|---|---|---|
| 12745-26 | Wrench complete with adapter | $ 5.00 |
| 12745-36 | Adapter only for late clutch disc nut | 1.00 |

# SERVICE SHOP DOPE

No. 140 April 20, 1936




## REGULATING OIL TO VALVES

Late - 61" Models

Setting of rocker shafts regulates oil to valves.

Original factory setting is indicated by groove in right end of each shaft and punch mark in aluminum housing.

Since adjustment must be very fine for only a very small amount of oil to valves, original setting may not be just right for all valves and further adjustment may be required. Too little oil will be indicated by valves running dry and squeaking. Overoiling will be indicated by oil splashing from spring covers. Of course there will normally be a little oil vapor or spray from covers even with correct oiling.

To adjust for more or less oil to any valve, remove rocker shaft nuts, and turn shaft as indicated by arrows.

When readjusting, turn shaft only a little at a time, about 1/32" to 1/16".

Once new motor valve oiling has been regulated and has gone along satisfactorily for a time, should a valve cover then fill with oil and splash over, it is probably due to the return line from cover to rocker housing becoming clogged with particles of dirt or carbon. In this case disconnect return line from rocker housing and blow out with air hose. When cylinder heads are removed for carbon cleaning and valve grinding, be sure to blow out cover return lines and also clean covers thoroughly.

HARLEY-DAVIDSON MOTOR COMPANY
Milwaukee, Wis., U. S. A.

# SERVICE SHOP DOPE

No. 142 July 1, 1936

## 61 OVERHEAD MOTOR - OIL REGULATION

(Refer to 61 rider instruction folder to look up illustration numbers given below)

Late 61 motors are running much higher oil mileage than earlier motors. This is not a matter of pump readjustment. It is a change in pinion gear shaft through which oil passes into motor. This change went into production with motor No. 36EL1755 and also applies to a few odd motors of lower number, listed at bottom of this bulletin.

We suggest this change in all earlier motors for better oil control. Pinion gear and shaft assembly No. 1, Illustration 5, is the part to be changed. Order No. 356-36A Original gear and shaft assemblies are returnable for credit, if returned within reasonable time, tagged with motor number, and not damaged outside of normal wear.

It is a simple job to make this change. First remove gearcase cover as shown in Illus. 5. Removing front exhaust valve pus rod will relieve cam gear of valve load (with gear marks in alignment) while making the change. Bear in mind that pinion shaft tongue and groove register if off center for one-way assembly. Don't start it wrong and try to force it. Be careful to get all gears back in place with marks in correct alignment. Note that gear case cover gasket is in good order, particularly around breather pocket in lower, rear corner of gear case as a leak betwben gear case and breather pocket will likely result in excessive oil discharge through breather into chain guard no matter how chain oil regulating screw in pump body may be readjusted.

Normally high oil mileage also depends to a great extent on regulation of oil to valve and front chain so there is not over-oiling and oil waste at these points. Furthermore, close regulation so that valves don't over-oil, but get only the slight smount of oil necessary for lubrication has a lot to do with good carburetion and good motor performance. If intake valve particularly are over-oiling, too much oil will be sucked into cylinder heads, through valve guides, on intake stroke, and over-oiling from this source has the same results in the way of heavy exhaust smoke and plug fouling as over-supply of oil to crankcase and too much oil passing pistons and rings. Plugs wet with oil and partially fouled make a motor lope and miss at low speeds and pop back through carburetor.

Readust screw that regulates front chain oiling until only a small amount of oil is discharged occasionally from front chain guard, rather than a continual heavy discharge that not only wastes oil , but also smears up rear wheen and rear end of motorcycle. Description No. 33, below Illus. 2 explains chain oiling adjustment. Chain oiling in connection with early motors will take finer regulation after pinion gear shaft change described above because with decreased oil supplied to motor base, there will be less oil mist exhausted through breather directly from crankcase.

Shop Dope No. 140 explains how to regulate oil to valves. Readjust for lightest possible oil supply without shutting off entirely. Valves require very little oil for good lubrication. Over-supply affects motor performance as explained above, besides wasting oil around valve spring covers. If now and then a valve cover accumulates and splashes out an excessive amount of oil, and readjusting rocker shaft for less oil doesn't seem to correct this condition, it is likely that pipe from spring cover to aluminum rocker housing is clogged with dirt and consequently surplus oil in spring cover is not being sucked back by motor base vacuum. The remedy in this case is to disconnect pipe from aluminum housing nipple, blow out pipe with air hose, and clean out hole in nipple.

In any case where a rocker arm shaft and valve appear to get too little oil, or no oil at all, and readjustment for more oil doesn't get results, first disconnect oil feed pipe at aluminum rocker housing to be sure oil is getting that far, then clear obstruction with air hose or remove rocker shaft and clean out oil passages. A light obstruction can very often be cleaned out with air hose without removing shaft.

With the new pinion shaft and other attention described above, oil mileage may run anywhere from 200 to 400 miles per quart or possibly even more, depending on speed and operating conditions. Moderate driving means high oil mileage, but as driving speed goes up, oil mileage goes down. A motor in sidecar service can naturally be expected to use more oil than a solo motor.

Use "Regular Heavy" oil for summer service. This grade of oil is heavy enough for any kind of service and heavier oil should not be used.

Latest ignition timing for the 61 motor is 7/16" before top center. Earlier 61 motors were timed 3/8". As 7/16" timing effects worthwhile improvement in carburetion and all around performance all early motors should be checked and reset accordingly.

Motors below 36EL1755 fitted with latest pinion shaft:

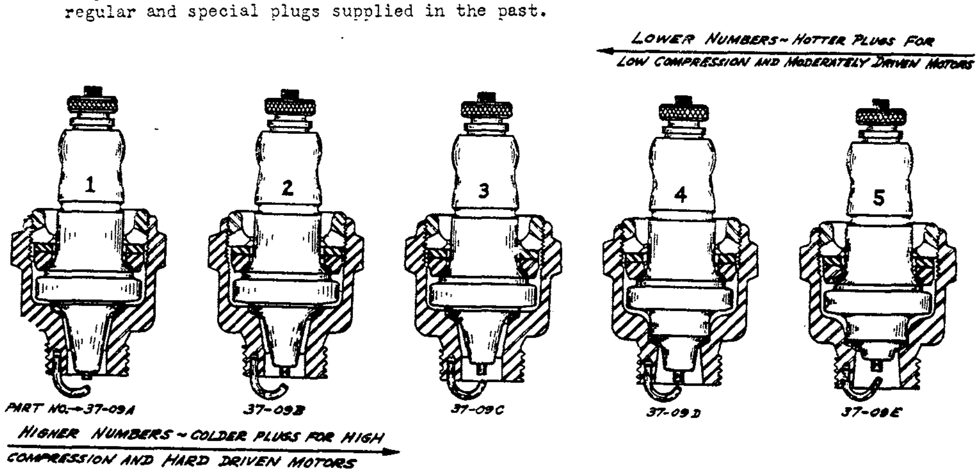
| | | | |
|---|---|---|---|
| 1754 | 1732 | 1687 | 1420 |
| 1753 | 1731 | 1680 | 1400 |
| 1752 | 1730 | 1666 | 1363 |
| 1751 | 1729 | 1645 | 1347 |
| 1750 | 1727 | 1629 | 1307 |
| 1749 | 1726 | 1595 | 1298 |
| 1748 | 1725 | 1594 | 1294 |
| 1747 | 1724 | 1588 | 1235 |
| 1746 | 1723 | 1581 | 1203 |
| 1745 | 1721 | 1566 | 1183 |
| 1744 | 1720 | 1542 | 1175 |
| 1743 | 1719 | 1531 | 1135 |
| 1742 | 1716 | 1521 | 1134 |
| 1741 | 1714 | 1519 | 1121 |
| 1740 | 1712 | 1518 | 1118 |
| 1739 | 1708 | 1507 | 1089 |
| 1738 | 1704 | 1506 | 1087 |
| 1737 | 1703 | 1489 | 1083 |
| 1736 | 1700 | 1480 | 1081 |
| 1735 | 1699 | 1441 | 1053 |
| 1734 | 1697 | 1436 | 1018 |
| 1733 | 1693 | 1434 | |

# SERVICE SHOP DOPE

No. 144 September 9, 1936

NEW SMALL-BASE PLUG

Only this type plug will be supplied from now on. It supersedes all other big-base regular and special plugs supplied in the past.




1 - Plugs Nos. 1 and 2 are equipment plugs in new motors. No. 1 in low compression motors, and No. 2 in high compression motors.

Nos. 3, 4 and 5 are special plugs, particularly No. 5 which is an extra cold plug for extremely hard service.

2 - After a new motor has gone through its running-in period, colder than equipment plugs may be needed, depending on compression ratio and how hard motor is driven. This cannot be determined by compression ratio alone, as some high compression motors see very moderate service, and some low compression motors are driven very hard.

3 - If, in a motor in average good condition as concerns valve seating, compression, timing, etc., plugs after a short time in use are found with cores blistered, cracked or partially burned away, this indicates the need of either a richer high speed carburetor adjustment or colder plugs. If plugs are found with an accumulation of oily soot or carbon, and possibly fouling difficulty is experienced, this indicates the need of either reduced oil supply or hotter plugs.

(See Other Side)

In some cases best results may be found using a colder plug in one cylinder than in the other. In this case it is usually the front cylinder that takes the colder plug as this cylinder is not as likely to foul plug at low speed. Here's the thing to bear in mind: The colder the plug that can be used without running into fouling difficulties and hard starting, the longer plug life will be, and the less chance there is of engine failure and damage from preignition and overheating.

4 - The core tip of a plug in hot service will in time, possibly only a short time, acquire a brownish, glassy coating. This oxide coating is a conductor when hot, and will cause missing at high speed or under heavy motor load. Plugs should be cleaned regularly to remove this coating.

5 - Do not take plugs apart to clean, nor try to save a few cents by installing new core only when a plug has to be renewed. Reassembling without proper equipment for adjusting and testing, runs into a high percentage of failures due to leakage and core cracking. These things very often contribute to serious motor trouble.

The recommended method of cleaning is with a sand-blast cleaner found in nearly every service station.

6 - Correct plug gap is .025 to .030 inch. Since gap increases slowly with use due to gradual burning away of electrodes, plugs should be checked and reset occasionally. When re-gapping, adjust only the base electrode, as bending center electrode will break porcelain core. For high speed service it is well to adjust gap to low limit (.025").

7 - This new series of plugs gives you an assortment with which you can meet the requirements of any normal engine in any sort of use. Carry a complete stock.

(Note - The two-piece cast aluminum plug shield furnished with 1935 and earlier radio-equipped motorcycles requires an adapter to fit it to the new plug. The number of this adapter set for two plugs is 8371-36, list price 50¢. The later stamped plug shield fits either large or small base plug.)

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

# SERVICE SHOP DOPE

No. 146 November 4, 1936

NEW TRANSMISSION MOUNTING

Applying to all 1937 - 61, 74 and 80 models, also a few of the latest 1936 61 models, the transmission is secured at five points instead of only four as in the past. Besides the four clamping studs with which you are familiar, there is a clamp bracket on frame underneath starter side of transmission, and a cap screw through this bracket secures the transmission at this point. When this change was first made, a bracket fitted to transmission end completed the clamping arrangement, however, in connection with later transmissions this bracket has been eliminated by a boss cast intergral with transmission case. Either way, the frame bracket remains the same.

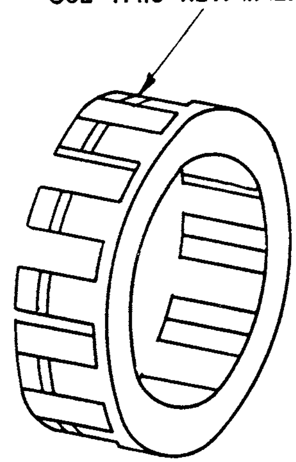
Bear this in mind and caution your riders of the models mentioned that when there is occasion to free transmission when re-adjusting front chain they have four nuts and a cap screw to loosen instead of just four nuts as mentioned in all instructions that have gone out up to this time. Also remind them to be sure to tighten cap screws as well as nuts after chain adjustment is completed.

You will recall that earlier 1936 - 61 models had only an adjustable supporting screw under the right side of transmission to take the kick starter load and as this screw head merely rested on frame tube, it did not require attention when loosening transmission for chain adjustment.

# SERVICE SHOP DOPE

No. 147 November 4, 1936

USE THIS RETAINER



This is a reminder that you should use only retainers identified with groove around the outside diameter in servicing lower connecting rod bearings, all models, as this is an improved and strengthened retainer developed especially for lower rod bearing. For some time, only this type of retainer has been used in new motor assembly and supplied on parts order and with rod assemblies sent back to the factory for reconditioning.

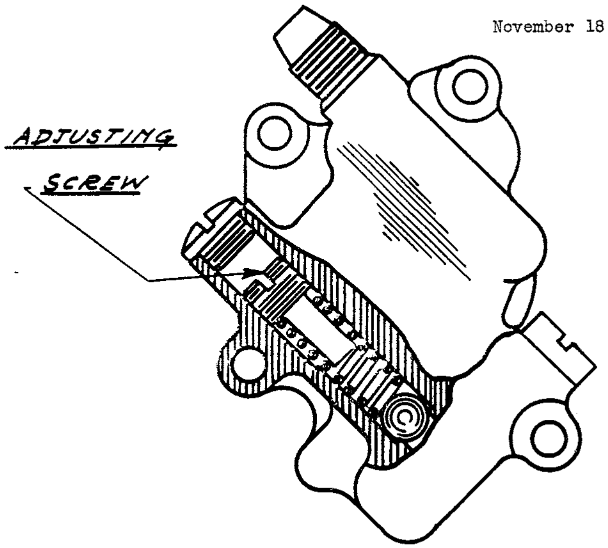
In overhauling older motors that may need refitting of lower connecting rod bearing to take up excessive clearance, unless inspection proves that the retainers are of latest type with identifying groove, it is advisable to replace them with new ones even though they may appear to be in good condition.

If you have any retainers of earlier type in stock set them aside to be used in servicing other than lower connecting rod bearings.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wisc., U.S.A.

# SERVICE SHOP DOPE

No. 149 November 18, 1936




MAKE THIS READJUSTMENT

Readjust oil pressure regulator of all -

1937 - 45 motors below 37 W 1289

1937 - 74 and 80 motors below 37 UL 2177

Turn regulator adjusting screw all the way down until it bottoms lightly against ball. Do not force it. Then, back up adjusting screw nine full turns.

Normal oil mileage for these models is 200 to 400 miles per quart, depending on nature of service, fast or moderate driving, etc. With the above recommended readjustment made, if it is then found after further service that oil mileage is not running within the normal range, readjust further.

Turning adjusting screw inward (to right) increases pressure and lowers oil mileage. Turning adjusting screw outward lowers pressure and raises oil mileage.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

NOTE - Be sure to insert screw driver in shallow slot in adjusting screw head. If inserted in deep slot, screw head will be expanded and wedged making it very hard to turn.

# SERVICE SHOP DOPE

SPECIAL November 30, 1936

## 74 CU. IN. TWIN MOTOR FITTING SPECIFICATIONS

NOTE: These supersede all previous specification (last specication sheet dated May 15, 1934) and apply to all 1930, and later 74" motors.

PISTON CLEARANCE -- ALUMINUM PISTON - 2 slot, cam ground type - New piston fitted in straight bore cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.

Measure 2-slot piston at bottom of skirt, front and rear

PISTON-CYLINDER HEAD CLEARANCE --(All models except VC Commerical) 1/16" to 3/32" (VC Commercial, discontinued after 1933) 7/64" to 9/64"

PISTON PIN IN ALUMINUM PISTON -- 2-slot type - light hand press fit.

PISTON PIN IN UPPER END OF CONNECTING ROD ......... .001" loose

PISTON RING GAP AND GROOVE CLEARANCE -- Straight bore cylinder .010" gap ½" from top of cylinder. Rings should be .0015" to .002" loose in piston grooves.

LOWER CONNECTING ROD BEARING . . . . . . . . . . . . . . . . .001" to .00125" loose

CONNECTING RODS -- .006" to .010" clearance between flywheels -- roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT -- .0045" loose at inner end of bushing -- .002" loose at outer end of bushing (Bushing is taper reamed with special reamer).

SPROCKET SHAFT -- .0005" to .001" loose in roller bearing -- .006" to .007" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY -- .004" to .008" end play in crank case

CAM GEARS -- .0005" to .001" loose in crank case and cover bushings -- free to .005" end play.

INTERMEDIATE GEAR -- .001" to .0015" loose on stud

TAPPET GUIDES -- .0005" to .001" press fit in crank case

VALVE TAPPETS -- .0005" to .001" loose in tappet guides.

# SERVICE SHOP DOPE

SPECIAL

January 8, 1937

## MOTOR FITTING SPECIFICATIONS

### 1925 to 1929 61 cu. in., and 74 cu. in. Motors

| | | | | |
|---|---|---|---|---|
| PISTON CLEARANCE: | Iron Alloy Pistons | 1925 to 1929 | 61 cu in. motor | - .002" to .00275" |
| | " " " | " " " | 74 cu. in. " | - .003" to .004" |
| | Aluminum & Dow Metal Pistons | " " " | 61 cu. in. " | - .0115" to .0135" |
| | " " " " " | " " " | 74 cu. in. " | - .0135" to .0155" |

(Measure all pistons just below the top group of rings and cylinders about 1/2" from top of bore, front and rear)

PISTON PIN IN IRON ALLOY PISTON --.0005" to .001" press fit in lock pin side -- plug or slip fit in opposite side.

PISTON PIN IN ALUMINUM & DOW METAL PISTONS -- Snug press fit - not over .0005" tight

PISTON PIN IN UPPER CONNECTING ROD END (all models) - .001" loose

PISTON RING GAP AND GROOVE CLEARANCE -- .025" to .035" measured 1/2" from bottom of bore. Rings should be .0015" to .002" loose in Dow Metal piston grooves, and just free in Iron piston grooves.

LOWER CONNECTING ROD BEARING - Motors fitted with Iron Alloy Pistons-.0002 to .0003" loose Motors fitted with Aluminum or Dow Metal Pistons - .0004" to .0006" loose

CONNECTING RODS (All models) -- .006" to .010" clearance between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT - Motors fitted with Iron Alloy Pistons - .0035" loose at inner end of bushing -- .002" loose at outer end of bushing.
Motors fitted with Aluminum or Dow Metal Pistons -- .004" loose at inner end of bushing .0025" loose at outer end of bushing (Bushing is taper reamed with special reamer.)

SPROCKET SHAFT (all models) - .0005" to .001" loose in roller bearing

FLYWHEEL ASSEMBLY (all models) -- .003" end play in crankcase

OILER GEAR, INTERMEDIATE GEAR & GENERATOR DRIVE GEAR (All models) -- .001" to .0015" loose on studs.

CRANK CASE BREATHER -- 1/16" to 3/32" open when front piston is on top dead center (opening must be on forward side of port in crank case)

# SERVICE SHOP DOPE

No. 150

January 8, 1937

## 74 AND 80 CU. IN. TWIN MOTOR FITTING SPECIFICATION (1930 TO AND INCLUDING 1936)

PISTON CLEARANCE - Iron Alloy Pistons - Used in 1930-34 motors fitted with taper bore cylinder - .004" to .005".
ALUMINUM & DOW METAL PISTONS - Solid skirt type - used in 1930-34 motors fitted with taper bore cylinders - .016" to .018".
ALUMINUM PISTON - Slotted, cam ground type - New piston fitted in straight bore cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.

Measure solid skirt piston at bottom of skirt, front and rear. If piston has vertical slot in addition to horizontal slots, fit with vertical slot forward.

Measure cylinder about ½" from top of bore, front and rear.

PISTON - CYLINDER HEAD CLEARANCE - (All modes except VC Commercial) 1/16" to 3/32" (VC Commercial, discontinued after 1933) 7/64" to 9/64"

PISTON PIN IN IRON ALLOY PISTONS -- .0005" to .001" press fit in lock pin side - plug or slip fit in opposite side.

PISTON PIN IN DOW METAL & ALUMINUM PISTONS - Solid Skirt type - .0005" to .001" press fit in piston.

PISTON PIN IN ALUMINUM PISTON - Slotted type - Light hand press fit.

PISTON PIN IN UPPER END OF CONNECTING ROD - .001" loose

PISTON RING GAP AND GROOVE CLEARANCE - Taper bore cylinder .006" gap ½" from top of cylinder. Straight bore cylinder .010" gap ½" from top of cylinder. Rings should be .003" loose in Dow Metal & Aluminum piston grooves and just free in Iron piston grooves.

LOWER CONNECTING ROD BEARING - .001" to .00125" loose.

CONNECTING RODS - .006" to .010" clearance between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT - .0045" loose at inner end of bushing - .002" loose at outer end of bushing (Bushing is taper reamed with special reamer.)

SPROCKET SHAFT -- .0005" to .001" loose in roller bearing - .006" to .007" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY - .006" to .010" end play in crank case

CAM GEARS - .0005" to .001" loose in crankcase and cover bushings - free to .005" end play.

INTERMEDIATE GEAR - .001" to .0015" loose on stud.

TAPPET GUIDES - .0005" to .001" press fit in crank case

VALVE TAPPETS - .0005" to .001" loose in tappet guides

# SERVICE SHOP DOPE

No. 150A January 8, 1937

74 AND 80 CU. IN. TWIN MOTOR FITTING SPECIFICATION (1937 MODELS)

PISTON CLEARANCE - ALUMINUM PISTON - Slotted, cam ground type - New piston fitted in straight bore cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.

Measure piston at bottom of skirt, front and rear. If piston has vertical slot in addition to horizontal slots, fit with vertical slot forward. Measure cylinder about 1/2" from top of bore, front and rear.

PISTON-CYLINDER HEAD CLEARANCE - 1/16" to 3/32"

PISTON PIN IN PISTON -- Light hand press fit

PISTON PIN IN UPPER END OF CONNECTING ROD - .001" loose.

PISTON RING GAP AND GROOVE CLEARANCE - Straight bore cylinder .010" gap ½" from top of cylinder. Rings should be .003" loose in grooves.

LOWER CONNECTING ROD BEARING --- .001" to .0015" loose

CONNECTING RODS - .006" to .010" clearance between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT - .0005" to .001" loose in roller bearing - .007" to .009" loose in oil retaining bushing, and .0005" to .001" loose in cover bushing. Oil hole in cover bushing is 30° ahead of top center, and in line (on opposite side) with drilled oil feed channel in cover.

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .007" to .009" loose in oil retaining bushing

FLYWHEEL ASSEMBLY - .012" to .014" end play in crank case

CAM GEARS -- .0005" to .001" loose in crank case and cover bushings - free to .005" end play.

INTERMEDIATE GEAR -- .001" to .0015" loose on stud

TAPPET GUIDES - .0005" to .001" press fit in crank case

VALVE TAPPETS -- .0005" to .001" loose in tappet guides

CRANK CASE BREATHER - Which is a part of, and drives scavenger pump, is timed according to instructions in Rider Instruction Folder.

# SERVICE SHOP DOPE

No. 150B January 8, 1937

61 CU. IN. TWIN MOTOR FITTING SPECIFICATION (O.H.V. MODELS)

PISTON CLEARANCE - ALUMINUM PISTON -- Slotted, cam ground type - new piston fitted in cylinder .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service. Measure piston at bottom of skirt, front and rear. Measure cylinder about 1/2" from top of bore, front and rear.

PISTON PIN IN PISTON -- Light hand press fit

PISTON PIN IN UPPER END OF CONNECTING ROD -- .001" loose

PISTON RING GAP AND GROOVE CLEARANCE -- .010" gap ½" from top of cylinder. Rings should be .003" loose in grooves.

LOWER CONNECTING ROD BEARING - .001" to .0015" loose

CONNECTING RODS -- .006" to .010" end play between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

SPROCKET SHAFT & PINION GEAR DRIVE SHAFT - .0005" to .001" loose in roller bearing .007" to .009" loose in oil retaining bushing.

PINION GEAR STUB SHAFT ASSEMBLY - Cork sealed, oil tight fit in flywheel shaft with copper washer behind - .001" to .0015" loose in cover bushing. Oil hole in caover bushing is centered with drilled oil feed channel in cover.

FLYWHEEL ASSEMBLY - .012" to .014" end play in crank case.

CAM GEAR - .001" to .0015" loose in crank case and cover bushing - free to .005" end play.

INTERMEDIATE GEARS - .001" to .0015" loose - free to .005" end play

TAPPET GUIDES -- .0005" to .001" press fit in crank case.

VALVE TAPPETS - .0005" to .001" loose in tappet guides.

ROCKER ARM FIT ON SHAFT - .0005" to .0015" loose - .003" to .006" end play

OIL PUMP DRIVE SHAFT - .001" loose in crank case bushing.

CRANK CASE BREATHER - Timed with front cylinder - opens 1/8" before top center to 1/8" after top center, and closes 13/16" to 15/16" after bottom center.

# SERVICE SHOP DOPE

No. 150C January 9, 1937

## 45 CU. IN. TWIN MOTOR FITTING SPECIFICATIONS - (1930 to and INCLUDING 1936)

NOTE: These supercede all previous specification and apply to all 1930 to, and including 1936 45" motors except RLDR model.

PISTON CLEARANCE - ALUMINUM AND DOW METAL PISTONS - Solid Skirt type - used in 1934 and earlier motors fitted with taper bore cylinders - .014" to .016"
ALUMINUM PISTON - Slotted, cam ground type - new piston fitted in straight bore cylinder. .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service. Measure solid skirt piston just below the top group of rings. Measure slotted piston at bottom of skirt, front and rear. If piston has verticial slot in addition or horizontal slots, fit with vertical slot forward. Measure cylinder about ½" from top of bore, front and rear.

PISTON-CYLINDER HEAD CLEARANCE -- 3/64" to 5/64"

PISTON PIN IN ALUMINUM AND DOW METAL PISTONS - Solid skirt type - .0005" to .001" press fit in piston.

PISTON PIN IN ALUMINUM PISTON - Slotted type - light hand press fit.

PISTON PIN IN UPPER END OF CONNECTING ROD - .001" loose

PISTON RING GAP AND GROOVE CLEARANCE - Taper bore cylinder - .006" gap ½" from top of cylinder. Straight bore cylinder - .010" gap ½" from top of cylinder. Rings should be .003" loose in grooves.

LOWER CONNECTING ROD BEARING - .0007" to .001" loose

CONNECTING RODS - .006" to .010" end play between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT - .0045" loose at inner end of bushing - .002" at outer end of bushing. (Bushing is taper reamed with special reamer)

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .006" to .007" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY - .004" to .006" end play in crank case.

CAM GEARS - .0005" to .001" loose in crank case and cover bushing - free to .005" end play

GENERATOR DRIVE GEARS AND SHAFT (1931 and earlier models) - Shaft must be free running fit; have .002" to .004" end play, and .001" to .0015" clearance in bearings. Small bevel gear should be .002" to .003" loose in bushing assembly, and shimmed to allow .002" to .004" clearance between bevel gears.

TAPPET GUIDES - .0005" to .001" press fit in crank case

VALVE TAPPETS - .0005" to .001" loose in tappet guides

# SERVICE SHOP DOPE

No. 150D January 8, 1937

## 45 CU. IN. TWIN MOTOR FITTING SPECIFICATION (1937 MODELS) EXCEPT WLDR MODEL

PISTON CLEARANCE - ALUMINUM PISTON -- Slotted, cam ground type - new piston fitted in straight bore cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.

Measure piston at bottom of skirt, front and rear. If piston has vertical slot in addition to horizontal slots, fit with vertical slot forward. Measure cylinder about ½" from top of bore, front and rear.

PISTON-CYLINDER HEAD CLEARANCE -- 1/16" to 3/32"

PISTON PIN IN PISTON -- Light hand press fit

PISTON PIN IN UPPER END OF CONNECTING ROD -- .001" loose

PISTON RING GAP AND GROOVE CLEARANCE -- Straight bore cylinder - .010" gap ½" from top of cylinder. Rings should be .003" loose in grooves.

LOWER CONNECTING ROD BEARING -- .0007" to .001" loose

CONNECTING RODS -- .006" to .010" end play between flywheels -- roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT -- .00075" to .00125" loose in roller bearing - .006" to .007" loose in oil retaining bushing, and .0005" to .001" loose in cover bushing. Oil hole in cover bushing is 30° ahead of top center and in line (on opposite side) with drilled oil feed channel in cover.

SPROCKET SHAFT -- .0005" to .001" loose in roller bearing - .006" to .007" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY -- .012" to .014" end play in crank case

CAM GEARS -- .0005" to .001" loose in crank case and cover bushings -- free to .005" end play.

TAPPET GUIDES - .0005" to .001" press fit in crank case.

VALVE TAPPETS -- .0005" to .001" loose in tappet guides

CRANK CASE BREATHER - Which is a part of, and drives scavenger pump, is timed according to instructions in Riders Instruction Folder.

SERVICE SHOP DOPE

150E January 8, 1937

SINGLE MOTOR FITTING SPECIFICATION - (ALL 1934 AND EARLIER)

PISTON CLEARANCE -- Dow Metal and aluminum -- .011" to .013" (Measure piston just below the top group of rings, and cylinder about 1/2" from top of bore, front and rear.)

PISTON-CYLINDER HEAD CLEARANCE (Side by side valve models) -- 3/64" to 5/64".

PISTON PIN IN PISTON -- Snug press fit -- not over .0005" tight.

PISTON PIN IN UPPPER END OF CONNECTING ROD -- .0005" loose

PISTON RING GAP AND GROOVE CLEARANCE -- .006" gap 1/2" from top of cylinder. Rings should be .0015" to .002" loose in grooves.

LOWER CONNECTING ROD BEARING -- .0003" to .0004" loose

CONNECTING RODS -- .010" to .020" end play between flywheels -- roller and retainer assembly should be narrower, but not more than .010" narrower than rod.

PINION GEAR SHAFT -- .0035" loose at inner end of bushing -- .0025" loose at out end of bushing. (Bushing is taper reamed with special reamer.)

SPROCKET SHAFT -- .0005" to .001" loose in roller bearing - .006" to .007" loose in chain lubricating bushing.

FLYWHEEL ASSEMBLY -- .002" to .006" end play in crank case

CAM GEARS -- .0005" to .001" loose in crank case and cover bushings -- free to .005" end play.

INTERMEDIATE AND OILER GEARS -- .0015" to .002" loose on studs

TAPPET GUIDES -- .0005" to .001" press fit in crank case

VALVE TAPPETS -- Free to .00075" loose in tappet guides.

SERVICE SHOP DOPE

No. 150F January 8, 1937

TIMING SPECIFICATIONS

1930 AND LATER 74 & 80 CU. IN TWIN ALL MODELS EXCEPT 1930 and 1931 V AND VC MODELS

INTAKE VALVE - OPENS when piston is - 9/32" to 13/32" before top dead center
CLOSES when piston is - 7/8" to 1-1/8" after bottom dead center.

EXHAUST VALVE - OPENS when piston is 5/8" to 7/8" before bottom dead center
CLOSES when piston is 1/4" to 3/8" after top dead center

IGNITION -- OCCURS when piston is 5/16" to 3/8" before top dead center on compression stroke. 3/8" timing (flywheel mark at rear of crankcase inspection hole) applies to moderate compression motors in solo service. High compression solo motor (8.2 heads) also all motors in sidecar service should be timed 5/16".

1930 AND 1931 74 CU. IN. TWIN V AND VC MODELS

INTAKE VALVE - OPENS when piston is 11/64" to 19/64" before top dead center
CLOSES when piston is 9/16" to 13/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 9/16" to 13/16" before bottom dead center
CLOSES when piston is 11/64" to 19/64" after top dead center

IGNITION - OCCURS when piston is 1/4" to 5/16" before top dead center on compression stroke

1936 AND LATER O.H.V. TWIN MODELS

INTAKE VALVE - OPENS when piston is 15/32" to 17/32" before top dead center
CLOSES when piston is 15/16" to 1-1/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 49/64" to 55/64" before bottom dead center
CLOSES when piston is 15/32" to 17/32" after top dead center
NOTE: Timing is check with tappets adjusted with .004" clearance.

IGNITION - OCCURS when piston is 7/16" before top dead center on compression stroke.

45 CU. IN TWIN (ALL MODELS)

INTAKE VALVE - OPENS when piston is 5/32" to 7/32" before top dead center
CLOSES when piston is 37/64" to 45/64" after bottom dead center

EXHAUST VALVE - OPENS when piston is 37/64" to 45/64" before bottom dead center
CLOSES when piston is 5/32" to 7/32" after top dead center

IGNITION - OCCURS when piston is 1/4" to 9/32" before top dead center on compression stroke

## 30.50 CU. IN SINGLE (ALL MODELS)

INTAKE VALVE - OPENS when piston is 5/16" to 9/16" before top dead center
CLOSES when piston is 11/16" to 15/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 1/2" to 3/4" before bottom dead center
CLOSES when piston is 1/4" to 1/2" after top dead center

IGNITION - OCCURS when piston is 1/4" to 5/16" before top dead center on compression stroke.

## 21 CU. IN. SIDE-BY-SIDE VALVE SINGLE

INTAKE VALVE - OPENS when piston is 1/8" to 3/16 before top dead center
CLOSES when piston is 7/16" to 9/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 7/16" to 9/16" before bottom dead center
CLOSES when piston is 1/8" to 3/16" after top dead center

IGNITION -- OCCURS when piston is 7/32" to 9/32" before top dead center on compression stroke.

## 21 CU. IN. OVERHEAD VALVE SINGLE

INTAKE VALVE - OPENS when piston is 3/32" to 5/32" before top dead center
CLOSES when piston is 3/32" to 5/32" after top dead center

EXHAUST VALVE - OPENS when piston is 7/16" to 9/16" before bottom dead center
CLOSES when piston is 3/32" to 5/32" after top dead center

IGNITION -- OCCURS when piston is 11/32" to 13/32" before top dead center on compression stroke.

## TAPPET CLEARANCES

NOTE: When checking valve timing according to piston postion, bear in mind that tappets must first be adjusted to the correct clearances.

ALL SIDE BY SIDE VALVE MODELS (SINGLES AND TWINS) -- INTAKE --.004" to .005"
EXHAUST -- .002" to .003"

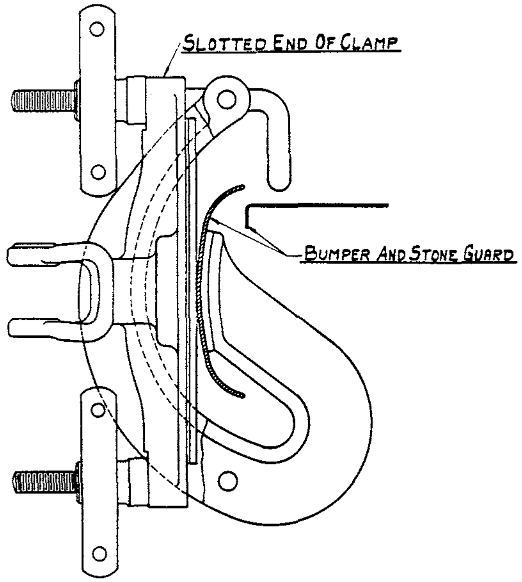
OVERHEAD VALVE SINGLE -- INTAKE AND EXHAUST -- .002" to .003"

OVERHEAD VALVE TWIN -- INTAKE AND EXHAUST _ Correctly adjusted when tappet has just noticeable play or shake, and can be turned freely with finger tips, complete around, without any trace of bind.

CIRCUIT BREAKER OPENING - ALL MODELS
Generator - .020" to .024"
Magneto -- .014" to .018"

# SERVICE SHOP DOPE

No. 151 January 7, 1937




NEW SERVI-CAR BUMPER CLAMP

**Only new outer clamp is needed. Clamp base attached to towbar is not changed. Part Number below covers only new outer clamp.**

**The new clamp is designed particularly for 1937 Oldsmobile bumper. It also fits many other cars, however, the standard outer clamp as furnished in the past will be continued as regular equipment with new Servi-Cars as it fits every type of bumper, except Oldsmobile.**

**Illustration shows clamp attached to 1937 Oldsmobile bumper which has complete stone shield enclosure at top of bumper. Some cars with stone shield at lower side of bumper require attaching clamp upside down.**

To attach clamp, hinge "hooked" eye bolt forward out of the way, rock top of clamp backward, insert shoe behind bumper, and then rock top of clamp forward and insert eye bolt in clamp base. Tighten wing nuts securely.

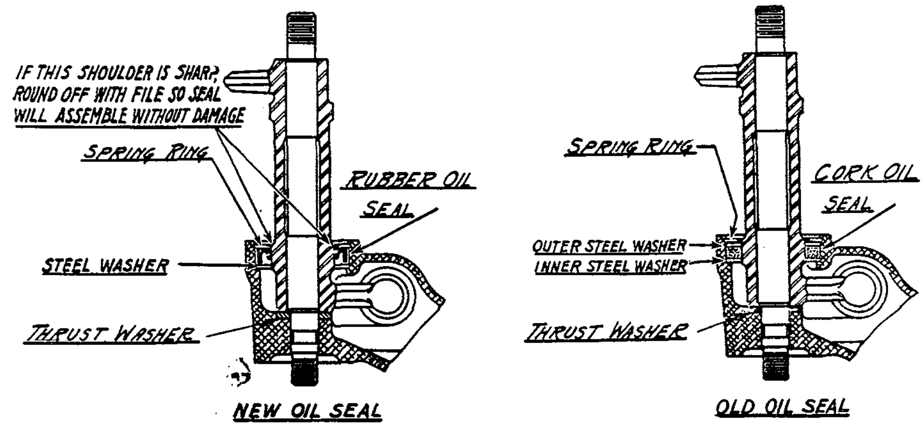
Part number and price of new outer clamp, extra with new Servi-Car, or ordered separately -

Part No. 7034-37 List Price [redacted] $5.00

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

# SERVICE SHOP DOPE

No. 153 January 26, 1937




O.H.V. MODEL

A NEW VALVE ROCKER HOUSING OIL SEAL OF RUBBER

The original cork oil seal has been replaced in new motor assembly and for service with a seal of synthetic rubber, which is a much more effective seal. Motor No. 37 E 1672 and all later motors have the new seal. A few earlier motors were also changed over before shipping. See footnote.

Discard any cork seals you may have in stock and use only the new seal for service. The part number of the new seal is 120-36, price 15 cents list each. (4 required)

Rocker assemblies must be removed from cylinder heads to install new seals. Before removing, take off large hex nuts at right end of shafts and make sure that shaft setting for valve stem oiling is clearly marked as each shaft is found to be set at the time. See "Shop Dope" No. 140A. After this has been done, disconnect oil pipes from aluminum housings, take out cap screws (three) that secure each housing to cylinder head, turn off left side shaft nuts, and remove as assemblies, housings with rocker arms, and shafts. Be very careful about driving shafts out of and into cylinder head brackets, when removing and replacing rocker assemblies, as it does not take a very heavy blow with a hammer to break a head bracket. Shafts will drift out and in easily, if both shafts of an assembly are drifted evenly so assembly does not become cocked.

(Over)

After assemblies are off, remove rocker shafts, cork seals, and rocker arms from aluminum housings. It is necessary to remove rocker arms from aluminum housings, as new seals must be installed over push rod end of arms. While assemblies are apart it will be well to clean out with an air hose all oil passages in shafts, rocker arms, and aluminum housings. Also blow out spring cover pipes.

Illustration shows cork seal assembly, and how new seal is assembled. If rocker arm shoulders at seal end of arm are found quite sharp, smooth and round them off with a file so new seal can be installed easily and without being damaged.

When re-assembling rockers and shafts in aluminum housings, see that housing steel thrust washers are in place. With this washer overlooked and left out, rocker arm will have excessive end play and if shaft nuts are pulled up very tight, aluminum housing or cylinder head bracket, or both, are likely to be broken. Push seals into place in rocker housing with a blunt punch. Do not use a sharp tool as seals may be damaged. Note that when replacing cork seal with the new seal, outer steel washer is to be discarded. Only the spring lock ring is used at outer side of new seal.

When re-installing rocker and housing assemblies on cylinder heads, drift shafts into head brackets very slowly and carefully. Tighten cap screws and nuts evenly to avoid cocking and strain that may cause binding and possibly breakage. First, pull up right and left side shaft nuts lightly - just tight enough to seat shaft shoulders against aluminum housings and head brackets, then, securely tighten aluminum housing cap screws. Finally, after noting that shaft marks indicating valve oiling adjustment are in correct alignment, securely tighten left and right side shaft nuts. With shaft nuts tightened, check rockers to see that they have sufficient end play for free action, but not more than .008 inch.

After assembly is completed, tappets adjusted, etc., turn motor over slowly with switch OFF to be sure everything is free and with required clearance. This is suggested because in odd cases, aluminum housing or head bracket breakage has been traced to bad tappet adjustment (too tight), possibly due to changing push rods from one position to another, with readjustment of tappets overlooked. In this case, a valve spring may bottom or a rocker strike top of aluminum housing before tappet has its full lift, and when this happens, something is going to be broken.

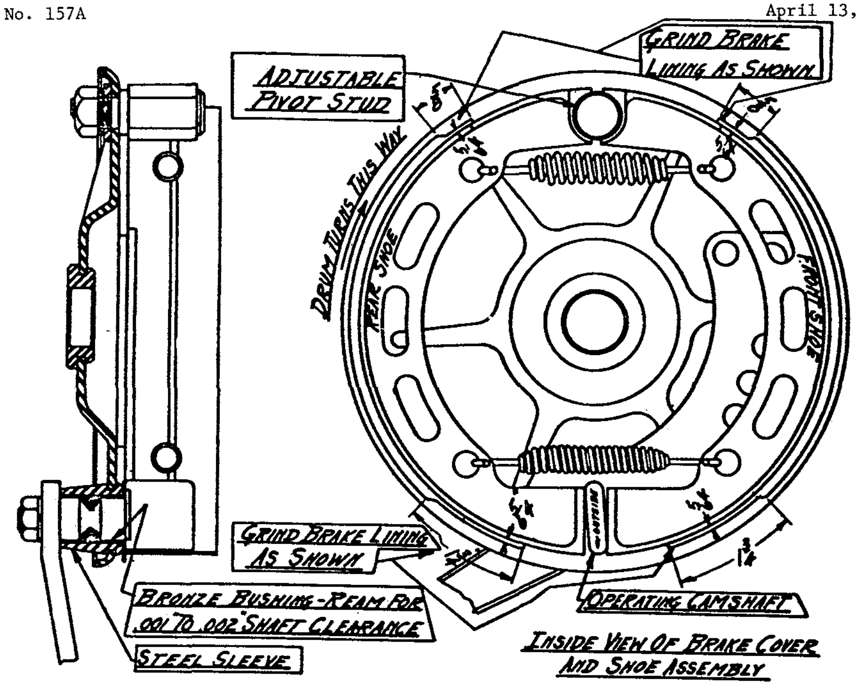
HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

Motors below 37E 1672 fitted with latest oil seals:

| | | | |
|---|---|---|---|
| 1670 | 1641 | 1590 | 1580 |
| 1648 | 1635 | 1587 | 1578 |
| 1647 | 1634 | 1586 | 1576 |
| 1646 | 1632 | 1585 | 1575 |
| 1645 | 1629 | 1584 | 1574 |
| 1644 | 1623 | 1583 | 1573 |
| 1642 | 1622 | 1581 | 1571 |

# SERVICE SHOP DOPE

No. 157A April 13, 1937




**HOW TO SERVICE A REAR WHEEL BRAKE THAT CHATTERS AND GRABS**
**(61, 74, and 80" MODELS)**

To what extent rear brake becomes self-energizing and its action severe, depends to a great extent on the amount of clearance or play in brake operating shaft bearing. Too much play allowed in fitting, or excessive play developing with wear, may make brake self-energizing to the extent of chattering and grabbing at times, particularly when brake is applied hard for emergency stop. The shock that goes with severe chattering and grabbing sometimes breaks off brake cover torque stud or lug which allows cover to turn, and breakage of operating shaft follows putting brake completely out of commission.

Brake operating shaft bearing sleeve in rear brake cover has not had a removable bushing since 1930. The steel sleeve itself has been sized to fit operating shaft. There has been no provision for installing a bushing in the event of excessive clearance developing and causing chatter.

Now. starting with motorcycles shipped from the factory January 11, and applying to all later machines, a bronze bushing is used, and it is finish reamed for a closed fit than has applied in the past.



Rear brakes from 1931 to and including early 1937 brakes that become severe and develop chattering can be serviced with the new bushing. Two reamers are needed to install bushi an end reamer to enlarge hole in steel sleeve, and a reamer for sizing bushing after it i pressed in. The finish reamer is stepped for three sizes - .001" steps. (Use end reamer in lathe or drill and drive at low speed, about 100 to 150 r.p.m. Apply a little oil as a cutting lubricant. Finish ream bronze bushing by hand.)

Part numbers and prices of reamers and bushing are as follows:

| | | |
|---|---|---|
| No. 12666-31 | Set of Reamers (2) | $4.00 net, per set |
| No. 4037-37 | Bronze Bushing | .30 list, each |

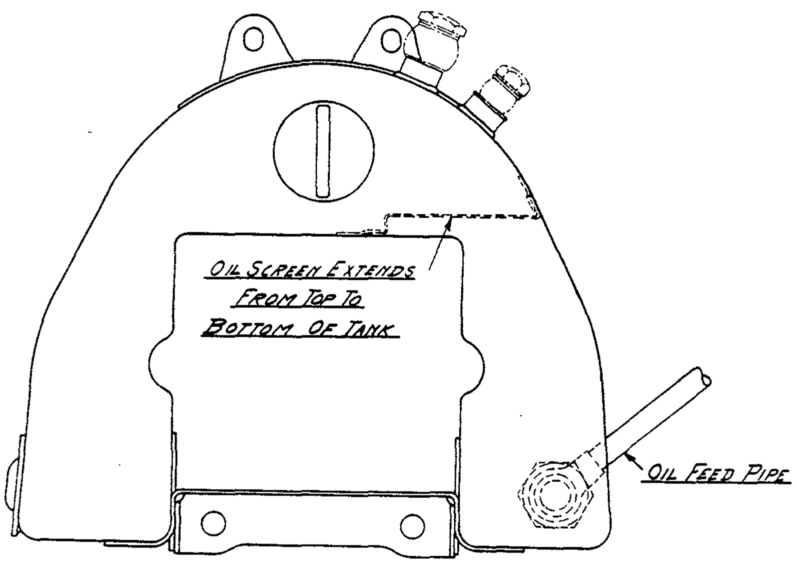
## BRAKE RELINING AND ADJUSTING

When servicing rear brake with new liners, grind off the ends of liners as shown in illustration. This lessens self-energizing action and contributes considerably to smooth braking. After brake with new liners is completely re-assembled, loosen pivot stud nut, apply heavy pedal pressure, and while brake is applied tighten stud nut. This adjusts shoes so that new liners have maximum contact with drum.

# SERVICE SHOP DOPE

No. 159

February 11, 1937




TOP VIEW OF TANK

## OIL TANK SCREEN

Until recently, the oil tank of the 61, 74, and 80 inch models has had a screen to catch any foreign matter that may get into tank through carelessness when adding oil. Illustration shows location of screen. Motorcycles shipped from the factory on and after January 20 have the screen cut and opened up. The screen will be left out of tanks of later production.

Reason for this change:- Cases have come to our attention where in freezing weather oil supply has been permitted to congeal to the extent of not passing freely through screen and as a result, oil returning from motor base to tank accumulates in the compartment ahead of screen, and the compartment behind screen which supplies oil feed pump runs short of oil.

- over -

Recommendation:- If you are in a locality that has below freezing winter temperature, cut and open up screen so there will be no doubt about oil supply getting to feed pump line nipple. Use a long heavy screwdriver, a carpenter's pinch bar, or some similar tool sharpened at the end to cut screen. Insert tool through filler opening, punch through screen as near the top as possible, cut down through screen to the bottom, and push it aside to make the largest possible opening. It is advisable to cut screen only once from top to bottom as attempting to cut it several times may leave some loose pieces in tank.

Opening up screen and leaving it out of later tanks simply means that more precautions will have to be taken to avoid getting foreign matter into tank when adding oil.

## WINTER ATTENTION FOR OIL SUPPLY

All 1937 Models

In below freezing winter weather possible congealing of oil to a point where it will not flow through lines is one thing to be watched. Another winter condition that has to be given some attention is water getting into oil supply due to normal crankcase condensation. With a motor frequently driven far enough to heat up crankcase to normal operating temperature, water from condensation is evaporated and discharged through breather. However, a motor driven only on short runs and not often thoroughly warmed up about motor base may possibly accumulate enough water so there is a chance of ice forming and shutting off oil supply to feed pump.

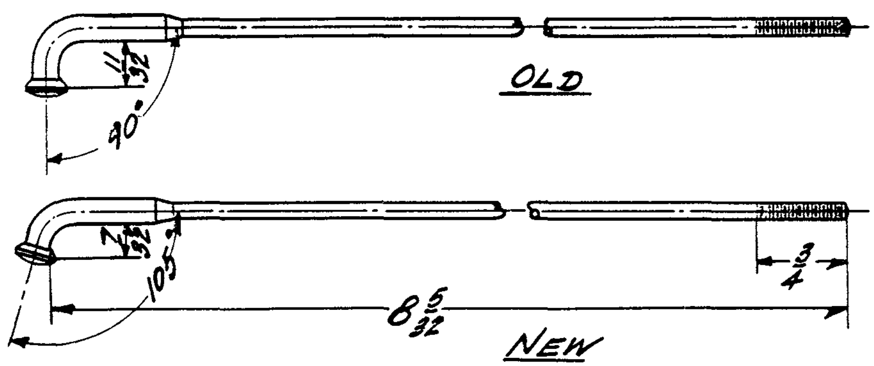
Use "Medium Heavy" Oil for winter service with temperature below freezing, and in localities where temperature goes down to 15 to 20 degrees above zero or colder, add enough kerosene to prevent congealing. The needed amount of kerosene depends upon how low the temperature goes. Don't add more than necessary to keep oil in a fluid state. A maximum of 20% kerosene (about 1-3/4 pints to a tankful of oil) should be sufficient for extreme cold operating conditions. Adding kerosene will not only keep oil fluid, but will also hinder freezing of any water in the oil supply.

Where winter weather is quite consistently below freezing, it is advisable to completely drain oil tank and put in a fresh oil supply at shorter intervals than recommended for summer service.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wisconsin
U.S.A.

# SERVICE SHOP DOPE

No. 162 March 10, 1937




Use The New Spoke

A new spoke with shorter head end has been developed to overcome stretching and breakage in heavy service. New wheels are now laced with this spoke, and it is supplied on parts orders. It applies to all 1937 wheels except 45 and Servi-Car front wheels.

Use only this new spoke for your service requirements. Order a supply under part #3943-36.

If you have a supply of old style spokes of this type, you can return them for exchange.

HARLEY-DAVIDSON MOTOR COMPANY
Milwaukee, Wisconsin
U.S.A.

# SERVICE SHOP DOPE

No. 163 March 22, 1937

## YES! CHROMIUM DOES NEED ATTENTION

There seems to be a mistaken notion that chromium plate is a finish that is impervious to weather conditions and that it never requires any care or attention. This is not correct and in this connection it might be interesting to note what British opinion is on this subject. Incidentally, they should be able to speak with authority since many English machines have chrome plated tanks, mudguard and numberous smaller fittings.

We quote from "The Motor Cycle", leading British Trade Journal, issue of February 18, 1937:

> "Recent grouses about the somewhat rapid deterioration of chromium plating when neglected by its owners make it evident that the motor cycling community labours under delusions with regard to chromium. It is not proof against neglect and will, in fact, quite speedily present a truly appaling appearance if grossly neglected. Its chief merit is that it can be kept in good condition with far less labour than nickel. If a nickelled article is left in damp air for a few days, it will promptly being in turn orange and pit, hweras after such brief mal-treatment a chromiumed article will merely lose its sheen. Once the nickel has oranged and pitted, it may be impossible to restore it fully; but dulled chromium can usually be brought up by merely wiping and rubbing.
>
> "Next, if the two surfaces be compared after longer neglect, any three months in damp air, there is precious little to choose between them. The chromium is likely to be quite as ruined as the nickel, and nothing much can be done about it. Users should note that ordinary metal polishes should never be applied to chromium, as they normally contain abrasive matter, which is fatal to chromium; if chromium has been seriously neglected, a special polish shold for the purpose should be applied.
>
> "So reads who occasionally leave a machine untended for weeks in damp air should eschew chromium tanks, and prefer enamel. The latest complain to reach me concerns a machine which is only nine months old, and has done 5,500 miles, so that it obviously has not been sotred for very long: yet its chromium tank is past praying for.
>
> "During storage for a lengthy period, any plated tank or other part should, of course, be heavily smeared with pure vaseline or painted over with cellulose varnish."

# SERVICE SHOP DOPE

No. 164 March 23, 1937

## 1937 - 45 CRANK PIN IS DIFFERENT FROM 1936 - 45 CRANK PIN

The crank pin used in 1937 - 45 motors has the oil hole drilled in a different position than the oil hole drilled in the crank pin applying to the 45 models for 1929 through 1936. Aside from this difference both crank pins look exactly alike, but because motor lubrication hinges on getting the right crank pin fitted to each type of motor, you should learn to identify these two different crank pins on sight.

CRANK PIN NO. 348-29 applies to all 45's from 1929 through 1936. This crank pin has the oil hole drilled at an angle of 90 degrees or 1/4 turn around from the key way. The intake end of this oil hole or channel starts at a distance of 11/32" from the outer edge of the ground taper on crank pin. From this point the agnle of the drilling brings the hole out exactly in the center of the roller bearing surface of crank pin.

CRANK PIN NO. 348-37 applies to 1937 - 45's. This crank pin has the oil hole drilled at an agle of 52 degrees or about 1/6 turn around from key way. The intake end of this oil hole or channel starts at a distance of 5/32" from outer edge of ground taper on crank pin and drilling is on an angle that brings other end of channel out at the center of the roller bearing surface of crank pin.

This difference in crank pins also prevents assembled sets of connecting rods with rollers and crank pin from being interchangeable. The individual front and rear connecting rods are interchangeable from 1932 through 1937. The 1931 and earlier front and rear rods as well as the assembled sets for these models are of course not interchangeable with 1932 and later model parts. We are allotting a new part number to the assembly applying to 1937 - 45's and we are listing this number as well as the numbers of the other assemblies below:

Part No. 289-37 set connecting rods complete with rollers and crank pin - 1937 45"

Part No. 289-32 set connecting rods complete with rollers and crank pin - 1932 to 1936 45" twins.

Part No. 289-29 set connecting rods complete with rollers and crank pin 1929 to 1931 45" twins.

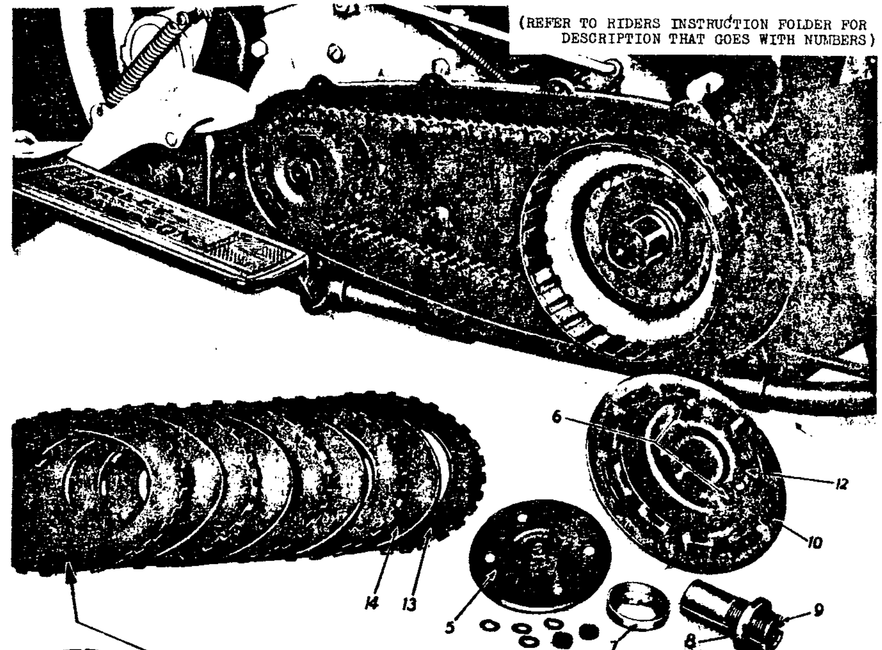
We suggest that you turn to page 13 of your 1937 spare parts catalog and mark the assembly numbers as given above so there will be no misunderstanding in placing orders for these items or in assembling the wrong parts when rebuilding motors. Furthermore, if you did not previously change the crank pin numbers in your parts book, we suggest that you turn to page 15 and do so at once.

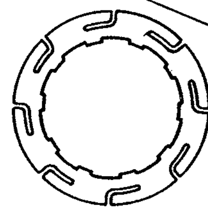
REMEMBER - THE TWO CRANK PINS REFERRED TO ABOVE ARE DISTINCTLY DIFFERENT AS FAR AS OIL HOLE LOCATIONS ARE CONCERNED AND TO GET THE WRONG PIN IN THE WRONG MOTOR MEANS SHUTTING OFF THE OIL SUPPLY WITH CONSEQUENT SERIOUS DAMAGE. THEREFORE, CAUTION THOSE WHO HANDLE THESE ITEMS NOT TO GET THEM MIXED UP AND NOT TO GET ASSEMBLED SETS OF CONNECTING RODS MIXED UP WHERE THIS CRANK PIN DIFFERENCE IS INVOLVED.

# SERVICE SHOP DOPE

No. 166 May 6, 1937

(REFER TO RIDERS INSTRUCTION FOLDER FOR DESCRIPTION THAT GOES WITH NUMBERS)



INSTALLING NEW "SPRUNG" DISC IN EARLY CLUTCH

TAKE OUT AND DISCARD THIS FIBRE DISC (OUTER FIBRE DISC)

PUT THIS NEW "SPRUNG" STEEL DISC IN ITS PLACE (BETWEEN STEEL DISCS)

PART NO.2487-36A
PRICE .75 LIST

## A NEW CLUTCH CUSHION (SPRUNG) DISC FOR SMOOTHER ACTION

New Big Twin motorcycles shipped from the factory after May 1st are fitted with this new disc.

Use it (only one to a clutch) for servicing earlier clutches that grab and chatter - 1936 - 61 model, 1937 - 61, 74 and 80 models.

Remove and discard original "sprung" (humped) steel disc used in early clutch which is usually the one indicated by arrow 14, although it is not always in this location. Replace it with a regular flat steel disc, part No. 2487-36.

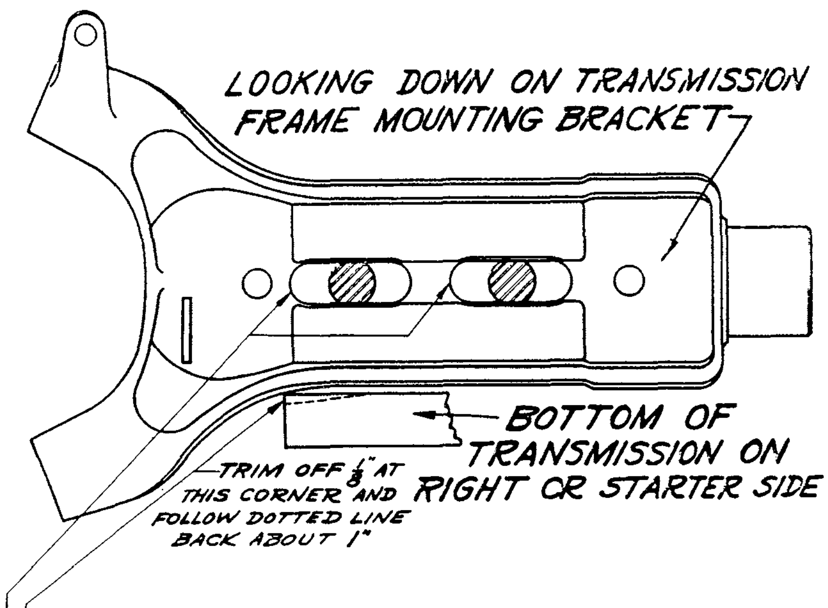
**HARLEY-DAVIDSON MOTOR CO.,** **Milwaukee, Wis., U.S.A.**

# SERVICE SHOP DOPE

Special

November 10, 1937

## SERVICING FIRST 1938 - 45" TRANSMISSION CASE WITH INSUFFICIENT FRAME CLEARANCE




For full range of front chain adjustment, this corner must be cut away to conform with curve of frame and have sufficient clearance so that transmission backward movement is not limited by interference at this point. Movement should be limited by transmission bottom studs striking ends of slots. Interfering corner can be cut away without removing transmission, (after removing battery and laying machine over on left side) with a small straight side chisel.

After corner has been cut away as shown in above cut, front chain should be disconnected and transmission moved all the way back (checking clearance as transmission is being moved) to make sure there is no interference.

CAUTION: If a transmission has this corner interference, attempting to move it further than the point of interference by simply applying force to adjusting screw will result in a broken gear box.


HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.


# SERVICE SHOP DOPE

No. 172

January 20, 1938

## FITTING 1938 TYPE VALVE SPRING COVERS TO 1936 and 1937 61" OHV CYLINDER HEADS

1. Remove tanks and cylinder heads

2. Strip fittings from cylinder heads and strip rocker housings. Put some identifying mark on valve guides as they should be pressed back in their respective holes if some guides are used again.

3. Discard original 3/32" thick steel spacing-thrust washers that will be found between right ends of rocker arm shafts and inside faces of aluminum housings. The 1/16" thick washers included with new parts are to be substituted for 3/32" washers discarded. Also discard original rocker arm oil seal washers and spring lock rings, but save four plain steel oil seal retaining washers (eight were used with earlier cork seals and four with earlier rubber seals) to use in the change-over.

4. Sort out new covers, screw plate and cover plates. Covers come in three lengths - longest one for front exhaust; shortest one for rear inlet; other two covers are of same length and are identified by length of oil return pipes - cover with longest pipe is for rear exhaust. The front and rear exhaust spring cover screw plates which partially encircle covers must be assembled on covers before covers are fitted to cylinder heads.

5. No comes the job of grinding additional cylinder head clearance for new covers and return pipes. There is no way of describing just where this grinding is necessary or how much material must be ground off as heads vary somewhat. All we can tell you is that additional clearance must be provided so that new covers seat squarely and firmly against cylinder head and flanges do not interfere with oil return pipes. Additional clearance for front exhaust will require the most grinding and rear exhaust comes next. Inlets require little if any grinding.

The ends of rocker arm shaft cylinder head brackets must be ground off slightly to allow clearance so covers can seat firmly against heads. This clearing away metal for new covers can be done altogether with a small portable or flexible shaft grinder with about a 1" wheel. If a burning torch is at hand, it can be used to take out larger sections.

If you are not equipped to do this job, and on't want to trust having it done in another shop, you can send head to the factory for necessary clearance grinding.

If you have several heads to change over, you may want to send the first set to the factory so you can see just how the grinding job is done and do the rest yourself. In this case it is advisable to send stripped heads and have them returned to you without any assembly. Once covers are assembled, guides pressed in, etc., you cannot see very well where additional grinding was done, and it wouldn't be practical to disassemble just for inspection.

6. After thoroughly cleaning heads, fit new covers. An asbestos oil seal gasket must be placed between each cover and cylinder head. Then press in valve guides as close as possible to a tight seat and still be able to shift cover slightly.

Fit rocker arm shafts only to bar aluminum housing and fit housings and shafts temporarily to cylinder heads to line up spring covers. Rocker shaft holes in covers will of course have to register exactly with hole in cylinder head rocker shaft brackets before shaft ends will pass through. Open ends of covers must be lined up as well as possible with holes in aluminum housings. They will not in every case center in holes but must not bear against aluminum housings. Occasionally it may be necessary to spring covers slightly to make them line up. After they have been lined up, finish pressing in valve guides to secure covers. If covers are not firmly secured, oil leakage will result. After covers are adjusted and guides tight, remove aluminum housings and rocker arm shafts.

It is of primed importance that valve guides fit tightly in clyinder heads. If they don't valves may not seat properly, spring covers will be loose and oil leakage between covers and cylinder heads will result. If original guide or new guide is not a tight press fit, an oversize guide must be fitted. Oversize guides can be obtained .001" and .002" oversize.

7. When guides are removed for any reason and replaced, or new guides fitted, valve seats must be trued up because it is impossible to get guides back so seats will be concentric with them. If a valve guide is not true with seat, valve, valve breakage may result due to cocked seating and deflection of valve stem. To do this job requires a grinder because the material from which the seat inserts are made is so hard a regular seat cutter will not work. Special attention must be given to the pilot to make sure it fits snugly in guide (before expanding if of that type), otherwise it will be impossible to true seat. The standard automobile pilot of corresponding size is usually too small to fit guides snugly due to the lesser clearance required for automobile motors.

Reface valves and if the ends of stems are goove and uneven, smooth and square them up on a grinder. Don't put valves back in with heads and stems so badly worn as to likely soon need renewal, requiring another head job at low mileage.

Before assembling valve springs, check their length to be sure none have been overheated and shrunk losing considerable of their normal tension. Badly weakened valve springs not only knock off top motor performance, but also allow valves to bounce in seating which accounts for abnormal wear of valves and seats and possible valve head breakage.

Standard length of new outer spring is approximately 1-15/16" - inner spring 1-9/16". When either spring becomes set more than 1/8" below standard length, it is advisable to fit new spring. (Note - a few new motors have been fitted with special springs identified with red paint applied to end coils. These springs measured when new - outer 1-13/16" - inner- 1-15/32". Allow the same shrinage allowed standard springs before replacing. Replacements can be made with new standard springs.)

8. Remove oil return pipe nipples from aluminum housings and elarge the holes in nipples with a 1/8" drill. Replace them and tighten securely.

9. Fit tubular cover spacer in rear (exhaust) aluminum rocker arm housing after painting outside where it enters hole with aluminum paint to prevent oil leakage. Make sure spacer bottoms in housing.

10. Before assembling rocker arms into aluminum housings, inspect rocker pads and ball studs. Worn rocker pads, if not too badly worn, can be dressed up on a grinding, maintaining original pad curve. Worn and flattened ball studs will have to be replaced, otherwise satisfactory tappet and push rod adjustment cannot be made and upper end push rod trouble is likely to be experienced. (All 1936 and some 1937 rockers do not have drilled oil passage through arm directly to ball stud, as applies with later 1937 and 1938 rockers. This later oiling arrangement effects more dependable lubrication of ball stud and push rod upper end. Some owners of earlier motors may want the later rockers installed.)

All washers must be assembled on rocker arms before arms can be fitted in aluminum housings. Sometimes it is necessary to grind off the rear edge of read exhaust rocker arm before it can be entered in housing. An oil seal steel retaining washer is furnished for small oil seal. For the large oil seals use the four steel retaining washers mentioned in No. 3.

The smallest oil seal is to be fitted to rear exhaust rocker arm with cupped side of washer toward push rod. One of the large oil seals has no fabric on either side and is to be fitted to rear exhaust rocker arm either side against end of spring cover. The three remaining oil seals are to be fitted with fabric side against ends of spring covers.



11. The order in which oil seals and retainers should be fitted in housings, is shown in illustration. Be sure to get the 1/16" steel thrust washers properly located in aluminum rocker housings because if they are not in place, spacing between aluminum housings and cylinder head brackets will not be right and one or more brackets will probably be snapped off, when shaft nuts are tightened.

12. After rocker arms, oil seals and rocker arm shafts have been assembled in housings, apply a thin coat of aluminum paint on under side of aluminum housings, where they rest on cylinder head brackets. This will insure against oil leakage around oil passage plugs.

13. Attach aluminum housings with assembled rockers to cylinder heads. Drive rocker shafts carefully into cylinder head brackets. Do not force them as it does not take a very heavy blow with hammer to break a head bracket. If shafts are drifted evenly into brackets to avoid cocking the assembly, they will go in easily. Fit plain washers temporarily, on left end of both inlet rocker arm shafts next to cylinder brackets to take up space. Tighten all shaft nuts evenly and (disregard overhead oiling adjustment for present) securely to imbed ends of spring covers in rubber seal washers.

Now that all shaft nuts are securely tightened, and width of the assembly determined, see that holes line up so cap screws securing aluminum housings to cylinder heads can be fitted without any binding. If screws will not enter freely something is wrong and they should not be forced into place. In this case inspection should be made to see that spacing-thrust washers are in place. If everything seems in order but holes are slightly misalinged, they can be elongated with a round file to permit entering screws.

Following this procedure in securing aluminum housings is also of prime importance because if spacing and alignment are not correct and screws and nuts are pulled up tights, mounting brackets will be under stress and breakage will probably result.

14. After head assemblies are tightened up, and before cover plates are fitted, note that rockers arms are not pinched endways. This is not likely to be found the case, expecially when using old rocker arms, but it is possible. As long as rocker arms are free endways, that is all that is necessary.

If it is found there is binding enways, rocker arm will have to be shortened by grinding off either end slightly. It is desirable to have a minimum of .005" to .010" end clearance to allow for possibility of assembly closing up a little bit as rocker arm shaft nuts are loosened and tightened later on. You don't have to worry about too much end clearance.

Determining whether or not there is end play and how much is not so easy with an assembly just put up with new covers and new seals, as new sealing wahsers pinch rocker arms very tightly and make them work hard as though they were a tight fit on shaft or were tight endways. This will have to be considered when determining end clearance.

15. Apply a thing coat of shellac on underside of cover plate gaskets and fit them on covers so holes line up. Now that assembly has been completed and rocker arm endplay check to make sure there is no binding, fit cover plate.

One way to fit cover plates is to use two tapered rods and insert them through screw holes to align plates so screws can be entered straight and not become cross threaded.

An easier method is to loosen rocker and housing assemblies, that is remove cap screws that secure aluminum housings, and also remove nuts on left ends of rocker arm shafts and drift the assembly away from ends of spring covers about 1/8". Fit cover plates and tighten screws securely, then drift assembly back in place and replace and tighten shaft nuts, and cap screws in aluminum housings, as explained in paragraph No. 13.

16. Attach oil return pipes, bending pipes as needed so they line up with nipples in housings.

17. Adjust overhead oiling before replacing cylinder heads.

Remove the four large nuts on ends (right side) of rocker arm shafts, and erase all marks on aluminum housings that were originally used for setting rocker arm shafts. Also slightly loosen left side shaft nuts.

Place rear aluminum housing drawing over rocker arm shafts in rear housing and front aluminum housing drawing over rocker arm shafts in front housing. Using a center punch or other sharp instrument, indent aluminum housings, registering the rool with setting marks on drawings. Remove drawings and turn rocker arm shafts so slots in shafts line up with marks made on housings. Tighten left side shaft nuts to hold shaft setting.

Fit fibre washers over shafts and replace large nuts and tighten securely. The base of nuts should bottom against fibre washers when tight and there should be approximatly .010" clearance between corners of nuts and aluminum housings. If necessary renew or add extra fibre washers to get clearance. If corners of nuts bottom against aluminum housings, oil leakage around nuts will probably result.

It may be necessary in some cases to readjust overhead oiling after motorcycle has been put back in service. Squeaking at rocker arm assembly indicates not enough oil and repeated plug fouling may be caused by over-oiling of inlet rocker arms.

Adjust tappets very carefully and be absolutes sure none are left too tight. A tappet left too tight may bottom valve spring before cam has reached its full lift, and when this happens some damage results. After motor is completely assembled, turn it over slowly by hand to be sure of no interference about valves and rockers before attempting to start it.

WHEN ORDERING 1938 VALVE ENCLOSURE TO CHANGE OVER - SPECIFY: PART NO. 173-38D "COMPLETE SET VALVE ENCLOSURES AND FITTINGS" -- List price $8.90 - EACH SET INCLUDES THE FOLLOWING:

| NO. OF PIECES | PART # | NAME |
|---|---|---|
| 34 | 018 | R.A. Cover Screw |
| 2 | 176-38 | " " " Plate |
| 2 | 176-38A | " " " " |
| 1 | 176-38D | " " " " |
| 1 | 176-38E | " " " " |
| 1 | 176-38C | " " " " |
| 1 | 175-38A | " " Gasket |
| 1 | 175-38B | Front Exh. R.A. Cover Gasket |
| 2 | 175-38 | Rocker Arm Cover Gasket |
| 1 | 173-38C | Rear Sch. R.A. Cover & Tube Assembly |
| 1 | 173-38 | Front Intake R.A. cover & Tube Assembly |
| 1 | 173-38A | Rear Intake R.A. Cover & Tube Assembly |
| 1 | 173-38B | Front Exh. R.A. Cover & Tube Assembly |

| NO OF PIECES | PART # | NAME |
|---|---|---|
| 1 | 174-38B | Front Exh. R.A. Cover Cap |
| 2 | 174-38 | Rear Exh. & Front Intake R.A. Cover cap |
| 1 | 174-38A | Rear Intake R.A. Cover Cap |
| 1 | 177-38 | Rear Exh. R.A. Cover adapter |
| 3 | 120-38 | R.A. Housing Oil Seal |
| 1 | 120-38A | R.A. Housing Oil Seal |
| 1 | 120-38B | " " " " |
| 1 | 178-38 | R.A. Cover adapter Washer |
| 4 | 176-37 | Asbestos Oil Seal Gasket (between bottom of spring cover and cylinder head) |
| 1 | 2806-38 | Motor Brace Assembly |
| 1 | 1233-38 | Carb. Choke lever assem. |
| 4 | 119-36A | R.A. Housing Washer, 1/16" |

SPECIAL NOTE: The 1/16" spacking washers (part #119-36A) are required with 1938 valve cover combinations installed with original 1936 and 1937 aluminum housings. These housings with the earlier cover arrangement required 3/32" thrust washer (part #119-36) for correct spacing.

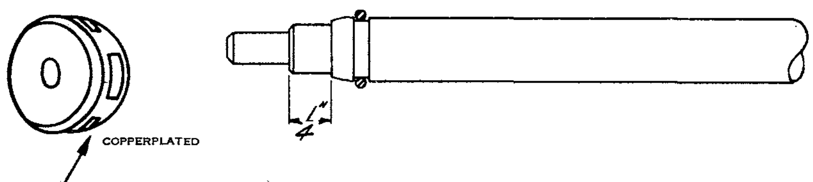
New aluminum housings used on 1938 motors and now supplied on parts orders are counterbored 1/32" deeper and must be used with the following spacings washers: On 1936 and 1937 motors with earlier valve spring covers use 1/8" washers as supplied with housings. On 1938 motors, also on 1936 and 1937 motors fitted with 1938 complete valve enclosures, use 3/32" washers (part #119-36).

# SERVICE SHOP DOPE

No. 174 March 28, 1938

## A NEW CLUTCH PUSH ROD & BEARING FOR 1938 - 61, 74 AND 80 MODELS

(This applies to 1938 models only)




New bearing which has heavier and stronger races is identified by copperplated housing. New push rod has longer pilot for bearing. Use only these latest parts for your service requirements. When servicing with new bearing, see that push rod is also latest type and that end against which bearing seats is in good condition.

1938 - 61 OHV models shipped from the factory after February 25, 1938, have the new push rod; and after March 8, 1938, the new bearing.

1938 - 74 and 80 models shipped from the factory after February 18, 1938, have the new push rod; after March 8, 1938, the new bearing.

If you have new motors in stock not yet sold and delivered, that were shipped from factory before the dates mentioned replace bearing, and also push rod if not the latest, before delivery.

Order at once, in the regular way, enough bearings and rods to take care of your requirements. Parts that you replace, new or damaged, return to factory for credit. Also when you have obtained a stock of the new parts, return for credit any new bearings or rods of earlier 1938 type you may have in stock.

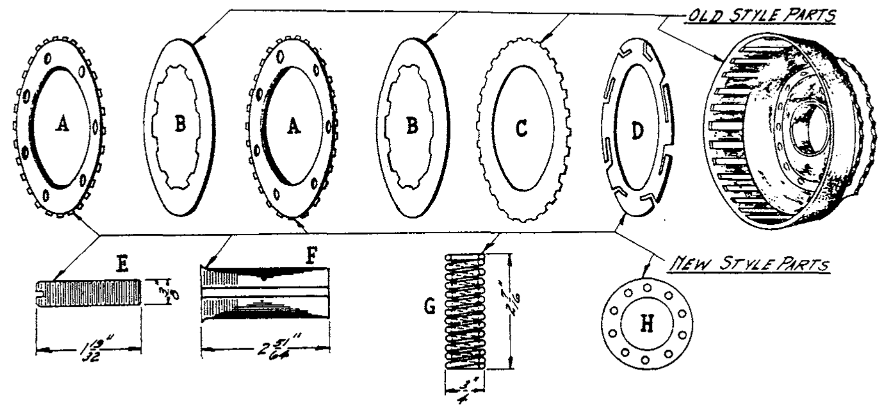
NOTE: - When a push rod bearing goes bad, the clutch release finger and push rod adjusting screw may or may not be damaged, depending on how far motorcycle is run after bearing goes bad. In every case where bearing fails, inspect these parts and renew if necessary. If bearing has jammed and worn a flat on release finger contact radius, finger should be replaced.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

| Part No. | Description |
|---|---|
| 2448-38 | Push Rod Bearing |
| 2446-38 | Clutch Push Rod |
| 2436-38 | Clutch Release Finger |
| 2463-36 | Push Rod Adjusting Screw |

# SERVICE SHOP DOPE

No. 175 April 15, 1938




## NEW CLUTCH DISC AND SPRING COMBINATION

(Illustration shows shell and discs in correct order of assembly)

| Symbol | No. Req. | Part Number | | List Prices |
|---|---|---|---|---|
| A | 2 | 2481-38 | Lined steel disc......................... | 1.20 each |
| B | 2 | 2487-36 | Plain steel disc......................... | .35 each |
| C | 1 | 2481-36 | Notched fibre disc....................... | .35 |
| D | 1 | 2487-36A | Sprung steel disc........................ | .40 |
| E | 1 | 2463-36 | Long adjusting screw..................... | .10 |
| F | 1 | 2275-38 | Clutch hub nut (later 1937-1938 61,74,80) | .90 |
| | | 2275-36A | Clutch hub nut (1936-61 and early 1937-61,74,80)............... | .90 |
| G | 10 | 2511-38 | Clutch springs........................... | .10 each |
| H | 1 | 2512-38 | Spring insulating gasket................. | .10 |

Discs "B" and "C" are old style parts the same as we have been using right along and which also apply to the new clutch. When ordering parts to convert early clutches, it will not be necessary to order these parts if original ones are in good condition or if you have some of them in stock.

New clutch hub nuts "F", which are longer, are copper plated for identification when furnished on parts order. Nuts used at the factory in new machine assembly are not copper plated. (Clutch hub nut has left hand thread.)

All 61, 74 and 80 models shipped from the factory after February 1, 1938, are fitted with this new clutch.

(over)

# SERVICE SHOP DOPE

No. 172A January 20, 1938

## 61 OHV UPPER END JOBS

Following are recommended flat labor rates to apply regularly to 61 OHV model uppper end jobs. (Head changeover to fit new covers i a combination with one of these jobs)

| | | LABOR |
|---|---|---|
| 1. | Remove tanks and cylinder heads and clean carbon and grind valves only - Does not include disassembling rocker housings and rocker arms for new seals or other attention nor inspecting pistons and rings: Does not include removing cylinders - Includes blowing out valve cover oil lines, installing one or more new valve guides or valves or both, refacing valves and seats as necessary. Fit new valve spring if needed. Remove and clean carburetor bowl Adjust circuit breaker points and check ignition timing. Inspect and clean spark plugs and check spark plug gaps. Check, and if necessary, readjust overhead oiling. Adjust chains. Adjust carburetor and test...... | $ 6.75 |
| 2. | Everything under #1 and disassemble housings for new seals, new rockers, or any other attention.............................. | 8.00 |
| 3. | Everything under #1 and removing cylinders for piston and ring inspection. Includes fitting either new rings or new pistons as may be needed. Does not include honing cylinders O.S. nor fitting new upper rod bushings or O.S. pins ............ | 8.25 |
| 4. | Everything under #1 and #2 and #3 .............................. | 9.50 |
| | Add - to #3 and #4 for each upper rod bushing or O.S. Pin ........ | .50 |

The job of initial fitting of new 1938 valve covers to a 1936 or 1937 motor is necessarily a combination with regular upper end job either #2 or #4 along with the following extra charges:

| | LABOR |
|---|---|
| Extra charge of extra work and fitting that goes with the initial installation of new covers, seals, etc. ........................... | $1.25 |
| Grinding additional cylinder head clearance, when done locally...... | 2.00 |

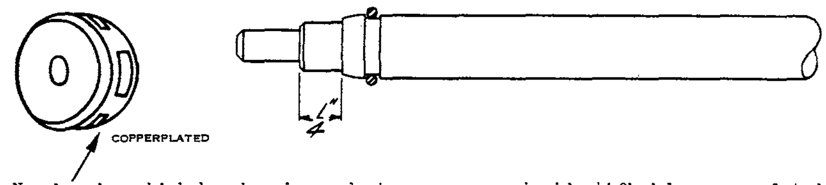
| FOR EXAMPLE - | COMBINATION WITH FLAT JOB #2 | COMBINATION WITH FLAT JOB #4 |
|---|---|---|
| | (Job #2) $8.00 | (Job #4) $9.50 |
| Clearance grinding | 2.00 | 2.00 |
| extra labor | 1.25 | 1.25 |
| New covers | 8.90 | 8.90 |
| New O.S. Valve guides, valves, etc., as needed | ? | ? |
| | $20.15 | $21.65 |

# SERVICE SHOP DOPE

No. 174 March 28, 1938

## A NEW CLUTCH PUSH ROD & BEARING FOR 1938 - 61, 74 AND 80 MODELS

(This applies to 1938 models only)




New bearing which has heavier and stronger races is identified by copperplated housing. New push rod has longer pilot for bearing. Use only these latest parts for your service requirements. When servicing with new bearing, see that push rod is also latest type and that end against which bearing seats is in good condition.

1938 - 61 OHV models shipped from the factory after February 25, 1938, have the new push rod; and after March 8, 1938, the new bearing.

1938 - 74 and 80 models shipped from the factory after February 18, 1938, have the new push rod; after March 8, 1938, the new bearing.

If you have new motors in stock not yet sold and delivered, that were shipped from factory before the dates mentioned replace bearing, and also push rod if not the latest, before delivery.

Order at once, in the regular way, enough bearings and rods to take care of your requirements. Parts that you replace, new or damaged, return to factory for credit. Also when you have obtained a stock of the new parts, return for credit any new bearings or rods of earlier 1938 type you may have in stock.

NOTE: - When a push rod bearing goes bad, the clutch release finger and push rod adjusting screw may or may not be damaged, depending on how far motorcycle is run after bearing goes bad. In every case where bearing fails, inspect these parts and renew if necessary. If bearing has jammed and worn a flat on release finger contact radius, finger should be replaced.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

| Part No. | Description |
|---|---|
| 2448-38 | Push Rod Bearing |
| 2446-38 | Clutch Push Rod |
| 2436-38 | Clutch Release Finger |
| 2463-36 | Push Rod Adjusting Screw |

Lined steel discs "A" must fit completely free in clutch shell with a little side play to allow for expansion. If the fit is very close, clutch may function normally when cold, but when hot discs may expand enough to bind in shell; in which case clutch will drag and will neither engage nor release properly.

Heat insulating gasket "H" is to be assembled on driving disc,back of springs.

Normal clutch spring tension adjustment with the new combination is the same as specified for earlier clutches - 11/32" from face of spring collar to shoulder on thrust plate mounting studs. See "Adjusting Clutch Spring Tension" in Rider's Instruction Folder.

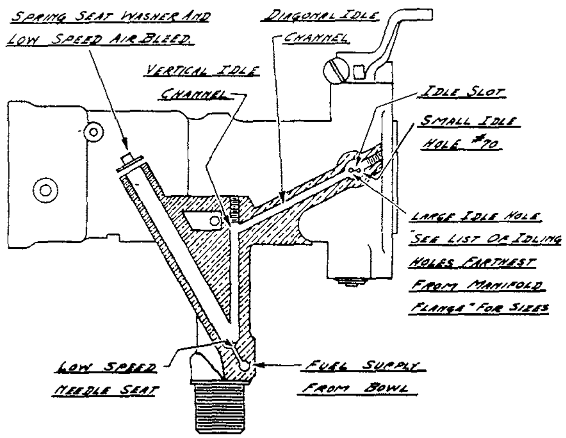
This new clutch combination was developed to meet particularly the extremely hard use to which clutches in city police and commercial service are subjected. It not only is a positive clutch for hard service,but also releasing action is very good which makes gear shifting easy. It can be applied to any 1936 - 61 and 1937 and later 61, 74, and 80 models originally fitted with earlier clutch assembly by simply installing the parts indicated in illustration as "New Style Parts". It is recommended that it be applied generally to earlier clutches when disc service is required.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

# SERVICE SHOP DOPE

No. 176 June 14, 1938

## SERVICE NOTES FOR MODEL "M" LINKERT CARBURETORS ON HARLEY-DAVIDSON MOTORCYCLES




Attention is called to carburetors which have crusted up with carbon, etc., around the throttle disc, etc., throwing adjustment and calibration of carburetor off normal and causing a lean spot off idle.

In some cases carburetors become crusted or caked around the throttle disc, throttle bore, in the idle holes at the closed disc, in the passages from the idle holes down to the idle or low speed needle valve. This crust should be removed, particularly when a lean spot comes in at speeds off idle up to 30 M.P.H. with the low speed (idle) adjustment set properly for idling. The idle adjustment should not be set to the very lean side when checking this point, but to a point about five clicks rich from the setting where the motor dies from leanness.

### How To Remove The Crust

1. Back off the idle stop screw so that the throttle disc closes tightly. With a sharp pointed tool like a sharp pen knife or scriber scratch a line on the closed throttle disc and also on the throttle barrel so that the lines on the disc and on the barrel meet. These lines should jibe up again when you replace the disc. Remove the throttle lever, throttle disc and shaft, the idle hole body plug next to the idle holes in the throttle barrel, the body plugs in the carburetor flange and carburetor body idle channels and the low speed (idle) lift lever and needle valve assembly. Also remove the venturi and nozzle.

2. Scrape out the caking or crust in the throttle barrel with a scraper or knife, being sure not to cut into the metal.

3. Clean up the throttle disc by rubbing it on both sides on emery cloth on a flat plate and clean the edge of the disc all around, being careful not to round the corners or cut into the metal.

4. Clean out the idle holes in the throttle barrel next to the disc with the proper size drills. See list for proper sizes for both holes for all models of carburetors.

(over)

| Model | Size | Venturi Size | Idle Hole Nearest Manifold Flange (Drill size) | Idle Hole farthest from Manifold Flange (Drill size) | Slot Width |
|---|---|---|---|---|---|
| M-4 | 1" | 7/8" | #70 | #54 | .009" |
| M-11 | 1" | 7/8" | #70 | #54 | .009" |
| M-16 | 1" | 7/8" | #70 | #54 | .009" |
| M-2 | 1¼" | 1-1/16" | #70 | #55 | .009" |
| M-5 | 1¼" | 1-1/16" | #70 | #53 | .009" |
| M-5F | 1¼" | 1-1/16" | #70 | #53 | .009" |
| M-21 | 1¼" | 1-1/16" | #70 | #55 | .009" |
| M-31 | 1¼" | 1-1/16" | #70 | #55 | .009" |
| M-31F | 1¼" | 1-1/16" | #70 | #55 | .009" |
| M-31F1 | 1¼" | 1-1/8" | #70 | #55 | .009" |
| M-41 | 1¼" | 1-1/16" | #70 | #55 | .009" |
| M-41F | 1¼" | 1-1/16" | #70 | #55 | .009" |
| M-41F1 | 1¼" | 1-1/8" | #70 | #55 | .009" |
| M-41L | 1¼" | 1-1/8" | #70 | #55 | .009" |
| M-41LF | 1¼" | 1-1/8" | #70 | #55 | .009" |
| M-51 | 1¼" | 1-1/16" | #70 | #55 | .009" |
| M-51F | 1¼" | 1-1/16" | #70 | #55 | .009" |
| M-51L | 1¼" | 1-1/8" | #70 | #55 | .009" |
| M-51LF | 1¼" | 1-1/8" | #70 | #55 | .009" |

(Model numbers followed by letter "F" or "F1" apply only to carburetors used on California Highway Patrol motors.)

5. Clean out the slot by inserting the tool with the blade in it through the slot between the two idle holes.

6. Clean out the idle channels with the #42 drill. When cleaning vertical idle channel don't completely bottom drill as doing so may damage low speed needle seat.

7. Clean out the low speed (idle) needle valve seat hole with the proper size drill. All 1¼" "M" carburetors are cleaned with the #53L drill, and all 1" "M" carburetors are cleaned with the #56L drill.

8. Blow out all channels and holes with compressed air and wash all parts in gasoline.

9. Re-assemble the parts, being sure the lift lever spring seat or washer is between the spring and carburetor body when assembling the low speed lift lever and needle valve assembly back into place. This spring seat or washer limits the air bleed to the idle and must be in place. Also be sure the throttle disc is assembled in the barrel properly and closes off tight before the disc screws are pulled down. Be sure to push up the shaft collar on the throttle shaft firmly against the body before tightening the throttle disc screws. Also have the disc in place with the correct side of disc up or toward the flange and with the lines you scratched lining up with each other exactly. The throttle lever should be clamped to the shaft with the disc wide open and with the throttle lever wide open stop against the body lug and with the wear take-up spring between the throttle lever and bearing.

### CARBURETOR CLEAN-UP TOOLS

A set of tools consisting of an idle slot cleaner and seven handled drills of sizes required for cleaning out Linkert carburetor channels and openings is available. These drills are for hand cleaning only. Do not use in power drill. Order set No. 12012-38, price $2.00 net.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

# SERVICE SHOP DOPE

No. 177 August 16, 1938

## NEW OIL SEAL PISTON RINGS

For Motors with Circulating Oiling System

Oil scraper ring with channel at edge of ring which has been used the past two years was recently discarded and a new more efficient oil seal ring is now being used in new motor assembly and supplied on parts orders. The new ring can be distinguished from the old one by the location of oil channel. New ring has a wide channel in the center of ring face.

In new motor assembly the new ring is being used only in lower ring groove of rear clyinder piston. However, in connection with a moderately driven motor where high oil mileage is desired, it can also be used safely on front piston.

The new oil rings for 61, 74, and 80 inch pistons have the same width as compression rings and earlier oil rings and, therefore, are fully interchangeable with earlier type oil rings. Oil ring for 45 model is wider than the standard 45 compression ring and the lower ring groove must be .129" wide (standard 45 ring groove is .0935")

All 45 pistons, front and rear, now used in new motors and also piston supplied on parts order have the wider lower ring groove. In new motors the front piston, which does not have an oil ring, is fitted with a plain ring in the lower groove the same width as the new oil ring.

Since pistons for all models supplied on parts order may be used in either front or rear cylinder, all pistons are supplied fitted with all plain rings. When a piston is used for servicing rear cylinder, (of a motor with circulating oiling system) an oil ring should be fitted in lower groove. This being the case, you should order a supply of new oil rings and have them on hand.

NEW OIL SEAL RINGS

| PART NO. | MODEL | PRICE |
|---|---|---|
| 266-36 | 61 and 74 | $ .25 list |
| 266-37 | 80 | .25 " |
| 263-38 | 45 | .25 " |

New plain ring for 45 front piston lower groove (same width as new oil seal ring) part No. 262-38, price 25¢ list. Remember that all 45 parts order pistons are furnished with this ring in lower groove.

If you have any 1936 - 61 models or 1937-38 motors of any model that are heavy oil users and possibly plug foulers, even though breather timing has been checked and found o.k. and oil pump readjusted for lower pressure, install the new oil seal ring. Bear in mind that the first essential for normal oil control and normal oil mileage (200 to 400 miles per quart for side valve motors and 250 to 500 miles for the overhead model) is correct breather timing. Pump pressure regulation and rings come next.

# SERVICE SHOP DOPE

No. 179 October 18, 1938

## IMPORTANT CLUTCH THRUST BEARING INFORMATION

We have recently been able to improve clutch push rod thrust bearings, part Nos. 2448-38 and 2448-36, so that these bearings are now decidely better and more dependable bearings than they have been in the past. You will find that as a general thing these improved bearings will stand up satisfactorily in any sort of service.

Bearing No. 2448-38 is the 1938 type bearing used in all 1938 big twins. Bearing No. 2448-36 applies to 45 model and also 1936 - 61" model, and all 1937 big twins.

Only these new bearing are now supplied on all parts orders. They are distinguished from earlier bearings of the same type by a whitened (cadmium plated) cover.

If you have not already received some of these new bearings with a parts order of a recent date, order a supply and use them for all future service requirements.

When replacing a worn out or damaged thrust bearing with a new one, always closely inspect end of push rod and release finger for damaged condition resulting from failure of bearing. Replace with new, either that may be found damaged, as the parts that work with a new bearing must also be in good condition if bearing is expected to stand up and give long service.

Do not fit a 1938 type bearing and push rod to a 1936 - 61" or any 1937 Big Twin model without also fitting 1938 type release finger which is wider and requires widening the slot between bosses in aluminum cover in order to get finger correctly located and centered with end of push rod. A 1938 type bearing cannot be used with a 1936 and 1937 release finger, because this finger was designed to be used with the samller diameter bearing and does not have sufficient clearance for larger diameter 1938 bearing.

Numerous inquiries have been received with regard to possibilities of using 1939 type Big Twin thrust bearing for servicing earlier models. This is possible but not very practicable. Besides a new thrust bearing, the change requires a new starter clutch, release finger and oil deflector. Also a new aluminum starter cover must be used or the original cover returned to the factory to be machined out to provide clearance for the new bearing. As a general practice it is advisable to service an earlier machine with new bearing of theoriginal type.

NOTE - Before installing a new thrust bearing to replace one that has gone bad, transmission case, particularly the starter compartment, should be thoroughly washed out to get rid of any small metal particles that may have been scuffed off the damaged balls and races. If these particles are not removed they will circulate through transmission with the oil and may not only damage the new bearing but may also damage the gears and other parts.

# SERVICE SHOP DOPE

No, 182

December 28, 1938

## NEW OIL SEAL FOR 45" INNER CLUTCH DISC

New oil seal is made of softer material than formerly used and although it is just as effective an oil seal it does not grip the roller race so tightly. Therefore, when clutch is released the gears and shifter clutches have less draf and shifting is easier.

In new clutch assembly, oil seal with retainer is pressed into inner clutch disc and locked by rolling over metal at outer edge of retainer.

After removing old seal, a suitable scraper should be used to cut away the rclled-over edge before installing new seal.

To install a new oil seal, proceed as follows:

Place the cork washer in bottom of recess in inner clutch disc, and then place the retainer and oil seal over the end of an outer roller race - part No. 2518-33. The roller race will expand the oil seal to fit the retainer and will also be used to drive or press in the retainer and oil seal.

The retainer must be pressed down just below flush with edge of inner clutch disc and staked in place by peening over metal at four equidistant points with a dull punch.

Only the new seal is now furnished on parts order under part No. 2524-36.

| | | |
|---|---|---|
| 2518-33 | Roller race - to ube used a pilot and driver to install new oil seal ...................... | $ 2.00 list |
| 2524-36 | Set oil retaining washers, clutch side ...... | .60 list |

# SERVICE SHOP DOPE

No. 187

March 15, 1939

## FURTHER 1938 AND EARLIER CLUTCH THRUST BEARING INFORMATION

(This supplements Shop Dope No. 179)

As explained in Shop Dope Bulletin No. 179, clutch push rod thrust bearing Nos. 2448-38 and 2448-36 were improved and made stronger some time ago.

Bearing No. 2448-38 is the 1938 type bearing used in all 1938 Big Twins. Bearing No. 2448-36 applies to 45 models and also 1936 - 61" model, and all 1937 Big Twins.

Only these new bearings are now supplied on all parts orders. At first they were distinguished from earlier bearings of the same type by a whitened (cadmium plated) cover. However, because the cadmium plating didn't clearly enough distinguish these late bearings from the earlier ones, we are now further distinguishing them by drilling a 1/16" hole in the cover. This hole is in addition to the cadmium plating.

Only bearings with cadmium plated cover or those with cadmium plate and a hole in the cover should be used for your future service requirements.

We want to mention, too, that clutch release fingers (both No. 2436-38, used on all 1938 Big Twins, and No. 2436-36, used on 1936 61" models and all 1937 Big Twins) have been changed and are now much stronger.

When replacing a worn-out or damaged thrust bearing with a new one, always closely inspect both ends of push rod as well as the release finger for damaged condition resulting from failure of bearing. If either is found damaged, replace with new, as the parts that work with a new bearing must also be in good condition if bearing is expected to stand up and give long service.

Do not fit a 1938 type bearing and push rod to a 1936 61" or any 1937 Big Twin model without also fitting a 1938 type release finger which is wider and requires widening the slots between bosses in aluminum cover in order to get finger correctly located and centered with end of push rod. A 1938 type bearing cannot be used with a 1936 and 1937 release finger because this finger was designed to be used with the smaller diameter bearing and it does not have sufficient clearance for the larger diameter 1938 bearing.

IMPORTANT = Before installing a new thrust bearing to replace one that has gone bad, transmission case (particularly the starter compartment) should be thoroughly washed out to get rid of any small particles of metal that may have been suffed off the damaged balls and races. If these particles are not removed, they will circulate through transmission with the oil and may not only damage the new bearing but may also damage the gears and other parts.

# SERVICE SHOP DOPE

No. 188 March 28, 1939

## NEW DUCKWORTH FRONT CHAIN

There has been a change in Duckworth 1/2" pitch, double row front chain applying to all big twin models from 1930 to date. This later chain, in a new endless chain, is fully interchangeable with a chain of earlier production but, inasmuch as the chain pin diameter has been changed, connecting links and repair links for one chain or the other are not interchangeable. This makes it necessary for you to carry two different types of repair links in stock.

Here is how you can distinguis between old and new style chains and their repair links. From the beginning, the later style chain and its repair links have been identified by the number D515 stamped in side plates. The very latest chain and also its repair links are further identified by copper plated center plates. This manner of identification of new chain repair links applies to all but roller block only. For this reason we recommend that you order complete repair link assemblies to insure having proper type of roller blocks for servicing old or new chains. Complete repair link for old style chain is #2015-30 and for new style chain is #2015-39.

Although the pin diameter of the new Duckworth D515 chain is same as regular Diamond 1/2" pitch, double front chain, Duckworth and Diamond links are not interchangeable. Diamond chain is about .010" wider and if the new D515 connector link is used, the spring clip will not go down into its retaining groove in link pins.

HARLEY-DAVIDSON MOTOR CO.

Milwaukee, Wis., U.S.A.

# SERVICE SHOP DOPE

No. 189 April 12, 1939

## FIXED OILING ON 61 OVERHEAD VALVES AND ROCKERS

On all 1936-37-38 and early 1939 - 61 OHV motors (up to and including 1939 EL1902), it was necessary in initial factory assembly, to adjust rocker arm shafts for correct oiling to valve stems, and further re-adjustment, if needed, could be made by dealer.

All later - 61" motors, starting with 39 EL1903, have fixed oiling arrangement to valve stems. No re-adjustment will be needed and no means of re-adjusting is provided. In assembling, the shafts are placed into the rocker arms without regard to location of oil feed holes.

In servicing motors, with motor number above 39 EL 1902, that require new rocker arms or shafts, be sure to use the new parts listed below.

| | |
|---|---|
| 98 - 39 | Front intake rocker arm |
| 99 - 39 | Rear intake rocker arm |
| 100 - 39 | Front exhaust rocker arm |
| 101 - 39 | Rear Exhaust rocker arm |
| 105 - 39 | Front intake rocker shaft |
| 106-39 | Rear intake rocker shaft |
| 107 - 39 | Front exhaust rocker shaft |
| 108-39 | Rear exhaust rocker shaft |

These parts are listed on page 7 in your 1939 Spare Parts Catalog and are marked "Later 1939 - 61" twins". Rocker arms and shafts for earlier 61" motors are also shown on page 7. Do not get them confused.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

# SERVICE SHOP DOPE

No. 191 April 28, 1939

FITTING 1939 CLUTCH THRUST BEARING TO EARLIER MODELS

(This applied to 1936 - 61s, and 1937 and later 61, 74 and 80 models)

We have had a number of inquiries about the possibility of servicing with 1939 type thrust bearing, earlier models that, for one reason or another, have given an unusual amount of trouble with original type thrust bearing. We advise that this change-over can be made, applying to the models mentioned above. As a matter of convenience when ordering, we have established a special part number covering the entire group of parts required and have set a special price on the group. Any of these parts ordered individually will be billed at catalog prices.

When ordering, specify: Part No. 2125-38 - 1939 Starter cover with clutch thrust bearing & other fittings . . . . $5.00 Net (Suggested list price $7.50)

The group of parts you will receive under the above number consists of:

1 2126-38 Starter cover
1 2436-39 Release finger
1 2430-38 Release finger shaft
1 2448-39 Thrust bearing
1 2146-39 Starter clutch with pin and spring
1 2151-39 Oil deflector
1 2149-39 Lock washer

In applying the 1939 thrust bearing combination to 1937 or 1936 models, it will be necessary, also, to fit the later push rod, part No. 2446-38 - 60¢ list.

A new aluminum starter cover is included in the group of change-over parts because to use the 1939 type thrust bearing, more cover clearance is required for bearing, and it is either a matter of using a new cover of having original cover re-machined. The earlier style cover can be machined for this added bearing clearance; and for those who want to send in original covers for machining, with 1939 style bearing and parts to be furnished and shipped with covers, we are willing to make a special combination price of $4.00 net. Considering the packing, transportation, and other expense connected with returning old covers to the factory for re-machining and the small difference between this change-over price as compared to the $5.00 net price established on the group of new parts, it will hardly be worth the dealer's while to send back any old covers for converting.

SPECIAL NOTE - Because of the special low price established on new parts and because we have no outlet for used parts, we cannot permit dealers to order sets of these parts in advance and then return old covers for credit less repair costs.

Shop Dope Sheet No. 191A furnished with each set of parts, contains complete fitting specifications.

# SERVICE SHOP DOPE

No. 191A April 28, 1939

INSTRUCTIONS FOR FITTING 1939 CLUTCH THRUST BEARING TO EARLIER MODELS

The 1939 type bearing can be used for servicing 1936, 1937, 1938 models, by changing all of the parts indicated by part number in illustration on reverse side.

Oil deflector is assembled as shown in illustration and is held with one of the screws that secures mainshaft bearing retaining plate. After this screw has been securely tightened, lock it by setting metal into screw head slot with a punch. It is important that this oil deflector be properly assembled as it provides lubrication for the mainshaft starter gear.

After the new starter clutch is assembled on the mainshaft and securely tightened, try the new bearing on it to be sure bearing is an entirely free fit and slides on and off with no more bind than should normally be accounted for by the ball plunger in starter clutch. Occasionally it may be found that while the starter clutch is a free fit in bearing before assembly, tightening the starter clutch on main shaft expands it enough to make it a tight fit in bearing, or possibly enough so it can't even be started into bearing. In this case you will either have to polish the outside diameter of starter clutch and the inside diameter of bearing with emery cloth to effect a free fit, or try another combination of parts that may fit better. One way or another the combination must be made an entirely free fit, otherwise clutch action will not be normal. After this fit has been checked, bearing is to be removed from starter clutch because in final assembly, it has to be assembled with the starter cover. Starter crank gear interference does not permit assembling it to transmission first and then installing aluminum cover.

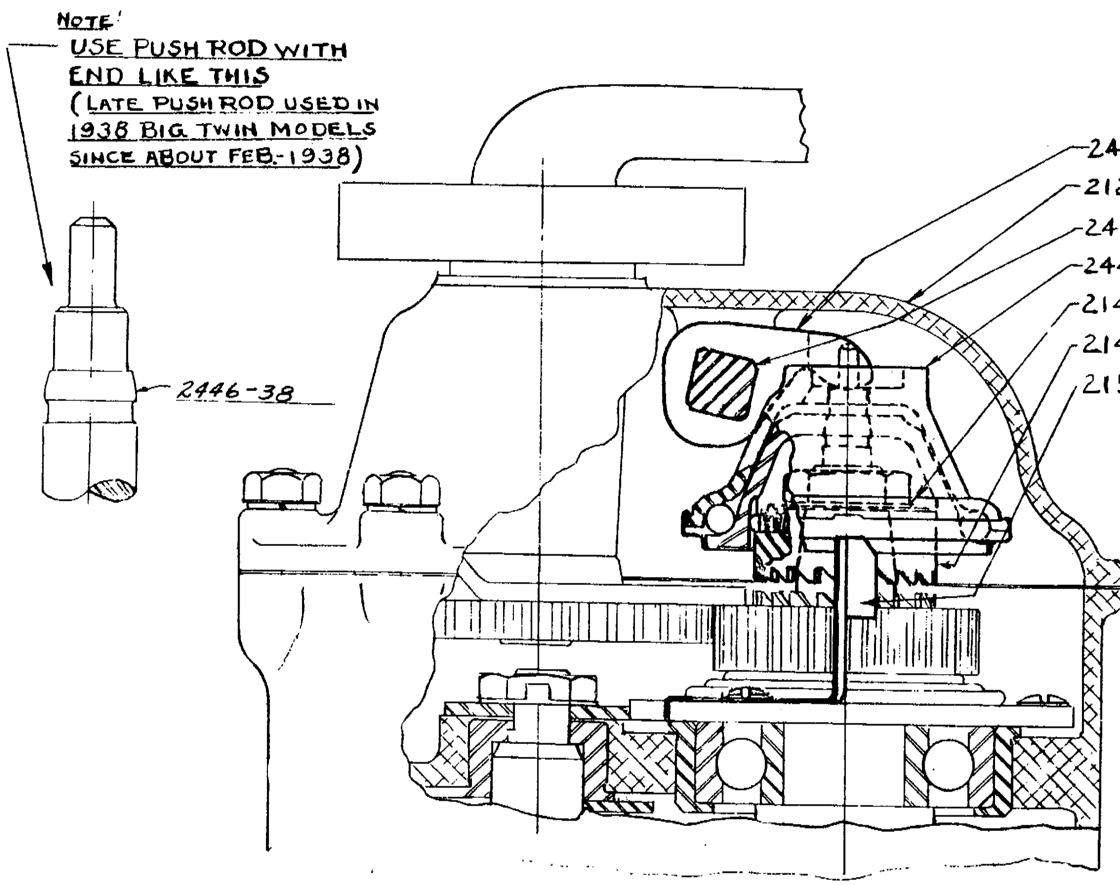
If motorcycle being serviced has a late type push rod as shown in illustration (part #2446-38) and end of push rod is in good condition, push rod is O.K. for the new bearing. Any earlier type of push rod or one of this type that is worn or damaged at the end as a result of bearing failure must be replaced with a new one.

When making final assembly of aluminum cover and bearing to transmission case, pull the end of push rod out a few inches and insert it into bearing to act as a pilot for bearing as the cover is pushed into place. Although assembly will be easier if starter clutch and bearing are turned so that the ball plunger in starter clutch registers with groove in bearing race, it is not altogether necessary that assembly be made with this register. If assembled with the ball at some other point, it will find its place after transmission is put in use.

After assembly is completed, adjust clutch controls in the usual manner.

Don't forget to refill transmission with oil.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.


NOTE:
USE PUSH ROD WITH
END LIKE THIS
(LATE PUSH ROD USED IN
1938 BIG TWIN MODELS
SINCE ABOUT FEB.-1938)
2446-38
2436-39
2126-38
2430-38
2448-39
2149-39
2146-39
2151-39

# SERVICE SHOP DOPE

THIS DOPE SHEET WAS SENT OUT WITH FIRST SHIPMENTS OF 1939 BEARINGS AND PARTS PRIOR TO TIME DOPE SHEETS 191 & 191A WERE PUBLISHED. SKETCH SIMILIAR TO ONE IN 191A WAS INCLUDED WITH THIS SHEET.

## NEW CLUTCH PUSH ROD BEARING FOR 61, 74 AND 80 MODELS (1939 TYPE)

This bearing can be used for servicing 1936, 1937 and 1938 models, by changing all of the parts indicated in illustration. While the aluminum starter cover in one of the parts to be exchanged, the original cover can be returned to the factory to be machined for necessary clearance so it can be used for exchange on some other machine to be serviced with the new bearing.

Oil deflector is assembled as shown in illustration and is held with one of the screws that secures mainshaft bearing retaining plate. After this screw has been securely tightened, lock it by setting metal into screw head slot with a punch. It is important that this oil deflector be properly assembled as it provides lubrication for the mainshaft starter gear.

After the new starter clutch is assembled on the mainshaft and securely tightened, try the new bearing on it to be sure bearing is an entirely free fit and slides on and off with no more bind than should normally be accounted for by the ball plunger in starter clutch. Occasionally it may be found that while the starter clutch is a free fit in bearing before assembly, tightening the starter clutch on main shaft expands it enough to make it a tight fit in bearing, or possibly enough so it can't even be started into bearing. In this case, you will either have to polish the outsdie diameter of starter clutch and the inside diameter of bearing with emory cloth to effect a free fit, or try another combination of parts that may fit better. One way or another the combination must be made an entirely free fit, otherwise clutch action will not be normal. After this fit has been checked, bearing is to be removed from starter clutch because in final assembly, it has to be assembled with the starter cover. Stárter crank gear interference does not permit assembling it to transmission first and then installing aluminum cover.

If motorcycle being serviced has a late type push rod as shown in illustration and end of push rod is in good condition, push rod is o.k. for the new bearing. Any earlier type of push rod or one of this type that is worn or damaged at the end as a result of bearing failure must be replaced with a new one.

When making final assembly of aluminum cover and bearing to transmission case, pull the end of push rod out a few inches and insert it into bearing to act as a pilot for bearing as the cover is pushed into place. Although assembly will be easier if starter clutch and bearing are turned so that the ball plunger in starter clutch registers with groove in bearing race, it is not altogether necessary that assembly be made with this register. If assembled with the ball at some other point, it will find its place after transmission is put in use.

After assembly is completed, adjust clutch controls in the usual manner.

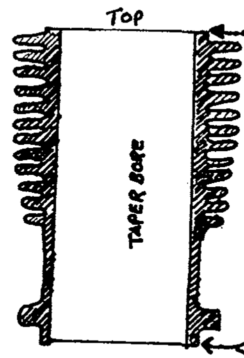
Don't forget to refill transmission with oil.

# SERVICE SHOP DOPE

No. 193 May 22, 1939

## CYLINDER REBORING AND PISTON FITTING INFORMATION

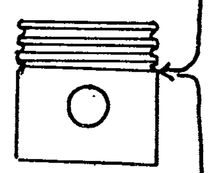
Taper Bore Cylinder and Solid Skirt Type Piston
(NOTE: Dimensions given are standard size)




| MODEL | SIZE |
|---|---|
| 21" | 2.870" |
| 30.50" | 3.0885" |
| 45" (1934 & earlier) | 2.745" |
| 61" (1923 & earlier) | 3.307" |
| 61" (1924 to 1929) | 3.305" |
| 74 & 80" (1934 & earlier) | 3.422" |

NOTE: Take cylinder measurement about ½" from top of bore, rather than at extreme top, when determining piston clearance given below.

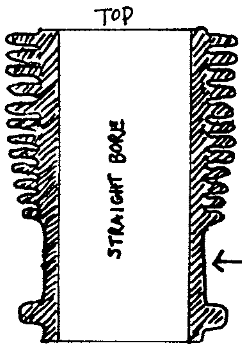
| | |
|---|---|
| 21" | 2.875" |
| 30.50" | 3.0935" |
| 45" (1934 & earlier) | 2.750" |
| 61" (1923 & earlier) | 3.310" |
| 61" (1924 to 1929) | 3.312" |
| 74 & 80" (1934 & earlier) | 3.429" |



| SOLID SKIRT Type Piston Model | Piston Size at measuring point - just below top group of rings | Piston Clearance |
|---|---|---|
| 21"(all models) Dow metal & Lynite | 2.8585" | .011" to .013" |
| 30.50 Dow Metal | 3.0767" | .011" to .013" |
| 45" Dow Metal * | 2.730" | .014" to .016" |
| 45" Lynite * | 2.731" | .014" to .016" |
| 61" Iron Alloy (1924-1929) | 3.3035" | .002" to .003" |
| 61" Dow Metal (1924-1929) | 3.293" | .0115"to .0135" |
| 74" Iron Alloy (1929 & earlier) | 3.419" | .003" - .004" |
| 74" Dow Metal (1930 to 1934) | 3.418" | .004" to .005" |
| 74 & 80" Dow Metal (1930-1934)* | 3.405" | .016" to .018" |
| 74 & 80" Lynite (1930-1934)* | 3.407" | .016" to .018" |

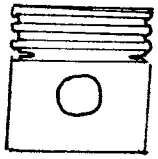
NOTE: Solid skirt pistons marked with * are no longer furnished on regular parts order. These pistons are superseded by slotted pistons. Cylinders should be straight ground - See other side.

CYLINDER REBORING AND PISTON FITTING INFORMATION
Straight Bore Cylinder and Slotted Type Piston
(NOTE: Dimensions given are standard size)




Standard bore dimension
of straight bore cylinder
for slotted piston

| | |
|---|---|
| 45" | 2.745" (1935 and later) |
| 74" | 3.422" 1935 and 1936, and all 80" |
| 61" | 3.3125" OHV and 1937 and later 74" |



Slotted piston should be fitted .001" to .002" clearance in straight bore cylinder checking fit at bottom of skirt, front and rear.

# SERVICE SHOP DOPE

No. 198 October 30, 1939

74 and 80 CU. IN. TWIN MOTOR FITTING SPECIFICATION (1930 TO AND INCLUDING 1936)

(THESE SUPERSEDE ALL PREVIOUS SPECIFICATION AND APPLY TO ALL 1930 TO AND INCLUDING 1936 - 74" and 80" MOTORS

PISTON CLEARANCE - IRON ALLOY PISTONS - Used in 1930-34 motors fitted with taper bore cylinders - .004" to .005" clearance.
ALUMINUM AND DOW METAL PISTONS - Solid skirt type - Used in 1930-34 motors fitted with taper bore cylinders - .016" to .018" clearance
ALUMINUM PISTON - Slotted, cam ground type - New piston fitted in straight bore cylinder .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service. Measure solid skirt piston just below the top group of rings. Measure slotted piston at bottom of skirt, front and rear. When fitting oversize piston which has vertical slot in addition to horizontal slots, fit with vertical slot forward. Measure cylinder about ½" from top of bore, front and rear.

PISTON - CYLINDER HEAD CLEARANCE - (All models except VC Commercial) 1/16" to 3/32" (VC Commercial, discontinued after 1933) 7/64" to 9/64".

PISTON PIN IN IRON ALLOY PISTON - .0005" to .001" press fit in lock pin side - plug or slip fit in opposite side.

PISTON PIN IN DOW METAL AND ALUMINUM PISTON - Solid skirt type - .0005" to .001" press fit in piston

PISTON PIN IN ALUMINUM PISTON - Slotted type - light hand press fit

PISTON PIN IN UPPER END OF CONNECTING ROD - .001" loose

PISTON RING GAP AND GROOVE CLEARANCE - Taper bore cylinder .006" gap ½" from top of cylinder. Straight bore cylinder .010" to .020" gap ½" from top of cylinder. Rings should be .004" loose in Dow Metal and Aluminum piston grooves and just free in Iron Piston grooves.

LOWER CONNECTING ROD BEARING - .001" to .00125" loose

CONNECTING RODS - .006" to .010" clearance between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrowere than front rod.

PINION GEAR SHAFT - .0045" loose at inner end of bushing - .002" loose at outer end of bushing. (Bushing is taper reamed with special reamer.)

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .006" to .007" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY - .006" to .010" end play in crank case

CAM GEARS - .0005" to .001" loose in crank case and cover bushings - free to .005" end play.

INTERMEDIATE GEAR - .001" to .0015" loose on stud

TAPPET GUIDES - .0005" to .001" press fit in crank case

VALVE TAPPETS - .0005" to .001" loose in tappet guides.

# SERVICE SHOP DOPE

No. 198A October 30, 1939

74 AND 80 CU. IN. TWIN MOTOR FITTING SPECIFICATIONS (1937 AND LATER MODELS

(NOTE: These supersede all previous specifications)

PISTON CLEARANCE - ALUMINUM PISTON - Slotted, cam ground type - New piston fitted in straight bore cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service. Measure piston at bottom of skirt, front and rear.
When fitting oversize piston which has vertical slot in addition to horizontal slots, fit with vertical slot forward.
Measure cylinder about 1/2" from top of bore, front and rear.

PISTON-CYLINDER HEAD CLEARANCE - 1/16" to 3/32"

PISTON PIN IN PISTON - Light hand press fit

PISTON PIN IN UPPER END OF CONNECTING ROD - .001" loose

PISTON RING GAP AND GROOVE CLEARANCE - Straight bore cylinder .010" to .020" gap 1/2" from top of cylinder. Rings should be .004" loose in grooves.

LOWER CONNECTING ROD BEARING - .001" to .0012" loose.

CONNECTING RODS - .006" to .010" clearance between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than forked rod.

PINION GEAR SHAFT - .00075" to .00125" loose in roller bearing and .0005" to .001" loose in cover bushing. Oil hole in cover bushing is $30^\circ$ ahead of top center, and in line (on opposite side) with drilled oil feed channel in cover.

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .007" to .009" loose in oil retaining bushing

FLYWHEEL ASSEMBLY - .012" to .014" end play in crank case

CAM GEARS - .0005" to .001" loose in crank case and cover bushings - free to .005" end play.

INTERMEDIATE GEAR - .001" to .0015" loose on stud.

TAPPET GUIDES - .0005" to .001" press fit in crank case.

VALVE TAPPETS - .0005" to .001" loose in tappet guides

CRANK CASE BREATHER - Which is a part of, and drives scavenger pump, is timed according to instructions in Riders Instruction Folder.

# SERVICE SHOP DOPE

No. 198B October 30, 1939

61 CU. IN. TWIN MOTOR FITTING SPECIFICATIONS (O.H.V. MODELS)

(NOTE: These supersede all previous specifications.)

PISTON CLEARANCE - ALUMINUM PISTON - Slotted, cam ground type - New piston fitted in cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.
Measure piston at bottom of skirt, front and rear.
Measure Cylinder about 1/2" from top of bore, front and rear.

PISTON PIN IN PISTON - Light hand press fit.

PISTON PIN IN UPPER END OF CONNECTING ROD - .001" loose

PISTON RING GAP AND GROOVE CLEARANCE - .010" to .020" gap ½" from top of cylinder. Rings should be .004" loose in grooves.

LOWER CONNECTING ROD BEARING - .001" to .0012" loose

CONNECTING RODS - .006" to .010" end play between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than forked rod.

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .007" to .009" loose in oil retaining bushing.

PINION GEAR SHAFT - (Solid and two piece type) - .001" loose in roller bearing, and .001" to .0015" loose in cover bushing. Oil hole in cover bushing is centered with drilled oil feed channel in cover. Two piece stub shaft assembly - cork sealed, oil tight fit in flywheel shaft with copper washer behind.

FLYWHEEL ASSEMBLY - .012" to .014" end play in crank case.

CAM GEAR - .001" to .0015" loose in crank case and cover bushings - free to .005" end play.

INTERMEDIATE GEARS - .001" to .0015" loose - free to .005" end play.

TAPPET GUIDES - .0005" to .001" press fit in crank case.

VALVE TAPPETS - .0005" to .001" loose in tappet guides.

ROCKER ARM FIT ON SHAFT - (1936 to 1937 models) .0005" to .0015" loose - .003" to .008" end play. (1938 and later models) .0005" to .0015" loose - .007" to .016" end play.

OIL PUMP DRIVE SHAFT - .001" loose in crank case bushing.

CRANK CASE BREATHER - Timed with front cylinder - opens 1/8" before top center to 1/8" after top center, and closes 13/16" to 1-5/16" after bottom center.

# SERVICE SHOP DOPE

No. 198C October 30, 1939

45 CU. IN TWIN MOTOR FITTING SPECIFICATIONS (1930 TO AND INCLUDING 1936) EXCEPT RLD MODEL ( These supersede all previous specification and apply to all 1930 to, and including 1936 45" motors

PISTON CLEARANCE - ALUMINUM AND DOW METAL PISTONS - Solid skirt type - used in 1934 and earlier motors fitted with taper bore cylinders -- .014" to .016" clearance. ALUMINUM PISTON -- Slotted, cam ground type - new piston fitted in straight bore cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service. Measure solid skirt piston just below the top group of rings. Measure slotted piston a bottom of skirt, front and rear.

When fitting oversize piston which has vertical slot in addition to horizontal slots, fit with vertical slot forward.

Measure cylinder about ½" from top of bore, front and rear.

PISTON CYLINDER HEAD CLEARANCE - 3/64" to 5/64"

PISTON PIN IN ALUMINUM AND DOW METAL PISTONS - Solid skirt type - .0005" to .001" press fit in piston

PISTON PIN IN ALUMINUM PISTON - Slotted type - Light hand press fit.

PISTON PIN IN UPPER END OF CONNECTING ROD - .001" loose

PISTON RING GAP AND GROOVE CLEARANCE - Taper bore cylinder - .006" gap ½" from top of cylinder: Straight bore cylinder - .010" to .020" gap ½" from top of cylinder. Rings should be .004" loose in grooves

LOWER CONNECTING ROD BEARING - .0007" to .001" loose

CONNECTING RODS - .006" to .010" end play between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT - .0045" loose at inner end of bushing - .002" at outer end of bushing. (Bushing is taper reamed with special reamer.)

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .006" to .007" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY - .004" to .006" end play in crank case.

CAM GEARS - .0005" to .001" loose in crank case and cover bushings - free to .005" end play.

GENERATOR DRIVE GEARS AND SHAFT (1931 and earlier models) - Shaft must be free running fit; have .002" to .004" end play, and .001" to .0015" clearance in bearings. Small bevel gear should be .002" to .003" loose in bushing assembly, and shimmed to allow .002" to .004" clearance between bevel gears.

TAPPET GUIDES - .0005" to .001" press fit in crank case

VALVE GUIDES - .0005" to .001" loose in tappet guides.

# SERVICE SHOP DOPE

No. 198D October 30, 1939

45 CU. IN TWIN MOTOR FITTING SPECIFICATIONS

(1937 AND LATER MODELS EXCEPT WLDR MODEL)

PISTON CLEARANCE - Aluminum Piston - Slotted, cam ground type - new piston fitted in straight bore cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service. Measure piston at bottom of skirt, front and rear.
When fitting oversize piston which has vertical slot in addition to horizontal slots, fit with vertical slot forward.
Measure cylinder about ½" from top of bore, front and rear.

PISTON-CYLINDER HEAD CLEARANCE - 1/16" to 3/32"

PISTON PIN IN PISTON - Light hand press fit

PISTON PIN IN UPPER END OF CONNECTING ROD - .001" loose

PISTON RING GAP AND GROOVE CLEARANCE - Straight bore cylinder - .010" to .020" gap ½" from top of cylinder. Rings should be .004" loose in grooves.

LOWER CONNECTING ROD BEARING - .0007" to .001" loose.

CONNECTING RODS - .006" to .010" end play between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than forked rod.

PINION GEAR SHAFT - .00075" to .00125" loose in roller bearing, and .0005" to .001" loose in cover bushing. Oil hole in cover bushing is 30° ahead of top center and in line (on opposite side) with drilled oil feed channel in cover.

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .006" to .007" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY - .012" to .014" end play in crank case.

CAM GEARS - .0005" to .001" loose in crank case and cover bushings - free to .005" end play.

TAPPET GUIDES - .0005" to .001" press fit in crank case.

VALVE TAPPETS - .0005" to .001" loose in tappet guides.

CRANK CASE BREATHER - Which is a part of, and drives scavenger pump, is timed according to instructions in Riders Instruction Folder.

# SERVICE SHOP DOPE

No. 198E October 30, 1939

SINGLE MOTOR FITTING SPECIFICATIONS - (ALL 1934 AND EARLIER MODELS)

PISTON CLEARANCE - Dow metal and aluminum - .011" to .013" clearance. (measure piston just below the top group of rings, and cylinder about 1/2" from top of bore, front and rear.)

PISTON - CYLINDER HEAD CLEARANCE (side by side valve models) - 3/64" to 5/64"

PISTON PIN IN PISTON - Snug press fit - not over .0005" tight.

PISTON PIN IN UPPER END OF CONNECTING ROD - .0005" loose.

PISTON RING GAP AND GROOVE CLEARANCE - .006" gap 1/2" from top of cylinder. Rings should be .0015" to .002" loose in grooves.

LOWER CONNECTING ROD BEARING - .0003" to .0004" loose.

CONNECTING RODS - .010" to .020" end play between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than rod.

PINION GEAR SHAFT - .0035" loose at inner end of bushing - .0025" loose at outer end of bushing (Bushing is taper reamed with special reamer).

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .006" to .007" loose in chain lubricating bushing.

FLYWHEEL ASSEMBLY - .002" to .006" end play in crank case.

CAM GEARS - .0005" to .001" loose in crank case and cover bushings - free to .005" end play

INTERMEDIATE AND OILER GEARS - .0015" to .002" loose on studs

TAPPET GUIDES - .0005" to .001" press fit in crank case.

VALVE TAPPETS - Free to .00075" loose in tappet guides.

SERVICE SHOP DOPE

No. 198F October 30, 1939

## TIMING SPECIFICATIONS

(NOTE: These supersede all previous specifications)

### 1930 AND LATER 74 & 80 CU. IN TWIN ALL MODELS EXCEPT 1930 & 1931 V AND VC MODELS

INTAKE VALVE - OPENS when piston is - 9/32" to 13/32" before top dead center
CLOSES when piston is 7/8" to 1-1/8" after bottom dead center

EXHAUST VALVE - OPENS when piston is 5/8" to 7/8" before bottom dead center
CLOSES when piston is 1/4" to 3/8" after top dead center

IGNITION - OCCURS when piston is 5/16" to 11/32" before top dead center on compression stroke.
11/32" timing (Flywheel mark at rear of crank case inspection hole) applies to moderate compression motors in solo service. High compression solo motor (8.2 heads) also all motors in sidecar service should be timed 5/16".

### 1930 AND 1931 - 74 CU. IN TWIN V AND VC MODELS

INTAKE VALVE - OPENS when piston is 11/64" to 19/64" before top dead center
CLOSES when piston is 9/16" to 13/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 9/16" to 13/16" before bottom dead center
CLOSES when piston is 11/64" to 19/64" after top dead center

IGNITION - OCCURS when piston is 1/4" to 5/16" before top dead center on compression stroke.

### 1936 AND LATER 61 CU. IN OVERHEAD VALVE TWIN MODELS

INTAKE VALVE - OPENS when piston is 5/16" to 3/8" before top dead center
CLOSES when piston is 15/16" to 1-1/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 49/64" to 55/64" before bottom dead center
CLOSES when piston is 5/16" to 3/8" after top dead center
NOTE: Timing is checked with tappets adjusted with .004" clearance

IGNITION - OCCURS when piston is 7/16" before top dead center on compression stroke.

### 45 CU. IN. TWIN (ALL MODELS EXCEPT WLDR)

INTAKE VALVE - OPENS when piston is 5/32" to 7/32" before top dead center
CLOSES when piston is 37/64" to 45/64" after bottom dead center

EXHAUST VALVE - OPENS when piston is 37/64" to 45/64" before bottom dead center
CLOSES when piston is 5/32" to 7/32" after top dead center

IGNITION - OCCURS when piston is 1/4" to 9/32" before top dead center on compression stroke.

### 30.50 CU. IN. SINGLE (ALL MODELS)

INTAKE VALVE - OPENS when piston is 5/16" to 9/16" before top dead center
CLOSES when piston is 11/16" to 15/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 1/2" to 3/4" before bottom dead center
CLOSES when piston is 1/4" to 1/2" after top dead center



IGNITION - OCCURS when piston is 7/32" to 9/32" before top dead center on compression stroke.

### 21 CU. IN SIDE BY SIDE VALVE SINGLE (ALL MODELS)

INTAKE VALVE - OPENS when piston is 1/8" to 3/16" before top dead center
CLOSES when piston is 7/16" to 9/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 7/16" to 9/16" before bottom dead center
CLOSES when piston is 1/8" to 3/16" after top dead center

IGNITION - OCCURS when piston is 7/32" to 9/32" before top dead center on compression stroke.

### 21 CU IN OVERHEAD VALVE SINGLE (ALL MODELS)

INTAKE VALVE - OPENS when piston is 3/32" to 5/32" before top dead center
CLOSES when piston is 7/16" to 9/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 7/16" to 9/16" before bottom dead center
CLOSES when piston is 3/32" to 5/32" after top dead center

IGNITION - OCCURS when piston is 11/32" to 13/32" before top dead center on compression stroke.

## TAPPET CLEARANCE

NOTE: When checking valve timing according to piston position, bear in mind that tappets must first be adjusted to the correct clearance.

ALL SIDE BY SIDE VALVE MODELS (SINGLE AND TWINS) - INTAKE - .004" to .005"
EXHAUST - .006" to .008"

OVERHEAD VALVE SINGE - INTAKE AND EXHAUST - .002" to .003"

61" OVERHEAD VALVE TWIN - INTAKE AND EXHAUST - Correctly adjusted when tappet has just noticeable play or shake, and can be turned freely with finger tips, completely around, without any trace of bind.

### CIRCUIT BREAKER OPENING - (ALL MODELS)

GENERATOR - .020" to .024"

MAGNETO - .014" to .018"

# SERVICE SHOP DOPE

No. 199 November 11, 1939

## WINTER TROUBLE SAVER

Winter is here or just around the corner. If you already have or will soon have below-freezing weather in your territory, now is the time to get a card or letter to all of your riders suggesting a winter tune-up job. Here are some of the things that need attention in getting ready for winter service:

Battery - Charge, inspect terminal connections and oil terminal felt washers.

Generator - Clean commutator. Inspect brushes and renew any nearly worn out. Check charging rate and if low, adjust higher. Remove bearing cover and pack bearing with Grade A grease.

Circuit Breaker Points - Clean and adjust, or renew.

Spark Plugs - Clean and adjust, or renew.

Valves - Clean carbon and grind valves, or if this is not done, on side valve motors raise valve covers and flush out thoroughly with kerosene while motor is running, to correct possible sticky, sluggish action. Adjust tappets.

Carburetor - Remove and clean thoroughly. At least, remove and clean bowl assembly, or if late carburetor with drain plug, remove plu-, drain and flush bowl. In re-adjusting set throttle stop screw for somewhat faster than normal summer idling. Remove and clean gas strainer.

Clutch - Check for slippage and also for complete disengagement.

Chains - Adjust and report condition, if bad.

Brakes - Adjust and report condition, if bad.

General Lubrication - Thoroughly grease complete machine. Oil control cables and control joints with light oil.

Transmission Oil - Same as motor. When cold enough so that shifting becomes difficult (even with "Medium Heavy" oil, after a motorcycle has stood for a time) add 1/3 to 1/2 pt. of kerosene, to thin oil. Late four speed transmission and also three speed and reverse transmission of the constant mesh type may become very difficult to shift unless this attention is given. Difficult shifting due to stiff oil also means har cranking when starting.

Motor Oil - When temperature is below freezing, change to "Medium Heavy" oil (61 OHV model uses "Medium Heavy" oil year-around)

SPECIAL INFORMATION ON MOTOR LUBRICATION APPLYING TO CIRCULATING OILING SYSTEM

Combustion in any engine generates water vapor. When starting and warming up in cold weather, considerable of the vapor that gets into crankcase condenses to water before crankcase is hot enough so it no longer acts as a condenser and exhausts the vapor through outside breather. If a motor is driven enough to get the crankcase thoroughly warmed up frequently, most of this water is again vaporized and blown out the outside breather. However, a moderately driven motor, seldom thoroughly warmed up, is likely to accumulate an increasing amount of water in oil tank. This water will, in freezing weather, become slush or ice and if allowed to accumulate too long, there is the chance that oil lines may be blocked with resulting damage to motor. Also, water mixed with



oil for some time forms sludge that is harmful to motor and causes undue wear of various working parts. Sludge also contains acid which causes parts to wear and fatigue very rapidly.

In extremely cold weather if motorcycle (particularly Servi-Car) is used daily even though total mileage run is quite low, interval between drains should be approximately one week. As a matter of oil economy during the frequent drain period and also to circulate the complete oil supply at shorter intervals and warm it up quicker to the point of evaporating any water in the system, consideration can be given to filling tank only about half full when fresh oil is added. This should be applied only to motorcycles where you are quite sure that the mileage between drains will be very low or you can depend upon the operator to watch closely to see that oil supply is not exhausted. You will have to be very cautious about doing this to avoid running into claims, where a machine is run far enough to exhaust the oil supply and damage the motor, with the owner or operator contending he understood the oil tank was completely filled as in warm weather and therefore, he feels you are responsible. When only partial filling of oil tank may be practiced it might be well to paste a warning sticker on oil tank cap or on tank near the filler opening.

When putting in fresh oil, in below-freezing weather, add a little kerosene - just enough to keep oil liquid to the point where it flows freely and will begin to circulate immediately when motor is started.

# SERVICE SHOP DOPE

August 7, 1940

## CURRENT AND VOLTAGE REGULATOR

The part number of the current and voltage regulator used on California Highway Patrol motorcycles and other radio-equipped machines is listed in the spare parts catalog as 8375-38. However, this part number includes besides the regulator, the mounting bracket and wiring necessary to use the regulator on a motorcycle not originally equipped with regulator. It has been reported by CHP headquarters that when replacement of current and voltage only has been required, dealers have been using part number 8375-38 even though the wiring and fittings were not needed. In the future, when only the regulator is needed, order Part No. 8375-38A Cureent & voltage regulator only.

While on the subject of current and voltage regulators, we want to mention that the regulator is apparently in a good many cases being blamed for bringing about trouble for which it is not actually responsible. In other words, in the case of a generator found overheated and damaged and also in the case of a regulator found with points in bad condition or damaged, it is in many instances taken for granted that the regulator went bad first and caused the generator to burn up. More likely what has actually happened first in most cases is that a poor or loose battery terminal connection or a loose connection elsewhere took the battery out of the circuit. The regulator then tries to act as both battery and regulator in controlling output of the generator but of course with the high output of a radio generator, the regulator can't stand this condition very long before it becomes overheated and damaged, with generator damage naturally following. We suggest that closer attention be given to keeping battery terminals in good order, battery wires in good condition and connections tight. If you will do this, it is a safe bet you'll not run into any amount of serious trouble either with regulators or generators. In fact, every flat rate job No. 7 on CHP motorcycles and particularly on those with radio generator and current regulator should include a close inspection of battery terminals and terminal connections and any faulty conditions discovered then should be corrected at once.

At this time we want to remind you that the servicing of a current and voltage regulator when trouble has been traced to the regulator should be referred to a United Motors Service Station. This equipment requires adjusting too closely as concerns setting gaps, spring tensions, and current and voltage values to be satisfactorily handled in the average motorcycle repair shop. As mentioned before, giving closer attention to wiring connections will reduce to a minimum attention required by regulators.

# SERVICE SHOP DOPE

No. 208 September 5, 1940

## CONNECTING ROD REPAIR EXCHANGE PRICES

On July 1, 1940, the following charges became effective on connecting rod repair exchanges:

| | List | Net |
|---|---|---|
| Rebushing set of connecting rods at both ends and fitting rollers, retainers and crank pin (any 61-74-80 model, to and including 1941 models) ........... | $ 7.30 | $ 4.75 |
| Rebushing set of connecting rods at both ends only | 5.00 | 3.25 |
| Rebushing set of connecting rods at both ends and fitting rollers, retainers, and crank pin (any 45 model, except WLDR and 1929 to 1931 model without bushings at upper end.** | 7.00 | 4.50 |
| Rebushing set of connecting rods at both ends only | 4.60 | 3.00 |
| Rebushing set of WLDR rods at both ends and fitting 1¼" crank pin with rollers and retainers (fit 1937 to 1941 models) | 12.55 | 8.15 |
| Rebushing WLDR rods at both ends only | 8.10 | 5.25 |

On the basis of the new price schedule, it will obviously be to your advantage and to the advantage of the customer not only to have all connecting rod repairs taken care of at our factory but also to have repaired rods come through fitted with rollers and crank pin. At these prices you are able to offer your customers a factory repair at a large saving over the cost of new parts and still make a fair margin of profit on each exchange. We suggest, too, that you offer these repair exchanges to your customers at our recommended list prices as a little later they will be published in a bulletin to riders.

**Since for the most part connecting rods of the type without bushing in the upper end as used in 45 cu. in. motors from 1929 through part of 1931 either are badly worn at the upper end or have been reamed to large oversizes, we do not consider it practicable to make further repairs on such rods. Consequently, they should not be sent in for exchange or repair, because they will not be accepted but will be scrapped.

It will also be necessary under the foregoing low exchange prices that rods returned for exchange be in perfect condition aside from requiring new bushings. Rods that are badly bent or twisted or otherwise damaged, or rods that have been plated or ground down or polished to a point of weakening them will not be accpeted for exchange; neither will we be in a position to recondition such rods individually. Therefore, you should watch carefully any connecting rods you accept for exchange.

In cases where 1936 45-74-80 rods with thin upper bushings have been sent in for repair, we have in the past made a point of shipping rebuilt rods with same type bushings. Since having thin or thick piston bin bushings does not affect interchangeability of these rods, we will not hereafter make any distinction between the two types. Consequently, if you send in rods with thin bushings and you get rods with heavy bushings in exchange, or vice versa, pay no attention to it.

# SERVICE SHOP DOPE

No. 211 November 5, 1940

## NEW SERVI-CAR TOWBAR CLAMP TO FIT 1941 MODEL AUTOMOBILES

In spite of everything we have been doing to speed up production, there is going to be some further delay in shipment of 1941 style twobar clamps as redesigned to fit latest 1941 car bumpers. The best delivery promise we have been able to get is around December 1, with a possible chance a limited number of clamps will be available somewhat sooner.

Now that all points of design of the new clamp have been settled, we can at least tell you what you are going to need to bring up to date the clamps on the 1941 Servi-Cars you have already received:

7030-39 Set of upper and lower clamp jaws with hand wheel and bolt
7006-39 New longer safety cable

At the time we start using the new clamp in new Servi-Car assembly, our records will show how many 1941 Servi-Cars you have received with old clamp. Without further follow-up on your part, we will ship you as many combination of the new fitting as you have received 1941 Servi-Cars with old clamp.

The combinations we are furnishing you for your early 1941 models will be furnished on a no charge exchange basis if you want it that way. We are actually going to bill these combinations to you at $1.50 net each. If you want to return the original 1941 clamp parts and safety cable, tagged with motor number, you will be credited with the full $1.50 charge. We repeat - it will not be necessary to follow up further for the clamp exchange fittings due you for early '41 Servi-Cars you will have received before we start shipping Servi-Cars with new clamp. All you have to consider are the additional changeover combinations and complete clamps you may need to take care of your owners of earlier than 1941 models.

## SERVICING EARLIER THAN 1941 SERVI-CARS WITH NEW CLAMP FITTINGS

1940 Servi-Cars require the same combination of fittings as listed for early 1941 Servi-Cars. Prices of these fittings are listed below. THERE IS NO EXCHANGE ALLOWANCE APPLYING TO OTHER THAN JUST YOUR EARLY 1941 SERVI-CARS.

1939 Servi-Cars require same combination of fittings. In addition, fork bracket 7009-39A to which clamp is secured when not in use, will have to be reshaped to raise it so clamp clears headlight, or a new bracket installed.

Earlier than 1939 Servi-Cars not equipped with permanently attached towbar but fitted with late vise-type clamp can be serviced with just new jaw combination, but towbars still fitted with earlier type clamp will have to be serviced with new clamp of latest type. New safety cable will be needed for Servi-Cars up to and including 1937, and new cable for 1938 Servi-Cars.

### NEW PARTS FOR 1940 MODELS

| | | list |
|---|---|---|
| 7030-39 | Set clamps only with hand wheel | $ 6.00 |
| 7006-39 | New Safety Cable | 3.50 |

### NEW PARTS FOR 1939 MODELS

| | | |
|---|---|---|
| 7009-39A | Towbar clamp bracket | 1.50 |
| 7030-39 | Set clamps only with hand wheel | 6.00 |
| 7006-39 | New Safety cable | 3.50 |

### NEW PARTS FOR 1932 TO 1938 MODELS

| | | |
|---|---|---|
| 7030-32 | Towbar clamp and swivel complete | 10.00 |
| 7006-32 | Longer safety cable (1932 to 1937) | 2.80 |
| 7006-38 | Longer safety cable (1938) | 3.80 |

# SERVICE SHOP DOPE

No. 215 January 2, 1941

## AN ADDITION TO THE HARLEY-DAVIDSON OIL FAMILY

Up to now we have furnished three grades of Harley-Davidson Oil: "High Speed Special" (140) for unusually hard and fast summer driving; "Regular Heavy" (105) for all ordinary service, all models excepting OHV motors, with temperature above freezing ($32^{\circ}$F.); "Medium Heavy" (75) for year-around service in OHV motors and for below freezing service in all other motors. This has been the lightest oil furnished and in localities where winter weather becomes so cold this oil gets stiff or congeals (approximate $+10^{\circ}$F.) it has been recommended that enough kerosene be added to keep oil fluid so it circulates freely immediately when motor is started.

The fourth grade of oil we will supply from now on is identified as "Light" oil (58) and is recommended for use in all models when winter temperature is below $+10^{\circ}$F. This will eliminate, until temperature reaches several degrees below zero, the need of adding kerosene to keep oil fluid.

Every dealer located where temperature goes to $+10^{\circ}$F. or colder for a longer winter period than just an occasional snappy morning, should order a supply of this new oil and furnish it to his riders. It will make starting easier and since it will circulate freely immediately on starting, it will lessen the possibility of starting and warming up motor damage. It will also have less tendency to form sludge in short run motors. Riders will go for this oil in a big way, some because they have been skeptical about it being o.k. to add kerosene to thin heavier oil, all of them because it eliminates the extra work of adding kerosene and deciding how much to add.

This new light oil is available only in one quart sealed can, in case lots of 24 quarts. Prices are the same as for "regular Heavy" or Medium Heavy" oil. Shipments can be made from our stocks in Milwaukee or Coraopolis, Pa., depending on whichever has the lowest freight rate to your city. Order by part number 11700X and send your order to MILWAUKEE.

# SERVICE SHOP DOPE

No. 216 February 10, 1941

## ROLLER BEARING ROLLERS

Here is a handy chart, giving information on roller bearing rollers. It is suggested that this data be kept in a prominent place so it can be referred to on a moment's notice.

Standard roller diameter is as follows: Large roller .250" - needle rollers (used without retainers) .152", .125", .114" and .0625". .250" and .152" rollers are furnished from .001" undersize to .001" oversize in steps of .0002". .125" and .114" rollers are furnished in .0004" and .0008" oversize only. .0625" roller is furnished in .0008" oversize only.

LARGE ROLLERS

| PART NO. | WHERE USED | NO. USED | LENGTH |
|---|---|---|---|
| 304-15 | Forked end Connecting Rod (1915-1939 61", 74" & 80") | 24 | .360" |
| " | Left crankcase (1929 & earlier 61" & 74" Twins) | 24 | " |
| " | Left crankcase (1929 & later 45" Twins) | 24 | " |
| " | Front Brake Hub (1930-1936 74" & 80" Twins) | 24 | " |
| " | Sidecar Brake Hub (1930-1936, except LE Model) | 28 | " |
| 304-40 | Forked End Connecting Rod (1940 & later 61", 74" & 80") | 36 | .344" |
| 305-15 | Single End Connecting Rod (1915-1939 61", 74" & 80") | 12 | .726" |
| " | Connecting Rod (30.50 Single) | 12 | " |
| " | Clutch Sprocket (1921-1936 61", 74" & 80" except 61" OHV) | 12 | " |
| 305-40 | Single End Connecting Rod (1940-later 61", 74" & 80") | 18 | .694" |
| 305-29 | Single End Connecting Rod (1929-later 45" Twins) | 12 | .550" |
| " | Right Crankcase (1937-later 45" Twins) | 12 | " |
| 306-26 | Right Crankcase (1936-61"; 1937-later 61", 74" & 80") | 12 | .600" |
| " | Connecting Rod (21" Single) | 12 | " |
| " | Left Crankcase (21" & 30.50" Single) | 12 | " |
| 2289-17 | Forked End Connecting Rod (1929-later 45" Twins) | 24 | .270" |
| " | Clutch Sprocket (1926-1934 Singles & 45" Twins) | 16 | " |
| " | Countershaft Gear - Standard Transmission (1931-earlier 61" & 74" Twins) | 24 | " |
| " | Main Drive Gear (1924-earlier 61" & 74" twins) | 20 | " |
| 2289-25 | Left crankcase (1930-later 61", 74" & 80" Twins) | 24 | .490" |
| " | Rear Wheel Hub (1923-1929 61" & 74" Twins) | 32 | " |
| " | Main Drive Gear (1925-1936 61", 74" 80" except 61: OHV) | 20 | " |
| " | Clutch Gear (1934-earlier 45" & Single Standard Trans) | 16 | " |
| " | Mainshaft (1934-earlier 45" & Single Standard Trans) | 12 | " |
| " | Interchangeable Wheel Hub(1930-36 74" & 80" Twins) | 28 | " |
| " | Countershaft Gear-Right Side-(1931 Reverse, 1932-36 Reverse & Standard transmission - 74" & 80") | 12 | " |
| " | Servi-Car Axle Outer Ends (1932 & later) | 24 | " |
| " | Wheel hubs(1935-later 45" rear wheel & 1941 Servi-Car front wheel, 1936 61", 1937-later 61", 74" & 80"-both wheels, "LE" model sidecar wheel | 26 | " |
| 2306-32 | Countershaft Gear-left side (1931 74" reverse, 1932-1936 74" standard & reverse transmission) | 21 | 5/8" |
| " | Clutch Gear-left side(1933-34 45" Twin & Single Reverse 1935-40 45" standard & reverse transmission | 31 | " |
| " | Mainshaft-right side-(1933-34 45" Twin and Single Reverse 1935 & later 45" Standard & reverse transmission | 21 | " |



LARGE ROLLERS

| PART NO. | WHERE USED | NO. USED | LENGTH |
|---|---|---|---|
| 2306-32 | Countershaft gear-left side (1933-1934 45" Twin and single reverse, 1935 & later 45" standard & reverse transmission | 19 | 5/8" |
| 2289-36 | Countershaft Gear (1936 61", 1937 & later 61" 74" & 80" | 44 | .615" |
| " | Main Drive Gear (1936 61". 1937 & later 61", 74" & 80" | 44 | " |
| " | Clutch Gear (1941 45") | 40 | " |
| 2289-39 | Countershaft Gear - right side (1939 & later 45") | 24 | 3/4" |
| 2289-36A | Countershaft Gear (1936, 74" & 80" - 4 Speed) | 78 | 39/64" |

When assembling needle rollers in outer race preparatory to final assembly, apply a small amount of grease to hold rollers in place. Assemble specified number of rollers and observe that the last roller goes all the way into place freely and without requiring any effort to force it. If it doesn't go into place freely, leave it out. This is sometimes necessary when fitting oversize rollers, because they not only take up radial clearance, but also take up circumferential clearance. Roller must not be crowded.

## CONVERSION TABLE

.270" - 6.86 mm.
.344" - 8.74 mm.
.360" - 9.15 mm
.490" - 12.45mm
.550" - 13.97 mm
.600 - 15.24 mm
.615" = 15.62 mm
.694" - 17.63 mm
.726" - 18.44 mm
39/64" - 15.48 mm
5/8" - 15.87 mm
3/4" - 19.05 mm

.001 - .025 mm

# SERVICE SHOP DOPE

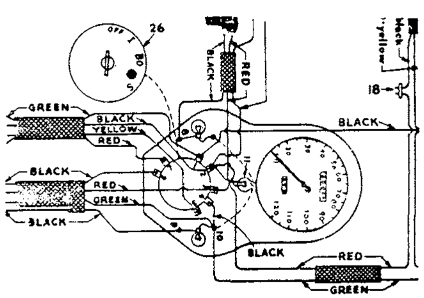
No. 217 (U.S. Army) April 15, 1941

## Ignition-Light Switch Change-Over

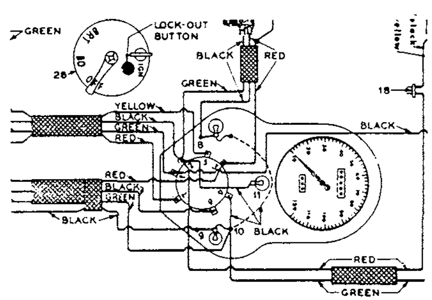
The first Harley-Davidson motorcycles with factory-equipped "blackout lights" furnished the U.S. Army were 1941 WLA models bearing U.S.A. numbers W-64291 to W-64939 inclusive, and W-65448 to W-65747 inclusive. These motorcycles were fitted with an ignition-light switch operated with only a key and lockout button.

Later "blackout light" equipped 1941 WLA models furnished the Army are fitted with a new type switch which has a key for ignition only, and a lever and lockout button to operate lights. U.S.A. numbers of motorcycles fitted with latest switch furnished to date of this Bulletin are W-65748 to W-66647 inclusive, and W-67848 to W-68447 inclusive.

Only the later type switch will be supplied on parts order in the future for replacement requirements applying to all "blackout light" equipped motorcycles. It will be supplied with all necessary extra fittings so it can be used either to replace the earlier type switch, or one of the same type. Harley-Davidson part number of this switch with fittings is 4527-41M.




WIRING CONNECTIONS TO EARLY TYPE SWITCH




WIRING CONNECTIONS WHEN REPLACING EARLY TYPE SWITCH WITH LATE TYPE SWITCH

Note that the same wires connect to terminals with same numbers on both switches:- 1--Black wire from blackout headlight No. 24 and green wire of tail lamp cable from blackout tail lamp No. 23. 2--Black wire from speedometer light No. 11; green wire of generator cable from generator terminal No. 15 marked "Switch"; black wire of tail lamp cable from service tail lamp No. 22; red wire of horn and light cable from terminal No. 18. 3--Red wire of generator cable from relay terminal marked "BAT."; red wire of main cable from terminal No. 19 (under saddle). 4--Black wire from No. 10. 5--Yellow wire of tail lamp cable from blackout stop light No. 23. 6--Black wire of main cable from terminal No. 20 (under saddle). 7--Red wire of tail lamp cable from service stop light No. 22.

Wiring diagrams and information above show and explain wiring connections when early type switch is replaced with later type. No wiring changes are necessary other than

- over -



connections at switch. Diagram of late type switch shows switch (No. 26) in correct position in relation to speedometer and switch panel. Switch is mounted with ignition key forward. Note that while early type switch and late type switch differ as concerns location of terminals and order of numbering, wiring connections according to terminal numbers are the same for both. In other words, wires from early type switch transfer to terminals with same numbers on late type switch. Bear in mind that late type switch diagram shown applies only to a switch change-over. It is not exactly like the wiring diagram in Rider Instruction Folder 45-B applying to motorcycles originally equipped with the later type switch.

Two wires disconnected from early type switch will be found too short to reach their respective terminals on late type switch. These are black wire to No. 6 terminal, and red wire to No. 7 terminal. The required extension wires with corresponding colors are furnished with new switch. Connect these extension wires with small bolts furnished and tape thoroughly so there will be no chance of shorting.

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New type switch is operated as follows: Turn key to right (1/4 turn) to turn ignition on. Key can be removed only when in off position. Removing key locks ignition.

Lights are controlled by lever. Lights are off when lever is in extreme right position, marked OFF. Turn lever to first left position (BO) for "blackout lights." After pressing down lockout button (located above and to right of light switch lever), lever can be turned to second left position (BRT) for bright (standard) running light.

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Bear in mind that above installation instructions apply only when early type switch is replaced with late type switch.

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When a motorcycle equipped with late type switch requires a replacement switch, extra fittings furnished with new switch can be discarded as they will not be needed. In making this installation, the wiring will of course be connected to replacement switch exactly the same as it is found connected to switch being replaced.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

# SERVICE SHOP DOPE

No. 218 Date-April 4-'41

## CRANK CASE BAFFLE PLATES AND CONNECTING ROD ARRANGEMENT

### 1936 and Later Engines with Circulating Oiling System

| 1937-'38 & '39 | 45" MODELS | | 1940 & Later |
|---|---|---|---|
| FRONT | Forked Connecting Rod — front cylinder. | Single End Connecting Rod — front cylinder. | FRONT |
| REAR | Single End Connecting Rod — rear cylinder. | Forked Connecting Rod — rear cylinder. | No Baffles REAR |
| 1936-'37-'38 & '39 61" O.H.V. Models | O.H.V. MODELS | | 1940 & Later O.H.V. Models |
| FRONT | Forked Connecting Rod — front cylinder. | Single End Connecting Rod — front cylinder. | No Baffles FRONT |
| REAR | Single End Connecting Rod — rear cylinder. | Forked Connecting Rod — rear cylinder. | No Baffles REAR |
| 1937-'38 | 74" & 80" SIDE VALVE MODELS | | 1939 & Later |
| FRONT | Forked Connecting Rod — front cylinder. | Single End Connecting Rod — front cylinder. | FRONT |
| REAR | Single End Connecting Rod — rear cylinder. | Forked Connecting Rod — rear cylinder. | No Baffles REAR |

Harley-Davidson Motor Company, Milwaukee, Wis.

## Service Information Applying to All Model "M" Linkert Carburetors on Army Motorcycles

The Model "M" Linkert carburetors used on Army motorcycles are as follows:

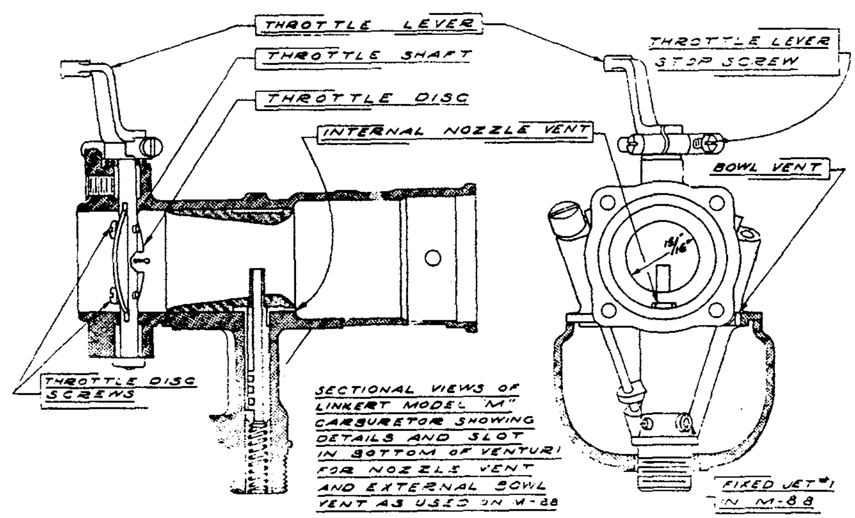
| | | | |
|---|---|---|---|
| M-64 | 1¼" size | M-90 | 1½" size |
| M-65 | " " | M-97 | " " |
| M-84 | " " | M-641 | " " |
| M-88 | " " | | |

All of these models have the model number stamped on the pad on top of the carburetor. A brief description of these carburetors follows:

The M-64 and M-65 models have external or outside nozzle and bowl vents; that is, the air bleed to the nozzle and to the bowl are from external holes drilled in the body casting. These two models are exactly alike except that one has a different size Fixed High Speed Jet than the other. (See instructions below). These two models are used with a standard (not oil bath) air cleaner.

The M-84 model has an internal vent in the form of a tube extending back of the venturi and pointing into the air stream. This vent supplies the air bleed to the nozzle. The bowl is vented through a hole drilled in the body and opening externally or outside. This model is used with an oil bath air cleaner and is equipped with a Fixed High Speed Jet (see instructions below).

The M-88 model has an internal vent to the nozzle in the form of a slot out in the lower side of the venturi on the air intake end. The bowl vent is external and the same as in M-64, M-65 and M-84. This model is equipped with a Fixed High Speed Jet (see instructions below) and is used with an oil bath air cleaner.




SECTIONAL VIEWS OF LINKERT MODEL "M" CARBURETOR SHOWING DETAILS AND SLOT IN BOTTOM OF VENTURI FOR NOZZLE VENT AND EXTERNAL BOWL VENT AS USED ON M-88

The M-90 model has an internal vent to the nozzle in the form of a slot cut in the lower side of the venturi on the air intake end. The bowl vent is external and the same as in M-64, M-65, M-84 and M-88. This model is equipped with Fixed High Speed Jet (see instructions below) and is used with an oil bath air cleaner. Bowl on M-90 model is different than on M-64, M-65, M-84 and M-88 in that this bowl uses a special gasket between upper edge of the bowl and the lower face of the body. This gasket must always be located in its proper place to seal the bowl to the body. Use a new gasket if the old one is the least damaged or defective. If gasket is not properly located, gasoline leakage at bowl will result.

M-97 model has an internal vent in the form of a tube extending into the air stream and back of the venturi. This vent supplies both the air bleed for the nozzle and the vent for the bowl. There are no external vents on this model. The special bowl gasket between the upper edge of the bowl and the lower face of the body must always be properly located and in place to seal the bowl to the body. Use a new gasket if the old one is the least damaged or defective. If this gasket is not correctly assembled, leakage of air will take place at the bowl edge and will cause the internal nozzle and bowl vent to be inoperative. This model is used with an oil bath air cleaner and is equipped with a Fixed High Speed Jet (see instructions below). Use M-90 model when replacement carburetor is needed.

The M-641 model has the same arrangement of vents as the M-88 and is used with an oil bath air cleaner. The M-641 carburetor is not equipped with a Fixed High Speed Jet. It has a standard High Speed Needle adjustment (adjusting needle near the air intake end of the carburetor and to the left looking at the air intake end). This adjustment should be set to $1\frac{1}{4}$ turns open for initial adjustment and then set in operation to the best setting for power, being sure not to adjust it too lean thus causing excessive engine heating.

The M-64, M-65, M-84, M-88, M-90, and M-97 carburetors with Fixed High Speed Jet are equipped with a special short needle valve to shut off the opening provided for variable high speed adjusting needle which is standard instead of fixed jet for all commercial motorcycle carburetors and also applies to M-641 Army carburetor. A locking plug screwed in above it locks it in place. This needle valve and its locking plug are located in the same place as just described for the High Speed adjustment in the M-641 model. This needle valve in M-64, M-65, M-84, M-88, M-90, and M-97 carburetors must always be fully seated or screwed down to a tight seat and the locking plug must be screwed down firmly to hold this needle valve in place. All high speed fuel in these models is delivered through High Speed Fixed Jet and there is no other adjustment for the high speed mixture.

All models have exactly the same bowl both in casting shape and in the complete float mechanism, except the M-90 and M-97 which both use the same special bowl. However, this special bowl contains the same parts as for all of the other carburetors.

## SERVICE NOTES APPLYING TO FAULTY CARBURETORS

These notes apply to carburetors which have been in service for some time and have become dirty, full of "crust" in the throttle barrel, and are found to be difficult to get adjusted properly. Usually the effect of excessive dirt or "crust" formation in the carburetor throttle barrel, around the throttle disc and in the fuel mixture passageways, is to cause the carburetor to have a lean spot off idle. This "crust" should be removed, particularly when a lean spot comes in at speeds off idle up to 30 M.P.H. with the low speed (idle) adjustment set properly for idling. The idle adjustment should not be set to the very lean side when checking this point, but to a point about five to ten notches rich from the setting where the motor dies from leanness.



## HOW TO REMOVE THE CRUST

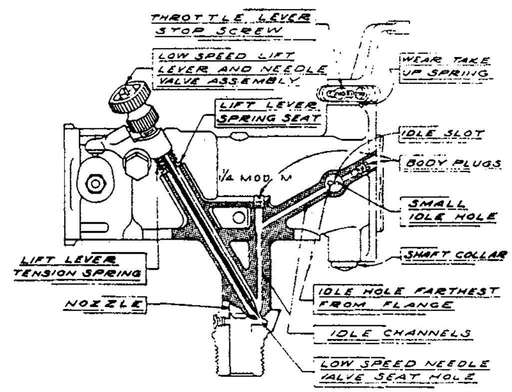
1. Back off the throttle lever stop screw so that the throttle disc closes tightly. With a sharp pointed tool like a sharp pen knife or scriber, scratch a line deeply on the closed throttle disc and also on the throttle barrel so that the lines on the disc and on the barrel meet. These lines should "jibe up" again when you replace the disc. Remove the throttle lever, throttle disc and shaft, the idle hole body plug next to the idle holes in the throttle barrel, the body plugs in the carburetor flange and carburetor body idle channels, and the low speed (idle) lift lever and needle valve assembly. Also remove the venturi and nozzle.

2. Scrape out the caking or "crust" in the throttle barrel with a scraper or knife, being sure not to cut into the metal.

3. Clean up the throttle disc by rubbing it on both sides on emery cloth on a flat plate and clean the edge of the disc all around, being careful not to round the corners or cut into the metal.

4. Clean out the idle holes in the throttle barrel next to the disc with the proper size drills. See list for proper sizes for both holes for all models of carburetors.

| Model (Stamped in top of Carb.Body) | Carb. Size | Venturi Size | Small Idle Hole Nearest Manifold Flange Drill Size | Idle Hole Farthest from Manifold Flange Drill Size | Slot Width | Fixed Jet No. |
|---|---|---|---|---|---|---|
| M-64 | $1\frac{1}{4}$" | 1-1/16" | #70 | #55 | .009" | #4 |
| M-65 | $1\frac{1}{4}$" | 1-1/16" | #70 | #55 | .009" | #5 |
| M-84 | $1\frac{1}{4}$" | 1-1/16" | #70 | #55 | .009" | #5 |
| M-88 | $1\frac{1}{4}$" | 15/16" | #70 | #55 | .009" | #1 |
| M-90 | $1\frac{1}{4}$" | 15/16" | #70 | #55 | .009" | #1 |
| M-97 | $1\frac{1}{4}$" | 1-1/16" | #72 | #55 | .009" | #5 |
| M-641 | $1\frac{1}{4}$" | 15/16" | #70 | #55 | .009" | --- |




VIEW OF LINKERT MODEL "M" CARBURETOR SHOWING LOW SPEED NEEDLE VALVE, LIFT LEVER SPRING SEAT, LOW SPEED NEEDLE VALVE SEAT HOLE, IDLE HOLES AND SLOT, BODY PLUGS, AND IDLE CHANNELS

5. Clean out the slot of all models by inserting the tool with the .009" blade through the slot between the two idle holes.

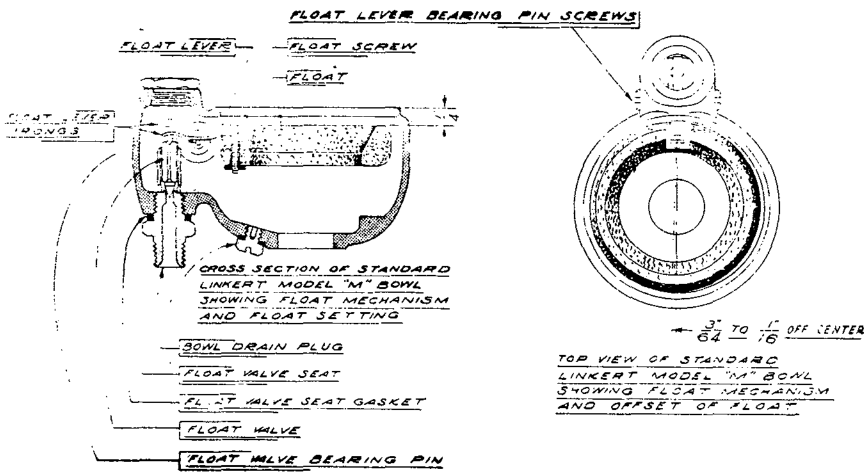
6. Clean out the idle channels with the #42 drill. When cleaning vertical idle channel do not completely bottom drill as doing so may damage the low speed needle seat.

7. Clean out the low speed (idle) needle valve seat hole with the proper drill size. The M-64, M-65, M-84, M-88, M-90, and M-97 carburetors are cleaned with the #53L drill. The M-641 is cleaned with the #53L#2 drill which has a smaller handle. (This tool has two rings around its handle.)

8. Blow out all channels and holes with compressed air and wash all parts in gasoline.

9. Re-assemble the parts, being sure the lift lever spring seat (washer) is between the spring and carburetor body when assembling the low speed lift lever and needle valve assembly back into place. This spring seat or washer limits the air bleed to the idle system and must be in place; otherwise carburetor cannot be adjusted for satisfactory motor idling.

Be sure the throttle disc is assembled in the barrel properly and closes off tight. Have the correct side of the disc up or toward the flange and with the lines you scratched lining up with each other exactly. Push up the shaft collar (on the throttle shaft) firmly against the body before tightening the throttle disc screws. The throttle lever should be clamped to the shaft with the disc wide open and with the throttle lever wide open stop against the body lug and with wear take-up spring between the throttle lever and bearing.




CROSS SECTION OF STANDARD LINKERT MODEL "M" BOWL SHOWING FLOAT MECHANISM AND FLOAT SETTING

TOP VIEW OF STANDARD LINKERT MODEL "M" BOWL SHOWING FLOAT MECHANISM AND OFFSET OF FLOAT

## ATTENTION TO MODEL "M" LINKERT CARBURETOR BOWLS

10. If the carburetor bowl continually leaks or runs over, remove it from the carburetor body and first remove all dirt by cleaning it out with gasoline and compressed air. Hold the bowl up-side-down so that the float valve closes and suck on the bottom of the float valve seat. The valve and seat should hold this suction. If the valve and seat leak after repeated testing, replace with a new float valve and float valve seat.

11. If the float is damaged or "logged" replace with a new float. Remove the old float by cutting the seal around the float screw which fastens the float to the float lever. This seal can be cut with a pocket knife. Remove the float screw and assemble the new float to the lever. This should be done with the float valve, float valve lever, float hinge pin and screws, float valve seat and gasket assembled in the bowl. Before tightening float screw securely, adjust as follows: Looking down on bowl with gasoline inlet side away from you, pull float toward you to the limit of slot in float lever and about 1/16" to left of center line. This provides



necessary body clearance. Tighten the float screw and cement the top of the float screw to the float with Dupont Household Cement, or with a mixture of celluloid dissolved in acetone, or with thick shellac. When the cement has dried thoroughly, check the float height and adjust as explained in 12.

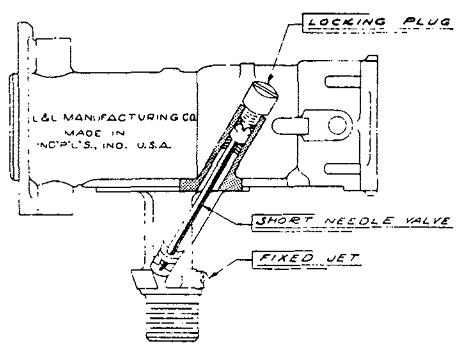
12. Check float level, and if necessary, re-set to 1/4". Measure directly opposite float lever with bowl held up-side-down (top of float to top of bowl). When re-adjusting Linkert carburetor float, do not attempt to do so by simply bending float lever upward in some manner, without dis-assembling from bowl. Re-adjusting in this manner bends and spreads the fingers between which the head of float needle fits, and thus develops lost motion between float and needle. Float and lever assembly should be removed from bowl, and lever then bent as required.

Before re-assembling, see that needle head is a good free fit between lever fingers with not more than approximately .003" play. This clearance can also be checked after the lever is assembled in bowl, by carefully placing a small screw driver or a small rod against the valve head in such a position that it will hold the valve firmly against the seat and yet not bind the lever. Moving the lever up and down will then show the amount of actual clearance between the valve head and fingers. If this clearance is excessive, the float mechanism will not feed properly. After assembling note that float is approximately square with top of bowl.

13. The bowl drain plug now being used in the Model "M" carburetors can be removed for quick flushing of the bowl. Before removing this plug, turn off the gas at the tanks. Be sure to pull this screw up tight when replacing.

## ADJUSTING CARBURETOR ON MOTOR

14. The low speed needle is the adjusting needle to the right (looking at the air intake end). If low speed needle is so far out of adjustment that motor does not start readily, screw it down until needle knurl bottoms, then unscrew it about three to four turns. After starting the engine, unscrew it further if too lean or turn it down if too rich. After motor has "warmed up" set low speed needle for smooth idling. Be sure choke is wide open before making idle mixture adjustments. Too rich an idle adjustment will cause excessive rolling, and too lean an adjustment will result in idle dying or very rough and unsteady operation. Starting and all-around carburetion are better with low speed adjustment slightly rich rather than as lean as it can be made and with throttle stop screw set for reasonably fast idling.




VIEW OF LINKERT MODEL "M" ARMY CARBURETOR SHOWING FIXED JET, SHORT NEEDLE AND LOCKING PLUG

15. There is no manual high speed adjustment on the M-64, M-65, M-84, M-88, M-90, and M-97 carburetors as explained above. These models are equipped with Fixed High Speed Jet as listed in the chart. Fixed high speed jet in these carburetors is effected by replacing one of the small drill hole plugs, near lower end of carburetor body, with a special jet plug. The size of hole in jet plug varies with carburetors of different models. Bear in mind, however, that this special jet plug cannot be duplicated by simply drilling a hole with a drill of certain size through one of the regular solid drill hole plugs. Several plugs drilled with the same

drill will vary considerably in the amount of fuel they flow. Therefore, each jet made at the carburetor factory must be tested individually on a flow meter to be sure of uniform flow, or in other words, uniform carburetor adjustment. In no case should jets be manufactured or re-drilled to different size. If a new jet is needed, order by number from the factory.

All fixed jets are numbered on the face next to the screw slot. Be very careful in handling. Particularly do not mar the screw driver slot. Use a screw driver blade that fits the slot and pull up the jet so that the taper end of the jet seats slightly in the carburetor body. Always place the fixed jet in the carburetor body hole pointing to the rear of the motorcycle.

16. To set the High Speed adjustment on the M-641 model, see the instructions given in the note about this model at the beginning of these notes.

HARLEY-DAVIDSON MOTOR CO.
8-6-41 Milwaukee, Wis., U.S.A.

# SERVICE SHOP DOPE

No. 220 May 1, 1941

USE OF PISTON SQUARING GAUGE ON THE 74" OHN MOTOR

Due to the miller reliefs in the lower skirt edge of the O.H.V., 74" pistons, it is impossible to accurately check rod alignment against piston squaring gauge #11919X.

The mechanic can slip an O.H.V. 61" piston temporarily on the rod for the purpose of making this check. The 61" piston skirt is not relieved permitting it to seat squarely on the gauge.

In the absence of a 61" piston a side valve 74" or 80" piston may be used, although the greater skirt length will not give quite as favorable a check.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U. S. A.

# SERVICE SHOP DOPE

No. 221 June 6, 1941

74 CU. IN TWIN MOTOR FITTING SPECIFICATION (1941 O.H.V. MODELS)

PISTON CLEARANCE -- ALUMINUM PISTON -- Slotted, cam ground type - new piston fitted in cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquire more clearance after short time in service.
Measure piston at bottom of skirt, front and rear.
Measure cylinder about 1/2" from top of bore, front and rear.

PISTON PIN IN PISTON -- Light hand press fit.

PISTON PIN IN UPPER END OF CONNECTING ROD -- .0008" to .0012" loose.

PISTON RING GAP AND GROOVE CLEARANCE -- .010" to .020" gap ½" from top of cylinder. Rings should be .004" loose in grooves.

LOWER CONNECTING ROD BEARING -- .001" to .0012" loose

CONNECTING RODS -- .006" to .010" end play between flywheels -- roller and retainer assembly should be narrower, but not more than .010" narrower than forked rod.

SPROCKET SHAFT -- .0005" to .001" loose in roller bearing - .007" to .009" loose in oil retaining bushing.

PINION GEAR SHAFT -- .0008" to .0012" loose in roller bearing - .0005" to .001" loose in cover bushing. Oil hole in cover bushing is centered with drilled oil feed channel in cover.

FLYWHEEL ASSEMBLY -- .012" to .014" end play in crank case.

CAM GEAR -- .001" to .0015" loose in crank case and cover bushings -- free to .005" end play.

INTERMEDIATE GEARS -- .001" to .0015" loose - free to .005" end play

TAPPET GUIDES -- .0005" to .001" press fit in crank case

VALVE TAPPETS -- .0005" to .001" loose in tappet guides.

ROCKER ARM FIT ON SHAFT -- .0005" to .0015"loose - .007" to .016" end play.

OIL PUMP DRIVE SHAFT -- .0008" to .0012" loose in crank case bushing.

CRANK CASE BREATHER -- Timed with front cylinder - opens 1/8" before top center to 1/8" after top center, and closes 13/16" to 1-5/16" after bottom center.

# SERVICE SHOP DOPE

No. 221A June 6, 1941

61 CU. IN TWIN MOTOR FITTING SPECIFICATION (1936 AND LATER O.H.V. MODELS)

(NOTE: These supersede all previous specifications.)

PISTON CLEARANCE -- ALUMINUM PISTON -- Slotted, cam ground type -- New piston fitted in cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.

Measure piston at bottom of skirt, front and rear.

Measure cylinder about 1/2" from top of bore, front and rear.

PISTON PIN IN PISTON -- Light hand press fit.

PISTON PIN IN UPPER END OF CONNECTING ROD -- .0008" to .0012" loose

PISTON RING GAP AND GROOVE CLEARANCE -- .010" to .020" gap ½" from top of cylinder Rings should be .004" loose in grooves.

LOWER CONNECTING ROD BEARING - .001" to .0012" loose

CONNECTING RODS -- .006" to .010" end play between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than forked rod.

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .007" to .009" loose in oil retaining bushing.

PINION GEAR SHAFT - (Solid and two piece type) - .0008" to .0012" loose in roller bearing, and .0005" to .001" loose in cover bushing. Oil hole in cover bushing is centered with drilled oil feed channel in cover.

Two piece stub shaft assembly -- cork sealed, oil tight fit in flywheel shaft with copper washer behind.

FLYWHEEL ASSEMBLY - .012" to .014" end play in crank case.

CAM GEAR - .001" to .0015" loose in crank case and cover bushings - free to .005" end play.

INTERMEDIATE GEARS -- .001" to .0015" loose - free to .005" end play.

TAPPET GUIDES - .0005" to .001" press fit in crank case.

VALVE TAPPETS -- .0005" to .001" loose in tappet guides

ROCKER ARM FIT ON SHAFT - (1936-1937 models) .0005" to .0015" loose - .003" to .008" end play. (1938 & later models) .0005" to .0015" loose - .007" to .016" end play

OIL PUMP DRIVE SHAFT - .0008" to .0012" loose in crank case bushing.

CRANK CASE BREATHER - Timed with front cylinder - opens 1/8" before top center to 1/8" after top center; and closes 13/16" to 1-5/16" after bottom center.

# SERVICE SHOP DOPE

No. 221B June 6, 1941

74 AND 80 CU. IN TWIN MOTOR FITTING SPECIFICATION (1937 AND LATER S.V. MODELS)

PISTON CLEARANCE - ALUMINUM PISTON - Slotted, cam ground type - New piston fitted in straight bore cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.

Measure piston at bottom of skirt, front and rear.

When fitting oversize piston which has vertical slot in addition to horizontal slots, fit with vertical slot forward.

Measure cylinder about 1/2" from top of bore, front and rear.

PISTON-CYLINDER HEAD CLEARANCE - 1/16" to 3/32"

PISTON PIN IN PISTON - Light hand press fit.

PISTON PIN IN UPPER END OF CONNECTING ROD - .0008" to .0012"

PISTON RING GAP AND GROOVE CLEARANCE - Straight bore cylinder .010" to .020" gap ½" from top of cylinder. Rings should be .004" loose in grooves.

LOWER CONNECTING ROD BEARING - .001" to .0012" loose.

CONNECTING RODS - .006" to .010" clearance between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than forked rod.

PINION SHAFT - .0006" to .0012" loose in roller bearing, and .0005" to .001" loose in cover bushing. Oil hole in cover bushing is 30° ahead of top center, and in line (on opposite side) with drilled oil feed channel in cover.

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .007" to .009" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY - .012" to .014" end play in crank case.

CAM GEARS - .0005" to .001" loose in crank case and cover bushings - free to .005" end play.

INTERMEDIATE GEAR - .001" to .0015" loose on stud.

TAPPET GUIDES - .0005" to .001" press fit in crank case.

VALVE TAPPETS - .0005" to .001" loose in tappet guides.

CRANK CASE BREATHER - Which is a part of, and drives scavenger pump, is timed according to instructions in Riders Instruction Folder.

# SERVICE SHOP DOPE

No. 221C June 6, 1941

## 74 AND 80 CU. IN. TWIN MOTOR FITTING SPECIFICATIONS (1930 TO AND INCLUDING 1936 MODELS)

(NOTE: These supersede all previous specifications)

PISTON CLEARANCE -- IRON ALLOY PISTONS -- Used in 1930-34 motors fitted with taper bore cylinders -- .004" to .005" clearance.
ALUMINUM AND DOW METAL PISTONS - Solid skirt type - used in 1930-34 motors fitted with taper bore cylinders - .016" to .018" clearance.
ALUMINUM PISTON -- Slotted, cam ground type - New piston fitted in straight bore cylinder .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.

Measure solid skirt piston just below top group of rings. Measure slooted piston at bottom of skirt, front and rear.

When fitting oversize piston which has vertical slot in addition to horizontal slots, fit with vertical slot forward.

Measure cylinder about ½" from top of bore, front and rear.

PISTON - CYLINDER HEAD CLEARANCE (all models except VC Commercial) 1/16" to 3/32" (VC Commercial, discontinued after 1933 7/64" to 9/64")

PISTON - PIN IN IRON ALLOY PISTON -- .0005" to .001" press fit in lock pin side -- plug or slip fit in opposite side.

PISTON PIN IN DOW METAL AND ALUMINUM PISTONS - Solid skirt type - .0005" to .001" press fit in piston.

PISTON PIN IN ALUMINUM PISTON - Slotted type - light hand press fit.

PISTON PIN IN UPPER END OF CONNECTING ROD -- .0008" to .0012" loose.

PISTON RING GAP AND GROOVE CLEARANCE - Taper bore cylinder .006" gap ½" from top of cylinder
Straight bore cylinder .010" to .020" gap ½" from top of cylinder.
Rings should be .004" loose in Dow Metal & Aluminum piston grooves and just free in Iron Piston grooves.

LOWER CONNECTING ROD BEARING - .001" to .00125" loose.

CONNECTING RODS - .006" to .010" clearance between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT - .0045" loose at inner end of bushing - .002" loose at outer end of bushing (Bushing is taper reamed with special reamer)

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .006" to .007" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY - .006" to .010" end play in crank case

CAM GEARS - .0005" to .001" loose in crank case and cover bushings - free to .005" end play.

INTERMEDIATE GEAR - .001" to 0015" loose on stud.

TAPPET GUIDES - .0005" to .001" press fit in crank case.

VALVE TAPPETS - .0005" to .001" loose in tappet guides.

# SERVICE SHOP DOPE

No. 221D June 6, 1941

## 45 CU. IN TWIN MOTOR FITTING SPECIFICATION (1937 AND LATER MODELS) EXCEPT WLDR & WR

NOTE: These supersede all previous specification. Last specification sheet 10/30/39

PISTON CLEARANCE - ALUMINUM PISTON - Slotted, cam ground type - new piston fitted in straight bore cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.

Measure piston at bottom of skirt, front and rear.

When fitting oversize piston which has vertical slot in addition to horizontal slots, fit with vertical slot forward.

Measure cylinder about ½" from top of bore, front and rear.

PISTON-CYLINDER HEAD CLEARANCE - 1/16" to 3/32"

PISTON PIN IN PISTON - Light hand press fit.

PISTON PIN IN UPPER END OF CONNECTING ROD - .0008" to .0012"

PISTON RING GAP AND GROOVE CLEARANCE - Straight bore cylinder - .010" to .020" gap ½" from top of cylinder. Rings should be .004" loose in grooves.

LOWER CONNECTING ROD BEARING - .0007" to .001" loose.

CONNECTING RODS - .006" to .010" play between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than forked rod.

PINION GEAR SHAFT - .0008" to .0012" loose in roller bearing, and .0005" to .001" loose in cover bushing. Oil hole in cover bushing is 30° ahead of top center and in line (on opposite side) with drilled oil feed channel in cover.

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .006" to .007" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY - .012" to .014" end play in crank case.

CAM GEARS - .0005" to .001" loose in crank case and cover bushings - free to .005" end play.

TAPPET GUIDES - .0005" to .001" press fit in crank case.

VALVE TAPPETS - .0005" to .001" loose in tappet guides.

CRANK CASE BREATHER - Which is a part of, and drives, scavenger pump, is timed according to instructions in Riders Instruction Folder.

# SERVICE SHOP DOPE

No. 221 E June 6, 1941

45 CU. IN TWIN MOTOR FITTING SPECIFICATIONS (1930 TO AND INCLUDING 1936) EXCEPT RLDR

PISTON CLEARANCE - ALUMINUM AND DOW METAL PISTONS -- Solid skirt type - used in 1934 and earlier motors fitted with taper bore cylinders -- .014" to .016" clearance.
ALUMINUM PISTON - Slotted, cam ground type - new piston fitted in straight bore cylinder .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.
Measure solid skirt piston just below the top group of rings.
Measure slotted piston at bottom of skirt, front and rear.
When fitting oversize piston which has vertical slot in addition to horizontal slots, fit with vertical slot forward.
Measure cylinder about ½" from top of bore, front and rear.

PISTON-CYLINDER HEAD CLEARANCE -- 3/64" to 5/64"

PISTON PIN IN ALUMINUM AND DOW METAL PISTONS - Solid skirt type .0005" to .001" press fit in piston.

PISTON PIN IN ALUMINUM PISTON -- Slotted type - light hand press fit

PISTON PIN IN UPPER END OF CONNECTING ROD -- .0008" to .0012" loose

PISTON RING GAP AND GROOVE CLEARANCE - Taper bore cylinder .006" gap ½" from top of cylinder
Straight bore cylinder - .010" to .020" gap ½" from top of cylinder
Rings should be .004" loose in grooves.

LOWER CONNECTING ROD BEARING - .0007" to .001" loose

CONNECTING RODS - .006" to .010" end play between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than front rod.

PINION GEAR SHAFT - .0045" loose at inner end of bushing - .002" at outer end of bushing (bushing is taper reamed with special reamer).

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .006" to .007" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY - .004" to .008" end play in crank case.

CAM GEARS - .0005" to .001" loose in crank case and cover bushings - free to .005" end play.

GENERATOR DRIVE GEARS AND SHAFT (1931 and earlier models) - Shaft must be free running fit; have .002" to .004" end play, and .001" to .0015" clearance in bearings. Small bevel gear should be .002" to .003" loose in bushing assembly, and shimmed to allow .002" to .004" clearance between bevel gears.

TAPPET GUIDES - .0005" to .001" press fit in crank case

VALVE TAPPETS - .0005" to .001" loose in tappet guides.

# SERVICE SHOP DOPE

No. 221F June 6, 1941

SINGLE MOTOR FITTING SPECIFICATIONS - (ALL 1934 AND EARLIER MODELS)

(NOTE: These supersede all previous specifications)

PISTON CLEARANCE - Dow metal and aluminum - .011" to .013" clearance. (Measure piston just below the top group of rings, and cylinder about 1/2" from top of bore, front and rear).

PISTON - CYLINDER HEAD CLEARANCE (Side by side valve models) - 3/64" to 5/64"

PISTON PIN IN PISTON - Snug press fit - not over .0005" tight.

PISTON PIN IN UPPER END OF CONNECTING ROD - .0005" loose

PISTON RING GAP AND GROOVE CLEARANCE - .006" gap 1/2" from top of cylinder. Rings should be .0015" to .002" loose in grooves.

LOWER CONNECTING ROD BEARING - .0003" to .0004" loose

CONNECTING RODS - .010" to .020" end play between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than rod.

PINION GEAR SHAFT - .0035" loose at inner end of bushing - .0025" loose at outer end of bushing. (Bushing is taper reamed with special reamer.)

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .006" to .007" loose in chain lubricating bushing.

FLYWHEEL ASSEMBLY - .002" to .006" end play in crank case.

CAM GEARS - .0005" to .001" loose in crank case and cover bushings - free to .005" end play

INTERMEDIATE AND OILER GEARS - .0015" to .002" loose on studs

TAPPET GUIDES - .0005" to .001" press fit in crank case

VALVE TAPPETS - Free to .00075" loose in tappet guides.

# SERVICE SHOP DOPE

No. 221G June 6, 1941

## TIMING SPECIFICATIONS

1930 and LATER 74 & 80 CU. IN. S.V. TWIN - ALL MODELS EXCEPT 1930 & 1931 V AND VC MODELS

INTAKE VALVE -- OPENS when piston is 9/32" to 13/32" before top dead center
CLOSES when piston is 7/8" to 1-1/8" after bottom dead center

EXHAUST VALVE -- OPENS when piston is 5/8" to 7/8" before bottom dead center
CLOSES when piston is 1/4" to 3/8" after top dead center.

IGNITION -- OCCURS when piston is 5/16" to 11/32" before top dead center on compression stroke.

11/32" timing (flywheel mark at rear of crank case inspection hole) applies to moderate compression motors in solo service. High compression solo motor (8.2 heads) also all motors in sidecar service should be timed 5/16".

1930 AND 1931 74 CU. IN TWIN V AND VC MODELS

INTAKE VALVE - OPENS when piston is 11/64" to 19/64" before top dead center
CLOSES when piston is 9/16" to 13/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 9/16" to 13/16" before bottom dead center
CLOSES when piston is 11/64" to 19/64" after top dead center

IGNITION - OCCURS when piston is 1/4" to 5/16" before top dead center on compression stroke.

1936 AND LATER 61 CU. IN OVERHEAD VALVE TWIN MODELS

INTAKE VALVE - OPENS when piston is 5/16" to 3/8" before top dead center
CLOSES when piston is 15/16" to 1-1/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 3/4" to 7/8" before bottom dead center
CLOSES when piston is 5/16" to 3/8" after top dead center.

IGNITION - OCCURS when piston is 7/16" before top dead center on compression stroke.

74 CU. IN OVERHEAD VALVE TWIN MODELS

INTAKE VALVE - OPENS when piston is 3/8" to 7/16" before top dead center
CLOSES when piston is 1-3/64" to 1-11/64" after bottom dead center

EXHAUST VALVE - OPENS when piston is 27/32" to 31/32" before bottom dead center
CLOSES when piston is 3/8" to 7/16" after top dead center.

IGNITION - OCCURS when piston is 7/16" before top dead center on compression stroke.

45 CU. IN. TWIN (ALL MODELS EXCEPT WLDR & WR)

INTAKE VALVE - OPENS when piston is 5/32" to 7/32" before top dead center
CLOSES when piston is 37/64" to 45/64" after bottom dead center

EXHAUST VALVE - OPENS when piston is 37/64" to 45/64" before bottom dead center
CLOSES when piston is 5/32" to 7/32" after top dead center.

IGNITION -- OCCURS when piston is 1/4" to 9/32" before top dead center on compression stroke.



30.50 CU. IN. SINGLE (ALL MODELS)

INTAKE VALVE - OPENS when piston is 5/16" to 9/16" before top dead center
CLOSES when piston is 11/16" to 15/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 1/2" to 3/4" before bottom dead center
CLOSES when piston is 1/4" to 1/2" after top dead center

IGNITION -- OCCURS when piston is 1/4" to 5/16" before top dead center on compression stroke.

21 CU. IN. SIDE BY SIDE VALVE SINGLE (ALL MODELS)

INTAKE VALVE - OPENS when piston is 1/8" to 3/16" before top dead center
CLOSES when piston is 7/16" to 9/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 7/16" to 9/16" before bottom dead center
CLOSES when piston is 1/8" to 3/16" after top dead center

IGNITION - OCCURS when piston is 7/32" to 9/32" before top dead center on compression stroke.

21 CU. IN OVERHEAD VALVE SINGLE (ALL MODELS)

INTAKE VALVE - OPENS when piston is 3/32" to 5/32" before top dead center
CLOSES when piston is 7/16" to 9/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 7/16" to 9/16" before bottom dead center
CLOSES when piston is 3/32" to 5/32" after top dead center

IGNITION -- OCCURS when piston is 11/32" to 13/32" before top dead center on compression stroke.

## TAPPET CLEARANCES

NOTE: When checking valve timing according to piston position, bear in mind that tappets must first be adjusted to the correct clearances.

ALL SIDE BY SIDE VALVE MODELS (SINGLES AND TWINS) --

INTAKE -- .004" to .005"
EXHAUST - .006" to .008"

OVERHEAD VALVE SINGLE -- INTAKE AND EXHAUST - .002" to .003"

OVERHEAD VALVE TWINS -- INTAKE AND EXHAUST - Correctly adjusted when tappet has just noticeable play or shake, and can be turned freely with finger tips, completely around, without any trace of bind.

## CIRCUIT BREAKER OPENING

All models -- .020" to .024"

SERVICE SHOP DOPE

No. 222 (U.S. Army) June 25, 1941

## IGNITION-LIGHT SWITCH REPLACEMENT

The first Harley-Davidson motorcycles with factory-equipped "blackout lights" furnished the U.S. Army were 1941 WLA models bearing U.S.A. numbers W-64291 to W64939 inclusive, and W-65448 to W65747 inclusive. These motorcycles were fitted with "Mico" ignition-light switch operated with only a key and lockout button.

Later "blackout light" equipped 1941 WLA models furnished the Army were fitted with "Remy" switch with a key for ignition only, and a lever and lockout button to operate lights. U.S.A. numbers of motorcycle fitted with this switch are W-65748 to W66647 inclusive, and W-67848 to W68012 inclusive.

Latest "blackout light" equipped WLA models starting with W68013 are fitted with a Harley-Davidson switch the same as found in this replacement kit. This switch has a winged knob for turning ON and OFF both ignition and lights. It also has a service light lockout button. Switch is provided with lock and key to permit locking, if desired, when motorcycle is not in use. When switch is unlocked and motorcycle is in use, key should be removed from lock. Only this Harley-Davidson switch (Part No. 4527-41M) is now supplied for replacement requirements applying to all "Blackout light" equipped motorcycle. Switch positions: - Turn LEFT all the way for OFF (This is the only position in which switch can be locked); turn to first right position for ignition only; turn to second right position for ignition and "blackout lights"; press lockout button and turn to third right position for ignition and service lights.

Harley-Davidson replacement switch kit contains the following parts: One complete switch; Two spacers 19/32" long; One submounting plate; Two countersunk head screws 8-32 x 7/8" long; Twi 8-32 x 3/8" long screws; Four #8 lock washers; One wire with terminals (attached to switch); One 6-32 x 3/16" long bolt and nut; One piece of tape; One adapter ring 1-61/64" inside diameter; Four spacers 23/32" long; Four fillister head screws 8-32 x 1" long.

When replacing a "Mico" switch the following parts are not needed, and should be discarded: Four 23/32" long spacers; Four fillister head screws 8-32 x 1: long; Two #8 lock washers.

When replacing "Remy" switch discard the following: Two spacers 19/32" long; One sub-mounting plate; Two countersunk head screws 8-32 x 7/8"; Two 8-32 x 3/8" long screws; One 6-32 x 3/16" bolt and nut; One piece of tape; One adapter ring.

Study wiring diagrams and determine type of switch being replaced. Note that while switches differ as concerns location of terminals and order of numbering, wiring connections according to terminal numbers are the same to Harley-Davidson switch as to the switch it replaces. In other words, wires from earlier type switch transfer to terminals with same numbers on Harley-Davidson switch.

### REPLACING "MICO" SWITCH

Remove switch panel cover, disconnect wires, remove and discard switch and mounting spacers. Mount new sub-plate on switch panel base, using 19/32" long spacers underneath, and secure with two countersunk head screws. To properly locate switch in relation to opening in panel cover, end of sub-plate with widest spacing between screw holes must be assembled to left side. Place switch on sub-plate with lockout button forward and attach with two 8-32 x 3/8" long screws and lock washers. Tail and stop light wire cable will be found entering switch panel on left side of switch. Transfer this cable to right side and connect wires to switch according to diagram. Extra wire in kit (attached to switch) replaces original wire connecting switch terminal No. 4, and signal light terminal No. 10. Original wire connecting these therminals is needed as an extension for black wire to switch terminal No. 6, which will be found too short to reach new switch. Connect extension wire with small bolt and tape connection thoroughly so there will be no chance of shorting. Operate switch and note that all wires are arranged so there is no interference.

Adapter ring is furnished to reduce size of opening in panel cover to fit Harley-Davidson switch. Insert ring into panel opening from top side, and peen the underside of ring as necessary at four or more points to secure it in cover. Cover can then be fitted to base.

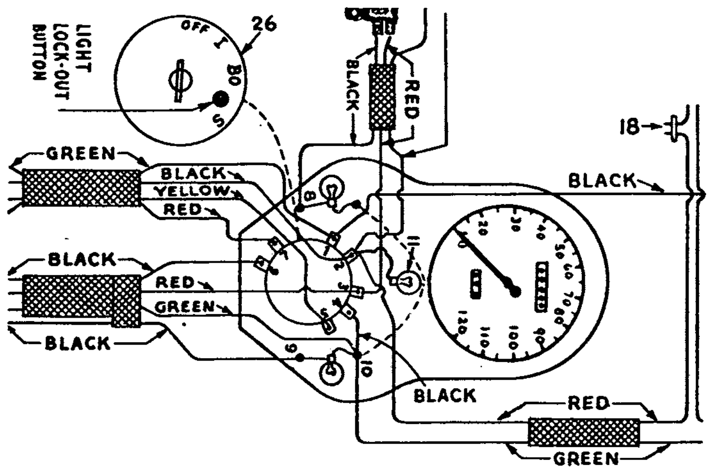
### REPLACING "REMY" SWITCH

Remove switch panel cover, disconnect wires, remove and discard switch and mounting spacers. Mount new switch with 23/32" long spacers underneath and secure with four 8-32 x 1" long fillister head screws and lock washers. Connect wires to switch according to diagram. Extra wire in kit (attached to switch) replaces original wire connecting switch terminal No. 4 and signal light wire No. 10. Original wire connecting these terminals can be discarded. Operate switch and note that all wires are arranged so there is no interference. Assemble switch panel cover.

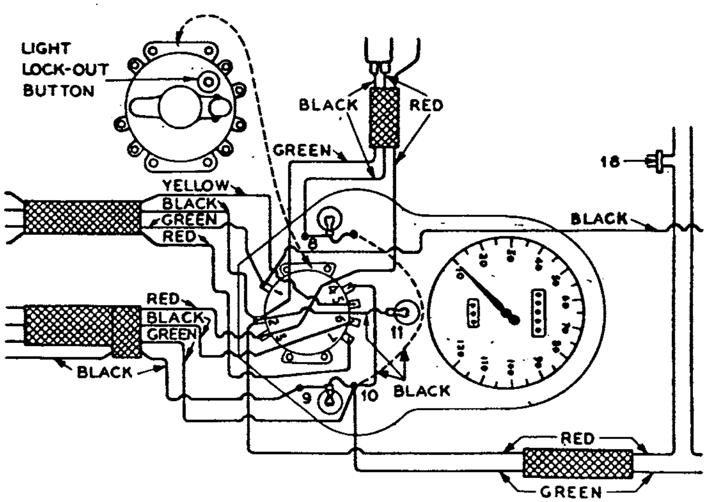
Bear in mind that the above installation instructions apply when an earlier type "blackout" switch is replaced with a Harley-Davidson "blackout" switch.

When a motorcycle already equipped with a Harley-Davidson switch requires a replacement switch, all extra fittings furnished with new switch can be discarded as they will not be needed. In making this installation the wiring will of course be connected to replacement switch exactly the same as it is found connected to switch being replaced.

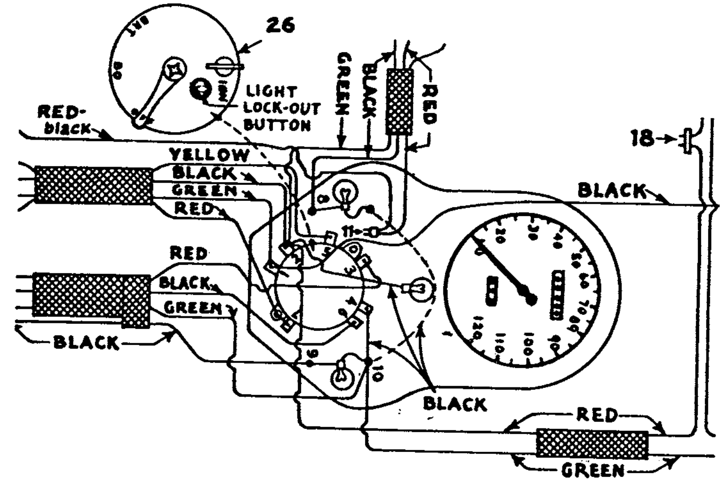
## SUPPLEMENT TO SWITCH REPLACEMENT DOPE SHEET NO. 222
## DATED JUNE 25, 1941



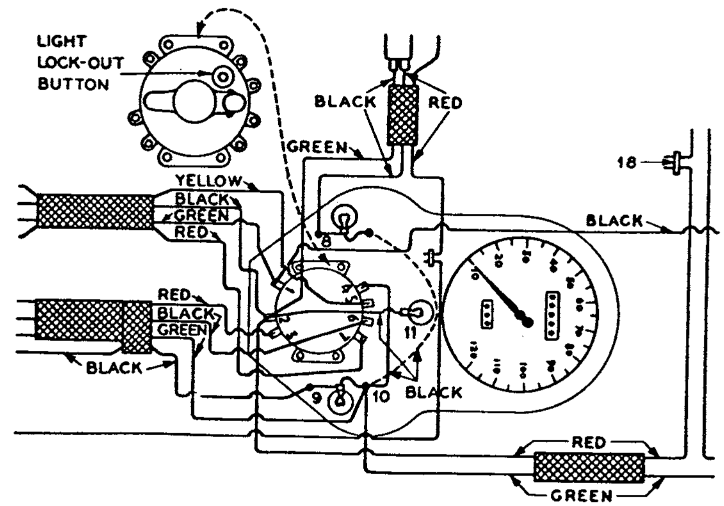

Wiring Connections to "Mico" Switch




Wiring Connections When Replacing "Mico" Switch With Harley-Davidson Switch




Wiring Connections to "Remy" Switch




Wiring Connections When Replacing "Remy" Switch With Harley-Davidson Switch

**HARLEY-DAVIDSON MOTOR CO.**
**Milwaukee, Wis., U. S. A.**

SERVICE SHOP DOPE

No. 224 August 15, 1941

## REBUILDING WHEELS

In rebuilding wheels it is general practice to simply true up and tighten spokes about as tight as they can be tightened with spoke wrench.

Ouite a number of rebuilt wheels do not run very far until the spokes, or at least part of them, are found loosened-up to some extent.

The following suggestions will help you build a wheel in which the spokes will stay tight much longer.

After all nipples have been pulled up until spokes are normally tight and wheel is true, or nearly so, seat each spoke head into hub flange with a sharp blow, using a flat nose punch and hammer. Then, re-tighten all nipples and finish truing wheel. This method allows spokes to be drawn tighter at the start and prevents possibility of spokes loosening, due to spoke heads seating into flange, after wheel is put into service.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

SERVICE SHOP DOPE

No. 225 August 15, 1941

## OVERSIZE WHEEL MOUNTING SOCKET SCREW

An oversize wheel mounting socket screw is available under Part No. 43531-35, for all 1935 and later 45" rear wheels, all 1936 and later 61" O.H.V. and all 1937 and later 74's" and 80" front, rear and sidecar wheels.

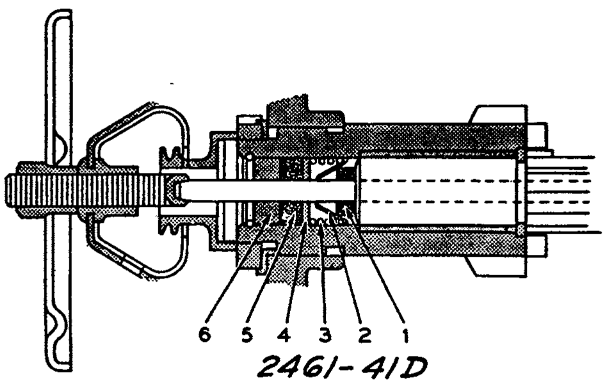
If the threads become stripped in the brake shell hub on any of these models, it is a simple matter to make a satisfactory repair job. Since the standard wheel mounting socket screw is 3/8" - 20 U.S.F. thread and the oversize socket screw is 7/16" - 20 U.S.F. thread, it is not necessary to drill out stock before re-threading hub for the oversize screw. It is only necessary to re-thread the stripped hole with a 7/16" - 20 U.S.F. tap.

The standard wheel socket screw wrench fits the oversize screw.

# SERVICE SHOP DOPE

No. 226 December 22, 1941

NEW CLUTCH GEAR OIL SEAL




| ITEM NO. | NAME |
|---|---|
| 1 | RUBBER SEAL |
| 2 | RETAINING CUP |
| 3 | SPRING |
| 4 | STEEL WASHER |
| 5 | RUBBER SEAL |
| 6 | STEEL GUIDE |

2461-41D
SET CLUTCH GEAR OIL SEAL PARTS
(AS FITTED TO LATER 1942-45 MODELS AT FACTORY; ALSO USED AS A COMPLETE SET TO REPLACE ORIGINAL OIL SEAL PARTS ON 1941 AND EARLY 1942-45 MODELS)

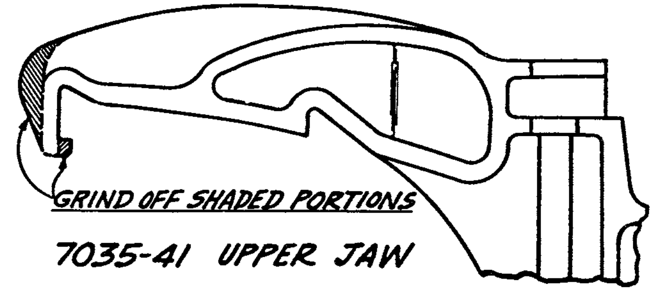
A new clutch gear oil seal has been used in production on all 1942 - 45 cu. in. model motorcycles (including Servi-Cars), shipped after about November 1, 1941.

This is an improved seal that will do a better job of keeping clutch disc dry and free of oil than the one it replaces. It can be fitted to all 1941 and earlier 1942 - 45 cu. in. and Servi-Car motorcycles provided it is used as a complete unit. Individual parts will not be supplied. Order 2461-41D, Set Clutch Gear Oil Seal Parts - Price 75¢, list.

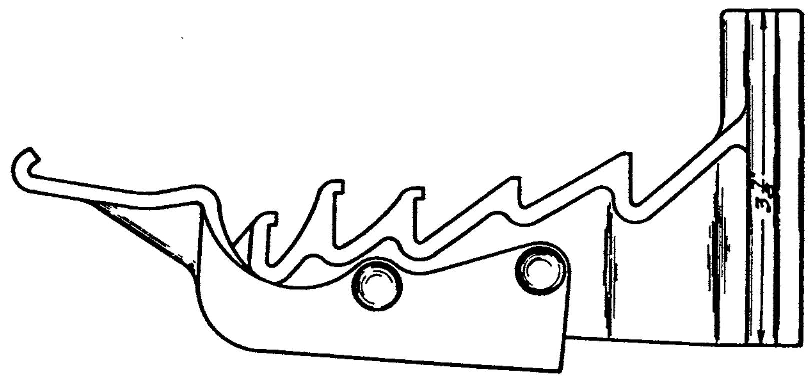
# SERVICE SHOP DOPE

No. 227 January 15, 1942

1942 SERVI-CAR JAW CLAMP CHANGES




7035-41 UPPER JAW



7034-41 LOWER JAW

At the start of the 1942 season the Servi-Car jaw clamp was redesigned to permit wider jaw clamp opening to accomodate increased width of some of the 1942 auto bumpers. Upper jaw screw pilot and lower jaw screw guide were each made 1/2" longer. Hand wheel screw was also lengthened proportionately. After this change had gone into production some further bumper changes were made with the result that the first 1942 jaw clamp would not fit some 1942 model bumpers properly. Thus, additional clamp jaw changes were necessary.

Upper jaw outer notch lip is now ground off and end reinforcing rib is eliminated. This is to adapt jaw to 1942 Nash series bumpers. Lower jaw has an extended lip or notch for use on 1942 Nash Deluxe bumpers.

The new clamp is to be used in the conventional way on most bumpers, including 1942 Standard Series Nash models. However, the 1942 Deluxe Nash bumper and stone shield construction is such that there is no part of bumper extended above shield. To fasten a clamp to it at all, the latest 1942 lower jaw with its long, thin hook or jaw must be used as the upper jaw; the upper jaw as the lower, and the hand wheel upside down.

# SERVICE SHOP DOPE

No. 228 January 30, 1942

WAR-TIME BAN ON OHV ROCKER ARM HOUSING SYNTHETIC OIL SEALS

Due to government restrictions on the use of rubber and synthetic rubber compounds, we will have to discontinue immediately the use of synthetic seals for OHV rocker arm enclosures.

Until such time as we may be able to find a satisfactory substitute, we will not be able to furnish the following seals on parts orders:

120-38 Oil Seals 1½"
120-38A Oil Seals 1-15/32"
120-38B Oil Seals 1-33/64"

The only seal of which there is a small quantity available for shipment is 120-35 Housing Rubber Packing Washer.

Shipping records show that a large quantity of these synthetic seals have been supplied on parts orders in the past. This is obviously because most dealers make it a practice when working on OHV motors to renew all oil seals, even though the old ones may not be in bad shape. From now on, it will be necessary for you to re-use old seals; in that way making your present stock of new seals last as long as possible.

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wisconsin U.S.A.

# SERVICE SHOP DOPE

No. 229 February 20, 1942

SERVICE NOTES FOR ALL MODEL "M" LINKERT CARBURETORS ON HARLEY-DAVIDSONS

These notes apply to carburetors which have been in service for some time and have become dirty, full of "crust" in the throttle barrel and are found to be difficult to get adjusted properly. Usually the effect of excessive dirt or "crust" formation in the carburetor throttle barret, around the throttle disc and in the fuel mixture passageways is to cause the carburetor to have a lean spot off idle. This crust should be removed, particularly when a lean spot comes in at speeds off idel up to 30 m.p.h. with the low speed (idle) adjustment set properly for idling. The idle adjustment should not be set to the very lean side when checking this point, but to a point about five to ten notches rich from the setting where the engine dies from leanness.

HOW TO REMOVE THE CRUST

1. Back off the throttle lever stop screw so the throttle disc closes tightly. With a sharp pointed tool like a sharp pen knife, scratch a line deeply on the closed throttle disc and also on the throttle barrel so that the lines on the disc and on the barrel meet. These lines should "jibe up" again when you replace the disc. Remove the throttle lever, throttle disc and shaft, the idle hole body plug next to the idle holes in the throttle barrel, the body plugs in the carburetor flange and carburetor body idle channels and the low speed (idle) lift lever and needle valve assembly. Also remove the venturi and nozzle.

2. Scrape out the caking or crust in the throttle barrel with a scraper or knife, being sure not to cut into the metal.

3. Clean up the throttle disc by rubbing it on both sides on emery cloth on a flat plate and clean the edge of the disc all around, being careful not to round the corners or cut into the metal.

4. Clean out the idle holes in the throttle barrel next to the disc with the proper size drills of clean up tool set described at end of this bulletin. See following list for proper sizes for both holes for all models of carburetors.

| MODELS (Stamped in top of carb. body) | Carb. Size | Venturi Size | Small idle hole nearest manifold flange (drill size) | Idle hole farthest from manifold flange (drill size) | Slot Width |
|---|---|---|---|---|---|
| M-4/11/16 | 1" | 7/8" | #70 | #54 | .009" |
| M-2 | 1¼" | 1-1/16" | #70 | #55 | .009" |
| M-5-5F | 1¼" | 1-1/16" | #70 | #53 | .009" |
| M-21 | 1¼" | 1-1/16" | #70 | #55 | .009" |
| M-25 | 1½" | 1-5/16" | #72 | #55 | .009" |
| M-31-31F | 1¼" | 1-1/16" | #70 | #55 | .009" |
| M-31FL | 1¼" | 1-1/8" | #70 | #55 | .009" |
| M-35-35F-35S-36 | 1½" | 1-1/8" | #72 | #55 | .0155" |
| M-41-41F | 1¼" | 1-1/16" | #70 | #55 | .009" |
| M-41L-41LF | 1¼" | 1-1/8" | #70 | #55 | .009" |
| M-45 | 1½" | 1-5/16" | #72 | #55 | .020" |
| M51-51F | 1¼" | 1-1/16" | #70 | #55 | .009" |
| M-51L-51LF | 1¼" | 1-1/8" | #70 | #55 | .009" |
| M75-75F | 1½" | 1-5/16" | #72 | #55 | .020" |

(Model numbers folowed by letter "F" of FL" or "LF" apply only to carburetors used on California Highway Patrol motors.)

5. Clean out the slot of al 1" and 1¼" carburetors by inserting the tool with the .009" blade (this tool has plain handle) through the slot between the two idle holes. Use the tool with .0155" blade (this tool has two rings around handle) to clean out the slot in M25, M35, M35F, and M35S 1½" carburetors. Use the tool with .020" blade (this tool has 3 rings around handle) to clean the slot in M75 and M75F 1½" carburetors.

6. Clean out the idle channels with #42 drill. When cleaning vertical idle channel do not completely bottom drill as doing so may damage the low speed needle seat.

7. Clean out the low speed (idle) needle valve seat hole with the proper drill size. All earlier 1¼" and 1½" "M" carburetors are cleaned with the #53L drill. Later M-35, M-35S, M-75 and M-75F, 1½" carburetors, have a smaller channel above the seat hole and for these use the #53L #2 drill which has a smaller handle, (this tool has two rings around handle). All model 1" carburetors are cleaned with #56L drill.

8. Blow out all channels and holes with compressed air and wash parts in gasoline.

9. Re-assemble parts, being sure the lift lever spring seat or washer is between the spring and carburetor when assembling the low speed lift lever and needle valve assembly back into place. This spring seat or washer limits the air bleed to the idle system and must be in place, otherwise carburetor cannot be adjusted for satisfactory engine idling.

Be sure throttle disc is assembled in barrel properly and closes off tight. Have the correct side of disc up or toward the flange and with the lines you scratched lining up with each other exactly. Push up shaft collar on throttle shaft firmly against body before tightening throttle disc screws. The throttle lever should be clamped to shaft with disc wide open and with the throttle lever wide-open stop against the body lug and with wear take-up spring between throttle lever and bearing.

10. If the carburetor bowl continually leaks or runs over, remove it from the carburetor body and first remove all dirt by cleaning it out with gasoline and compressed air. Hold bowl up-side-down so the float valve closes and suck on the bottom of the float valve seat. The valve and seat should hold this suction. If the valve and seat leak after repeated testing, replace with new float valve and float valve seat.

11. If the float is damaged or "logged" replace with new float. Remove old float by cutting the seal around float screw which fastens float to float lever. The seal can be cut with a pocket knife. Remove float screw and assemble new float to lever. This should be done with the float valve, float valve lever, float hinge pin and screws, float valve seat and gasket assembled in the bowl. Before tightening float screw securely, adjust as follows: looking down on bowl with gasoline inlet side away from you, pull float toward you to the limit of slot in float lever and about 1/16" to left of center line of bowl. This provides necessary body clearance. Tighten the float screw and cement top of the float screw to float with Dupont Household Cement or with a mixture of colluloid dissolved in acetone or with thick shellac. When cement has dried thoroughly check the float height and adjust as explained in 12.

12. Check float lever, and if necessary, re-set to ¼". Measure directly opposite float lever with bowl held u-side-down(top of float to top of bowl.) When re-adjusting Linkert carburetor float, do not attempt to do so by bending float lever upward to some manner, without disassembling from bowl. Re-adjusting in this manner bends and spreads the fingers between which the head of float needle fits, and thus develops lost motion between float and needle. Float and lever assembly should be removed from bowl, and then lever bent.

Before re-assembling, see that needle head is a good free fit between lever fingers with not more than approximately .003" play. This clearance can also be checked after lever is assembled in bowl, by carefully placing a small screw driver or small rod against valve head in such a position that it will hold the valve firmly against seat and yet not bind lever. Moving lever up and down will then show the amount of actual clearnace between valve head and fingers. If this clearance is excessive the float mechanism will not feed properly. After assembling, note float is approximately square with top of bowl.



13. The bowl drain plug now being used in Model "M" carbuetors can be removed for a quick flushing of the bowl. Before removing this plug turn off the gasoline at the tanks. Be sure to pull up this screw tight when replacing.

14. In adjusting the carburetor, set the low speed needle for smooth idling, and set throttle lever stop screw for desired idling speed.

Starting and all-around carburetion are better with low speed adjustment slightly rich rather than as lean as it can be made, and with throttle stop set for reasonably fast idling.

Average high speed needle adjustment for best engine performance is as follows: All Side by Side Valve engine carburetors - about 1½ turns open; all OHV engine carburetors-Model M-25 about 1¼ turns open; Model M-35 and M-36 about 1-1/8 turns open; Models M-45 and M-75 about 1-3/4 turns open. It is advisable to set high speed adjustment slightly rich rather than as lean as possible as a lean high speed mixture causes overheating.

## CARBURETOR CLEAN-UP TOOLS

These tools are for hand cleaning only. Do not use in power or hand drill. A complete kit including 12 tools is covered by Part No. 12012-38, list price $6.00. If you already have a set of clean-up tools that originally included ten tools, you will need only two extra tools to make your kit complete, part No. 12012-38L and 12012-38M. If you have an earlier kit that originally included only eight tools, you will need to complete it with the two extra tools just mention and also two additional tools, part No. 12012-38J and 12012-38K. Extra tools are 50¢ list, each.

SERVICE SHOP DOPE

SPECIAL

March 26, 1942

XA MODEL - ENGINE FITTING SPECIFICATIONS

CYLINDER - Standard bore - 3.062" to 3.063"

PISTON CLEARANCE IN CYLINDER: .002" to .003" measuring piston at bottom of skirt, at right angles to pin (across thrust faces). WARNING: This fitting clearance applies only to manufacturer's taper - cam ground piston, which is .002" smaller at top of skirt underneath lower ring, than at bottom of skirt. This clearance (.002" to .003") is not sufficient for straight cam ground piston obtained from some other source.

PISTON - CYLINDER HEAD CLEARANCE: 1/16" to 3/32"

PISTON PIN IN PISTON: Light hand press fit.

PISTON PIN IN UPPER CONNECTING ROD BUSHING: .0008" to .0013" clearance; .001" preferred.

PISTON RING GAP: .007" to .017"

PISTON RING SIDE CLEARANCE IN GROOVES: .004"

CONNECTING ROD LOWER END BEARING: .00075" to .0025" clearance; .001" preferred

CONNECTING ROD LOWER END SIDE PLAY: .005" to .011". Retainer must be narrower, but not more than .014" narrower than connecting rod.

CAM SHAFT: .0005" to .0015" clearance; .001" preferred (front and rear bearings)

OIL PUMP DRIVE GEAR: .0005" to .0015" clearance .001" preferred

IDLER GEAR: .001" to .002" clearance; .0015" preferred

VALVE STEM - VALVE GUIDE CLEARANCE: .0035" to .0055"

TAPPET GUIDES: Slip fit to .001" loose in crankcase

VALVE TAPPET-TAPPET GUIDE CLEARANCE: .0005" to .0015"; .001" preferred

TAPPET CLEARANCES: Engine cold. Intake, .004" to .006"; Exhaust, .012" to .014"

CIRCUIT BREAKER POINTS: .022" tap with breaker lever on highest point of cam

SPARK TIMING: 1/64" before top center on compression stroke with automatic spark advance in retarded position.

CRANKCASE BREATHER TIMING: Engage in narrow slot(identified with yellow paint) of breather sleeve with pin on cam gear.

VALVE TIMING: Time according to mark on crankcase gear and mark on cam shaft gear. Intake opens 15/32" to 9/16" before top center; Intake closes 1-11/32" to 1-15/32" after bottom center; Exhaust open 1-1/4" to 1-3/8" before bottom center; Exhaust closes 31/64" to 37/64" after top center.

CAUTION: Both intake and exhaust tappets must be adjusted to .005" while checking valve timing according to piston position. After checking valve timing, exhaust tappets must be readjusted .012" to .014" for normal operation

ASSEMBLED BALL BEARINGS: All bearings in case or on shaft, slip fit to light press fit. When bearing is worn to extent of appreciable shake or play, it should be renewed.

CLUTCH SPRINGS: Must be of equal length.

REAR WHEEL SPRING SUSPENSION GUIDE BEARINGS: .001" to .002" clearance on vertical guide post; .0015" preferred. When pressing new bushing in guides, bushing must be inserted with chamfered end outward. Peen metal of guide into chamfer of bushing at three equidistant points to securely hold bushing in place.

SERVICE SHOP DOPE

No. 231

October 23, 1944

BIG TWIN TRANSMISSION STARTER CLUTCH AND MAINSHAFT BALL BEARING PULLER

PART NUMBER 12737-43

This puller applies to 1936 61" OHV and all 1937 and later Big Twin transmissions. One end of puller has full engaging lip; this end pulls the starter clutch. The other end has four, lipped prongs; this end pulls mainshaft bearing.

CAUTION: This toll is intended to be used only for removing starter clutch and a worn out or damaged ball bearing from a complete transmission assembly, in the chassis when there is no reason to disassemble transmission further than actually required to permit replacement of starter mainshaft parts and/or bearing. When for one reason or another transmission must be completely disassembled, but ball bearing is still in good condition and usable, it is not necessary to use this tool for bearing removal, and it should not be used for this purpose as engaging it will damage bearing. When this applies, use tool for removal of only the starter clutch.

DISASSEMBLING PREPARATORY TO REMOVING STARTER CLUTCH AND MAINSHAFT BALL BEARING

1. If motorcycle is equipped with sidecar, remove sidecar first.
2. Remove muffler and rear cylinder exhaust pipe.
3. Remove clutch release lever. Use an all-purpose claw puller to pull release lever from shaft.
4. Place oil drain pan under transmission and remove starter cover nuts and plain washers. Pull off starter cover assembly.
5. Remove clutch push rod from mainshaft.
6. Wash starter compartment and parts with solvent, kerosene or gasoline.

REMOVING STARTER CLUTCH

1. Bend edge of starter clutch nut lock washer away from side of starter clutch nut.
2. Remove starter clutch nut and lock washer.
3. Insert puller center adapter into end of mainshaft. Push mainshaft gear inward as far as possible and insert puller halves between ratchet teeth on starter clutch and starter mainshaft gear.

   Hold puller body halves in place and slide sleeve over them. Push sleeve on until it is flush with inner end of puller halves.

   Engage puller screw and block in bayonet slots in puller halves. Hold screw block in position, with screw centered in adapter in shaft end, and tighten screw. If starter clutch does not come off shaft by exerting hand pressure on screw, strike end of screw sharp blows with a light hammer.

4. Remove the two starter clutch keys from keyways in mainshaft. Also remove starter mainshaft gear and spring from mainshaft.

REMOVING MAINSHAFT BALL BEARING

1. Remove the four bearing housing retaining plate screws and bearing housing retaining plate. Note that starter gear oil deflector is held in place by the upper front screw, and that V-notch in bearing housing retaining plate is upward and toward the front.

2. Bend ear of lock washer away from bearing lock nut.

3. Remove bearing lock nut using Harley-Davidson special wrench #12733-41. Also remove lock washer.

4. If transmission has late style shielded bearing, drill or punch a hole in shield plate and pry shield out of bearing assembly.

5. Insert puller center adapter in end of mainshaft.

Insert the lipped prongs of puller body into inner ball race. If ball retainer interferes with hooking the prongs of puller in inner race, use a small blunt punch and light hammer to flatten four points of ball retainer to permit prongs of puller to seat fully in ball path.

Hold puller halves in place and push sleeve over them. Be sure inner end of sleeve is pushed in against bearing to prevent springing or breaking puller prongs.

Engage puller screw and block in bayonet slots in puller halves. Hols screw block in position with screw centered in adapter in shaft end and turn screw to right. Continue to turn until bearing is removed.

NOTE: If bearing housing comes out of case with ball bearing, remove old bearing from housing and replace housing in case before installing new bearing.

REASSEMBLY TIPS

Use a light hammer and block of hard wood or brass drift to drive bearing into place.

Be sure ball bearing nut and starter clutch nut are tightened securely and lock washers are bent up against one flat side of each nut.

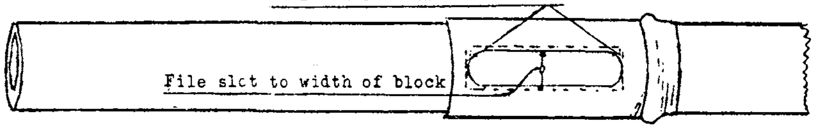
If a 1939 or later transmission, or if an earlier model transmission in which the late type push rod thrust bearing has been installed (large bearing that fits over starter clutch). next install thrust bearing on starter clutch and s-e that is slides freely, back and forth. This is essential for normal clutch operation. After this check, remove thrust bearing and insert it into cover, with slot in outer bearing race engaging clutch release finger. Insert push rod small diameter end into thrust bearing and insert the other end of push rod into mainshaft. With push rod serving as a pilot, move the cover assembly into place, observing at the same time that groove in thrust bearing inner race and ball punger in starter clutch align so they will be engaged when assembly is completed.

# SERVICE SHOP DOPE

No. 232 October 30, 1944

## SERVICING HANDLEBARS WITH WORN SLOTS

File ends of slot as shown




Guide Block 3321-31A

There now is available an oversize plunger guide block with which to service all 1931 and later handlebars that become worn in the plunger control slot to the extent of unsatisfactory grip operation. Repair is accomplished by the use of a new oversize plunger guide block which replaces the original block.

This new block is 1/2 inch long and 7/16 inch wide and slot can be widened for either dimension. First, file slot to meet the 7/16 inch dimension, and if it does not smooth up at this width, use the 1/2 inch dimension. File same amount of metal from both sides of slot, which was originally about 3/8 inch wide. Observe that top of guide block does not protrude above sides of slot; if it does, it will be necessary to deepen recess in plunger.

With a smooth file, file slot as square as possible in relation to the bearing surfaces of the new block, as sharp edges and uneveness in the slot will cause plunger guide block to hang and prevent free movement.

Avoid filing slot wider than necessary. The new block can be used as a gauge by inserting it into the nearly finished slot and filing away only the sections of the slot that do not allow free movement.

File slot ends square, as shown in sketch above, so that plunger guide block has the required amount of movement to fully operate throttle or spark lever.

Part No. 3321-31A - - - - - - - List Price $ .10

HARLEY-DAVIDSON MOTOR CO.
Milwaukee, Wis., U.S.A.

# SERVICE SHOP DOPE

No. 233 November 16, 1944

## OPERATION/MAINTENANCE MANUALS - PARTS LIST FOR MOTORCYCLES SOLD THROUGH ARMY SURPLUS

During the past three or four months, the Government has sold a large number - 3,000 to 5,000 Army suplus, used Harley-Davidson military model motorcycles. There is still a large surplus accumulation of motorcycles yet to be sold. Included in the motorcycles already sold are 800 to 900 XZ shaft-drive models. The others sold and the balance yet to be sold are principally 1940, 1941 and 1942 WLA models. The WLA model is basically our standard 45 cu. in. Twin model with various changes and additions to adapt it to military service. The XA model is strictly a special motorcycle built entirely to Army specification. This model has a 180 degree twin-opposed engine set transversely in frame and is shaft driven.

A portion of both types of these motorcycles have been purchased by Harley-Davidson dealers the remainder have been purchased by used-car dealers. Many of the machines of both models have already been resold to individuals, and we are receiving numerous letters from these individuals regarding questions they have about their motorcycles. Since all Army motorcycles originally carried an information plate advising the numbers of the Spare Parts List and Operation and Maintenance Manual supplied with these machines, the inquiries we receive request principally these publications or information as to how to obtain them. There is also much question about obtaining spare parts for both models. The purpose of this bulletin is to information you in the future individuals making inquiry will be referred back to their nearest Harley-Davidson dealer for any desired information - parts, manuals, etc.

WLA Operation and Maintenance Manual No. TM-10-1175 is availab.e The price is $1.25 net $2.00 list. Order under Part #13862-42. WLA Spare Parts List No. TM-10-1482 is not now available and is not likely to become available later.

Spare parts for WLA model motorcycles are available. Standard 45 cu. in. twin model parts apply as a general thing to the WLA model and you should order from regular catalog. Some of the exceptions are mudguards, oil bath air cleaner, carburetor (which is adapted to oil bath air cleaner), blackout lighting system, ignition and light switch, cylinder heads, and other strictly Army fittings such as skid plate, gun scabbard and ammunition box brackets, saddlebags, etc. When ordering painted parts be sure to specify whether original Olive Drab color or some other color is desired. When ordering parts applying to any of the equipment exceptions listed, give a clear description of item or items desired and mention year and model.

AX Model Operation and Maintenance Manusl No. TM-10-1293 is available. XA Model Spare Parts list is not available now, but may be later.

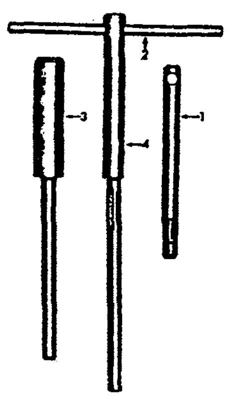
Spare parts and service tools for the XA model are not available. If and when Spare Parts List, spare parts and service tools become available you will be notified. In the meantime, it will be of no avail to attempt to obtain parts by ordering according to the many part and tool numbers shown in the Operation and Maintenance Manual.

SERVICE SHOP DOPE

No. 235 December 23, 1944

## REPLACING WORN THROTTLE SHAFT AND SHAFT BUSHINGS IN HARLEY-DAVIDSON CARBURETOR WITH TOOL SET NO. 12012-44D, FEDERAL STOCK NO. 41-K-144-10

1. Remove throttle disc and worn throttle shaft.
2. Oil tap and turn it into either bushing at least four or five threads; then back it out about 1/2 turn so it will be loose and easily removed from bushing after driving out.
3. Drive out tap and bushing with drift.
4. Repeat operations 1, 2 and 3 to remove opposite bushing.
5. Drive in new bushings with line drift. Bushing is in place when drift bottoms on carburetor body.
6. Line ream one bushing and then the other.
7. Insert new throttle shaft and install disc. Disc renewal is not usually necessary. If found worn or damaged to the extent of requiring renewal, be sure to install a new one with the same identification number stamped in face of disc. With disc correctly installed and in closed position, number will be seen through manifold end of carburetor and will be on the opposite side of carburetor from small idle holes. Shift disc to best position for close fitting all around its edge. Press collar on lower end of throttle shaft against carburetor body. Hold throttle shaft and disc snugly in these positions while tightening disc screws.




1. Drive-out tap
2. Handle for 1 & 4
3. Drift
4. Line Reamer

SERVICE SHOP DOPE

No. 236 January 18, 1945

## BIG TWIN TRANSMISSION SHIFTER FORK GAUGE, PART NO. 12074-39

This tool applies to 1936 61 OHV and all 1937 and later big twin transmissions. The purpose of this tool is to locate and hold transmission shifter fork fingers in the exact positions they will have when transmission cover assembly is installed. Tool allows unobstructed view of interior of transmission so that "enutral" side clearance of shifting members (shifter clutch or gear) from gears with which they engage can be gauged.

Note that each end fitting of tool has a hole on one side and dowel pin on the other side. The dowel pins are for locating on cover; the holes for locating on transmission case.

Applying to 1939 and later transmissions, shifter fingers (.287" dia.) require a roller (.370" dia.). Be sure this roller is in place on each finger when using tool and also when transmission cover is finally installed. 1938 and earlier transmissions were originally assembled with solid type fingers (.370" dia.); however, in connection with service required in the meantime, the roller type finger which, with roller, is interchangeable with the solid type, may have been installed. Watch This. Tool is to be used as follows:

1. Place tool on cover.
2. With the aid of 3/8" gauge rod furnished with tool, set first on gauge block and then the other in perfrect alignment with straight section of their respective cam slots. Tighten lock screws securely.
3. Remove tool from cover, turn it over, place it on transmission case with shifter fingers engaged.
4. With suitable thickness gauges, check clearance of shifting members.

All shifter clutches must be centered. When centered, 1938 and later mainshaft shifter clutch should have about .100" clearance, both sides. 1936-37 mainshaft shifter clutch should have about .075" clearance, both sides. 1936 and later countershaft shifter clutch should have about .075" clearance, both sides.

Where shifter clutch engagement is with dogs protruding from face of gear, turn gear so dogs on gear are fully facing each other before checking clearance. Exception-dogs on 1938 and later main drive gear and mainshaft shifter clutch are bevel faced, so clearance must be checked with only their highest points facing each other.

Space sliding gear about .055" from mainshaft gear with which it engages. Have highest points of rounded ends of gear teeth exactly in alignment with each other when checking this clearance.

Shifting members are readjusted to correct side clearance by increasing or decreasing the number of shims between shifter fork and shifter finger. To make this readjustment requires removing shifter fork shaft and shifter fork assemblies from transmission. Shims are available .007" and .014" thick. After adding or taking out shims, be usre fork assembly lock nut is firmly tightened, and secured with lock washer. Caution: while this nut must be very tight so that fork is held firmly, don't over-do it. Overtightening may close up the hole in bushing so it is no longer a free sliding fit on shaft. In this case, lap out as necessary or install new bushing. Fork assembly must slide freely.

Tool must be reset for each transmission to which it is applied, as no two transmissions are likely to have exactly the same relation between cover and case.

# SERVICE SHOP DOPE

No. 234 February 1, 1945

## CONCERNING SYNTHETIC CASINGS AND TUBES

For several months new motorcycles and sidecars have been shipped with synthetic rubber casings and tubes exclusively. Up to now, all synthetic casings and tubes have been made of Buna-S. These casings have been marked S-3 and tubes are identified by a continuous red band. Later we may get some Butyl tubes which will be marked with a continuous blue band.

Synthetic tires have generally given satisfactory service. Only an occasional tube failure for other reason than puncture has been reported. Investigation of such failures has proven that in nearly every case failure was the result of tube having been installed by procedure long recognized os OK for natural rubber tubes, but not good enough for synthetic tubes. Synthetic tubes do not have the same stretching qualities natural rubber tubes have. They are more inclined to split and tear; therefore, synthetic tubes must be free from all strains and stresses after installing and inflating. To get the best service from synthetic casings and tubes, these things are vitally important:

1. Install correctly.
2. Maintain correct air pressure
3. Do not overload
4. Avoid high speeds.

Before installing tube in casing all dust and dirt, particularly hard particles which might chafe an inflated tube, must be carefully removed. Wipe tube and inside of casing thoroughly with clean, dry cloth. If rim is dirty or rusty, it will take a good cleaning with stiff wire brush. Be sure to examine used casing carefully for fabric injuries which, if neglected, will damage tube.

Dust tube, inside of casing and rim strip that covers spoke end liberally with soap-stone powder. Insert tube in casing and apply soap solution. If no vegetable soap is available, use soapstone powder more freely. Be careful not to use so much that it piles up in casing It is desireable to use vegetable oil soap solution for lubricating tube and side of casing about a third of the way up from bead toe, also face of rim strip that covers spoke ends, rather than to depend entirely upon soapstone powder as soap suds lubricate more effectively and better assure tube properly shaping iteself to rim well without adhesion, stretch or strain. Do not use so much soap solution it runs into crown of casing. We recommend Murphy's Vegetable Oil Soap mixed with just enough water to form a bubbly, sudy, slippery solution. That's what it takes to do the job.

Synthetic rubber tires generate more heat from flexing under road contact then natural rubber tires. Therefore, maintenance of correct inflation and avoiding high speeds are "musts" if dependable performance is to be gotten from them.

Tube injuries in synthetic tubes can be satisfactorly repaired, but the job requires a different repair technique than used for nature rubber and it must be done just right. Cold patching synthetic tubes is not recommeded except for emergency road service repair. Motorcycles should not be run farther than absolutely necessary with a cold-atch synthetic tube.

Pre-war hot patches designed for natural rubber tubes are not satisfactory for synthetic tubes. Synthetic rubber requires a different hot-patch material and longer, hotter curing. The patches developed for synthetic tubes are, however, OK for both natural rubber and synthetic tubes. We are now in a position to supply synthetic hot-patching equipment for repairing small tube injuries. You may order under the following part numbers:

| | | |
|---|---|---|
| 11585-45 | Camel Vulcanizing clamp and 3 partches | $ .75 list |
| 11586-45 | Box of 10 round patches | .60 " |
| 11587-45 | Box of 10 oblong patches | .60 " |

# SERVICE SHOP DOPE

No. 234-A February 1, 1945

## COLD-PATCHING SYNTHETIC TUBES

Col-patching synthetic rubber tubes is not recommended as a permanent repair. It should be considered only as an emergency roadside repair when hot-patching equipment is not available. Where this temporary repair method is necessary, carefully observe these directions for best results.

Nail holes that have not started any appreciable tear need not be trimmed.

If possible, tube injuries other than nail holes should be rounded at the ends and trimmed with scissors or knife to prevent tearing.

Buff tube corss-sectionally for one inch from all edges of injury. Do not buff circumferentially. Reason is that tube will tear much more readily lengthwise of tube than crosswise. Buff THOROUGHLY to remove ALL glaze from buffed area. Adequate buffing is extremely important. Buff until tube shows even, blackish color with no streaks of surface glaze showing. Buffed area should have appearance and feel of suede leather if buffing job has been done correctly. Use sand paper, emery cloth, or top of repair kit can. Be careful not to start deep scratches. Firm, steady pressure will get the job done right.

Blow dust from buffed area. Don't touch with fingers. Apply one coat of cold-patching cement. Cemented area should be about 1/4" larger is all directions than patch to be used. Scrape off excess cement with dull knife blade.

Cut required size patch from patch stock. Patch should overlap injury about one inch in all directions. Remove protective cloth covering, place patch over injury and roll or "stitch down" thoroughly with edge of repair kit can.

Never run a cold-patched synthetic tube farther than absolutely necessary because this type of repair is not dependable for synthetic rubber. When it lets down, tube injury may be found torn to point where tube is damaged beyond further practicable repair. As soon as possible, cold patch should be removed, injury repaired by hot-patching or vulcanizing, and tube re-installed according to recommended procedure.

# SERVICE SHOP DOPE

No. 234B February 1, 1945

## HOT-PATCHING SYNTHETIC TUBES

Nail-hole injuries that have not started any appreciable tear need not be trimmed. For all other tube injuries, trim edges of injury and round out of "buttonhole" ends to prevent splitting or tearing. Use scissors or leather punch. Injuries larger than 1/2" trimmed length, should be vulcanized.

Buff tube cross-sectionally 1" from all edges of injury. Do not buff circumferentially. Reason is that tube will tear much more readily lengthwise of tube than crosswise. Also buff edges of injury.

Buff THOROUGHLY TO REMOVE ALL GALZE from buffed area. Adequate buffing is extremely important. Buff until tube shows even blackish color with no streaks of surface glaze showing. Buffed area should have appearance and feel of suede leather if buffing job has been done properly. Use "handee" type electric hand grinder and emery drum if available, otherwise emery cloth, sand paper, or top of repair kit can. In buffing, be careful not to start deep scratches. Firm, steady pressure will get the job done right.

Blow dust from buffed area; don't touch with fingers.

While the use of cement is not a "must" it is advisable in shop practice to apply one coat of vulcanizing cement over entire buffed area, including edges of injury. Hole in tube should be filled in with piece of patch, cut to fit. If area to be filled in is small, cut piece from patch you intend using for repair of tube; if larger area, cut up another patch.

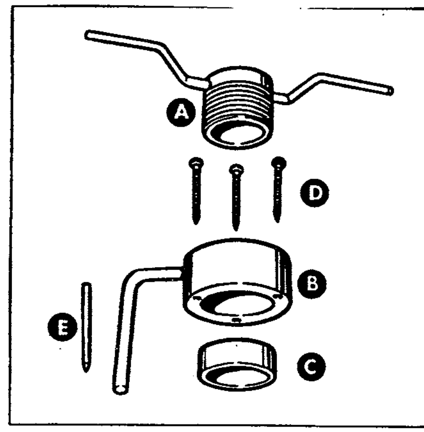
Remove protective cloth covering from patch and center patch over tube injury. Place patch in clamp over tube. Turn clamp screw down as tight as possible without crushing edges of patch pan. Light fuel cookie wick with match and let it set until it can be handled comfortably with bare fingers (About 10 minutes or more)

Re-install tube in casing according to recommended procedure.

Tube injuries larger than 1/2" (trimmed size) should be repaired by vulcanizing. Any reliable tire repair shop should be able to do this work for you.

# SERVICE SHOP DOPE

No. 237 May 14, 1945




## "BIG TWIN" TRANSMISSION MAIN DRIVE GEAR OIL SEAL TOOL

This tool applies to 1936-61 OHV and all 1937 and later Big Twin transmissions. It enables removing worn-out or damaged oil seal and installing a new seal without removing transmission from motorcycle chassis. It also works equally well with transmission out of chassis. Transmission must be assembled, except clutch and countershaft sprocket, in order to use tool.

### DISASSEMBLING PREPARATORY TO REPLACING OIL SEAL WITH TRANSMISSION IN MOTORCYCLE CHASSIS

Shift transmission into low gear and lock rear wheel brake to prevent parts from turning while disassembling. Remove outer front chain guard, engine sprocket, front chain, clutch assembly, inner chain guard, countershaft sprocket and rear chain. (Note: Clutch hub nut and countershaft sprocket nut are left thread).

### REMOVING OIL SEAL

Place Sleeve "C" on end of main drive gear and against transmission case or mounting plate and while holding body in this position, insert center punch "E" through each of the three holes in body and center punch oil seal. Remove body and drill a 3/32" hole through metal face of oil seal, at each punch mark. Replace body and insert the three self-tapping screws "D" through body into holes drilled in oil seal. Tighten screws until body is snug against oil seal. Turn actuating screw "A" into body and continue turning until oil seal is free from transmission case. Remove tool and discard old oil seal. Remove and discard cork gasket found behind oil seal.

### INSTALLING NEW OIL SEAL

Before installing new seal, remove burrs with scrapper from outer edge of oil seal recess in transmission case, particularly where aluminum was staked to secure seal just removed. Place new cork gasket into oil seal recess in transmission case. Apply oil or grease to lip of oil seal to prevent turning member from burning and damaging new seal when first put into service. Insert sleeve "C" into oil seal. Place sleeve and seal on main drive gear with lip side of seal toward transmission case and move both sleeve and seal inward as far as they will go. Observe location of staking notches in outer face of seal and turn seal so it will not stake at the same points old seal was staked.

Place body on sleeve, against oil seal, and turn actuating screw into body as far as it will go without pulling body away from seal. Install mainshaft clutch hub nut and turn in against actuating screw. Back out actuating screw until body has pushed oil seal into place and body is tight against end of gear box. Remove mainshaft nut and tool. Using small, blunt chisel or punch, stake aluminum of transmission case into the three notches in seal outer face. This prevents oil seal from turning or working out.

### REASSEMBLING TIPS

Applying to 1938 or later transmission, be sure small "L" shaped key is installed between spline of main drive gear and notch in outer end of main gear spacer. Securely tighten engine sprocket nut, countershaft sprocket nut and clutch hub nut. Be sure to lock countershaft sprocket nut and clutch hub nut by bending up lip of lock washer.

# SERVICE SHOP DOPE

No. 240 November 15, 1945

## NEW MOTORCYCLES EQUIPPED WITH DRY BATTERY

Since our source of supply of regular wet batteries is temporarily shut off because of labor problems, we are forced to ship, equipped with dry battery, all motorcycles that would regularly be equipped with wet battery. This applies to all motorcycles shipped from the factory since about November 12. Machines so fitted have a small manila tag attached to the battery marked "dry battery" and also have a large while tag captioned "THIS BATTERY IS DRY CHARGED" covering instructions for preparing the battery for service, attached to the frame tube next to battery.

In preparing dry battery for service, the instructions given on the tag should be followed very carefully with exceptions noted below. Battery solution of 1.285 gravity required for filling can be purchased locally from any recognized battery shop. About one-fifth gallon is the average amount of solution required for one battery.

EXCEPTIONS; Paragraph 4 of instructions and the footnote indicating date before which battery may be placed in service without charing apply to military emergency use only. For your purpose this information should be disregarded. All batteries should be fully prepared according to paragraphs 1, 2, 3, 5, and 6.

# SERVICE SHOP DOPE

No. 240E December 10, 1945

## NEW MOTORCYCLES EQUIPPED WITH DRY CHARGED BATTERY

Since our supply of regular dry (moist uncharged) batteries is temporarily shut off, all motorcycles regularly equipped with this type of battery are now being shipped with a dry battery of a somewhat different type know as a "dry charged battery." The two types of batteries look exactly alike but the dry charged battery has a gray paint mark on the negative terminal and carries with it a white instruction tag imprinted in red entitled, "This battery is dry charged".

In preparing a dry charged battery for service the instructions given on the tag should be followed very carefully with the exceptions noted in the following parpagraph. Battery solution of 1.285 gravity (tropical countries 1.225) required for filling can be purchased from any recognized battery shop. About one-fifth U.S. gallon is the average amount of solution required for one battery.

EXCEPTIONS: - Paragraph 4 of instructions and the footnote indicating date before which battery may be placed in service without charging apply to military emergency use only. For your purpose this information should be disregarded. All batteries should be fully prepared according to paragraphs 1, 2, 3, 5, and 6.

We have been using the dry charged battery in new motorcycles only since about November 21, 1945. Consequently if you have any motorcycles enroute to you some of them may still be fitted with the regular dry (moist uncharged) battery, the same as you have been getting right along. This battery carries a yellow instruction tag imprinted in black and the instructions on that tag must be followed carefully without exception when placing this type of battery in service.

# SERVICE SHOP DOPE

No. 241 January 21, 1946

## FACTORY REPAIR

We are now in a position to again accept some material for repair. However, our capacity for repairing is still very limited. It therefore is essential that you repair in your own shop and avoid factory repair as far as possible, especially as concerns frames and forks. Unless this is done, we are very likely to again find the Factory Repair Department hopelessly swamped with returned material and the time required for repair again a matter of weeks or possibly months.

Here are some things to bear in mind in connection with the matter if factory repair jobs:

To facilitate repair at this end, it is necessary that all frames and forks be returned thoroughly cleaned. We do not have the facilities for cleaning frames and forks individually as, in their turn, they come up for repair. Dirty frames and forks must be set aside until enough have been accumulated to warrant diverting new production cleaning equipment for the necessary time to this job which of course means considerable delay as well as added repair cost.

Frames to be returned should be completely stripped, that is no assembled fittings should be left attached; neither should assembled forks be returned.

We are not in a position to repaint any frames or forks.

It is not economical to repair a frame if the total repair cost amounts to more than approximately $15.00 net. Therefore, it is hardly worthwhile to return for repair a badly mangled frame, possibly with broken tubes or fittings, which pretty obviously is going to run into higher repair cost.

We are again in a position to accept connecting rods in exchange for rebuilt combinations. In this connection remember that the rods returned for exchange must be in perfect condition aside from requiring new bushings. Rods that are badly bent or twisted or are damaged otherwise, or rods that have been plated or have been ground down or polished to a point of weakening them will not be accepted for exchange; neither are we in a position to recondition such rods individually. Bear in mind also that we cannot exchange or repair connecting rods for 1934 or earlier single models; 1931 or earlier 45 cubic inch twin models; 1929 or earlier 61 and 74 cubic inch twin models.

As concerns assemblies such as engine, transmission and generator, or other odd parts that you may wish to send to the factory for repair, please do not return any such items without first writing us for approval because we may not be able to make desired repair within reasonable time. This also applies to a complete motorcycle that you might be considering driving or sending in to the factory for some reapir or adjustment work.

# SERVICE SHOP DOPE

No. 242 February 10, 1946

## ROLLER BEARING ROLLER GUIDE

Here is a handy chart, giving information on roller bearing rollers. It is suggested that this be kept in a prominen- place so it can be referred to on a moment's notice.

Rollers .250" and .1875" are used in retainers. Needle rollers .152", .125", .114" and .0625" are used without retainers.

Rollers .250", .1875" and .152" are furnished from .001" undersize to .001" oversize in steps of .0002"

Rollers .125" and .114" are furnished only .0004" and .0008" oversize.

Rollers .0625" are furnished only .0008" oversize.

| PART NO. | WHERE USED | NO. USED | LENGTH | STD. DIA. |
|---|---|---|---|---|
| 304-15 | Forked End connecting rod (1915-1939 61", 74" & 80" Twins) | 24 | .360" | .250" |
| " | Left Crankcase (1929 & earlier 61" & 74" Twins) | 24 | " | " |
| " | Left Crankcase (1929 & later 45" Twins) | 24 | " | " |
| " | Front Brake Hub (1930-36 74" & 80" Twins) | 24 | " | " |
| " | Sidecar Brake Hub (1930-36) except LE Model) | 28 | " | " |
| 304-40 | Forked End Connecting Rod (1940 & later 61" 74" & 80" Twins) | 36 | .344" | .1875" |
| 305-15 | Single End Connecting Rod (1915-39 61" 74" & 80" Twins) | 12 | .726" | .250" |
| " | Connecting Rod (30.50" Single) | 12 | " | " |
| " | Clutch Sprocket (1921-36 61", 74" & 80" except 61" OHV) | 12 | " | " |
| 305-40 | Single End Connecting Rod (1940 & later 61", 74" & 80" Twins) | 18 | .694" | .1875" |
| 305-29 | Single End Connecting Rod (1929 & later 45" Twins) | 12 | .550" | .250" |
| " | Right Crankcase (1937 & later 45" Twins) | 12 | " | " |
| 305-26 | Right Crankcase (1936 61"; 1937 & later 61", 74" & 80" Twins) | 12 | .600" | .250" |
| " | Connecting Rod (21" Single) | 12 | " | " |
| " | Left Crankcase (21" & 30.50" Single) | 12 | " | " |
| 2289-17 | Forked End Connecting Rod (1929 & later 45" Twins) | 24 | .270" | .250" |
| " | Clutch Sprocket (1926-34 Singles and 45" Twins) | 16 | " | " |
| " | Countershaft Gear-Std. Transmission (1931 & earlier 61" & 74") | 24 | " | " |
| " | Main Drive Gear (1924 & earlier 61" & 74") | 20 | " | " |
| 2289-25 | Left Crankcase (1930 & later 61" 74" & 80" Twins | 24 | .490" | .250" |
| " | Rear Wheel Hub (1923-29 61" & 74" Twins) | 32 | " | " |
| " | Main Drive Gear (1925-36 61", 74" & 80" Twins except 61 OHV) | 20 | " | " |
| " | Clutch Gear (1934 & earlier 45" & Single Std. transmission) | 16 | " | " |
| " | Mainshaft (1934 & earlier 45" & Single Std. transmission) | 12 | " | " |
| " | Interchangeable Wheel Hub (1930-36 74" & 80" Twins) | 28 | " | " |
| " | Countershaft Gear-right side-(1931 Reverse-1932-36 Reverse & Std. Transmission 74" & 80" Twins) | 12 | " | " |

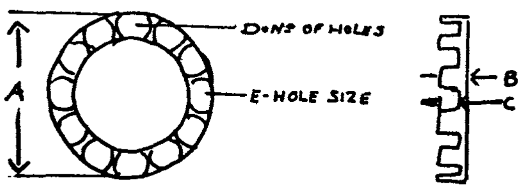
| PART NO | WHERE USED | NO. USED | LENGTH | STD. DIA. |
|---|---|---|---|---|
| 2289-25 | Servi-Car Axle Outer Ends (1932 & later) | 24 | .490" | .250" |
| " | Wheel Hubs (1935 & later 45" Rear Wheel and 1941 Servi-Car front wheel, 1936 61", 1937 & later 61", 74" & 80"-both wheel, "LE" Model Sidecar wheel) | 26 | " | " |
| 2306-32 | Countershaft gear - left side (1931-74" reverse, 1932-36 74" Std. & reverse transmission) | 21 | 5/8" | .152" |
| " | Clutch Gear - left side - (1933-34 45" twin & single reverse, 1935-40 45" std. & reverse transmission) | 31 | " | " |
| " | Mainshaft-right side - (1933-34 45" twin & single reverse, 1935 & later 45" std & reverse transmission) | 21 | " | " |
| " | Countershaft Gear-left side (1933-34 45" twin & single reverse, 1935 & later 45" std. & reverse transmission) | 19 | " | " |
| 2289-36 | Countershaft Gear (1936 61", 1937 & later 61", 74" & 80") | 44 | .615" | .125" |
| " | Main Drive Gear (1936 61", 1937 & later 61", and 80" twins) | 44 | " | " |
| " | Clutch Gear (1941 45") | 40 | " | " |
| 2289-39 | Countershaft Gear - right side (1939 & later 45") | 24 | 3/4" | .114" |
| 2289-36A | Countershaft Gear (1936 74" & 80" - 4 speed) | 78 | 39/64" | .0625" |

When assembling needle rollers in outer race preparatory to final assembly, apply a small amount of grease to hold rollers in place. Assemble specified number of rollers and observe that the last roller goes all the way into place freely and without requiring any effort to force it. If it doesn't go into place freely, leave it out. This is sometimes necessary when fitting oversize rollers, because they not only take up radial clearance, but also take up circumferential clearance. Rollers must not be crowded.

# SERVICE SHOP DOPE

No. 242A March 4, 1946

GUIDE FOR QUICK IDENTIFICATION OF ROLLER RETAINERS




| PART NO | WHERE USED | NO. USED | A | B | C | D | E |
|---|---|---|---|---|---|---|---|
| 301-15 | Front & rear Connecting rod lower end (1921-36 Big Twins) | 4 | 1-29/64" | .434" | .370" | 12 | .260" |
| " | Left Crankcase (1929 & earlier 61 & 74") | 2 | " | " | " | " | " |
| " | Front Brake Hub(1930-36 Big Twins) | 2 | " | " | " | " | " |
| " | Connecting Rod 30.50"-Single | 2 | " | " | " | " | " |
| " | Clutch Sprocket (1921-36 Big Twins Except 61" OHV) | 2 | " | " | " | " | " |
| 301-36 | Front & rear connecting rod lower end (1936 61", 1937-39 Big Twins) | 4 | 1-37/64" | .434" | .370" | 14 | .260" |
| 301-29 | Front & rear connecting rod lower end (1929 & later 45" models) | 4 | 1-29/64" | .341" | .282" | 12 | .260" |
| 301-40 | Front & rear connecting rod lower end (1940 & later big twins) | 4 | 1-19/32" | .434" | .354" | 18 | .1935" |
| 301-26 | Connecting Rod(21" single) | 2 | 1-21/64" | .370" | .309" | 12 | .260" |
| | Left crankcase (21"&30.50 single) | 2 | " | " | " | " | " |
| 415-36 | Right crankcase(1936 61", 1937 & later Big Twins) | 2 | 1-29/64" | .370" | .321" | 12 | .260" |
| 415-37 | Right Crankcase (1937 & later 45") | 2 | 1-21/64" | .341" | .282" | 12 | .260" |
| 417-29 | Left Crankcase (1929 & later 45") | 2 | 1-21/64" | .444" | .377" | 12 | .260" |



| PART NO | WHERE USED | NO. USED | A | B | C | D | E |
|---|---|---|---|---|---|---|---|
| 417-30 | Left Crankcase(1930 & later Big twin models) | 2 | 1-29/64" | .581" | .502" | 12 | .260" |
| " | Servi-Car axle outer ends (1932 and later) | 2 | " | " | " | " | " |
| " | Wheel hub-1935 & later 45" rear wheel; 1941 & later Servi-Car front wheel; 1937 & later Big twins, also 1936 OHV front & rear wheel "LE" sidecar wheel | 2 | " | " | " | " | " |
| 3993-23 | Rear wheel Hub (1934-39 Big Twin models) | 2 | 1-53/64" | .581" | .502" | 16 | .260" |
| | Clutch Gear(1934 & earlier single & 45" models) | 1 | " | " | " | " | " |
| 2286-25 | Main Drive Gear(1925-36 Big Twins except 61" OHV) | 1 | 2.580" | .612" | .502" | 20 | .260" |
| 2538-26 | Clutch Sprocket (1926-34 Single and 45") | 1 | 1-53/64" | .341" | .292" | 16 | .260" |
| 2291-26 | Transmission mainshaft (1929-34 single and 45" | 2 | 1-21/64" | .303" | .252" | 12 | .260" |
| " | Transmission countershaft gear right side (1932-36 Reverse & 3 speed Big Twins except 61"OHV) | 2 | " | " | " | " | " |
| 3922-30 | Wheel Hub (1930-36 Big Twins except 61" OHV) | 1 | 1-37/64" | .581" | .502" | 14 | .260" |
| 6171-30 | Sidecar Brake Shell Hub (1930-36 Big Twins) | 1 | 1-45/64" | .434" | .377" | 14 | .260" |
| 3967-35 | Wheel Hub(1935 & later 45" rear wheel; 1941 & later Servi-Car front wheel; 1937 & later Big Twins, also 1936 OHV front & rear wheel; "LE" sidecar wheel | 1 | 1-45/64" | .573 | .502" | 14 | .260" |

# SERVICE SHOP DOPE

No. 247

May 22, 1946

## CONNECTING ROD IDENTIFICATION GUIDE

Connecting rods can be identified by numbers forged in web or rod (disregard any letters following number).

### 45" MODELS (EXCEPT WLDR AND WR)

| Year Model | Forging No. | Part No. |
|---|---|---|
| 1932 and later | | |
| Forked End Rod | UA 705 | 283-32 |
| Single End rod | UA 706 | 284-32 |

### 74" and 80" Side Valve Models

| Year Model | Forging No. | Part No. |
|---|---|---|
| 1930 to 1936 | | |
| Forked End Rod | SA 705 | 285-30 |
| Single End Rod | SA 706 | 286-30 |
| 1937 and later | | |
| Forked End Rod | ZA 705 | 285-37 |
| Single End Rod | ZA 706 | 286-37 |

### 61" and 74" O.H.V. Models

| Year Model | Forging No. | Part No. |
|---|---|---|
| 1936 and later | | |
| Forked end rod | XA 705 or 40A 705 | 285-36 |
| Single End Rod | XA 706 or 40A 706 | 286-36 |

Connecting rods with letters DA, MA, OA, OM, RA, or TA preceding forging number are obsolete. They can no longer be obtained new, nor will they be repaired at the factory.

Some rods require 1" outside diameter piston pin bushing; other 57/64" outside diameter bushing. Some forked rods have more lower end enclosure than others. Rods that differ in any of these respects, but have same forging numbers, are considered interchangeable.

# SERVICE SHOP DOPE

No. 250

May 27, 1946

## USE CORRECT TYPE CRANK PIN IN 45 CU. IN. ENGINE

In a letter dated April 2, 1946, sent out by the Parts Department dealers were offered numerous Army Surplus Parts at special reduced prices. Among the items offered was:

289-32 - Set Connecting Rods Cpt. "These new rods, fitted with bearings and crankpin. They fit 1937 to 1946 - 45" Twins. They cannot be used in models older than 1937"

This connecting rod and bearing assembly can be used only in 1937 and later 45 cu. in. twin engines, because the crank pin fitted to the assembly is of the type ordinarily used only in new engine production. It has only one oil hole which registeres with the oil passage in right side flywheel of the 1937 and later engine but does not register with oil passages in right side of 1936 and earlier engine.

Connecting rod set with rollers and crank pin shipped on parts order since 1937 to other than the Army, formerly under catalog number 289-32 and now under catalog number 289-32A is fitted with crank pin formerly catalog number 348-29 and now catalog number 248-29B which has two oil holes in it making it apply to either 1936 and earlier or 1937 and later engines.

Although most dealers and their mechanics are familiar with the fact that only the two-hole type crank pin supplied individually and with rod sets on parts order as described above, is interchangeable in 1932 to 1946 engines and that the single-hole type crank pin as used in new engine production can be applied only to engines from 1937 to date; it will do no harm to again remind your mechanics and your parts man regarding this point. This caution will be especially timely, not only in connection with the use of the surplus connecting rod sets we're offering for sale, but also because many Army Surplus Parts are showing up from other sources and you might run on to some of the individual crank pins with one oil hole. If these are used in earlier than 1937 engines, lubrication will be shut off.

SERVICE SHOP DOPE

No. 251 July 1, 1946

NEW MOTORCYCLE PREVENTIVE MAINTENANCE OF FIRST IMPORTANCE

When you deliver a new motorcycle have a definite understanding with the purchaser that it is to be brought back to you after it has been operated its first 250 to 500 miles so you can give it the following attention:

SECURELY RE-TIGHTEN - Cylinder bas nuts, Cylinder head bolts or nuts, Intake manifold nuts.

RE-ADJUST, IF NECESSARY - Front drive chain oiler adjusting screw

No matter how securely nuts, bolts, and screws may be tightened in original assembly, initial seating of gaskets, joint surfaces, and bolts and screw heads after motorcycle is put in use, tends to develop looseness. It may not be much, but just enough so parts are no longer held together firmly. Vibration, wear and very often breakage are the results of this looseness.

Long established new motorcycle servicing calls for a complete checkup, tune-up, and re-tightening of all nuts, bolts and screws at 1000 to 1500 miles. This also includes re-tightening engine mounting bolts, cylinder head frame brace, transmission mounting, etc. However, this interval is too long for the items listed above. THEY MUST BE GIVEN ATTENTION at 250 to 500 MILES, and should be checked again at 1000 to 1500 miles.

It is especially important that cylinder base nuts be securely retightened. If a cylinder is even very slightly loose, the high frequency vibration and impact set up at cylinder base flange by the engine power impulses will in short time fatigue and crack cylinder around its base. When a cylinder lets go, the rest of engine is usually pretty much wrecked, and repair is an expensive job.

As nearly everyone knows, the good performance and life of a front chain depends entirely upon its ample lubrication. The quantity of oil required for ample lubrication is very slight. However, oiling must be constant. If oiling fails for a period of only a few hours or few hundred miles, especially when operating at high spped, chain is likely to be ruined. Initial oiling adjustment is set at the factory as closely as possible to normal service requirements, however, the quantity of oil involved is so small, initial adjustment cannot always be trusted as final. At 250 to 500 miles, remove inspection hole cover and make close inspection of chain. If chain appearance raises the least doubt as to its getting ample lubrication, add one or two more .002" washers under head of chain oiler adjusting screw. A well lubricated chain not only has an oily surface, but is also clean and free of discoloration. If chain has a brownish hue, and rusty appearance at side and center plates, it is under-lubricated even though the surface may be oily.

Since the quantity of oil involved is small, the opening through which oil bleeds to chain is regulated by adjusting screw to a very small orifice. Sediment and gummy matter accumulated in oil supply deposits in and around this orifice and gradually decreases the oil supplied to chain. In other words, a chain that lubricated perfectly the first 2000 miles, may run short of oil the second 2000 miles. You will go a long way toward eliminating chain failure by following the 250 to 500 mile recommendation and training your riders as follows: At intervals of 1000 to 1500 miles, loosen the chain oiler adjusting screw, and back it up about two turns. Operate this way a few miles and then turn screw back down lightly against its adjusting washers. This procedure flushes away accumulated sediment and restores oil orifice to its original size.

SERVICE SHOP DOPE

252 November 1, 1946

CARE OF TIRES AND WHEELS

When a racing motorcycle or car is being groomed for an event on road or track, as close attention is given to perfect condition of wheels and tires as to engine tuning. Wheel bearings are checked, wheels and tires are checked for out-of-true sideways, eccentricity, out-of-round, and out-of-balance. Careful attention is given to everything. If a tire tread is found worn irregular, tires are transposed or new tire installed. Inflation pressure is carefully adjusted to the poundage know to be right for weight of vehicle.

In other words, engine RPM and horsepower don't mean anything unless vehicle being driven can be guided with ease and safety at top speed. Stock model motorcycles today are approaching the speed of racing model motorcycles. Therefore, due attention to wheels and tires of stock motorcycles driven solo at high speed is just as essential as a racing motorcycle. Riders as a general thing do their own tire inflating and a wide variable is found in the pressures to which they inflate. This probably is mainly becuase no one has taken the time to impress them with the importance of correct inflation pressures according to load and tire size, and to enlighten them as to the influence this has on good or bad high speed handling.

Here and there a rider transposes his tires to avoid excessive irregular wear of front tire tread and to equalize tire wear, but most riders don't make this a practice because they don't realize it is a <u>must</u>. A tire kep in continuous <u>front</u> end service long enough to allow tread to wear noticeably irregular and peaked, is <u>very</u> likely to handle poorly at high speeds especially if <u>over-inflated</u>. When a rider complains of bad handling at higher speeds, check as follows:

1. Loose wheel axle nuts
2. Excessive wheel hub bearing play
3. Loosened spokes
4. Rear wheel alignment in frame and with front wheel
5. Rims and tires too much out-of-true sideways (should not be more than 3/64")
6. Rims and tires too much out-of-round or eccentric with hub(not more than 3/32")
7. IRREGULAR OR PEAKED FRONT TIRE TREAD WEAR: ALSO DETERMINE MILEAGE SINCE TIRES WERE LAST TRANSPOSED. IF MILEAGE IS 2500 OR MORE, TRASPOSE TIRES EVEN THOUGH IRREGULAR WEAR OR PEAKING OF FRONT TREAD IS NOT VERY NOTICEABLE.
8. Tire inflation as per inlation pressure chart. DO NOT OVER-INFLATE.
9. Tire and wheel balance. Static balancing is satisfactory.
10. Correct adjustment of steering head bearings and indication of pitted ball races.
11. Normal functioning of hydraulic forks, rear fork and shock absorbers.
12. Good working order and adjustment of steering damper so it can be applied easily and gradually to any desired steering friction.

With attention given as outlined you will find any high speed handling faulst corrected. The possible exception will be the case where there is serious frame or fork misalignment or mayble a tire in extremely bad condition which should be replaced. REMEMBER, TRANSPOSING TIRES AND INFLATING NO HIGHER THAN THE RECOMMENDED PRESSURE ARE OF FIRST IMPORTANCE. IN MANY CASES YOU WILL FIND THAT THIS ATTENTION ALONE APPLIED TO A MOTORCYCLE THAT DEVELOPS FAULTY HANDLING AT HIGHER SPEEDS, WILL GAIN THE DESIRED RESULT.

The advisable thing to do is to offer your riders this chassis tuneup as preventive maintenance to be repeated at about 3000 mile intervals. If you sell this plan you can be sure you will hear little about faulty handling.

# SERVICE SHOP DOPE

No. 252-A

November 1, 1946

TIRE INFLATION PRESSURES

BIG TWIN - SOLO RIDER ONLY

4.00" Tire - Front 14 lbs, Rear - 16 lbs.
5.00" Tire - Front 12 lbs., Rear - 14 lbs

SOLO - RIDER AND ONE PASSENGER

4.00" tire - Front 18 lbs., Rear 26 lbs.
5.00" tire - Front 12 lbs., Rear 16 lbs.

SIDECAR - RIDER AND ONE SIDECAR PASSENGER OR 150 LB. SIDECAR LOAD

4.00" tire - Front 20 lbs., Rear 24 lbs., Sidecar 14 lbs.
5.00" tire - Front 14 lbs., Rear 16 lbs., Sidecar 14 lbs.

PACKAGE TRUCK - RIDER AND 150 lbs. TRUCK LOAD

4.00" tire - Front 22 lbs., Rear 30 lbs., Package Truck 16 lbs.
5.00" tire - Front 14 lbs., Rear 20 lbs., Package Truck 14 lbs.

45" MODEL - SOLOR RIDER ONLY

4.00" tire - Front 12 lbs., Rear 14 lbs.
5.00" tire - Front 12 lbs., Rear 12 lbs.

SOLO - RIDER AND ONE PASSENGER

4.00" tire - Front 14 lbs., Rear 22 lbs.
5.00" tire - Front 12 lbs., Rear 14 lbs

The above tire inflation pressures are based on rider and passenger weight of approximately 150 lbs. each; Package Truck load 150 lbs.

When these loads are exceeded by 50 lbs or more, increase tire pressure as follows: For each 50 lbs of overload, increase pressure of rear tire, 2 lbs.; front tire, 1 lb.; sidecar or package truck tire, 1 lb.

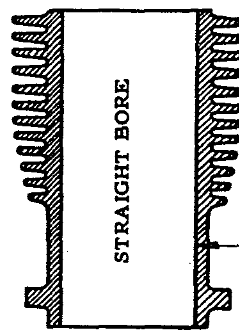
# SERVICE SHOP DOPE

No. 253

December 23, 1946

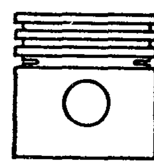
**CYLINDER REBORING AND PISTON FITTING INFORMATION**
**Supersedes Shop Dope Sheet No. 212**
**Straight Bore Cylinder And Slotted Type Piston**
**(Note: Dimensions given are standard size.)**

**TOP**




**Standard bore dimension of straight bore cylinder for slotted piston**

| | |
|---|---|
| 45" (1935 and later) | 2.745" |
| 74" (1935 and 1936, and all 80") | 3.422" |
| 74" Side Valve (1937 and later) | 3.3125" |
| 61" Overhead Valve (1936 and later) | 3.3125" |
| 74" Overhead Valve (1941 and later) | 3.4375" |



**Slotted piston should be fitted .001" to .002" clearance in straight bore cylinder, checking fit at bottom of skirt, front to rear.**

**HARLEY-DAVIDSON MOTOR CO.**
**Milwaukee, Wisconsin**
**U.S.A.**

# SERVICE SHOP DOPE

No. 255 February 25, 1947

## HARLEY-DAVIDSON FACTORY MECHANICS' SCHOOL REOPENS!

Now we can make the announcement of the opening of the factory training school for Harley-Davidson dealers and their mechanics. On Monday, March 17, 1947, the doors will open on a new and completely modern classroom for the first three-week course in a series that will last as long as the demand for mechanics' training exists.

A word about the school. Harley-Davidson has invested thousands of dollars in building and furnishing a 2100 square foot, permanent Mechanics' School. No expense has been spared in making this a strictly modern school for the instruction of Harley-Davidson mechanics. All the very latest tool and service equipment has been installed.

Requests for attendance at the Mechanics' School are bound to be many. Selection of students will be made in the following manner:

(a) All applicants considered must be authorized Harley-Davidson dealers, or their mechanics who are occupied FULL TIME with the servicing of Harley-Davidson motorcycles.

(b) All applicants must be approved by the Harley-Davidson traveling representative for the territory.

(c) Enrollment will be determined on the basis of order in which applications are received and how urgently the dealer is in need of aid to bring his service up to approved standards.

Until such time as all dealers urgently in need of service aid have had the opportunity to enroll themselves or a mechanic, only one enrollment per dealer will be accepted.

It is not advisable for a dealer to enroll a mechanic with very little or no experience at all anticipating developing him into a full-fledged mechanic in the school. A man doesn't need to be a thoroughly experienced mechanic to be enrolled, but unless he has had enough practical experience to have a dealer's shop picture and knows something of the service problems, he will not hand on to enough information to make it worth while.

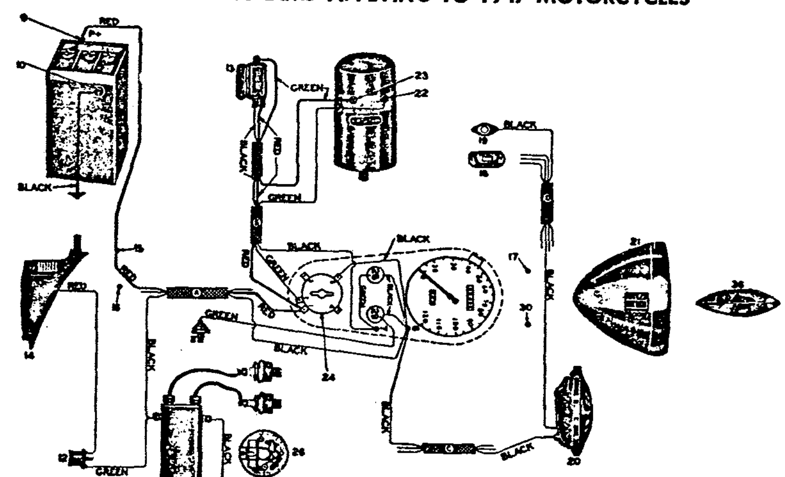
The school schedule is laid out for a three-week course, the first class to start on March 17, and finish April 4th. The second class is scheduled to begin April 7th and finish April 25th. The third class will being April 28th and finish May 16th. New classes, to be announced later, will be starting about every three weeks. Subjects covered include all phases of modern motorcycle service work on all Harley-Davidson models. Shop equipment and efficient shop operation will also be gone into thoroughly. Tuition is free - the only expense encountered in attending school will be transportation, room, board and necessary personal expenses.

Room and board or rooms only in sufficent number are not available near the factory, so arrangements have been made for room accomodations downtown at "770 Marshall" Hotel, just one and one-half blocks from the Chicago and Northwestern Depot. This is an apartment hotel. Each apartment has one double and one single bed for accomodating up to three men. Each apartment has a private bath. Applying only to those enrolled in our school, those students willing to put up three men in an apartment can get accomodations at $1.33 per man, per day, or $9.31, per man, per week. Food costs will, of course, depend upon where and how a man eats. A minimum estimate would be approximately $2.00 per day or $14.00 per week, and this would have to be added to room cost.

# SERVICE SHOP DOPE

No. 256 April 10, 1947

## WIRING DIAGRAMS APPLYING TO 1947 MOTORCYCLES




**Wiring Diagram: Generator — Battery; Ignition; Horn; Generator and Oiling System Signal Lights and Stop Lamp — 1947 Models**

A. THREE WIRE CABLE—Green wire; red wire; black wire.

B. THREE WIRE CABLE—Green wire; red wire; black wire.

C. THREE WIRE CABLE—Green wire; red wire; black wire.

D. LOOM (four wires)—Black wire with red tracer; red wire with yellow tracer; red wire with black tracer; black wire.

1. SWITCH TERMINAL—Cable "A" red wire from junction terminal (15); cable "B" red wire from relay (13) (terminal marked "BAT").

2. SWITCH TERMINAL—Cable "B" green wire from generator "switch" terminal (22).

5. SWITCH TERMINAL—Black wire from junction terminal (6).

6. JUNCTION TERMINAL—Cable "C" black wire from horn (20); black wire from oil signal light (29); black wire from generator signal light (28); black wire from switch terminal (5); cable "A" black wire from coil front terminal.

7. JUNCTION TERMINAL—Cable "B" black wire from relay (13); green wire from generator signal light (28).

9. BATTERY POSITIVE TERMINAL (left side)—Red wire from junction terminal (15).

10. BATTERY NEGATIVE TERMINAL (right side) — Black wire from ground terminal on frame.

11. OIL PRESSURE SIGNAL SWITCH—Green wire from oil signal light (29).

12. STOP LAMP SWITCH—Red wire from tail and stop lamp (14); green wire from coil front terminal.

13. RELAY—Cable "B" red wire from switch terminal (1) to relay terminal marked "BAT"; cable "B" black wire from junction terminal (7); green wire from generator "relay" terminal (23).

14. TAIL AND STOP LAMP—Red wire from stop lamp switch (12).

15. JUNCTION TERMINAL (in right side of motorcycle frame under saddle)—Cable "A" red wire from switch terminal (1); red wire from battery positive terminal (9).

19. HORN SWITCH—Loom "D" black wire from horn (20).

20. HORN—Loom "D" black wire from horn switch (19); cable "C" black wire from junction terminal (6).

22. GENERATOR ("SWITCH") TERMINAL—Cable "B" green wire from switch terminal (2).

23. GENERATOR ("RELAY") TERMINAL—Green wire from relay (13).

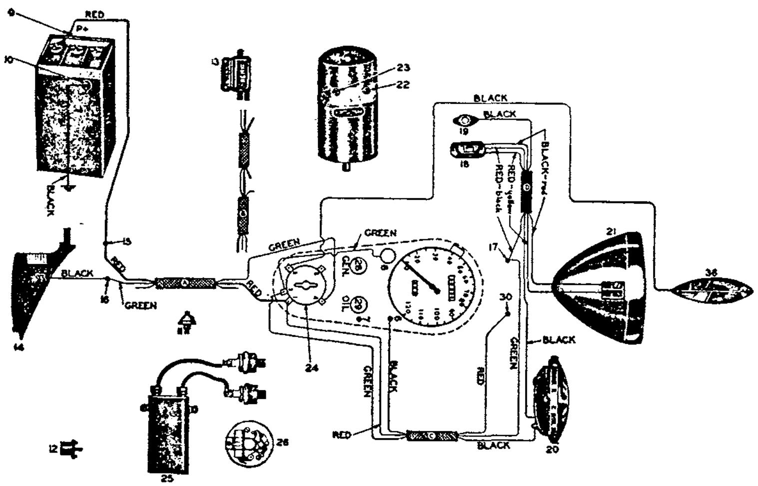
24. IGNITION-LIGHT SWITCH (top view)—Switch is OFF when switch lock cover hinge is directly forward. Turn to first right position for ignition only. Switch is provided with lock and key to permit locking, if desired, when motorcycle is not in use. It can be locked in OFF and PARK positions only. When switch is unlocked and motorcycle is in use, key should be removed from lock.

25. IGNITION COIL—Cable "A" black wire from junction terminal (6); green wire from stop lamp switch (12); black wire (low tension wire) from circuit breaker (26).

26. IGNITION CIRCUIT BREAKER—Black wire (low tension wire) from coil rear terminal.

28. GENERATOR SIGNAL LIGHT (marked "GEN")—Black wire from junction terminal (6); green wire from junctional terminal (7).

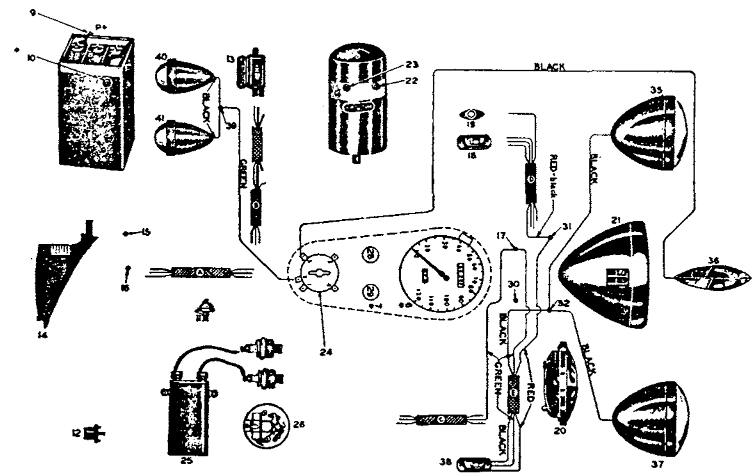
29. OIL PRESSURE SIGNAL LIGHT (marked "OIL")—Green wire from oil pressure signal switch (11); black wire from junction terminal (6).




## Wiring Diagram: Lighting System and Horn — 1947 Models

A. THREE WIRE CABLE—Green wire; red wire; black wire.
C. THREE WIRE CABLE—Green wire; red wire; black wire.
D. LOOM (four wires)—Black wire with red tracer; red wire with yellow tracer; red wire with black tracer; black wire.
1. SWITCH TERMINAL—Cable "A" red wire from junction terminal (15); cable "C" red wire from junction terminal (30).
2. SWITCH TERMINAL—Cable "C" green wire from junction terminal (17); green wire from speedometer light (8).
3. SWITCH TERMINAL—Black wire from mudguard lamp (36).
4. SWITCH TERMINAL—Cable "A" green wire from junction terminal (16).
6. JUNCTION TERMINAL—Cable "C" black wire from horn (20).
8. SPEEDOMETER LIGHT—Green wire from switch terminal (2).
9. BATTERY POSITIVE TERMINAL (left side)—Red wire from junction terminal (15).
10. BATTERY NEGATIVE TERMINAL (right side) — Black wire from ground terminal on frame.
14. TAIL AND STOP LAMP—Black wire from junction terminal (16).
15. JUNCTION TERMINAL (in **right** side of motorcycle frame under saddle)—Cable "A" red wire from switch terminal (1); red wire from battery positive terminal (9).
16. JUNCTION TERMINAL (in left side of motorcycle frame under saddle)—Cable "A" green wire from switch terminal (4); black wire from tail and stop lamp (14).
17. JUNCTION TERMINAL (**front** terminal—left side, in headlamp bracket)—Cable "C" green wire from switch terminal (2); loom "D" red wire with black tracer from handlebar toggle switch (18).
18. HANDLEBAR TOGGLE SWITCH—Loom "D" black wire with red tracer from headlamp large terminal screw; loom "D" red wire with yellow tracer from headlamp small terminal screw; loom "D" red wire with black tracer from junction terminal (17).
19. HORN SWITCH—Loom "D" black wire from horn (20).
20. HORN—Cable "C" black wire from junction terminal (6); loom "D" black wire from horn switch (19).
21. HEADLAMP—Loom "D" black wire with red tracer from handlebar toggle switch (18) to large terminal screw; loom "D" red wire with yellow tracer from handlebar toggle switch (18) to small terminal screw. Note: Headlamp is shown in upside down position.
24. IGNITION-LIGHT SWITCH (top view)—Switch is OFF when switch lock cover hinge is directly forward. Turn **left** for parking lights—first **right** position for ignition only—second right position for ignition and running lights. Bear in mind that lighting headlamp when engine is dead also turns ignition ON. Switch is provided with lock and key to permit locking, if desired, when motorcycle is not in use. It can be locked in OFF and PARK positions only. When switch is unlocked and motorcycle is in use, key should be removed from lock.
30. JUNCTION TERMINAL—(**front** terminal—right side, in headlamp bracket)—Cable "C" red wire from switch terminal (1). This is a live terminal and can be used for accessory lamps independent of ignition-light switch.
36. MUDGUARD LAMP—Black wire from switch terminal (3).






## Wiring Diagram: Lighting System Accessory Lamps (does not apply to Police Pursuit Lamps) — 1947 Models

Note: With this method of wiring, when spotlamps are turned ON, headlamp is automatically turned OFF and vice-versa.

C. THREE WIRE CABLE—Green wire; red wire; black wire.
D. LOOM (four wires)—Black wire with red tracer; red wire with yellow tracer; red wire with black tracer; black wire.
E. THREE WIRE CABLE (clamped on outside of right handlebar)—Green wire; red wire; black wire.
2. SWITCH TERMINAL—Green wire from junction terminal (39).
3. SWITCH TERMINAL—Black wire from mudguard lamp (36).
17. JUNCTION TERMINAL (**front** terminal—left side, in headlamp bracket)—Cable "C" green wire; cable "E" green wire from handlebar toggle switch (38). Note: Loom "D" red wire with black tracer is connected to this terminal for Standard Equipment Lighting System, but when installing spotlamps, it is disconnected from this terminal and reconnected to junction terminal (31).
31. JUNCTION TERMINAL (**side** terminal—left side, in headlamp bracket)—Cable "E" red wire from toggle switch (38); loom "D" red wire with black tracer.
32. JUNCTION TERMINAL (**side** terminal—right side, in headlamp bracket)—Black wires from spotlamps (35) and (37); cable "E" black wire from toggle switch (38).
35. SPOTLAMP—Black wire from junction terminal (32).
36. MUDGUARD LAMP—Black wire from switch terminal (3).
37. SPOTLAMP—Black wire from junction terminal (32).
38. HANDLEBAR TOGGLE SWITCH (clamped to right bar) —Cable "E" red wire from junction terminal (31); cable "E" green wire from junction terminal (17); cable "E" black wire from junction terminal (32).
39. JUNCTION TERMINAL (in saddle bar—right side)—Green wire from switch terminal (2); black wires from saddle lamps (40) and (41).
40. SADDLE LAMP—Black wire from junction terminal (39).
41. SADDLE LAMP—Black wire from junction terminal (39).

# SERVICE SHOP DOPE

No. 260 July 1, 1947

74 CU. IN. O.H.V. ENGINE FITTING SPECIFICATIONS (1941 TO AND INCLUDING 1947 MODELS)

PISTON CLEARANCE - ALUMINUM PISTON -- Slotted, cam ground type - new piston fitted in cylinder .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.

Measure piston at bottom of skirt, front to rear.

Measure cylinder about 1/2" from top of bore, front to rear.

PISTON PIN IN PISTON -- Light hand press fit.

PISTON PIN IN UPPER END OF CONNECTING ROD -- .0008" to .0012" loose

PISTON RING GAP AND GROOVE CLEARANCE -- .010" to .020" gap, 1/2" from top of cylinder. Rings should be .004" loose in grooves.

LOWER CONNECTING ROD BEARING -- .001" to .0012" loose

CONNECTING RODS -- .006" to .010" end play between flywheels -- roller and retainer assembly should be narrower, but not more than .010" narrower than forked rod.

SPROCKET SHAFT -- .0005" to .001" loose in roller bearing - .007" to .009" loose in oil retaining bushing.

PINION GEAR SHAFT -- .0008" to .0012" loose in roller bearing -- .0005" to .0012" loose in cover bushing. Oil slot in cover bushing is centered with drilled feed oil channel in cover.

FLYWHEEL ASSEMBLY -- .012" to .014" end play in crank case.

CAM GEAR -- .001" to .0015" loose in crank case and cover bushings - free to .005" end play.

INTERMEDIATE GEARS -- .001" to .0015" loose on studs

TAPPET GUIDES -- .0005" to .001" press fit in crank case

VALVE TAPPETS -- .0008" to .00175" loose in tappet guides

ROCKER ARM FIT ON SHAFT -- .0005" to .0015" loose - .007" to .016" end play

OIL PUMP DRIVE SHAFT -- .0008" to .0012" loose in crank case bushing

CRANK CASE BREATHER -- Timed with front cylinder - opens 1/8" before top center to 1/8" after top center, and closes 13/16" to 1-5/16" after bottom center.

# SERVICE SHOP DOPE

No. 260B July 1, 1947

74 AND 80 CU. IN. SIDE VALVE ENGINE FITTING SPECIFICATIONS (1937 AND LATER MODELS)

(NOTE: These supersed previous specifications dated June 6, 1941)

PISTON CLEARANCE -- ALUMINUM PISTON - Slotted, cam ground type - New piston fitted in straight bore cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.

Measure piston at bottom of skirt, front to rear.

Measure cylinder about 1/2" from top of bore, front to rear.

PISTON-CYLINDER HEAD CLEARANCE -- 1/16" to 3/32" with piston at top center.

PISTON PIN IN PISTON -- Light hand press fit

PISTON PIN IN UPPER END OF CONNECTING ROD -- .0008" to .0012" loose.

PISTON RING GAP AND GROOVE CLEARANCE -- .010" to .020" gap, 1/2" from top of cylinder. Rings should be .004" loose in grooves.

LOWER CONNECTING ROD BEARING -- .001" to .0012" loose.

CONNECTING RODS -- .006" to .010" clearance between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than forked rod.

PINION GEAR SHAFT -- .0008" to .0012" loose in roller bearing, and .0005" to .0012" loose in cover bushing. Oil hole in cover bushing is $30^\circ$ ahead of top center, and in line (on opposite side) with drilled feed oil channel in cover.

SPROCKET SHAFT -- .0005" to .001" loose in roller bearing - .007" to .009" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY -- .012" to .014" end play in crank case.

CAM GEARS - .0005" to .001" loose in crank case and cover bushings - free to .007" end play.

INTERMEDIATE GEAR -- .001" to .0015" loose on stud.

TAPPET GUIDES -- .0005" to .001" press fit in crank case.

VALVE TAPPETS -- .0005" to .001" loose in tappet guides

CRANK CASE BREATHER - Which is part of, and drives scavenger pump, is timed according to instructions in Riders Instruction Folder.

# SERVICE — SHOP DOPE

No. 260C July 1, 1947

## 74 & 80 CU. IN. SIDE VALVE ENGINE FITTING SPECIFICATIONS

(1930 TO AND INCLUDING 1936 MODELS)

PISTON CLEARANCE -- IRON ALLOY PISTONS -- Used in 1930-34 engines fitted with taper bore cylinders -- .004" to .005" clearance.
ALUMINUM AND DOW METAL PISTONS -- Solid skirt type -- used in 1930-34 engines fitted with taper bore cylinders -- .016" to .018" clearance.
ALUMINUM PISTON -- Slotted, cam ground type -- New piston fitted in straight bore cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.

Measure solid skirt piston just below the top group of rings.

Measure slotted piston at bottom of skirt, front to rear.

Measure cylinder about 1/2" from top of bore, front to rear.

PISTON-CYLINDER HEAD CLEARANCE --All models except VC Commercial, 1/16" to 3/32"; VC Commercial, discontinued after 1933 7/64" to 9/64" - with piston at top center

PISTON PIN IN IRON ALLOY PISTON -- .0005" to .001" press fit in lock pin side - plug or slip fit in opposite side.

PISTON PIN IN DOW METAL AND ALUMINUM PISTONS - Solid skirt type .0005" to .001" press fit in piston.

PISTON PIN IN ALUMINUM PISTON -- Slotted type - light hand press fit.

PISTON PIN IN UPPER END OF CONNECTING ROD -- .0008" to .0012" loose

PISTON RING GAP AND GROOVE CLEARANCE - Taper bore cylinder, .006" gap, 1/2" from top of cylinder. Straight bore cylinder, .010" to .020" gap, 1/2" from top of cylinder. Rings should be .004" loose in Dow metal and Aluminum piston grooves and just free in Iron piston grooves.

LOWER CONNECTING ROD BEARING -- .001" to .0012" loose

CONNECTING RODS - .006" to .010" clearance between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than forked rod.

PINION GEAR SHAFT - .0045" loose at inner end of bushing --.002" loose at outer end of bushing. Bushing is taper reamed with special reamer.

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .006" to .007" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY - .006" to .010" end play in crank case.

CAM GEARS - .0005" to .001" loose in crank case and cover bushings - free to .005" end play

INTERMEDIATE GEAR - .001" to .0015" loose on stud.

TAPPET GUIDES - .0005" to .001" press fit in crank case.

VALVE TAPPETS -- .0005" to .001" loose in tappet guides.

# SERVICE — SHOP DOPE

No. 260D July 1, 1947

## 45 CU. IN. SIDE VALVE ENGINE FITTING SPECIFICATION (1937 AND LATER MODELS)

EXCEPT WLDR AND WR MODELS

PISTON CLEARANCE -- ALUMINUM PISTON - Slooted, cam ground type - new piston fitted in straight bore cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.

Measure piston at bottom of skirt, front to rear

When fitting oversize piston which has vertical slot in addition to horizontal slots, fit with vertical slot forward.

Measure cylinder about 1/2" from top of bore, front to rear.

PISTON CYLINDER HEAD CLEARANCE -- 1/16" to 3/32" with piston at top center

PISTON PIN IN PISTON -- Light hand press fit.

PISTON PIN IN UPPER END OF CONNECTING ROD -- .0008" to .0012" loose

PISTON RING GAP AND GROOVE CLEARANCE - Straight bore cylinder - .010" to .020" gap, 1/2" from top of cylinder. Rings should be .004" loose in grooves.

LOWER CONNECTING ROD BEARING -- .0007" to .001" loose.

CONNECTING RODS -- .006" to .010" end play between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than forked rod.

PINION GEAR SHAFT - .0008" to .0012" loose in roller bearing, and .0005" to .0012" loose in cover bushing. Oil slot in cover bushing is 30° ahead of top center and in line (on opposite side) with drilled feed oil channel in cover.

SPROCKET SHAFT - .0005" to .001" loose in roller bearing - .006" to .007" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY - .009" to .011" end play in crank case

CAM GEARS - .0005" to .001" loose in crank case and cover bushings - free to .007" end play.

INTERMEDIATE GEAR -- .001" to .0015" loose on stud.

TAPPET GUIDES - .0005" to .001" press fit in crank case.

VALVE TAPPETS -- .0005" to .001" loose in tappet guides

CRANK CASE BREATHER - Which is a part of, and drives scavenger pump, is timed according to instructions in Riders Instruction Folder.

# SERVICE SHOP DOPE

No. 260E July 1, 1947

## 45 CU. IN. SIDE VALVE ENGINE FITTING SPECIFICATIONS (1930 TO AND INCLUDING 1936) EXCEPT WLDR MODEL

PISTON CLEARANCE -- ALUMINUM AND DOW METAL PISTONS - Solid skirt type used in 1934 and earlier engines fitted with taper bore cylinders - .014" to .016" clearance.
ALUMINUM PISTON - Slotted, cam ground type - new piston fitted in straight bore cylinder, .001" to .002" clearance. Piston shapes to cylinder and acquires more clearance after short time in service.

Measure solid skirt piston just below the top group of rings.

Measure slotted piston at bottom of skirt, front to rear.

When fitting oversize piston which has vertical slot in addition to horizontal slots, fit with vertical slot forward.

Measure cylinder about 1/2" from top of bore, front to rear.

PISTON-CYLINDER HEAD CLEARANCE -- 3/64" to 5/64" with piston at top center

PISTON PIN IN ALUMINUM AND DOW METAL PISTONS -- Solid skirt type - .0005" to .001" press fit in piston

PISTON PIN IN ALUMINUM PISTON -- Slotted type - light hand press fit.

PISTON PIN IN UPPER END OF CONNECTING ROD -- .0008" to .0012" loose

PISTON RING GAP AND GROOVE CLEARANCE - Taper bore cylinder, .006" gap, 1/2" from top of cylinder. Straight bore cylinder, .010" to .020" gap, 1/2" from top of cylinder. Rings should be .004" loose in grooves.

LOWER CONNECTING ROD BEARING -- .0007" to .001" loose

CONNECTING RODS--.006" to .010" end play between flywheels - roller and retainer assembly should be narrower, but not more than .010" narrower than forked rod.

PINION GEAR SHAFT -- .0045" loose at inner end of bushing - .002" at outer end of bushing. Bushing is taper reamed with special reamer.

SPROCKET SHAFT -- .0005" to .001" loose in roller bearing - .006" to .007" loose in oil retaining bushing.

FLYWHEEL ASSEMBLY - .004" to .008" end play in crank case.

CAM GEARS -- .0005" to .001" loose in crank case and cover bushings - free to .005" end play.

GENERATOR DRIVE GEARS AND SHAFT (1931 and earlier models) -- Shaft must be free running fit; have .002" to 004" end play, and .001" to .0015" clearance in bearings. Small bevel gear should be .002" to .003" loose in bushing assembly, and shimmed to allow .002" to .004" clearance between bevel gears.

TAPPET GUIDES -- .0005" to .001" press fit in crank case

VALVE TAPPETS -- .0005" to .001" loose in tappet guides.

# SERVICE SHOP DOPE

No. 260G July 1, 1947

## TIMING SPECIFICATIONS

### 74 & 80 CU. IN. SIDE VALVE ENGINE (1930 AND LATER MODELS EXCEPT 1930 AND 1931 V & VC)

INTAKE VALVE - OPENS when piston is 9/32" to 13/32" before top dead center
CLOSES when piston is 7/8" to 1-1/8" after bottom dead center

EXHAUST VALVE - OPENS when piston is 5/8" to 7/8" before bottom dead center
CLOSES when piston is 1/4" to 3/8" after top dead center

IGNITION -- OCCURS when piston is 5/16" to 11/32" before top dead center on compression stroke.

11/32" timing (Flywheel mark slightly forward of center of crank case inspection hole) applies to moderate compression engines in solo service. High compression solo engine (8.2 heads) also all engines in sidecar service should be timed 5/16".

### 74 CU. IN. SIDE VALVE ENGINE (1930 AND 1931 V AND VC MODELS)

INTAKE VALVE - OPENS when piston is 11/64" to 19/64" before top dead center
CLOSES when piston is 9/16" to 13/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 9/16" to 13/16" before bottom dead center
CLOSES when piston is 11/64" to 19/64" after top dead center

IGNITION - OCCURS when piston is 1/4" to 5/16" before top dead center on compression stroke.

### 61 CU. IN. OHV ENGINE (1936 AND LATER MODELS)

INTAKE VALVE - OPENS when piston is 19/64" to 25/64" before top dead center
CLOSES wehn piston is 29/32" to 1-3/32" after bottom dead center

EXHAUST VALVE - OPENS when piston is 23/32" to 29/32" before bottom dead center
CLOSES when piston is 19/64" to 25/64" after top dead center

IGNITION - OCCURS when piston is 7/16" before top dead center on compression stroke.

### 74 CU. IN. O.H.V. ENGINE (1941 AND LATER MODELS)

INTAKE VALVE - OPENS when piston is 23/64" to 29/64" before top dead center
CLOSES when piston is 1-1/64" to 1-13/64" after bottom dead center

EXHAUST VALVE - OPENS WHEN PISTON IS 13/16" to 1" before bottom dead center
CLOSES when piston is 23/64" to 29/64" after top dead center

IGNITION - OCCURS when piston is 7/16" before top dead center on compression stroke.

### 45 CU. IN. SIDE VALVE ENGINE (ALL MODELS EXCEPT WLDR & WR)

INTAKE VALVE - OPENS when piston is 5/32" to 7/32" before top dead center
CLOSES when piston is 37/64" to 45/64" after bottom dead center

EXHAUST VALVE - OPENS when piston is 37/64" to 45/64" before bottom dead center
CLOSES when piston is 5/32" to 7/32" after top dead center

IGNITION - OCCURS when piston is 1/4" to 9/32" before top dead center on compression stroke.

30.50 CU. IN. SIDE VALVE SINGLE ENGINE (ALL MODELS)

INTAKE VALVE - OPENS when piston is 5/16" to 9/16" before top dead center
CLOSES when piston is 11/16" to 15/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 1/2" to 3/4" before bottom dead center
CLOSES when piston is 1/4" to 1/2" after top dead center

IGNITION - OCCURS when piston is 1/4" to 5/16" before top dead center on compression stroke.

21 CU. IN SIDE VALVE SINGLE ENGINE (ALL MODELS)

INTAKE VALVE - OPENS when piston is 1/8" to 3/16" before top dead center
CLOSES when piston is 7/16" to 9/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 7/16" to 9/16" before bottom dead center
CLOSES when piston is 1/8" to 3/16" after top dead center

IGNITION - OCCURS when piston is 7/32" to 9/32" before top dead center on compression stroke.

21 CU. IN O.H.V. SINGLE ENGINE (ALL MODELS)

INTAKE VALVE - OPENS when piston is 3/32" to 5/32" before top dead center
CLOSES when piston is 7/16" to 9/16" after bottom dead center

EXHAUST VALVE - OPENS when piston is 7/16" to 9/16" before bottom dead center
CLOSES when piston is 3/32" to 5/32" after top dead center

IGNITION - OCCURS WHEN piston is 11/32" to 13/32" before top dead center on compression stroke.

## TAPPET CLEARANCES

45" AND SINGLE SIDE VALVE ENGINES -- INTAKE - .004" to .005"
EXHAUST - .006" to .007"

74" & 80" SIDE VALVE ENGINES -- INTAKE - .004" to .005"
EXHAUST - .007" to .008"

O.H.V. SINGLE ENGINE -- INTAKE AND EXHAUST - .002" to .003"

O.H.V. TWIN ENGINE -- INTAKE AND EXHAUST - Correctly adjusted when tappet has just noticeable play or shake, and can be turned freely with finger tips, completely around, without any trace of bind.

NOTE: ALL SIDE VALVE ENGINES AND O.H.V. SINGLE ENGINE - When checking valve timing according to piston position, first make sure tappets are adjusted to the correct clearance as given above.

O.H.V. TWIN ENGINE - When checking valve timing according to piston position, first adjust all valve tappets temporarily to .004" clearance. Turn engine in direction it runs until valve being checked is open .001" before measuring piston position. After timing has been checked valve tappets must be readjusted to the correct clearance as given above.

## CIRCUIT BREAKER OPENING

ALL MODELS -- .022"

# SERVICE SHOP DOPE

No. 263 November 21, 1947

SERVICE INFORMATION ON HYDRAULIC TYPE PUSH RODS ON 1948 OVERHEAD VALVE ENGINES

## PUSH RODS AND VALVE TAPPETS (RIDER INFORMATION)

Push rods are self-adjusting, hydraulic type. They automatically adjust their length to compensate for hot engine expansion and valve mechanism wear, and thus keep the valve mechanism free of lash when engine is running. Tappet adjustment is required only in new engine assembly, and when engine is reassembled after reapir, to compress the push rod hydraulic units to the length specified for normal functioning.

On starting an engine, which has been shut off even for a few minutes, the valve mechanism may tend to be slightly noisy till the hydraulic push rods completely refill with oil. If at any time, other than a short period immediately after engine is started, valve mechanism becomes abnormally noisy, it is an indication that one or more of the hydraulic push rod units may not be functioning properly. Always check lubricating oil supply in oil tank first, if the valve mechanism becomes noisy, since normal circulation of oil through engine is necessary for proper operation of hydraulic units. If there is oil in tank, the push rod units may not be function properly due to contamination in oil supply Drive at moderate speed to nearest Harley-Davidson dealer for further attention.

## ADJUSTING TAPPETS OF 1948 OVERHEAD VALVE ENGINES (MECHANIC INFORMATION)

Engine must be cold.

Remove push rod cover keepers and telescope covers to expose tappets

Before readjusting a tappet, make sure it is at its lowest position. You can make sure of this by turning engine in direction in which it runs until the like tappet (intake or exhaust) in the other cylinder is at its highest position (Valve fully open).

Loosen tappet adjusting screw lock nut and turn tappet screw down until push rod is free and has noticeable shake. When checking for push rod shake, grasp push rod with finger tips just below cylinder head, and shake toward front and rear of engine.

Slowly turn tappet screw upward just far enough to take up all push rod shake. Now, mark tappet screw with chalk or some other manner, so its turns can be accurately counted, and then continue turning it upward exactly three full additional turns.

Adjust the other three tappets the same way.

With tappets accurately adjusted, according to above, hydraulic units will be compressed 3/32" which is the specified setting for normal functioning.

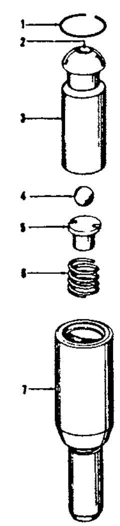
If after readjusting tappets, engine does not start readily because of loss of compression in one or both cylinders, allow engine to stand a few minutes before further attempt to start. This standing time is required to allow the newly adjusted hydraulic units time to leak-down until valves are fully seated.

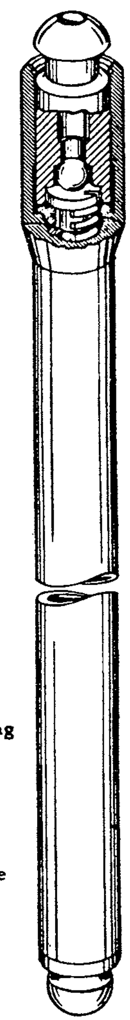
Bear in mind that after initial tappet adjustment as described above, hydraulic type push rods are self-adjusting to compensate for hot engine expansion and valve mechanism wear. Therefore, tappet adjustment is normally required only in new engine assembly and when engine is reassembled after having been taken apart for repair.

## SERVICING HYDRAULIC PUSH ROD (DEALER AND MECHANIC INFORMATION)

Servicing push rod consists only of removing it from engine, disassembling hydraulic unit, washing the parts thoroughly, and reassembling.





**PUSH ROD HYDRAULIC UNIT**

1. **Plunger retaining snap ring**
2. **Oil inlet hole**
3. **Plunger**
4. **Ball check-valve**
5. **Ball retainer**
6. **Plunger spring**
7. **Cylinder**

There are two principal parts of the hydraulic unit. These are the plunger #3 and the cylinder #7. The plunger contains the check valve assembly, which is held in position by the plunger spring #6. It is recommended that only one unit at a time be taken apart for service and that it be reassembled before working on another unit, as plunger and cylinder are selectively fitted by manufacturer to clearance required to allow definite leakage rate between plunger and cylinder. Plunger or cylinder of one unit MUST NOT BE INTERCHANGED with plunger or cylinder of another unit.

As the hydraulic unit cylinder is a press fit into push rod, it will be necessary to service unit without removing from push rod. Where a complete unit must be replaced, cylinder can be forced out of push rod and new unit pressed or diven in.

In disassembling hydraulic unit, first remove snap ring #1, which is located at top of cylinder; then remove plunger from cylinder. In case plunger does not pull out of cylinder easily, grip top of plunger with pair of pliers wrapped with tape and pull with twisting motion.

During the disassembly operation, it is advisable to hold the hydraulic unit over pan of clean solvent in which parts are to be washed, or at least over a bench, so check valve parts will not become lost. After removing plunger, disassemble check valve parts 4 and 5 and wash all thoroughly.

After parts have been thoroughly washed, test hydraulic unit to determine if check valve is holding, and also whether leakage past plunger is still normal. Thic can be done as follows: (DO NOT OIL ANY PARTS WHEN MAKING THIS TEST)

Assemble ball 4, retainer 5 and spring 6 back into plunger then, holding plunger in upside-down position so ball falls into its seat, start cylinder onto plunger. Quickly push cylinder down over plunger and immediately releast it. If unit is in good order and check valve is holding, cylinder should bounce back.

If when cylinder is quickly pushed down and immediately released, it stays down, either the check valve is leaking, or cylinder and plunger are worn to extent there is excessive leakage past plunger. In order to determine whether check valve is leaking, place finger over hole 2 at end of plunger and repeat the test operation. If cylinder now bounces back as it should, it is an indication that check valve is leaking possibly due to parts still being dirty. Rewash parts thoroughly and repeat test operation. If cylinder still does not bounce back, the complete hydraulic unit should be replaced with a new one.

If above described test shows unit functioning normally, complete reassembly by installing snap ring 1 making sure it seats in its groove near top of cylinder.

If a serviced push rod is to be used immediately, it is not necessary to re-oil the hydraulic unit before assembling push rod in engine. The engine oiling system will re-oil the unit as soon as engine is started. After reassembling push rod in engine, be sure tappet is accurately readjusted according to tappet adjusting instructions in this bulletin. A newly serviced hydraulic may be noisy for several minutes after engine is started, as some time is required to work out all the air and fill unit with oil.

SERVICE SHOP DOPE

No. 267 February 19, 1948

## 125 MODEL CAUTION

Few of the 125 models supplied to dealers to date have been sold and put into active service. Most of them are still retained for display and demonstration. This means that the engines of these motorcycles are being started frequently, so those interested may observe how easily engine starts and how it runs. Possibly now and then a short ride is taken, but seldom is engine run long enough to warm it up to normal operation temperature.

Combustion in any gasoline engine generates water vapor. When a cold engine is started, some of this vapor condenses on cold cylinder wall and piston. It is not until engine parts reach a temperature of approximately 160 degrees F. that internal condensation ceases and parts are free of moisture. Therefore, when an engine is frequently started cold, but is not run long enough to warm up, the cylinder wall and rings will soon be rusted, eventually to the extent that engine will be found "frozen" and can't be cranked. This condition will develop in any engine, whether four cycle or two cycle, however, it will develop sooner in a two cycle engine, because the two cycle engine lubricating oil is taken into engine in a diluted state, and cylinder wall does not have as heavy a coating of oil as the four cycle engine, to protect from moisture that may be present when engine is dead.

## PREVENTIVE MEASURES

Whenever engine is started, run it long enough to thoroughly warm up, so that any moisture inside will be dried up

OR

If short demonstrating starts and runs that don't warm up engine must be made, at the end of each day during which one or more starts and short runs have been made, remove spark plug, put a teaspoonful of engine oil into cylinder and crank engine several times (ignition off), to thoroughly distribute oil to cylinder wall and rings.

The above PREVENTIVE MEASURES will not apply to a 125 model sold and put into private owner use. A private owner will usually start engine only when driving far enough to warm it up to normal operating temperature.

SERVICE SHOP DOPE

No. 268 February 24, 1948

## VALVE SPRING TESTING INFORMATION

New Valve Spring Length and Poundage

| MODEL | PART NO. | APPROXIMATE FREE LENGTH | VALVE CLOSED | VALVE OPEN Spring compressed to |
|---|---|---|---|---|
| 1932 to 1940 45 cu. in. model | 168-32 | 2-3/16" | 1-7/8" - 50 to 60 lbs. | 1-9/16" - 90 to 100 lbs. |
| 1941 and later 45 cu. in. model | 168-41 | 2-19/32" | 2-3/16" - 50 to 60 lbs. | 1-7/8" - 90 to 100 lbs. |
| 1930 and later 74 and 80 cu. in. L head models | 168-30B | 2-7/16" | 2-1/8" - 55 to 65 lbs. | 1-3/4" - 125 to 135 lbs. |
| 1936 and later 61 and 74 cu. in. | 168-36 | Outer Spring 1-13/16" | 1-13/32" - 55 to 65 lbs. | 1-1/16" - 110 to 120 lbs |
| O.H.V. models | 169-36 | Inner Spring 1-15/32" | 1-1/4" - 25 to 35 lbs | 29/32" - 70 to 80 lbs. |

It is recommended that a used spring be discarded when poundage shows 5 lbs. below low limit poundage of new spring.

# SERVICE SHOP DOPE

No. 271 March 25, 1948

## GREASE 125 MODEL WHEEL HUB BEARINGS

In factory assembly the wheel hub bearings of 125 model motorcycles below No. 48S2800 were only lightly greased. Because of insufficient grease to adequately lubricate bearings and protect them from moisture entering hubs, a number of bearings have been found unduly worn and badly rusted.

Starting with No. 48S2800 wheel bearings (not wheel hubs) have been packed full of grease.

Avoid trouble with bearing failures by immediately regreasing the wheel hub bearings of all 125's below 48S2800. Use Harley-Davidson or other equally good wheel bearing grease, and pack bearings full.

HARLEY-DAVIDSON MOTOR CO.

Milwaukee 1, Wis., U.S.A.

# SERVICE SHOP DOPE

No. 278 October 14, 1948

## SERVICING 1948 OVERHEAD VALVE ENGINES FOR BEST OIL CONTROL

Anything above 250 miles per quart of oil is considered normal oil mileage. Where oil mileage may be reported considerably below 250 miles per quart don't jump to the conclusion that piston rings or cylinder bores or both are in bad order. There are other reasons for abnormal oil consumption.

Before taking any action get a complete case history. If the report claims heavy exhaust smoke and possibly repeated plug fouling, and your observations and tests confirm this, there is no futher question but what, excessive oil is passing through one or both combustion chambers, and an engine top end job will have to be done to determine why. If there is no evidence of heavy exhaust smoke of plug fouling, but you confirm the report of oil mileage below normal, it may be due to one or more of the conditions described below, in which case engine probably will not need to be opened up for internal inspection.

Maybe front chain oiler is adjusted to feed an excessive amount of oil, and possibly motorcycle has been equipped with a rear chain oiler as supplied by various accessory producers. A combination like this, set for heavy feed, can account for as much as 50% of oil used. Possibly oil pump check valve ball is not seating perfectly, and oil is being lost to the outside through breather when motorcycle is standing for any length of time. Possibly considerable oil is being waster due to a leak somewhere about engine as a result of a sandhole in one of the castings, a broken or damaged gasket or push rod cover seal, or loosened fittings.

Where investigation proves that low oil mileage is due to excessive amount of oil passing through combusion chambers and out with exhuast, proceed as follows with upper end job:

1. When removing cylinder heads, carefully inspect head gaskets around the holes that match oil passages that feed oil to overhead fittings, and drain back the discharged oil. If you find a break or furrow between one of these holes and the inside diameter of gasket, this alone is enough to account for excessive oil consumption, plug fouling, and heavy exhaust smoke. Unless gaskets are in perfect condition and form a perfect seal around these holes, the combustion chamber of cylinder involved will be flooded with oil. Also examine cylinder head joint face around these holes. If the joint face between one of these holes and combustion chamber has been nicked or deeply scratched, the result will be the same as with gasket damaged as described above.

Also examine cylinder base gaskets as cylinders are removed. Observe whether or not gaskets are in good order around the hole punched for oil passage up the right side of cylinders. A break in base gasket from this hole inward is likely to result in the oiling system running lower than normal pressure and an over supply of oil in crankcase.

2. Remove cylinder head covers and make close inspection of rocker arms. Observe particularly that welch plugs (one in each end or arm) are securely in place. If an arm is found with welch plug out, be sure to find the plug, as it may be lodged somewhere in the oil return channel down the left side of head and cylinder. Unless found and removed, it will probably eventually shift into a position where it completely blocks the return channel. In this case, the cylinder head will be flooded with oil, and the job of removing cylinder will have to done over in order to remove obstruction. Where a welch plug has come out of place, it can be re-installed by soldering or brazing. A welch plug that appears to be even slightly loose should be treated in the same manner; as a missing or

badly leaking welch plug will drop overhead oil pressure so low, especially when oil is hot, that pushrod hydraulic units will become noisy. (Latest rocker arms which went into new assembly near the end of the 1948 season have no welch plugs. Only one end of the arm requires plugging, and a solid, drive fit plug is installed. Only rocker arms of this construction are now supplied on parts order.)

Also inspect rocker arms for loosened or broken pushrod ball socket. A ball socket in bad order may also bleed away enough oil so pushrod hydraulic units do not get the oil required for normal quietness of operation. (The pushrod ball socket has been so changed and strengthened that there will probably be litted if any breakage in the future.

3 The next step is checking cylinder heads for possible oil leak from top of head into the intake port. There is considerable oil discharged from overhead fittings onto top of head, and if there is a leak through the head into the intake port, due to a loose valve guide or sand hole, some of this oil will be sucked through into inlet port and combustion chamber. Enough will be sucked through to cause plug fouling, heavy exhaust smoke, and to drop oil mileage way below normal. In other words, the result will be the same as if rings and cylinder bores were in bad order. This check should be made by applying air pressure to intake port and at the same time applying gasoline or solvent to top of head around valve guide and the surrounding area above inlet port. If there is a leak around valve guide or elsewhere it will be indicated by bubbles. Even the slightest leak found must be corrected. If there should be a leak around inlet valve guide, due simply to guide fitting loosely in head, it probably can be serviced satisfactorily with an oversize guide. If, however, it is found that guide hole in head is out of round, there is no satisfactory repair. When a new oversize guide is installed to replace one found with a leak by it, repeat the air test after new guide is installed, even though it does seem to drive in with a normally tight fit. If hole in head is out of round, guide may drive in tight, but still have a leak by it. A sand hole through head into intake port can usually be repaired with low temperature welding material.

A set of fittings with which a dealer can make a quick air pressure check for inlet port leakage is in the making, but not yet available. As soon as these fittings are available, you will be advised. In the meantime you can devise a temporary means of making this check. All you need is a plug or cork of a size to fit cylinder head inlet nipple. The plug must have a small pipe installed through it, so air pressure can be applied. With inlet valve assembled and plug pushed tight into inlet nipple, apply air pressure and at the same time apply gasoline or solvent to top of head around valve guide. The exhaust valve guide should also be tight in head. However, if there happened to be a minor leak by it, there would be little if any effect on oil consumption.

4. Next check cylinder bores and pistons for size and condition. If it is found that cylinder bores are not enlarged enough, due to wear, to require refinishing oversize, make another extremely close inspection of the bore of each cylinder to be sure that the ring path is smooth and polished as it should be, with only minor up and down scratches where the piston thrust faces take bearing against cylinder bore. If the ring path in one or both cylinders has dull, lapped appearance, this indicates there are probably a multitude of fine scratches the length of ring path, all around the bore, as a result of ring scuffing. If this condition exists, bore should be refinished oversize. Simply re-ringing a scratched bore, even though a the new ring set includes the most effective type of oil ring, is not likely to effect a satisfactory oil seal. Bear in mind that there is a difference between scored cylinder bores and scratched bores. Scoring, which results from high speed or overheated operation, is damage that can't be overlooked and leaves no choice about refinishing. Bore scratching to the extent of excessive oil passing, even with new rings, is not so readily observed. Take no chances on cylinder bore condition. Unless the bore is unquestionably smooth and shiny, except for minor streaks or scratches where piston takes bearing against cylinder bore, refinish.



5. The new piston ring combination to be used on each piston is two No. 265-38 compression rings for the 61 OHV or two 265-41 compression rings for the 74 OHV. A new type vented oil ring is to be used for the 61 OHV, part No. 22374-49 or part no. 22364-49 for later 1948 74 OHV. Since the new type oil ring is 3/16" wide it cannot be used on the earlier 1948 74"OHV piston, because that piston had an oil ring groove only 1/8" wide. Later 1948 74" OHV pistons have oil ring groove 3/16" wide. This change went into production with engine No. 48FL 10184. When servicing an early 1948 74 OHV equipped with pistons with 1/8" oil ring groove, which are still in condition for further use, use vented oil ring 266-41A which is 1/8" wide. All the piston ring numbers above cover standard size rings. In the future when pistons or rings are ordered, covering pistons and rings for 1948 OHV models, instead of furnishing four rings, all alike, per piston, the new combination of two compression rings and one 3/16" wide vented oil ring per piston will be furnished.

For sometime the 3/32" wide compression rings furnished for 1948 overhead engines (also apply to earlier than 1948 74 OHV) have been bevel backed rings. One side of ring has inner edge beveled. This side of ring is or should be marked "TOP". This type of ring must be installed in piston with beveled edge upward, whether or not that side is marked TOP". If installed with beveled edge down, this type of ring becomes an oil pumper.

6. The next step is to conver the oil pump as follows: It is not necessary to remove complete oil pump from engine in order to make these changes. Remove pump cover and governor rotor, and also remove cover plate. Discard governor rotor and cover plate. Install new cover plate 683-49. You will note that new cover plate blocks off the holes in pump body and cover that formerly passed oil to and from governor. (If new cover plate is not available when it is desired to make this pump change, use original plate after securely plugging these holes.) After plate and gasket are installed, replace pump cover. Remove and discard pump check valve spring 703-48 and replace it with check valve spring 703-36, which is a much lighter spring. 703-36 is the same check valve spring used in 1947 and earlier oil pumps. With the above changeds made in oil pump, oil pressure builds up much faster from low speed, and considerable more oil is circulated through engine while idling and operating in the low speed range. This explains the ring change from a moderate to a venter oil control ring.

7. When servicing an engine as above, if piston rings were found badly worn and scuffed, and cylinder walls scratched and scuffed, don't fail to thoroughly flush out engine base, timing gear case, and oil tank before reassembling and putting engine back in service. Where these is undue piston and cylinder wear, engine oil becomes contaminated with fine particles of metal. Unless a newly serviced engine is put back in use with clean, fresh oil, free of metal particles and other contamination, undue wear is again likely to be experienced. Even an engine that appears clean, and with little if any ring and cylinder bore wear, should at least have the oil tank drained, flushed and refilled with fresh oil before putting back in use.

8. When reassembling cylinders and heads, apply gasket sealer to all gaskets. If the head cover gaskets you have available are only 1/32" thick, use two per head, if approximately 3/64" thick use only one gasket. Only the later 3/64" thick cover gasket is now used in new production and supplied on parts orders.

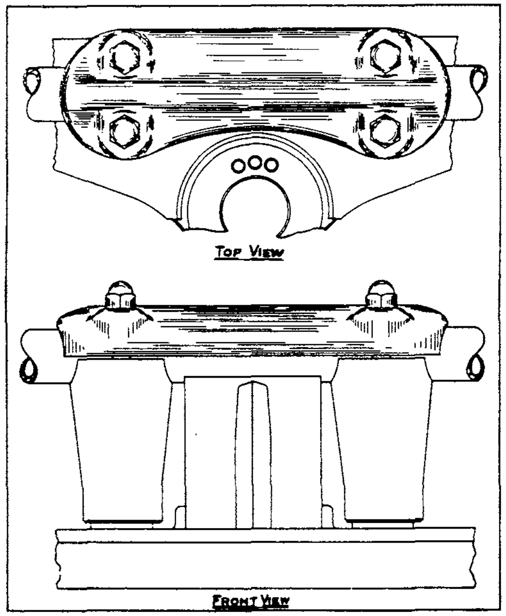
9. Install spark plugs with latest 7/8" outside diamter plug gasket, especially if there has been seepage of oil between cylinder head and spark plug insert. The new larger gasket will seal any leakage at this point as it is large enough to overlap the insert and seal against head surface.

If you still have some new 1948 OHV motorcycles in stock, make the above described oil pump converstion before delivering. These engines are fitted with the four rings per piston combination applying to all late 1948 overheads. However, it will be o.k. to make the pump change without going into engines to fit the later vented oil ring. It is also permissible in the case of any 1948 OHV engine that is running normal or above normal oil mileage to convert oil pump.

# SERVICE SHOP DOPE

No. 287 April 15, 1949

## NEW HANDLEBAR REINFORCING LINK




All Hydra-Glide OHV model motorcycles with rubber-mounted handlebars shipped on and after April 7, 1949 are fitted with a new metal (chrome plated) handlebar reinforcing link. Does not apply to Hydra-Glide models with solid-mounted handlebars.

We consider it advisable to install this link on all 1949 OHV Hydra-Glide motorcycles with rubber mounted handlebars that were shipped without it. This applies to all such motorcycles that you have delivered as well as to any you might still have in stock.

Prompt action is suggested. Parts needed will be supplied on no charge terms. Just tell us on enclosed post card how many sets of parts you need for motorcycles you have sold and which are still serviced by you. Required parts will be sent just as soon as possible. Don't put off returning the card with full information - Do it today!

### INSTALLATION INSTRUCTIONS

Replace original 4 riser cap screws with the 4 double-end studs furnished, long end downward. Tighten securely. Place link over upper ends of studs, install and tighten acorn nuts.

HARLEY-DAVIDSON MOTOR CO.
MILWAUKEE 1, WIS., U.S.A.

NOTE: This bulletin being sent to direct dealers only. Be sure to include motorcycles sold by associate dealers when ordering reinforcing links needed.

# SERVICE SHOP DOPE

No. 291 October 20, 1949

## VENTED FORK CAP SCREWS FOR HYDRA-GLIDE FORKS

Since about the middle of May, 1949, all Hydra-Glide Harley-Davidsons have had vented fork cap screws to relieve air pressure which, in earlier unvented forks, sometimes caused oil leakage past the fork slider seals.

It has been decided to supply fork vents for all Hydra-Glides that left the factory with forks not vented. The service vent being furnished idffers somewhat from the production type vent, although they both work on the same principle. Both types of vents incorporate a natural rubber valve that allows air to escape, but no air to enter forks. The service type vents can be installed without disassembling fork further than simply removing original cap screws. (Forks already fitted with production type vents can be distinguished from others by a 3/32" air escape hole leading from one face of hexagaon headed fork cap screws to center of screw.)

These fork vents are being supplied without charge, Since the job of installing the vents is a minor one, you should install them in the motorcycles for which they are intended promptly and without charge to the owners. Getting these vents installed without delay will put an end to complaints about fork oil leakage. Although a fork may be leaking oil at the top of slider at the time vented cap screws are installed, it ordinarily is not necessary to renew or give any attention to slider seals. Simply installing vented cap screws stops the leak.

CAUTION: Be sure to follow instruction of installation carefuuly. After draining oil from fork sides, measure closely the quantity of oil put back in - Don't overfill - use only Harley-Davidson fork oil. Extreme care must be used in handling rubber valves to be sure they are not punctured. If they are damaged, they cannot perform their intended function of allowing air to escape without permitting air to enter forks.

After fork, fitted with standard solo springs and originally unvented, has had vents installed and air pressure no longer builds up, the fork will be noticeably softer, and will "bottom" more readily, on rough roads and when front brake is applied. If after fork venting, futher useage of motorcycle proves forks are too soft, spring spacer can be installed underneath each spring, or heavy duty springs can be installed. Unless a motorcycle carries an extremely heavy load, installing spring spacers underneath original solo springs usually effect the best riding combination. New motorcycle forks assembled with standard solo springs have included this same spacer for some time.

It will be noted that spring spacer has one end counterbored and other end shouldered. It is to be assembled underneath springs with shouldered end upward.

How to distinguish between standard and heavy duty fork springs:

STANDARD SPRING - WIRE SIZE 3/16"
HEAVY DUTY SPRING - WIRE SIZE .200" (APPROX. 13/64")
STANDARD SPRING IS LONGER THAN HEAVY DUTY SPRING

SERVICE SHOP DOPE

No. 292 November 15, 1949

## 125 MODEL FITTING SPECIFICATIONS

PISTON CLEARANCE - ALUMINUM PISTON - Taper ground - new piston fitted in cylinder .003" to .004" clearance, measuring piston at extreme bottom of skirt and cylinder 1/2" from top of bore, front to rear. Before installing cylinder, locate piston rings so ends register with retaining pins in ring grooves.

PISTON PIN IN PISTON -.0003"tight at room temperature. Apply a thin coat of engine oil on piston pin. Heat piston just enough so pin can be pushed into piston bosses by hand and install piston with arrow stamped on head pointing to front.

PISTON PIN IN UPPER END OF CONNECTING ROD - .0008" to .0012" loose.

PISTON RING GAP AND GROOVE CLEARANCE - .012" to .020" gap, 1/2" from top of cylinder. Rings should be .004" loose in grooves.

LOWER CONNECTING ROD BEARING - .0008" to .001" loose. Apply thin coat of engine oil on rollers.

CONNECTING ROD - .011" to .017" endplay between flywheels.

FLYWHEEL ASSEMBLY - Bearing fit on sprocket shaft and armature shaft - size to size to light press fit.

In order to disassembly and reassemble flywheels the set of Flywheel/Connecting Rod Assembly Tools is necessary. Sprocket shaft, armature shaft and crank pin are press fit in flywheels (apply thin coat of engine oil to shafts and crank pin before pressing them into wheels). The sprocket shaft and armature shaft must be pressed into wheels to correct depth and armature shaft must be located in flywheel so keyway in shaft in in correct relation to crank pin for ignition timing after armature and circuit breaker cam have been installed. Above tools serve this purpose and maintain close alignment of shafts when reassembling wheels. Sprocket shaft and armature shaft must run true within .001" with flywheel assembly installed in flywheel truing device.

CRANKCASE ASSEMBLY - Good crankcase compression is essential to proper function of the 125 engine. Scrape all gasket cement or sealer from crankcase joint faces, clean faces and then before installing flywheels in crankcase apply thin coat of gasket cement or sealer to crankcase joint face - also apply thin coat of engine oil to all bearings - DO NOT POUR ANY OIL INTO FLYWHEEL COMPARTMENT. Apply thin coat of gasket cement to all gasketed surfaces. Bearing fit in crankcase size to size to light press fit.

GENERATOR ARMATURE AND CIRCUIT BREAKER CAM - After armature has been installed and tightened commutator run-out must not exceed .002". Circuit breaker cam runout must not exceed .003" checking at concentric section of cam next to commutator. Check with dial indicator.

CIRCUIT BREAKER POINT GAP - .020"

SPARK PLUG GAP - .025" to .030"

IGNITION TIMING - Time so ignition occurs when piston is 7/32" before top dead center.

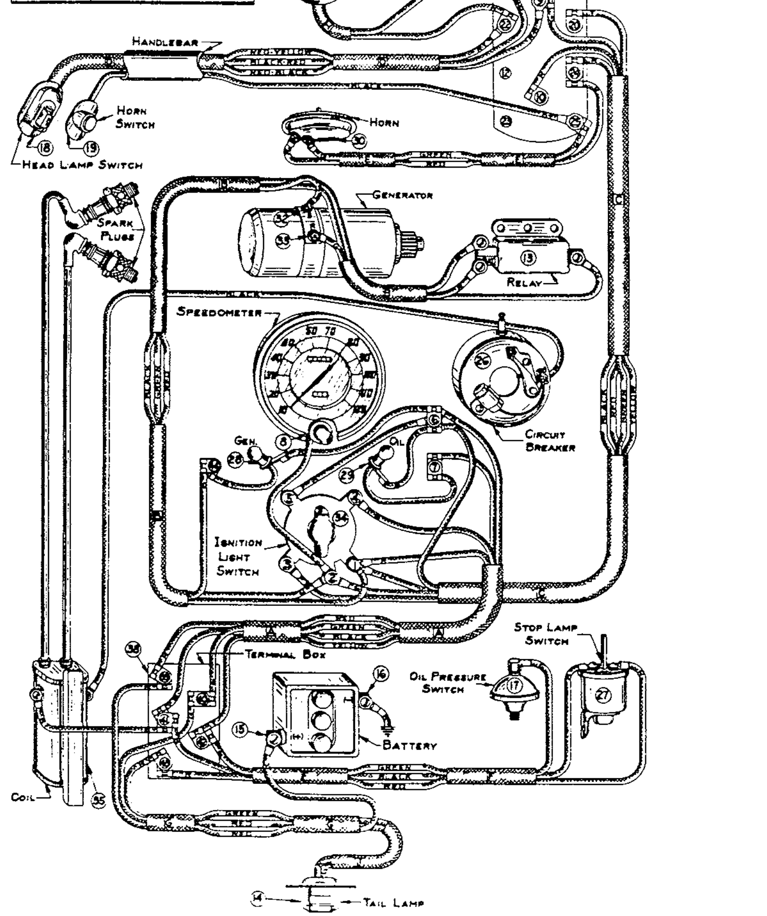
TRANSMISSION BEARING - Bearing fit on mainshaft - size to size to light press fit. Bearing fit in transmission case size to size to light press fit. Countershaft in countershaft bushings .0005" to .0015" loose. Before reassembling apply a thin coat of engine oil to all bearings, gears and shafts. After engine and transmission have been completely reassembled POUR 20 OZ. HARLEY-DAVIDON "MEDIUM HEAVY" OIL INTO CLUTCH COMPARTMENT before putting in service.

SERVICE SHOP DOPE

NO. 294 NOVEMBER 30, 1949

## 1949-1950 WIRING DIAGRAM FOR 61 AND 74 HYDRA-GLIDE MODELS

| KEY TO COLOR CODE | |
|---|---|
| R = RED | R-B = RED WITH BLACK TRACER |
| G = GREEN | B-R = BLACK WITH RED TRACER |
| B = BLACK | R-Y = RED WITH YELLOW TRACER |
| Y = YELLOW | |



A. FOUR WIRE CABLE - Red, green, black and yellow wires from switch and instrument panel base, terminals #1, 4, 6 and 7. Right front cable in panel base to terminal box behind ignition coil.

B. THREE WIRE CABLE - Red, green and black wires from switch and instrument panel base terminals #1, 2 and 44. Left cable in panel base to generator and cut-out relay.

C. FOUR WIRE CABLE - Red, green, yellow and black wires from switch and instrument panel base terminals #1, 2, 3 and 6. Right rear cable in panel base to terminal plate on fork.

D. THREE WIRE CABLE - Red wire with black tracer; Black wire with red tracer and Red wire with yellow tracer from headlamp switch on handlebar to terminal plate terminals #9, 21 and 22. Black wire with white tracer from horn switch to terminal plate terminal #25.

E. TWO WIRE CABLE - Red and green wires from terminal plate terminals 24 & 25 to horn.

F. THREE WIRE CABLE - Black, green & red wires from terminal box, terminals 41, 42 and 43 oil pressure switch and stop lamp switch.

G. LOOM - (three wires)-Red, green & red wires from terminal box terminals 39, 40 & 43.

H. LOOM - (Two wires)- Black & red wires from terminal plate terminals 21 & 22 to headlamp.

J. LOOM - (two wires)-Red & green wires, continuation from 3 wire loom(G) to tail lamp.

1. SWITCH TERMINAL-Red wire through cable A to terminal 39; red wire through cable A to relay 13; red wire through cable C to terminal 10.
2. SWITCH TERMINAL-Green wire through cable C to terminal 9; green wire through cable B to generator switch terminal 32; green wire to speedometer light 8.
3. SWITCH TERMINAL - Yellow wire through cable C to terminal 20.
4. SWITCH TERMINAL - Green wire through cable A to terminal 40
5. SWITCH TERMINAL - Black wire to junction terminal 6.
6. JUNCTION TERMINAL-Black wire through cable C to terminal 24; black wire to oil pressure signal light 29; black wire to generator light 28; black wire to switch terminal 5; black wire through cable A to terminal 41.
7. JUNCTION TERMINAL-Yellow wire through cable A to terminal 42; green wire to oil signal light 29.
8. SPEEDOMETER LIGHT - Green wire to switch terminal 2.
9. TERMINAL - Green wire through cable C to switch terminal 2; red wire with black tracer through cable D to head lamp toggle switch 18.
10. TERMINAL-Red wire through cable C to switch terminal 1. This is a light terminal and can be used for accessory lamps independent of ignition-light switch.
12. TERMINAL-Not used with standard wiring.
13. CUT OUT RELAY-Red wire from relay terminal marked BAT through cable B to switch terminal 1; black wire from junction terminal 44 through cable B to relay; green wire from generator relay terminal 33 through cable B to relay.
14. TAIL AND STOP LAMP - Red wire through loom J & loom G to terminal 43; green wire through looms J & G to terminal 40.
15. BATTERY POSITIVE TERMINAL(LEFT SIDE) Red wire through Loom G to terminal 39.
16. BATTERY NEGATIVE TERMINAL(RIGHT SIDE) Black wire to ground terminal on frame.
17. OIL PRESSURE SIGNAL SWITCH-green wire through cable F to terminal 42.



18. HANDLEBAR HEAD LAMP SWITCH-Black wire with red tracer through cable D to terminal 21; red wire with yellow tracer through cable D to terminal 22; red wire with black tracer through cable D to terminal 9.
19. HORN SWITCH - Black wire to terminal 25.
20. TERMINAL-Yellow wire through cable C to switch terminal 3. Used only with parking lamps.
21. TERMINAL-Black wire with red tracer through cable D to headlamp switch 18; black wire through loom H to headlamp 31.
22. TERMINAL - Red wire with yellow tracer through cable D to headlamp switch 18; red wire through loom H to headlamp 31.
23. TERMINAL-Not used with standard wiring.
24. TERMINAL - Black wire through cable C to junction terminal 6; red wire through cable E to horn 30.
25. TERMINAL - Green wire through cable E to horn 30; black wire to horn switch.
26. IGNITION CIRCUIT BREAKER - Black wire to coil 35 rear terminal.
27. STOP LAMP SWITCH - Red wire through cable F to terminal 43; black wire through cable F to terminal 41.
28. GENERATOR SIGNAL LIGHT (GEN) Black wire (under panel base)to junction terminal 6; green wire (under panel base) to junction terminal 44.
29. OIL PRESSURE SIGNAL LIGHT(OIL)-Black wire(under panel base) to junction terminal 6; green wire(under panel base) to junction terminal 7.
30. HORN-Red wire through cable E to terminal 24; green wire through cable E to terminal 25.
31. HEADLAMP-Red wire through loom H to terminal 22; black wire through loom H to terminal 21.
32. GENERATOR SWITCH TERMINAL-Green wire through cable B to switch terminal 2.
33. GENERATOR RELAY TERMINAL-Green wire through cable B to relay 13.
34. IGNITION-LIGHT SWITCH(Top view) Switch position for off, ignition only, ignition and running light and parking lights are shown. Switch can be locked in off and park only.
35. IGNITION COIL - Black wire to terminal 41; black wire to circuit breaker 26.
36. TERMINAL PLATE - Mounted on fork.
38. TERMINAL BOX - Mounted on frame behind ignition coil.
39. TERMINAL(Upper left terminal of terminals box)-Red wire through cable A to switch terminal 1; red wire through loom G to battery positive terminal 15.
40. TERMINAL(Upper right terminal of terminal box)-Green wire through cable A to switch terminal 4; green wire through loom G to tail and stop lamp 14.
41. TERMINAL-Center left terminal of terminal box-Black wire through cable A to junction terminal 6; black wire through cable F to stop lamp switch 27; black wire to front coil terminal.
42. TERMINAL-Lower right Terminal of terminal box-yellow wire through cable A to junction terminal 7; green wire through cable F to oil pressure signal switch 17.
43. TERMINAL-Lower left terminal box-Red wire through loom G and J to tail & stop lamp 14; red wire through cable F to stop lamp switch 27.
44. JUNCTION TERMINAL-Green wire(under panel base) to generator signal light 28; black wire through cable B to relay 13.

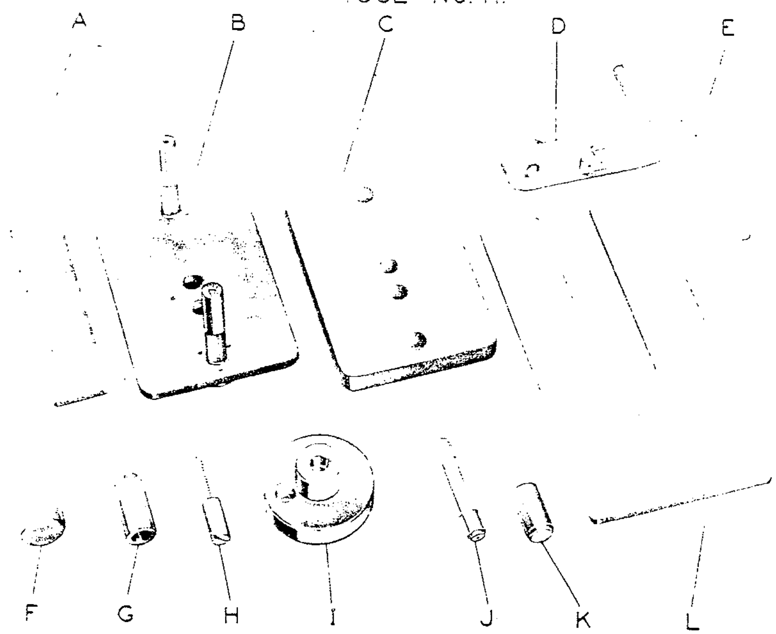
NOTE: Sidecar tail & stop lamps. If sidecar or package truck is equipped with tail & stop lamp, green wire of lamp cable is connected to terminal 40 & red wire to terminal 43 on terminal plate 38 behind ignition coil.

# SERVICE SHOP DOPE

NO. 295 NOVEMBER 1, 1949

## MODEL 125 FLYWHEEL and CONNECTING ROD ASSEMBLY TOOL SET

TOOL NO. 11.




ASSEMBLY PART NO. 96125-49

| | Part No. | Description |
|---|---|---|
| A. | 96138-49 | Flywheel Tapered Spacer. |
| B. | 96126-49 | Armature Shaft Installing Plate. |
| C. | 96126-49 | Sprocket Shaft Installing Plate. |
| D. | 96202-49 | Recess Clean-up Tool. |
| E. | 96207-49 | Staking Punch. |
| F. | 96133-49 | Press Block. |
| G. | 96134-49 | Crank Pin Pilot Aligning Sleeve. |
| H. | 96136-49 | Crank Pin Aligning Pilot. |
| I. | 96132-49 | Shaft Locating Press Block. |
| J. | 96130-49 | Drift and Pilot Pin. |
| K. | 96135-49 | Crank Pin Press Cap. |
| L. | 96137-49 | Flywheel Support Plate. |



Because shafts in Model 125 flywheel assembly are a straight press fit in the flywheels, and main shafts must be pressed into wheels to a specified depth to correctly position generator armature and engine sprocket, jig and fittings described are necessary for accurate assembly. With this jig shafts can be started and pressed in, in perfect alignment with flywheel holes.

If directions are followed closely, completed assembly will require little, if any, further truing between centers as shown in Illus. 12.

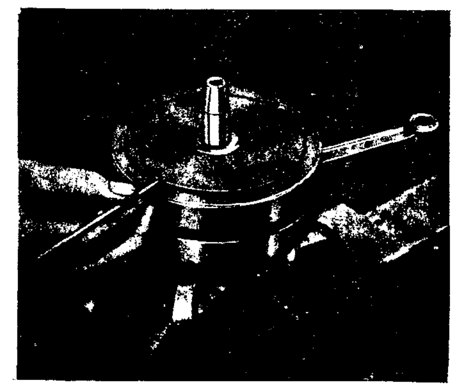
These are precision tools; they can be easily damaged through rough usage; handle with care.

ILLUS. 1

### REMOVING SHAFT BEARINGS

Make a puller bar attachment for Harley-Davidson wedge puller, Part No. 12738-48 as shown in Illus. 1. Puller bar can be made out of a piece of flat stock about 1/2" thick, 1-1/2" wide, and 4" long. Puller screw from one of several Harley-Davidson pullers can be used, size & thread 1/2" — 18. Two cap screws, 3/8" — 16 thread, about 3-1/2" long are required to attach bar to wedge. Ends of puller bar must be slotted, 7/16" wide and about 1" deep to allow for variable wedge width. With described puller available, secure flywheel shaft in a vise fitted with copper jaw caps and pull bearing; turn assembly over and pull the other bearing.

Note: When removing armature shaft bearing, insert a nut about 1/2" hex between end of shaft and puller screw, to prevent puller screw from damaging end of shaft.



ILLUS. 2

### REMOVING COMPRESSION PLATES

When wedge puller is used to remove sprocket and armature shaft bearings as shown in Illus. 1, compression plates may come out of their recesses as bearings are removed. However, if they do not, remove the plates in following manner.

Drill a small hole at edge of compression plate just deep enough to permit using a sharp pointed pry below edge of plate as shown in Illus. 2. The plate will readily break through the staking which overlaps edge of plate at eight equally spaced locations. Flywheels are now ready for disassembly as in Illus. 4.

ILLUS. 3

## COMPRESSION PLATE RECESS CLEAN-UP TOOL

After compression plates have been removed as shown in Illus. 2, clean up compression plate recess in each flywheel, using "Recess Clean-up Tool." (D).

First put a thin film of oil on shaft and slide tool onto it. Hold tool down firmly with one hand, and with other hand turn clockwise as shown in Illus. 3. The cutter will remove old staking from recess. Caution: Do not pull tool counter-clockwise, or a broken cutting edge will result.

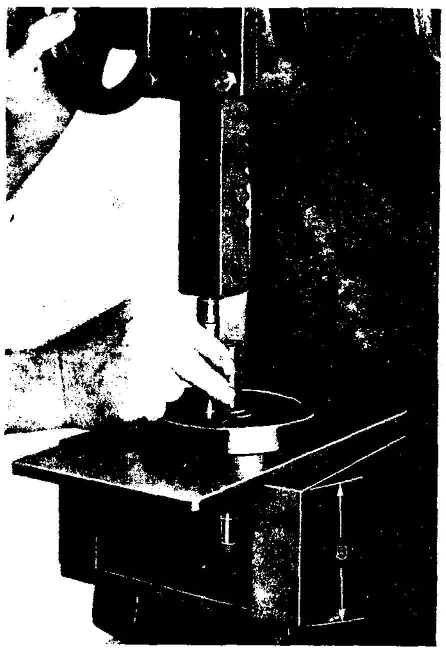
Cutter is adjustable to compensate for wear and sharpening. Adjust cutter so it completely cleans up staking around recess.

## DISASSEMBLING FLYWHEELS

Slide "Flywheel Support Plate" (L), between flywheels and place on two blocks as shown in Illus. 4.

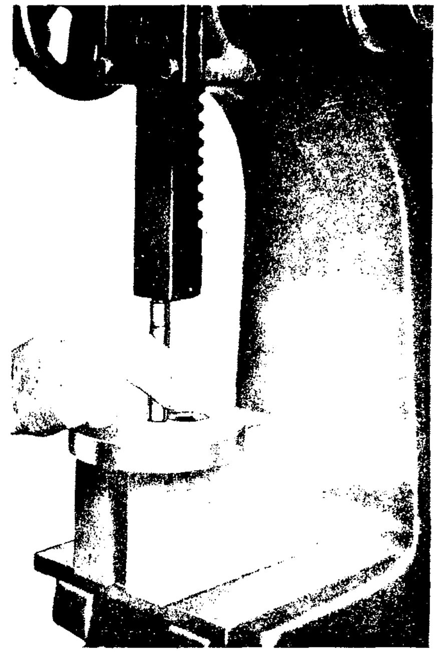
Blocks must be over 5" high so end of main shaft will not come in contact with bench before flywheels are fully separated. Then, using "Drift and Pilot Pin" (J), tapered end against crank pin, press out crank pin with connecting rod and lower flywheel attached.

Follow same procedure to remove crank pin from other flywheel.



ILLUS. 4





ILLUS. 5

## PRESSING OUT MAIN SHAFTS

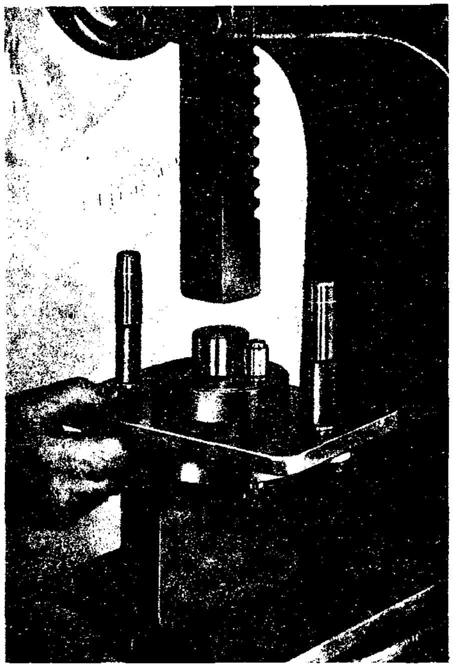
(Note: In most instances when flywheel assembly requires repair, only crank pin, connecting rod and rod bearings need be removed.

Main shafts (armature and sprocket) are seldom found worn or damaged to such extent that replacement is required. However, in any instance when flywheel assembly is removed from engine and taken apart, if there is the slightest possibility that main shafts have shifted from original specified depth, to which they were pressed into flywheels, they should be partially pressed out of wheels, then pressed back to specified depth, with jig fittings provided for that operation.

The things most likely to cause main shafts to shift from their locations as originally assembled, are hammering shafts when removing engine sprocket or generator armature, or hammering shafts or crankcases, when disassembling wheels from or into crankcases. Even though shafts are a real tight press fit in wheels, the impact of a moderate hammer blow is sufficient to move them.)

With flywheels separated as described under "Disassembling Flywheels" and shown in Illus. 4, the sprocket shaft, armature shaft, or both, can be removed for replacement, if necessary. See Illus. 5.

Place flywheel with shaft in it, on two blocks, shaft downward between blocks. Bring the two blocks as close to shaft as possible. Again use the Drift and Pilot Pin (with tapered end against end of shaft), and press out shaft.



ILLUS. 6

## REASSEMBLY

After flywheels have been disassembled, thoroughly cleaned, faulty parts discarded, and connecting rod serviced as necessary, oil shafts and holes in flywheels and proceed to assemble flywheels in following manner.

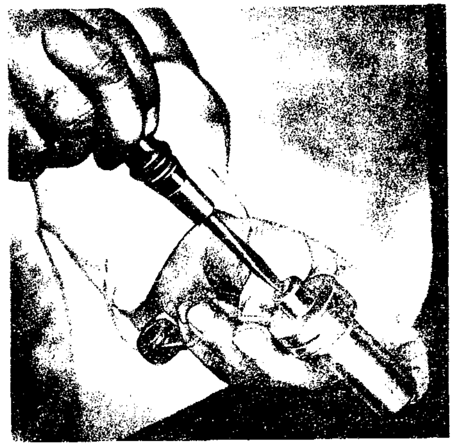
## INSTALLING MAIN SHAFTS

First install key in armature shaft. Place tapered end of shaft in "Shaft Locating Press Block" (I). Insert straight end of shaft through "Shaft Installing Plate" (B) into flywheel. Insert "Pilot Pin" (J) through hole in Press Block, hole in Installing Plate and crank pin hole in flywheel. Support wheel with a block placed directly underneath flywheel center hole and press shaft into flywheel as shown in Illus. 6. Be sure that Press Block is pressed down tight against Installing Plate (B). This procedure presses shaft the correct depth into flywheel and locates armature shaft keyway in relation with crankpin hole so that correct ignition timing can be attained, after armature and circuit breaker cam are installed.

Shafts must be a very tight press fit in flywheels. When a shaft has only a very light press fit in flywheel it is probably because flywheel hole has become enlarged. Wheel in this condition should be discarded and new one used.

Follow this same procedure when installing sprocket shaft, using "Sprocket Shaft Installing Plate" (C); however, key way location in relation to crank pin can be disregarded.



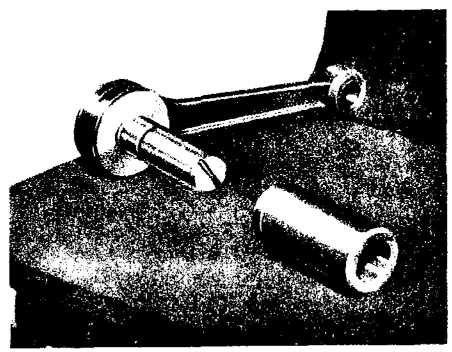


ILLUS. 7

## INSTALLING CRANK PIN PILOT

Attach "Crank Pin Aligning Pilot" (H) to crank pin as shown in Illus. 7. Hold small tapered end against one end of crank pin, then pass screw through crank pin from opposite end. Do not tighten as yet.

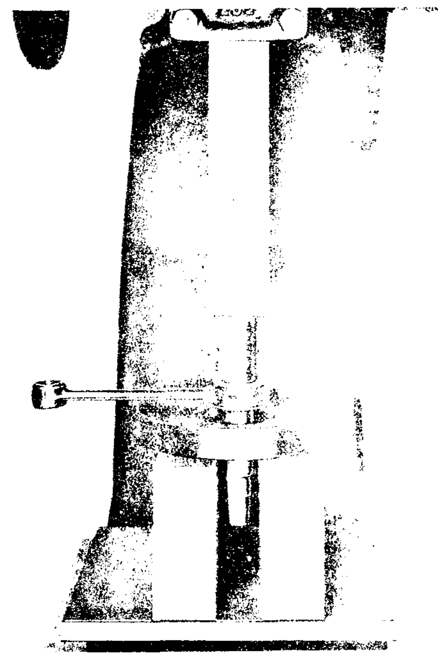
Next slide "Crank Pin Pilot Aligning Sleeve" (G) over Crank Pin Aligning Pilot and crank pin, (heavily chamfered end toward connecting rod). Tighten aligning pilot screw securely and remove sleeve.



ILLUS. 8

CRANK PIN PILOT ALIGNING SLEEVE

Illus. 7 shows the Crank Pin Pilot being secured while being held in alignment with the Crank Pin Aligning Sleeve. Illus. 8 shows Aligning Sleeve removed after Crank Pin Pilot has been secured.

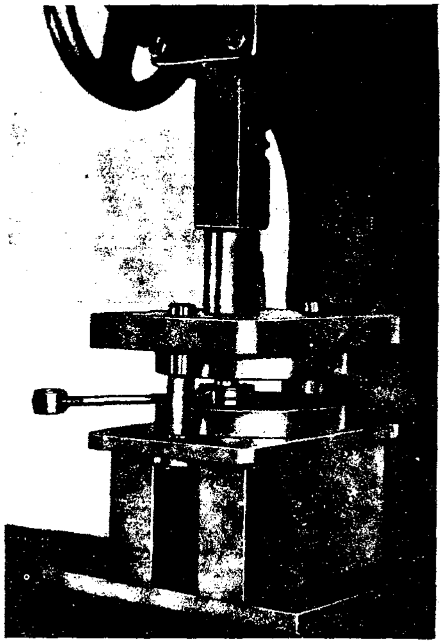


ILLUS. 9

## PRESSING CRANK PIN INTO FLYWHEEL

After end of crankpin has been coated with a thin film of engine oil, place flywheel in which armature shaft is installed on two blocks and insert Crank Pin Pilot into crank pin hole as shown in Illus. 9. Place "Press Cap" (K) on end of pin and press pin into flywheel until it bottoms.

Remove Press Block, also Crank Pin Pilot, and install Pilot on opposite end of crank pin in same manner as shown in Illus. 7 and explained under "Installing Crank Pin Pilot."



ILLUS. 10

PRESSING FLYWHEELS TOGETHER

Flywheels can now be pressed together in the following manner. See Illus. 10.

Place flywheel that has crank pin and connecting rod installed on "Armature Shaft Installing Plate" (B). Place flywheel in which sprocket shaft is installed on Sprocket Shaft Installing Plate.

Note that Sprocket Shaft Installing Plate is marked on one side "This side up." Flywheel must be held against opposite side.

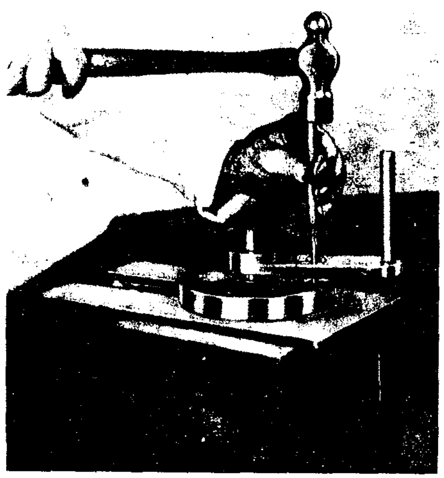
Holding flywheel against plate, start plate onto guide pins attached to Armature Shaft Installing Plate. At the same time guide Crank Pin Pilot through flywheel, then through hole in upper installing plate which corresponds with crank pin hole in flywheel. Push upper plate downward "by hand" until upper flywheel contacts end of crank pin. Using "Press Block" (F) over protruding end of Crank Pin Aligning Pilot, press down until upper flywheel bottoms against connecting rod thrust washer.

REINSTALLING COMPRESSION PLATES

Support flywheels as shown in Illus. 11 and install compression plates, preferably new plates if old plates are in the least damaged or out of shape.

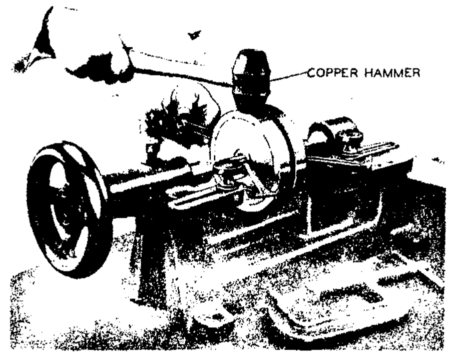
Using Compression Plate Recess Clean-up Tool as a guide, stake compression plates in place by upsetting edge of flywheel recess with "Staking Punch" (E). Note that end of this punch is angled, and is to be used with longer tip outward.

Make sure compression plates are well secured. Plates have a tendency to spring, and if not securely installed may break away from staking. A loose plate is not only noisy but also lowers engine performance due to below normal crankcase compression.



ILLUS. 11






ILLUS. 12

TRUING FLYWHEELS

Using "Flywheel Truing Device" Part No. 11962-X check armature and sprocket shaft run-out as shown in Illus. 12. Shafts must run true within .001". This is one half graduation on indicator scale. If armature and sprocket shafts run high near the crank pin, install a "C" clamp above crank pin and apply light pressure. With clamp in place strike flywheels very lightly above crank pin. Take another reading, if shafts still do not run true repeat operation again. Shafts must be within specification, so armature will run true, otherwise there will be excessive "brush hop" and arcing.

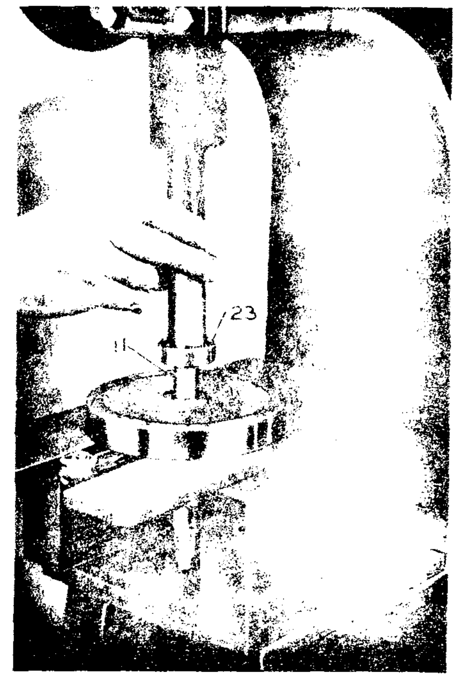
INSTALLING ARMATURE SHAFT BEARING

Again using two blocks and Flywheel Support Plate as shown in Illus. 13, press armature shaft bearing and sprocket shaft inner bearing on their respective shafts.

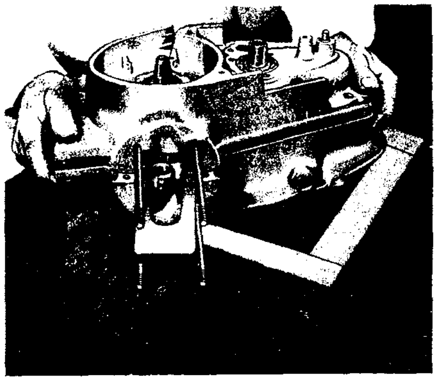
Place bearing on shaft. Use a sleeve or a piece of 3/4" pipe no less than 3" long, over shaft against ball bearing inner race. Press bearing on shaft until it bottoms.

Note: Shaft bearings have only a light press fit, therefore, there is little danger of moving shafts in flywheels when pressing bearings on.

Caution: When installing bearings - do not drive on with a hammer.




ILLUS. 13



ILLUS. 14

## INSTALLING FLYWHEEL ASSEMBLY IN CRANKCASES

Prepare crankcases for assembly: See that transmission and shifter parts are correctly assembled in left case. Thoroughly clean crankcase joint faces.

Insert "Flywheel Tapered Spacer" (A) between the two flywheels opposite crank pin, upper end of connecting rod between the two prongs of spacer as shown in Illus. 14. The purpose of this spacer is to prevent closing up flywheels and thus throwing wheel shafts out of alignment when installing flywheel assembly in crankcases. Do not force spacer between flywheels, just snug is all that is necessary.

Using a torch, heat left crankcase around bearing bore enough so bearing will slide easily into crankcase as flywheel assembly is installed in left case. Do not apply flame directly against oil seal. NOTE: At this point, observe that oil seal is snug against its retaining ring.

Insert flywheel assembly in left case. It is seated in left case when sprocket shaft bearing seats against oil seal retaining ring.

Next heat right crankcase around bearing bore and apply heat around open dowel pin holes. Apply sealer to joint faces of both cases.

Install right crankcase. Insert and securely tighten all crankcase clamp screws.

The next assembly operation is installing sprocket shaft outer bearing. However, before this can be done, it must be determined how many shims are required behind bearing to obtain correct clearance between bearing inner race and back face of engine sprocket.

The desired clearance is .003" to .012". To attain this clearance, shims are provided .007" thick. To determine how many shims are needed, temporarily insert, instead of bearing, a 45" model reverse gear spacing collar, part No. 2296-33A. Spacing collar is approximately the same width as bearing No. 9008. Insert this collar with large diameter inward against oil seal.

Install sprocket and securely tighten sprocket nut. Use feeler gauge to determine total clearance between back face of sprocket and collar. It can now be calculated how many .007" thick shims are required to reduce the total clearance to approximately .010". Sprocket and gauging collar can now be removed and correct number of shims inserted. Heat case around bearing hole and press bearing into place.

HARLEY-DAVIDSON MOTOR CO.

Milwaukee 1, Wis., U.S.A.