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AUTOMOTIVE WHEEL & TRACK ALIGNMENT BASICS

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MEC-163 EXAM PREVIEW

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Exam Preview:

1. Originally, roads were built with high crowns; that is, they were low in the middle and sloped upward to the sides.
   a. True
   b. False
2. Turning radius is nonadjustable, but it can be checked. Using turntable pads calibrated in degrees, turn the right wheel __ degrees and read the setting on the left wheel. Then turn the left wheel __ degrees and read the setting on the right wheel.
   a. 15
   b. 20
   c. 25
   d. 30
3. "Front-end alignment" refers to the relationship between the wheels of the vehicle and its suspension and steering. These relationships are calculated using angles known as steering geometry. Which of the following steering geometry angles corresponds to the description: this is the distance between the front of the front wheels as compared to the distance at the rear of the front wheels?
   a. Camber
   b. Caster
   c. Kingpin inclination
   d. Toe-in
4. When aligning the track roller frame with the sprocket and adjusting the front idler, you must follow the manufacturer's procedures.
   a. True
   b. False

5. According to the reference material, after you have adjusted caster and camber, you should now adjust toe-in. It is the last angle to be adjusted because caster and camber are so closely related.
    a. True
    b. False
6. "Front-end alignment" refers to the relationship between the wheels of the vehicle and its suspension and steering. These relationships are calculated using angles known as steering geometry. Which of the following steering geometry angles corresponds to the description: when viewed from the side of the wheel, this is the degree to which the kingpin or ball joint tilts forward or rearward in relation to the frame?
    a. Camber
    b. Caster
    c. Kingpin inclination
    d. Toe-in
7. Using Figure 12-23. —Patterns of tire wear, which of the following wear patterns indicates an issue with toe in or toe out wear?
    a. Cupped
    b. Center tread wear
    c. Feathered edge
    d. Shoulder wear
8. According to the reference material, steering axis inclination is adjustable; it is the angle formed by the true vertical centerline of the ball joints or kingpin
    a. True
    b. False
9. According to the reference material, the driver can sense steering and alignment trouble. Which of the complaints below corresponds to an issue with excessive caster?
    a. Steering wheel not centered
    b. Vehicle wanders
    c. Shimmy at low speeds
    d. Steers hard
10. Which of the following steering geometries can be affected by shifted or broken leaf springs or a bent or broken rear axle mount, bent frame, bent steering linkage, or misadjusted front-end alignment?
    a. Toe-in
    b. Kingpin inclination
    c. Tracking
    d. Turning radius

WHEEL AND TRACK ALIGNMENT

One of the most neglected areas in vehicle maintenance is front-end wheel alignment and track alignment. To assure the proper steering control and normal wear of tires and tracks, you must maintain proper alignment. As an inspector, floor supervisor, or shop supervisor, it will be your responsibility to identify, adjust, or supervise the corrective measures needed to keep your equipment in a safe, operating condition. This chapter covers the principles and adjustments of front-wheel alignment and the principles of track alignment.

STEERING GEOMETRY

"Front-end alignment" refers to the relationship between the wheels of the vehicle and its suspension and steering. These relationships are calculated using angles known as steering geometry. These angles are camber, caster, kingpin inclination, toe, turning radius, and tracking. The following paragraphs cover the definitions of these angles and their effects:

1. **CAMBER ANGLE.** As viewed from the front of the vehicle, the camber angle is the degree to which the wheel tilts inward or outward (fig. 12-1). It is measured in degrees and changes with the load of the vehicle and suspension movement. Positive camber is the outward tilt of the top of the wheel, and negative camber is the inward tilt. It is shown by a line drawn through the center of the wheel and a second line drawn straight up and down. They should intersect where the tire meets the road. Camber is a directional control angle and a tire wearing angle.

Originally, roads were built with high crowns; that is, they were high in the middle and sloped downward to the sides. A large amount of positive wheel camber was needed for the tire to contact the road squarely. If the tire does not set squarely on the road, it will wear on one side and will not get a good grip for positive steering control. Modern roads, however, are made flat with very little crown, so less camber is needed for this reason.

Even with flat roads, some camber is generally desirable, because it moves the point of contact between the tire and the road more directly under, and closer to, the steering knuckle pivot. This makes the wheels easier to pivot and reduces the amount of road shock sent to the vehicle suspension and steering linkage when the wheels hit bumps. It also places most of the load on the larger inner wheel bearing.

To avoid some bad effects, the amount of camber must be carefully considered when a vehicle is designed. If you have ever rolled a tire by hand, you soon learned that you did not have to turn the tire in order to turn a corner. All you had to do was tilt (camber) the tire to one side, and it rolled around the corner like a cone. This is not desirable for the wheels of a vehicle. The cone effect

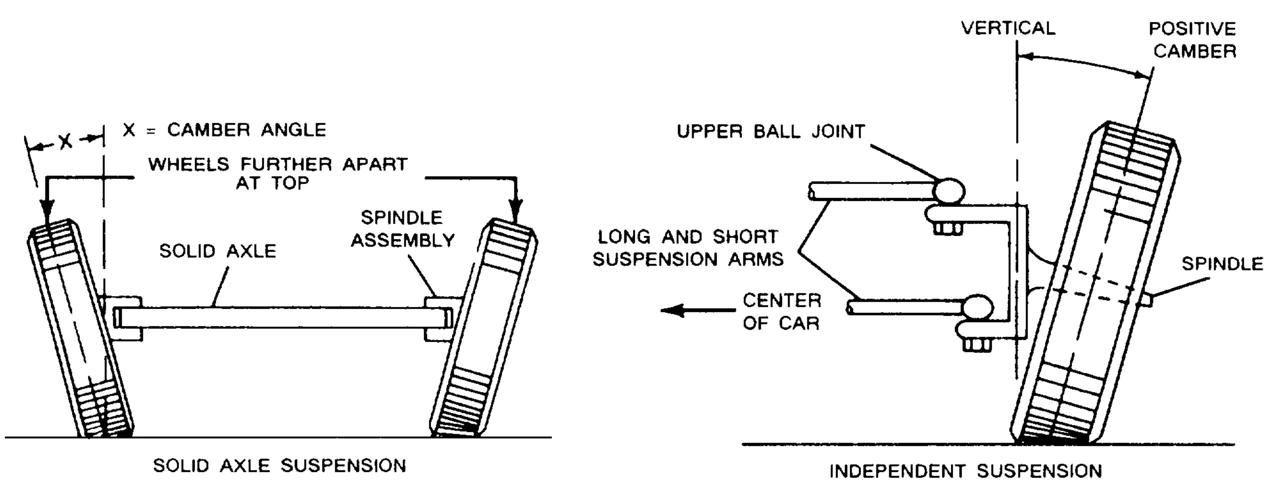


Figure 12-1.—Camber angle.

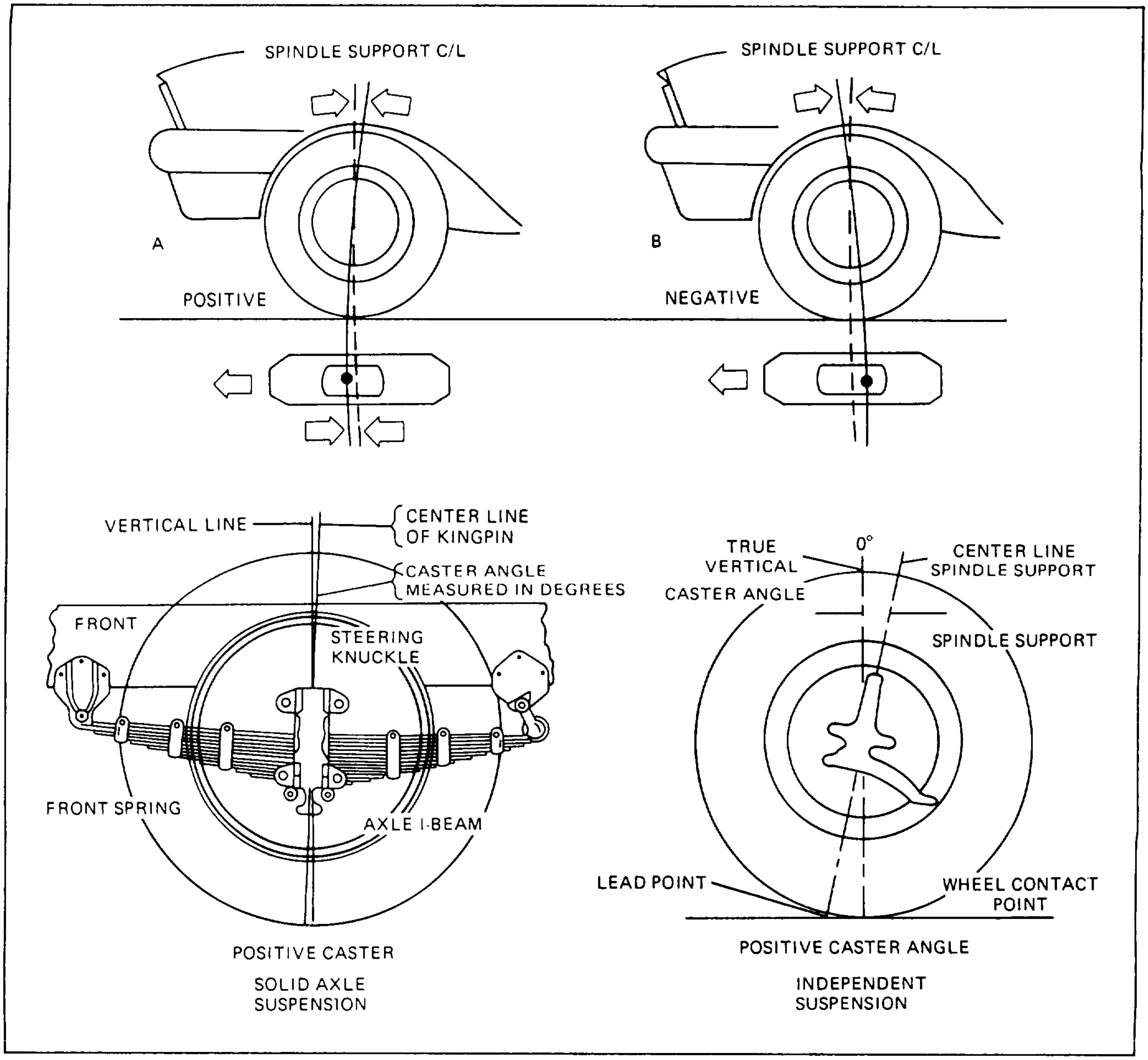


Figure 12-2.—Caster angle.

of excessive positive camber tries to pivot the wheels out on a vehicle.

2. **CASTER ANGLE.** When viewed from the side of the wheel, the caster angle is the degree to which the kingpin or ball joint tilts forward or rearward in relation to the frame (fig. 12-2). Like the camber angle, the caster angle is also measured in degrees. It is shown by a line drawn straight up and down, as in figure 12-2, and then a second line drawn through the center of the kingpin or pivot points. The caster angle is the angle formed at the point where the two lines cross, as viewed from the side of the vehicle.

A good example of caster is a bicycle. The fork is tilted backward at the top. A straight line drawn down through the front-wheel pivot or kingpin would strike the ground ahead of the point where the tire contacts the road. A wheel mounted in this fashion is said to have positive (+) caster or "just" caster. If the top of the kingpin is tilted forward so that a straight line drawn through it hits behind the point where the tire contacts the ground, the wheel is said to have negative (–) caster.

On a vehicle with axle suspension, caster is obtained by the axle being mounted so that the top of the steering knuckle or kingpin is tilted to the rear. On a vehicle with

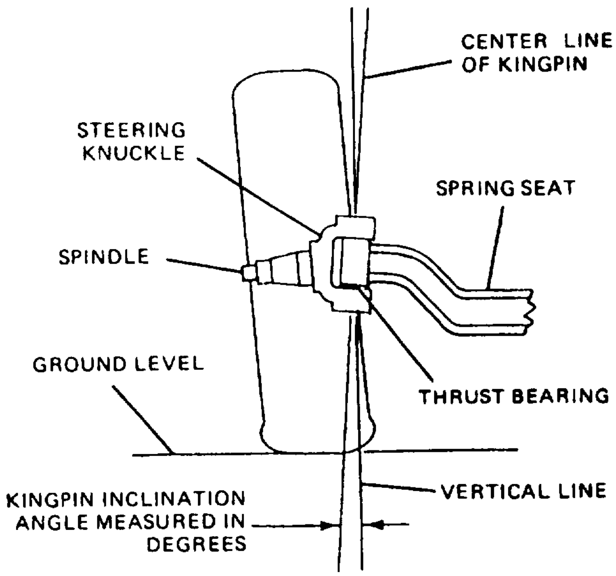


Figure 12-3.—Kingpin inclination.

independent suspension, the upper pivot point (ball joint) is set to the rear of the lower pivot point.

Caster is a directional control angle, but not a tire wearing angle. Positive caster causes the vehicle to steer in the direction in which it is moving. This is called an automatic steering effect; for instance, the forward momentum of a vehicle tends to keep wheels with positive caster in the straight-ahead position. After rounding a turn, this causes the wheels to return to a straight-ahead position when the driver releases the steering wheel. This automatic steering effect is also called self-righting or self-centering action.

Positive caster makes the turning of the steering wheel more difficult, whereas negative caster turns more easily, but will cause the vehicle to wander.

3. **KINGPIN INCLINATION.** The inward tilt of the kingpin at the top is known as kingpin inclination (KPI). KPI (fig. 12-3) is measured in degrees from the center line of the ball joint or kingpin to true vertical (0). It is a directional control angle with fixed relationship to camber settings. It is also nonadjustable. One purpose of this inclination is to reduce the need for excessive camber. Figure 12-4 shows a dead axle with fixed KPI. The angle of the kingpin and spindle is made extreme to clarify the principles involved.

Timing the wheels to the left or right revolves the spindles around the kingpin. As the spindle is moved to the left or right from the position shown in figure 12-4, B, its end moves down, as shown in figure 12-4, A and C. Thus, as the front wheels turn, the spindle will attempt to move down from the high point. Since the wheels and tires prevent the spindles from moving down, the axle is raised. This action tends to raise the front of the vehicle. As the turning force is removed from the wheels, the weight of the vehicle helps force the wheels back to the straight-ahead position.

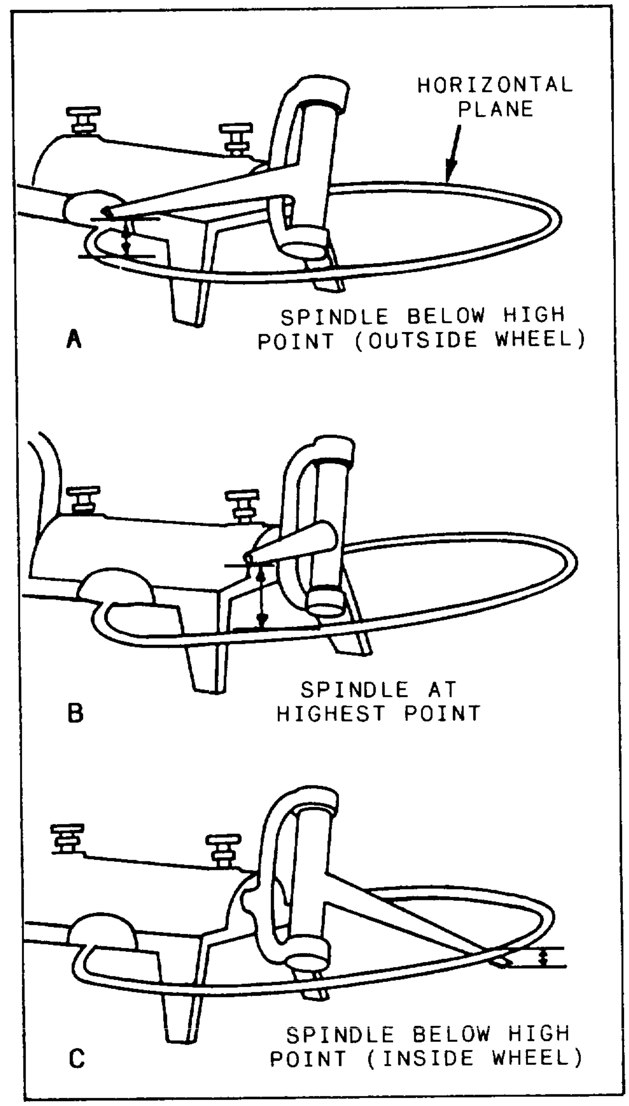


Figure 12-4.—Fixed KPI.

Vehicles with ball-joint suspension have what is known as steering axis inclination (SAI) which is defined as the inward tilt of the spindle support arm at the top. The spindle assembly is supported at the upper and lower control arms by ball joints. The pivoting axis of the wheel around the ball joints is the same as the kingpin axis of vehicles with dead axles.

4. **TOE-IN.** This is the distance between the front of the front wheels as compared to the distance at the

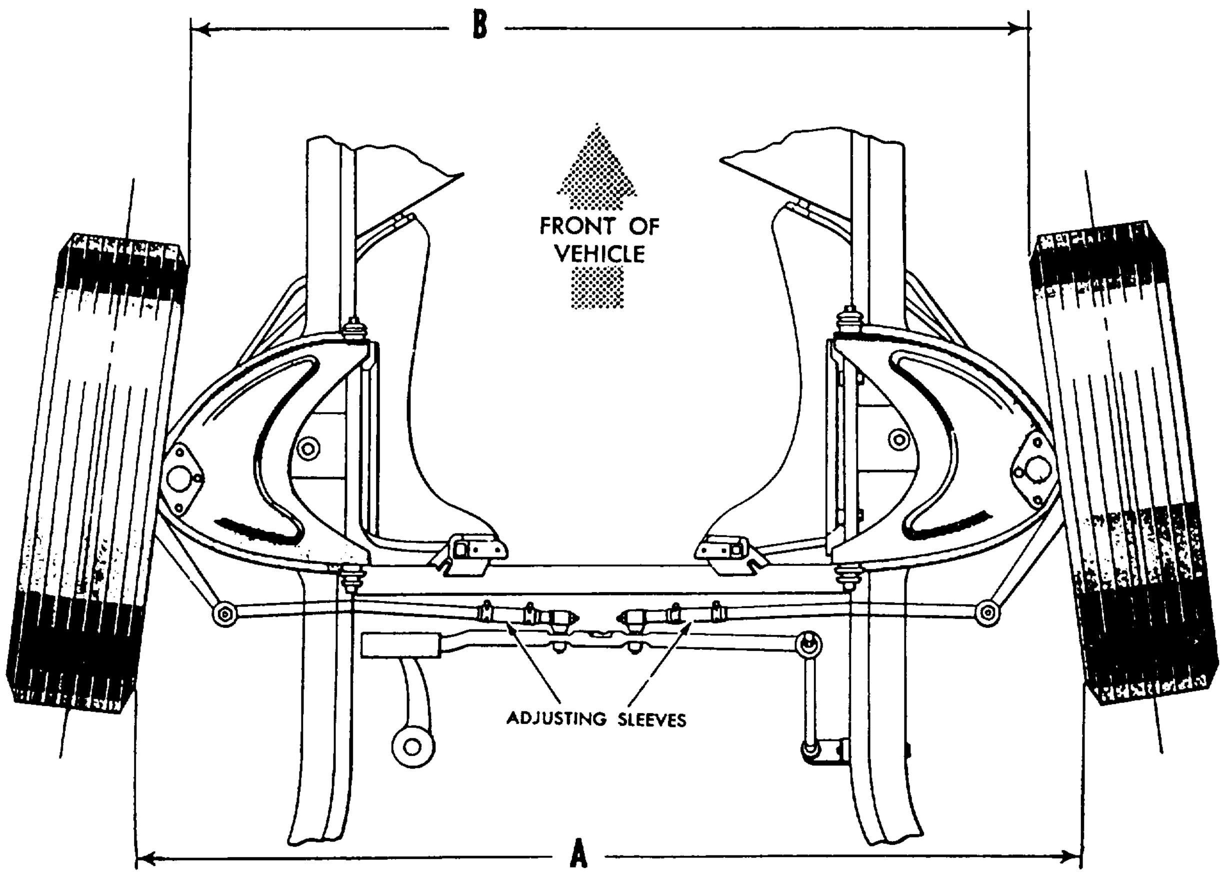


Figure 12-5.—Toe-in.

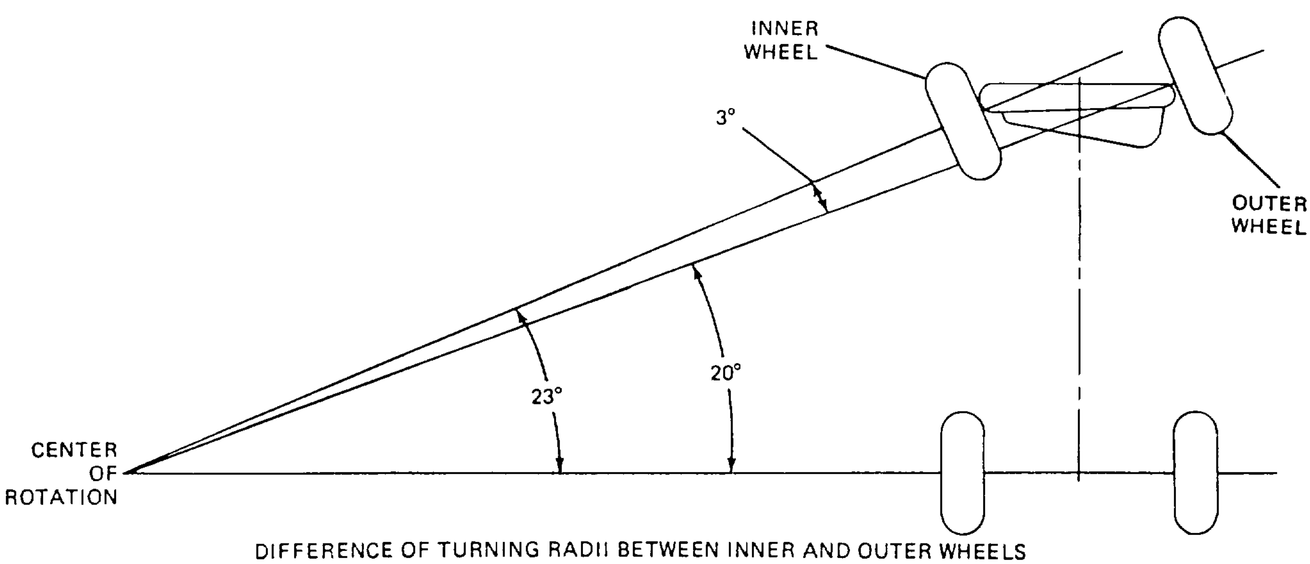


Figure 12-6.—Difference of radii between inner and outer wheels.

rear of the front wheels, as shown in figure 12-5. Note that line B is shorter than line A. The setting is taken at spindle height with the wheels in the straight-ahead position. Toe-in is measured in fractions of an inch. It is a tire wearing angle. The purpose of toe is to compensate for the normal looseness required in the steering linkage and to balance the effect of camber on the tires. The natural tendency of the wheel is to rotate like a cone around the point. If both front wheels are forced to follow a straight path by the motion of the vehicle, there is a continual tendency for the tires to slip away from each other. Toed-in wheels tend to travel toward each other and counteract this condition. By properly relating camber and toe-in, tire wear is reduced to a minimum. The motion of the wheel is balanced between two opposing forces, and pull on the steering mechanism is reduced.

Of all the alignment factors, toe-in is the most critical. A bent tie rod will change the amount of toe. Toe-in is adjusted last by your turning the tie rod sleeves.

5. **TURNING RADIUS.** The front-end assembly of the modern motor vehicle requires careful design and adjustment because each front wheel is pivoted separately on a steering knuckle. Because of this construction, the front wheels are not in the same radius line (drawn from the center of rotation [fig. 12-6]) when a vehicle is making a turn. Because each wheel should beat right angles to its radius line, it is necessary for the front wheels to assume a toed-out position when rounding curves. If they do not, the tires slip, which causes excessive tire wear. The inner wheel (the one closer to the center of rotation) turns more than the outer wheel, so it will travel in a smaller radius. This difference in the turning ratios of the two wheels is called toe-out. It is usually specified as the number of degrees over 20 that the inner wheel is turned when the outer wheel is turned 20 degrees. The-out on turns may be checked, but there is no provision made for its adjustment. The steering linkage must be examined carefully for bent or defective parts if this angle is not within the manufacturer's specifications.

6. **TRACKING.** Tracking (fig. 12-7) is the ability of the vehicle to maintain a right angle between the center line of the vehicle and both the front and rear axles or spindles. (The rear wheels should follow the front wheels.) If this angle is off, the vehicle will appear to be going sideways down a straight road. This problem could be caused by shifted or broken leaf springs or a bent or broken rear axle mount, bent frame, bent steering linkage, or misadjusted front-end alignment.

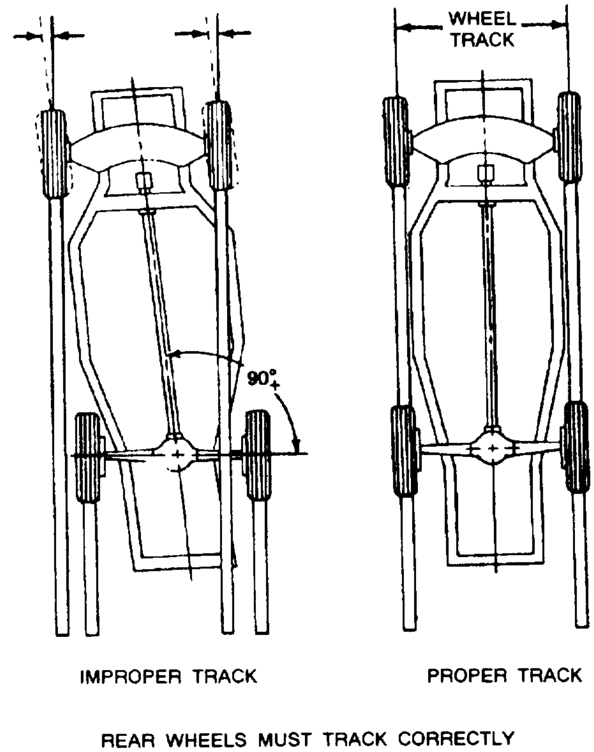


Figure 12-7.—Rear wheels must track correctly.

ADJUSTING WHEEL ALIGNMENT

In the preceding paragraphs, we covered the principles of the different angles involved in front-end alignment. In the following paragraphs, we will cover safety, tools, and alignment procedures.

SAFETY PRECAUTIONS

You should keep the following precautions in mind when you are working under a vehicle:

1. While repairing or adjusting the steering system and the wheel alignment, be sure the vehicle is and will remain stationary. At least one wheel should be blocked on both sides, even if the equipment is on a level surface.

2. Make yourself familiar with a suspension system before you work on it; know the "jack" points. You need to know which components bear the weight of the vehicle.

3. Make use of jack stands!

4. When using alignment equipment, follow the manufacturer's instructions.

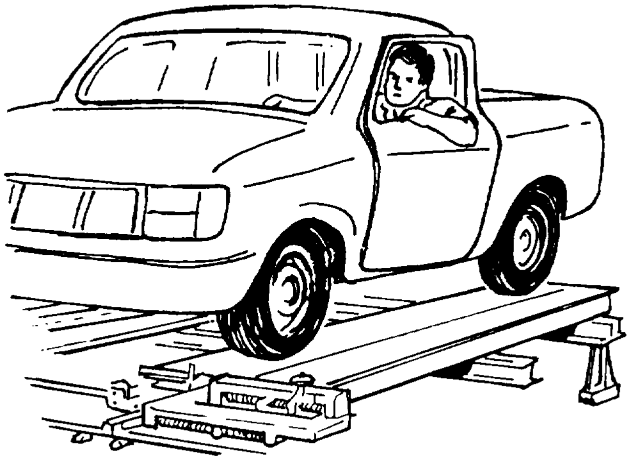


Figure 12-8.—Wheel alignment rack.

TOOLS FOR FRONT-END ALIGNMENT

To measure alignment angles, you will need special equipment, A wheel alignment rack (fig. 12-8) would be ideal. It positions a vehicle so that you can take measurements accurately and easily. However, it is doubtful that you will find such a setup in the battalions. You most likely will find the magnetic caster-camber gauge (fig. 12-9), a set of turntables (fig. 12-10), and a toe-measuring gauge (fig. 12-1 1). These three tools are the essentials. There are a large variety of tools on the market to aid you in making the actual caster, camber, and toe adjustments. Some are necessary; others can be substituted from your kit 13.

ALIGNMENT PROCEDURES

Check suspension and steering systems before making any of the following alignment adjustments:

1. Inspect the tires for correct size and inflate them to correct the air pressure. If the front tires are worn from misalignment, rotate or replace them. A tire worn on one side or the other will tend to pull to the worn side, even after the vehicle has been correctly aligned.

2. Inspect the wheel bearings, and correct excessive end play before making any other inspections or adjustments.

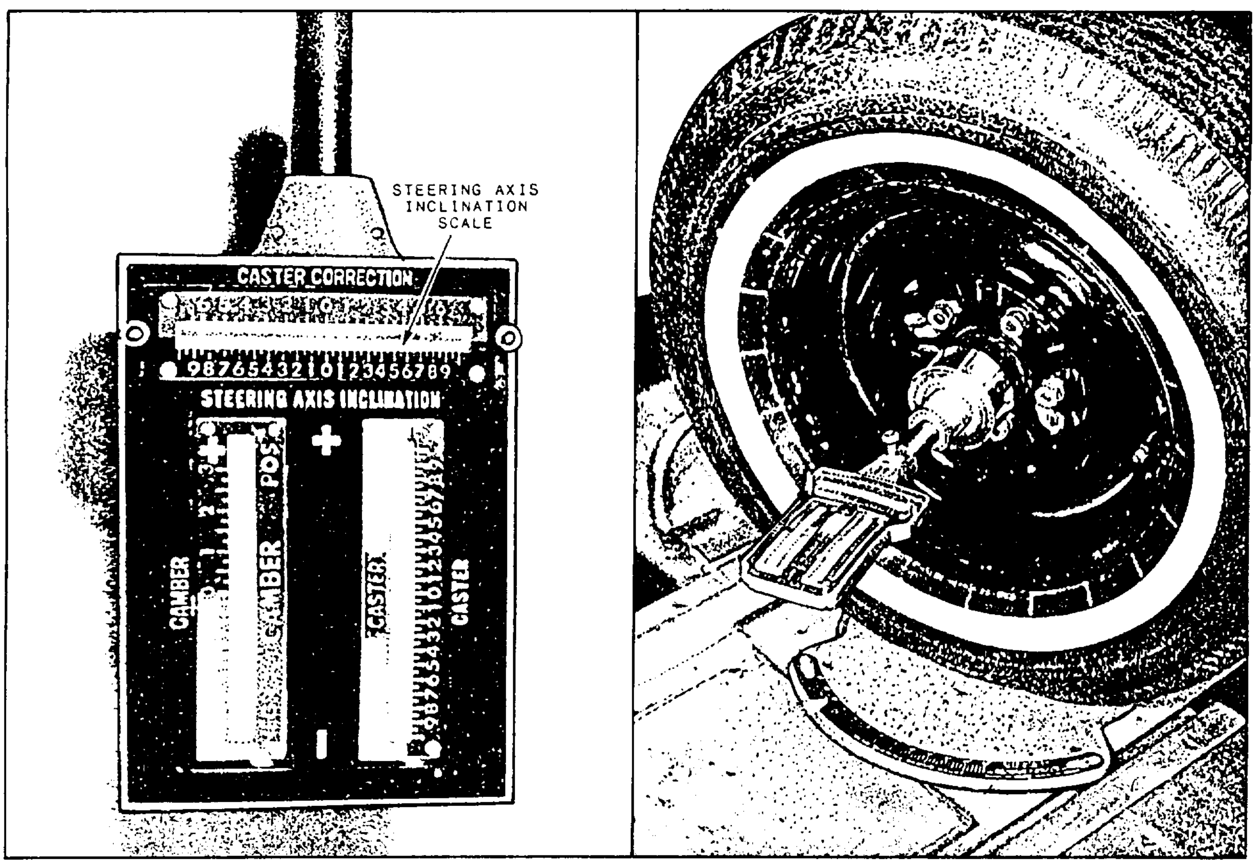


Figure 12-9.—Magnetic caster, camber gauge.

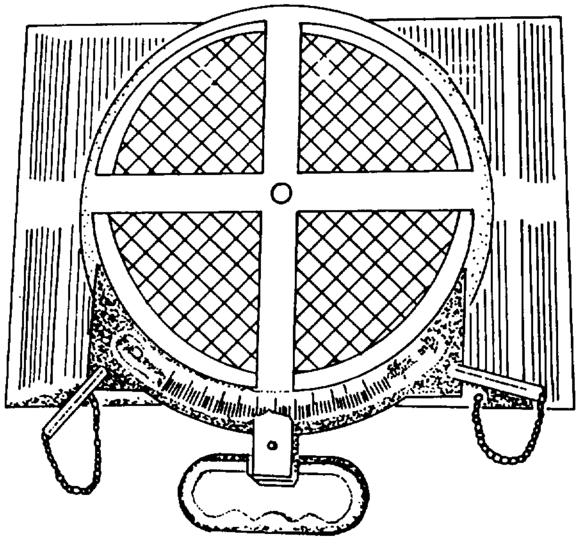


Figure 12-10.—Portable turntable.

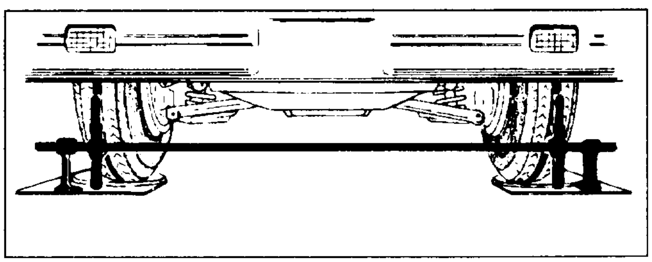


Figure 12-11.—Mechanical toe-measuring gauge.

3. Grasp the idler arm and try to work it up and down; then try to spread the tires apart while watching the steering linkage, (fig. 12-1 2). In either case, you should not see excessive movement. Inspect the tie rod ends for uncontrolled movement.

4. Check the upper and lower control arm bushing for wear or looseness. Either defect will contribute to improper alignment. Repair as needed.

5. Inspect the upper and lower ball joints. You are checking the axial and radial play. Make sure either does not exceed the manufacturer's specifications. Inspect one wheel at a time in the following manner: (A) If the lower ball joint carries the load (spring rides on the lower control arm) (fig. 12-13, A), place the jack under the lower control arm. If the upper ball joint carries the load (spring mounted on top of the upper control arm) (fig. 12-13, B), put the jack under the vehicle frame. (B) Using a pry bar under the tire, work it up and down while watching for movement at the ball joints. This is axial

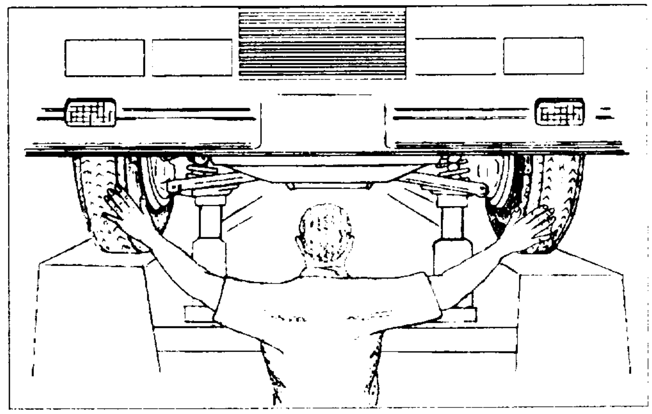


Figure 12-12.—Checking the steering linkage.

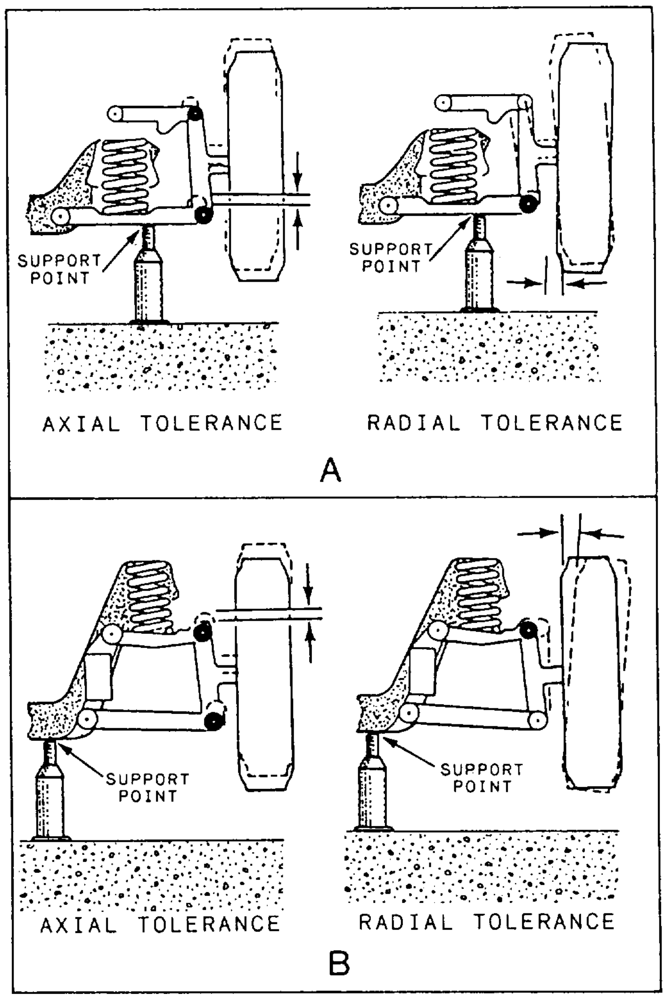


Figure 12-13.—Checking ball joints for wear.

play. (C) While holding the wheel at the top and bottom, push in at the top and pullout on the bottom; then reverse the procedure. You are checking for radial play. Some ball joints have wear indicators. The nipple that the grease fitting is threaded into sticks out of the ball joint

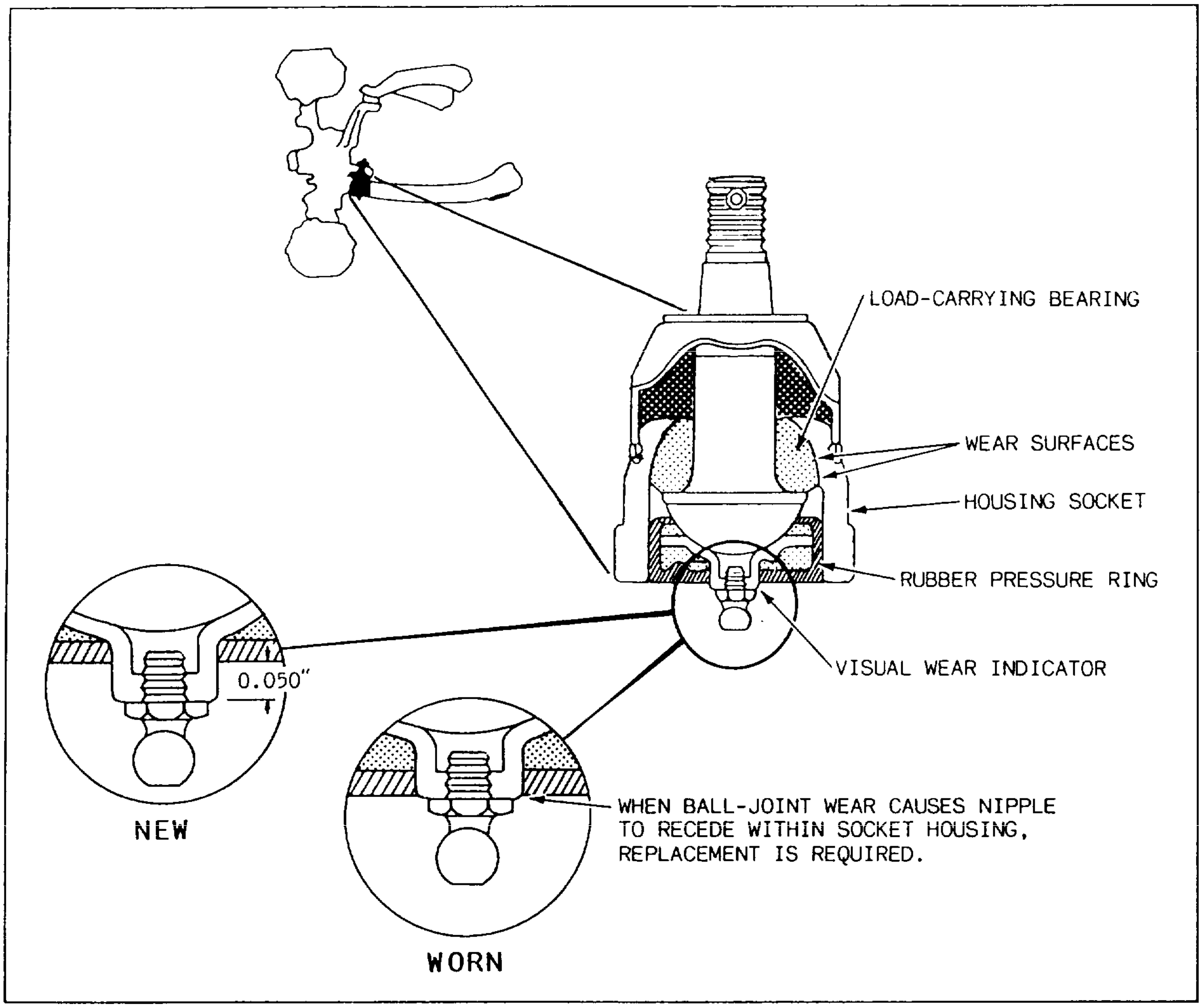


Figure 12-14.—Ball joint wear indication.

one-sixteenth inch (fig. 12-14). As the ballpoint wears, the nipple will move up into the balljoint housing. When the nipple is flush with the housing,replace the ball joint.

6. Check the shock absorber action and front springs for sagging or breakage.

7. Check the vehicle height. If the vehicle uses torsion bars vice coil springs, adjust the height by turning the adjusting bolt (fig. 12-15).

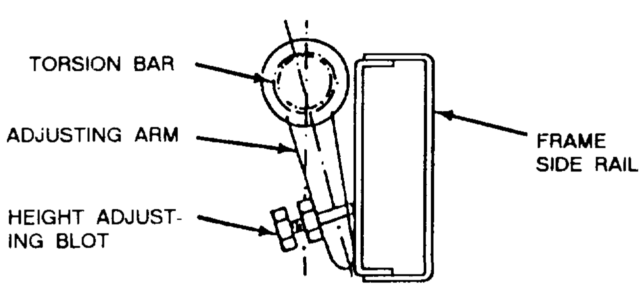


Figure 12-15.—Torsion bar adjusting bolt.

8. Inspect the steering wheel for excessive play and rough travel. The sector shaft (cross shaft) may require adjustment, which often cures steering looseness.

9. Vehicles should be aligned at curb height and weight. This means the vehicle should have no passengers, a full tank of fuel, and the proper amounts of coolant and lubricants. The spare tire and jack must be in the proper location.

ADJUSTABLE SUSPENSION ANGLES

Procedures for front-end alignment vary considerably with each make and model of vehicle. However, the basic principles do not change. Camber refers to the same angle in a Jeep as it does in a 15-ton stake truck Figure 12-16 shows some of the various adjustments for different model vehicles. Manufacturers have designed different ways of controlling front-end alignment adjustments. They are all a variation of one of the following:

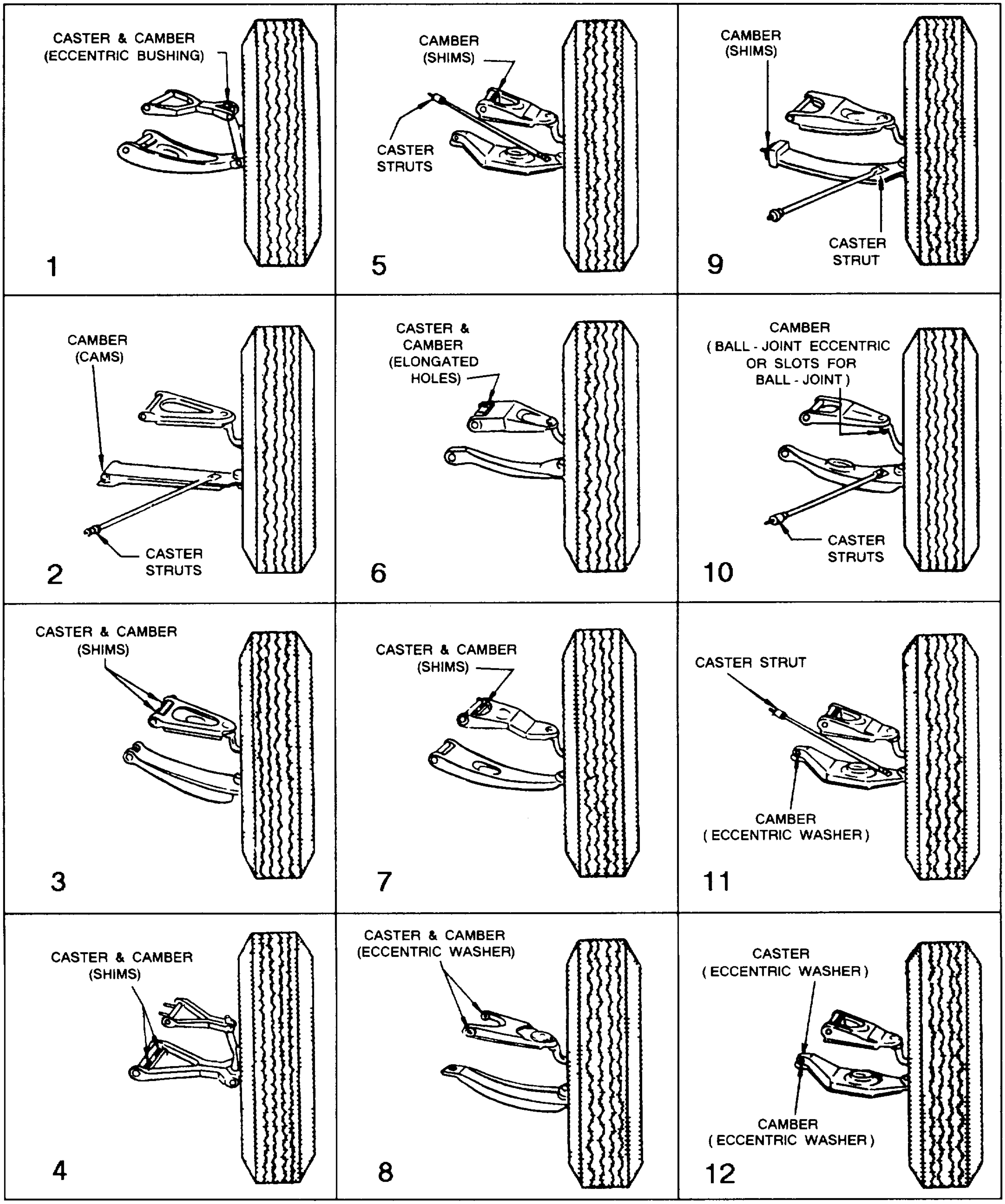


Figure 12-16.—Various locations of caster-camber adjustment points.

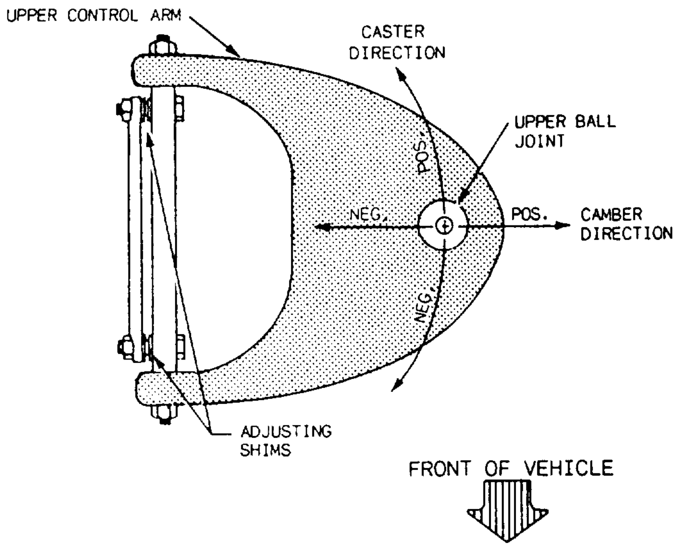


Figure 12-17.—Positive and negative directional movement of upper control arm.

1. Shims of various thickness at upper or lower control arm.

2. Eccentrics at upper or lower control arm and some use a strut rod for caster adjustment.

3. Elongated holes in the upper control arm or frame. The holes are serrated in the control arm and frame for a lock-tight fit.

Because all alignment angles are inter-related, one affecting the other, it is suggested you make your adjustments in the following order first-adjust caster, second-camber, third-center the steering wheel and adjust the tie rods so the wheels are straight ahead, and fourth-adjust toe-in.

Because of the variations in the different way each manufacturer designs a vehicle, you are advised to check the service manuals for specific adjustment locations and procedures.

CASTER/CAMBER ADJUSTMENTS

Regardless of the method or location of the adjustment, you should always consider the positioning of the upper control arm (specifically the ball joint) in relation to the lower. Whenever an adjustment is necessary, you must first consider in which direction you should move the upper control arm.

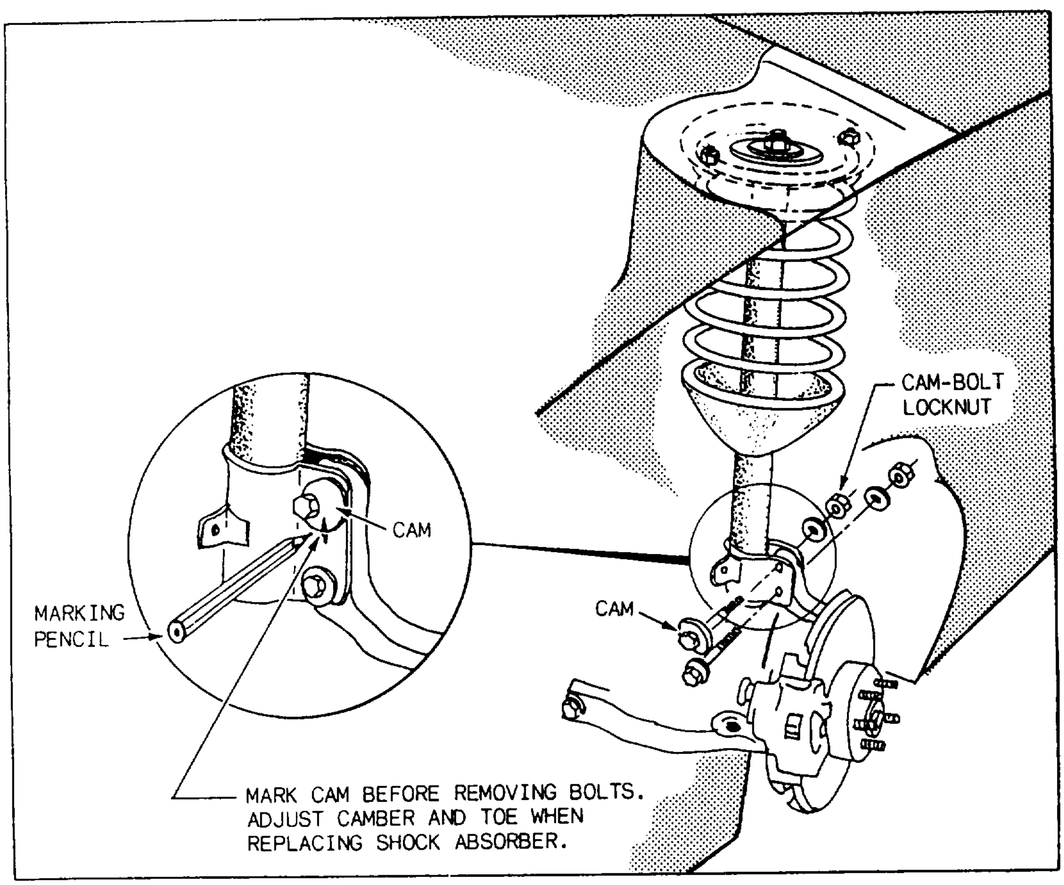


Figure 12-18.—MacPherson strut.

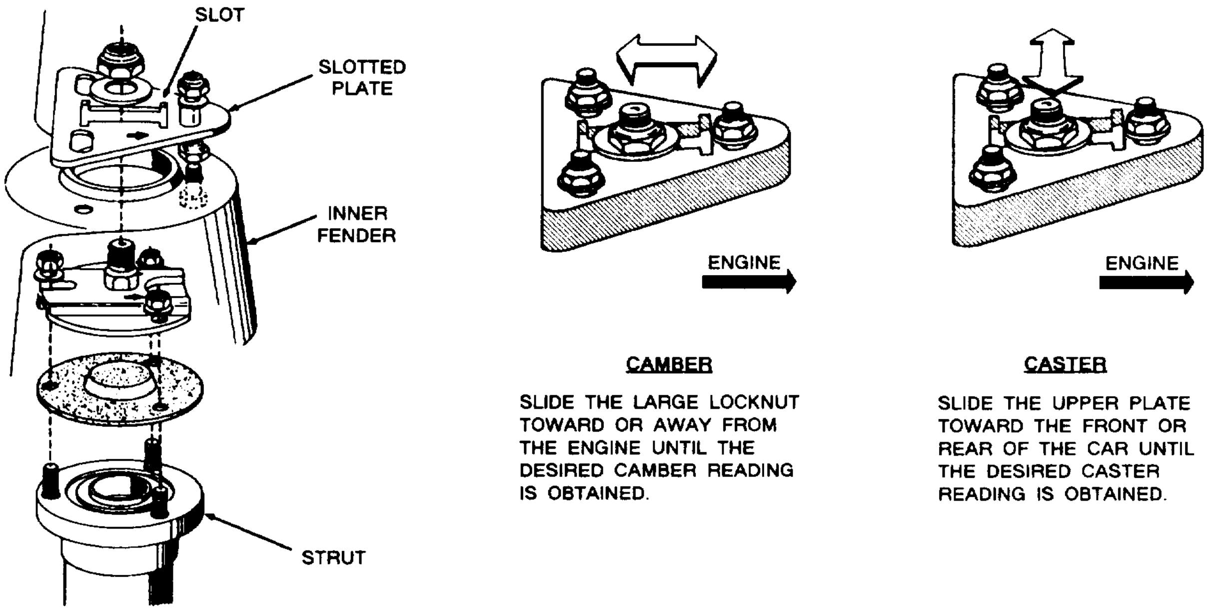


Figure 12-19.—Caster/camber adjustment kit for McPherson strut.

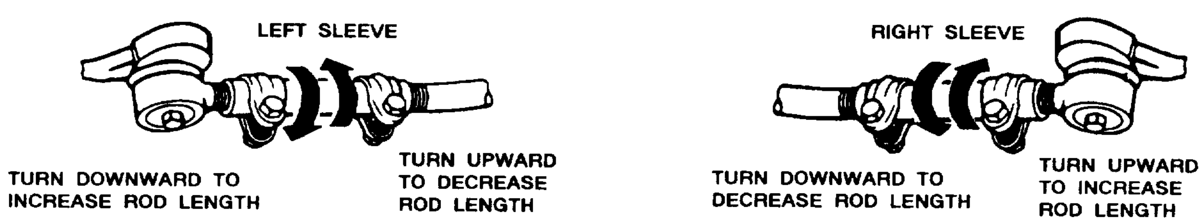


Figure 12-20.—Adjustments for toe-in and steering wheel alignment.

For example, if we move the upper ball joint to the rear of the vehicle, caster is changed in a positive direction (fig. 12-17). When you move the upper ball joint to the front of the vehicle, you change it in a negative direction.

It is the same when adjusting camber; you are still thinking of the top ball joint. Referring to figure 12-17, you see that by moving the top ball joint out, away from the vehicle, you change camber in a positive direction. Move it in, and you move it in a negative direction. Of course, when you move the ball joint, you are actually moving the entire upper control arm.

On vehicles with MacPherson-struts, (fig. 12-18), even though you are not dealing with upper and lower control arms, the principle is still the same. Some vehicles, from the manufacturer, do not provide a means for caster or camber adjustment. However, there is a kit (fig. 12- 19) available for those vehicles. Once the kit is installed, you will be able to make both adjustments. On other vehicles there is an adjustment for camber at the lower end of the strut, as shown in figure 12-18. You loosen the cam bolt locknut and route the cam bolt left or right. This moves the wheel in or out. Be sure to mark the location of all bolts when replacing these struts.

TOE-IN AND STEERING WHEEL ADJUSTMENT

After you have adjusted caster and camber, you should now adjust toe-in. It is the last angle to be adjusted, because caster and camber are so closely related. The adjustment of either will affect toe-in. It is adjusted in the same way on all vehicles-by turning the sleeves on the tie rod ends (fig. 12-20). This shortens or lengthens the steering linkage connecting the wheels.

Before you take the toe reading, it is important for you to make sure the front wheels are straight and the steering wheel is centered. You must center the steering wheel so that the steering gear is positioned on the high

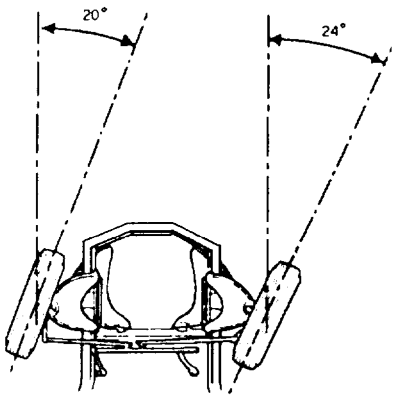


Figure 12-21.—Checking the turning radius.

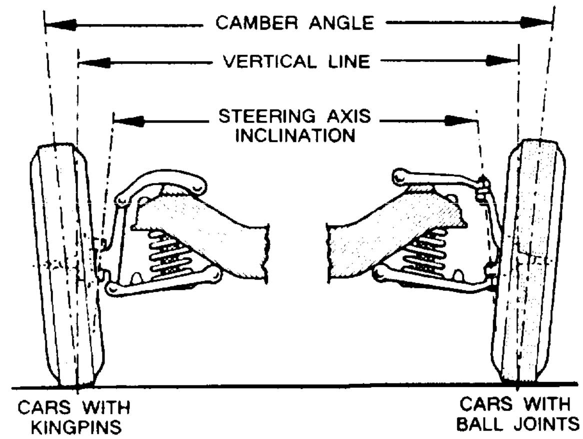


Figure 12-22.—Steering axis inclination.

point. This will cause less wear on the steering gears. A suggested procedure is as follows:

1. Position the wheels straight ahead; check the position of the steering wheel. It should be centered; if it is not, center it now. To find center, turn the steering wheel all the way to the left and count the number of turns while turning it all the way to the right. Now, turn the steering wheel back half the number of turns. Now check the front wheels; one may be turned in more or less than the other; adjust them so that they are parallel with the frame of the vehicle.

2. At this point, your toe reading should be zero (0). Now, adjust the toe by turning the tie rod end sleeves. They should be adjusted in equal amounts. If the setting is 1/4-inch toe-in, you take 1/8th off the right and 1/8th off the left wheel.

NONADJUSTABLE ANGLES

Now that we have covered the angles you can adjust, it is equally important that you understand the nonadjustable angles and how they can be checked as presented in the following section.

TURNING RADIUS

Turning radius is nonadjustable, but it can be checked (fig 12-21). Using turntable pads calibrated in degrees, turn the right wheel 20 degrees and read the setting on the left wheel. Then turn the left wheel 20 degrees and read the setting on the right wheel. Check your readings against the manufacturer's specifications. If all other adjustments are correct (caster, camber, toe-in), and the turning is incorrect, replacement of the steering arm is the only method of correction.

STEERING AXIS INCLINATION (SAI)

Steering axis inclination is nonadjustable; it is the angle formed by the true vertical centerline of the ball joints or kingpin (fig. 12-22). SAI and camber are closely related. If you change the camber by tilting the top of the wheel in or out, you change SAI an equal amount. As previously stated, SAI is nonadjustable; therefore, the angle built into the steering knuckle does not change unless it is bent.

To check the spindle or spindle support, measure both camber and SAI. If camber is positive, add the two measurements. If camber is negative, subtract the camber measurement from the SAI measurement. The resulting figure is the angle built into the spindle support. Check the manufacturer's specifications. If your readings differ from the manufacturers, then the only corrective action is to replace the bent spindle.

STEERING AND ALIGNMENT TROUBLE

The driver can sense steering and alignment trouble. He or she can detect hard steering or play in the steering system and will call you to find the trouble and remedy it. The following are some complaints and their possible causes;

1. When breaking, vehicle pulls to one side:

   a. Uneven tire pressure

   b. Brakes grab

   c. Caster incorrect or uneven

   d. Wheel bearing too tight

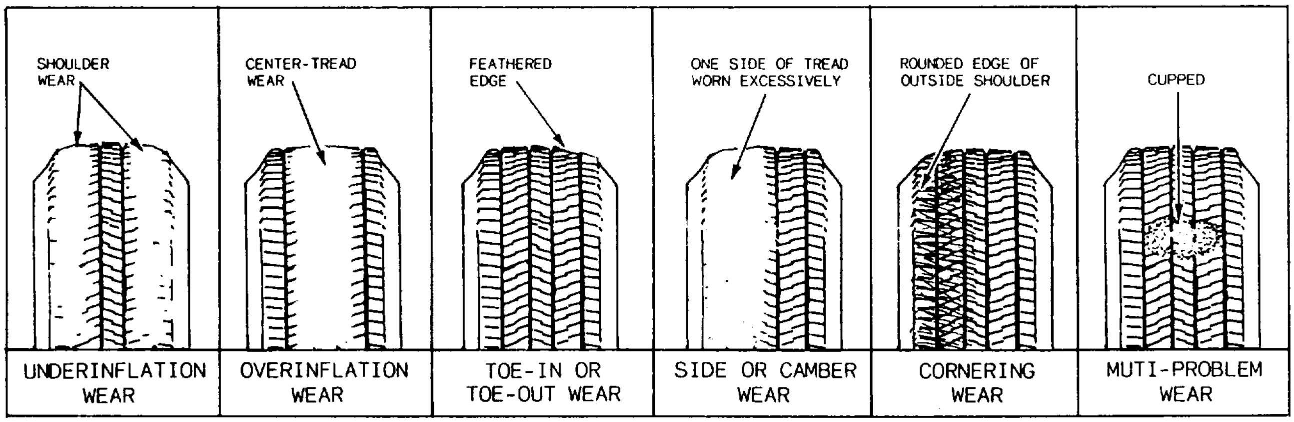


Figure 12-23.—Patterns of tire wear.

2. Shimmy at low speeds:
   - a. Low or uneven tire pressure
   - b. Loose linkage
   - c. Worn ball joints
   - d. Caster incorrect or uneven
3. Vehicle wanders:
   - a. Tire pressure incorrect or unequal
   - b. Caster or toe incorrect
   - c. Suspension components excessively worn or damaged
4. Steering wheel not centered:
   - a. Toe-in out of adjustment
   - b. Steering components bent
   - c. Steering wheel not properly placed on steering shaft
5. Steers hard:
   - a. Low tire pressure
   - b. Binding steering assembly or misadjusted
   - c. Excessive caster
   - d. Steering and suspension units not properly lubricated
6. Tire wear (fig. 12-23):
   - a. Underinflation causes wear at tread sides
   - b. Overinflation causes wear at tread center
   - c. Excessive camber causes wear at one tread side
   - d. Excessive toe-in or toe-out on turns causes tread to featheredge

TRACK ALIGNMENT

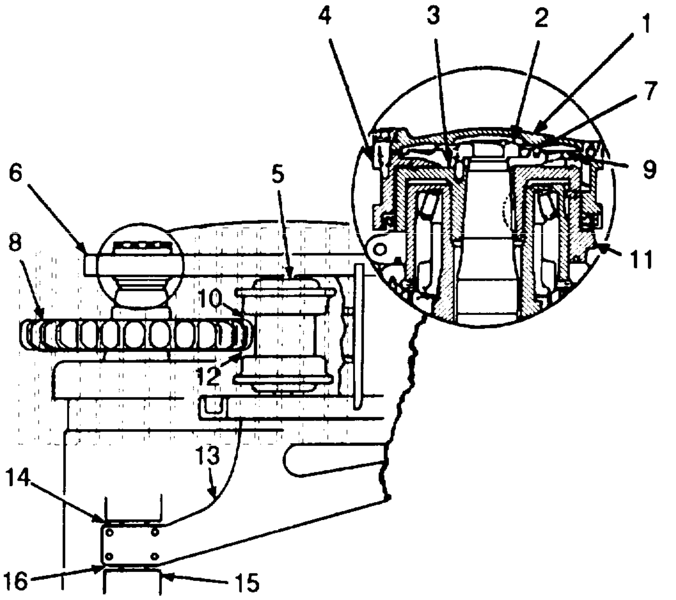
A misaligned front idler or track frame will cause many hours of project lost time and could cost several hundred dollars to replace worn-out components. You must know what components will be affected and what is involved in the proper alignment process. So, when this condition does arise, you will be able to diagnose it properly and take the corrective action needed to keep your equipment in the field and on the job.

Track frame misalignment can allow tee-out. This could cause excessive end wear of track pins, rail side wear and sprocket tooth gouging of the inside of the links, side wear of the sprocket and sprocket teeth, off-center external wear of the bushings, and flange wear of rear rollers. Misalignment of the front idler can cause wear of the front idler flange, the front track roller flanges, and the link side rails.

The use of track guiding guards keeps the track in proper alignment. These are called wear bars and plates. They are shimmied to align the idler with the track rollers. The side wear plates guide the idler, as it recoils back and forth. These guards should be reconditioned or adjusted to proper thickness, so they will guide the track squarely into alignment with the track rollers.

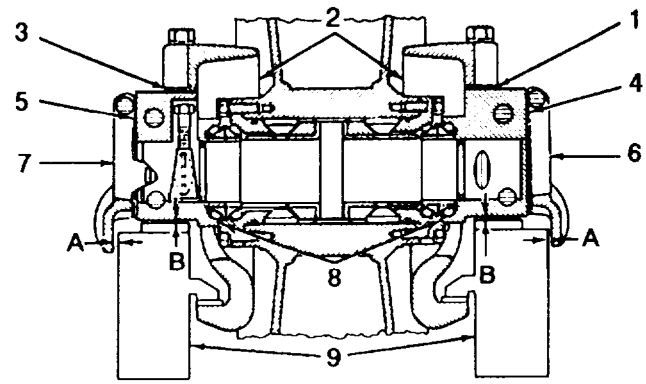
The front guiding guards receive the track from the idler and hold it in line for the first roller. The front roller then can be used fully for its intended purpose-that of carrying its share of the tractor load without having to climb the sides of the improperly aligned track.

The rear guiding guards hold the track in correct alignment with the driving sprocket, permitting a smooth, even flow of power from the sprocket to the track. With proper alignment, the gouging of link sides and sprocket teeth is eliminated.



1. Cap
2. Nut
3. Shims
4. Outer bearing assemble
5. Rear track roller
6. Track roller frame
7. Lock ring
8. Drive sprocket
9. Retainer assembly
10. Clearance
11. Holder assembly
12. Clearance
13. Diagonal brace
14. Clearance
15. Steering clutch case
16. Clearance

Figure 12-24.—Aligning track roller frame with sprocket.



1. Shims
2. Collars
3. Shims
4. Shims
5. Shims
6. Guide plate
7. Guide plate
8. End bearings
9. Frame. A: .03 ± .02 in. (0,76 ± 0,51 mm) dimension.
   B: .045 ± .015 in. (1,14 ± 0,38 mm) dimension.

Figure 12-25.—Aligning idler with track rollers.

The center guiding guards or track roller guards are available as attachments and are a continuation of the "hold the line" safeguard so important to extending track life. These center guards keep the track in line between the rollers when operating in rocky, uneven, or steep-sloped terrain, thereby reducing wear on the roller flanges and track links.

When aligning the track roller frame with the sprocket and adjusting the front idler, you must follow the manufacturer's procedures. The following procedure is an example of what is involved in these adjustments.

TRACK ROLLER FRAME ALIGNMENT WITH SPROCKET

1. For the following example, refer to figure 12-24. For the track to lead straight off of the rear roller (5) onto the drive sprocket (8) and not rub against either the sides of the sprocket or the rims of the track roller, the center of the roller should be centered with the sprocket.

2. The drive sprocket (8) should be centered with the rear roller (5) so the area (10) and (12) between the outer face of the sprocket and the inner edge of the track roller rim are equal.

3. In the recess in the steering clutch case (15), check the clearance of the diagonal brace (13) at points (14) and (16).

4. To make this adjustment, remove the cap (1) from the outer bearing assembly (4) and take off the lock ring (7), nut (2), and retainer assembly (9).

5. To move the roller frame out, you add shims (3) between the retainer assembly (9) and the holder assembly (11). This will decrease the clearance (12) at the roller and at the diagonal brace (14) and increase the clearance at (10) and (16).

6. To move the roller frame closer to the tractor, you remove shims (3). This decreases the clearance at (10) and (16) and increases the clearance at (12) and (14).

ADJUSTMENT OF THE FRONT IDLER

For the adjustment of the front idler, refer to figure 12-25. To align the idler with the track rollers and keep the clearance between the yoke and the plate within specifications for dimension (B), you install shims (1) and (3) between collars (2) and bearings (8).

To shift the idler from side to side in order to align the idler and track properly, you add enough shims (4) and (5) between bearings (8) and guide plates (6) and (7) to provide clearance (A) between guide plates (6) and (7) and the frame (9).

This chapter stresses the importance of your understanding and following the principles of front-end alignment and track alignment in vehicle maintenance. Although these principles will remain the same, the make and year of the equipment assigned to your unit will change. Therefore, it is always recommended that you refer to the manufacturer's repair manual for specific adjustments for your particular equipment.

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