RADIO Experimenters' GUIDE

ISSUED BY THE
NEWARK SUNDAY CALL

D. X. FROM COAST TO COAST :-: SELECTIVE :-:

Motorists have found that it pays to

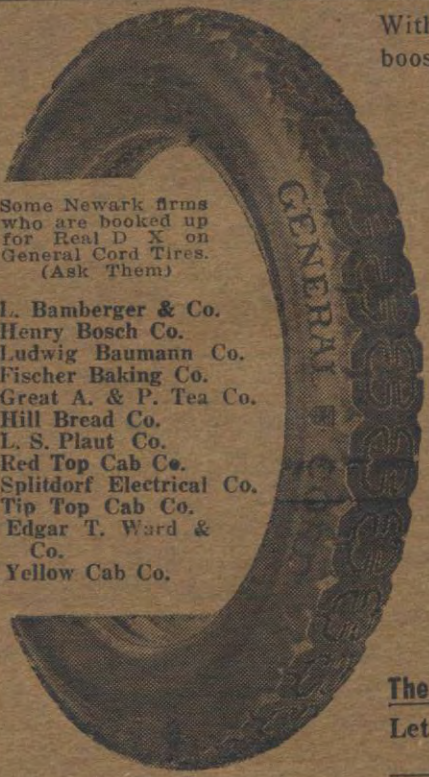
HOOK UP WITH THE

GENERAL

CORD TIRE

FOR REAL D. X. (LONG MILEAGE)

'They Go a Long Way to Make Friends'



Some Newark firms who are booked up for Real D X on General Cord Tires. (Ask Them)

L. Bamberger & Co.
Henry Bosch Co.
Ludwig Baumann Co.
Fischer Baking Co.
Great A. & P. Tea Co.
Hill Bread Co.
L. S. Plaut Co.
Red Top Cab Co.
Splitdorf Electrical Co.
Tip Top Cab Co.
Edgar T. Ward & Co.
Yellow Cab Co.

Without exception its users are boosters and loud speakers for

GENERAL CORDS

What regeneration does for your set, General Cords will do for your car. They both give real D. X. (long mileage). Get an amplifier for your tire mileage now by tuning in with

GENERAL CORDS

The Tires That Run on Less Air

Let Us Tell You About the New Balloon Tires

BURNET RUBBER CO.

Mitchell 1034

31 CENTRE ST., NEWARK, N. J.

One-Half Block East H. & M. Park Place Tube Station

"Home of Good Radio"

OUR policy of keeping up with the times by stocking only those brands of merchandise that are known and proven reliable, assures the buyer of the most value—with the thought always uppermost that the "Home of Good Hardware" has proven itself also the "Home of Good Radio."

General Radio	*Sleeper*
Dubilier	*Cutler Hammer*
Magnavox	*Weston*
Western Electric	*DeForest*
Paragon	*Brandes*
Grebe	*Baldwin*
Eveready	*Amertran*
Cardwell	*Amrad*
R. C. A.	*Acme*
Cunningham	*Atwater Kent*
Murdock	*U. S. Tool*

AND OTHERS OF EQUAL MERIT

Banister & Pollard Co.

"HOME OF GOOD HARDWARE"

206-208 Market St. Newark, N. J.

PHONE 1651 MARKET

RADIO

EXPERIMENTERS' GUIDE

AND LIST OF

RADIO BROADCASTING STATIONS *OF THE* WORLD

BY

Wm. F. B. McNEARY
ALBERT E. SONN
FRED H. CANFIELD

ISSUED FOR FREE DISTRIBUTION BY THE

RADIO DEPARTMENT
of the

NEWARK SUNDAY CALL

NOVEMBER, 1923

RADIO SETS

PARTS, SUPPLIES

We sell only the reliable, better grade equipment. In the wake of the enormously increased demand, radio equipment—good, bad and indifferent —has flooded the market. We carefully choose and offer to our customers only the goods of high-grade, dependable manufacturers. Note list below:

COMPLETE SETS

R. C. A. Westinghouse, Neutrodyne, Grebe, Kennedy, Crosley, Tusca, Moon.

DEFERRED PAYMENT PLAN

BASUB—THE "A" BATTERY SUBSTITUTE

On Demonstration at Our Store.

LOUD SPEAKERS

Magnavox, Western Electric, Music Master, Atlas, Metro, Morrison and others.

PHONES

Western Electric, Baldwin, Brandes, Radioceive, Murdock, Royalfone, etc.

HIGH-GRADE PARTS

U. S. Tool, General Radio, Atwater-Kent, Sleeper, Workrite, Fada, Dayton Radio Products, Shamrock, Acme, Amertran, Paragon, R. C. A. and many others.

RADIO INFORMATION BUREAU

We answer all questions, suggest proper equipment, tell you how to make installation and give you estimate of cost FREE!

THIS IS RADIO HEADQUARTERS

United Radio & Sport Shop

798 Broad St at Market

INTRODUCTION

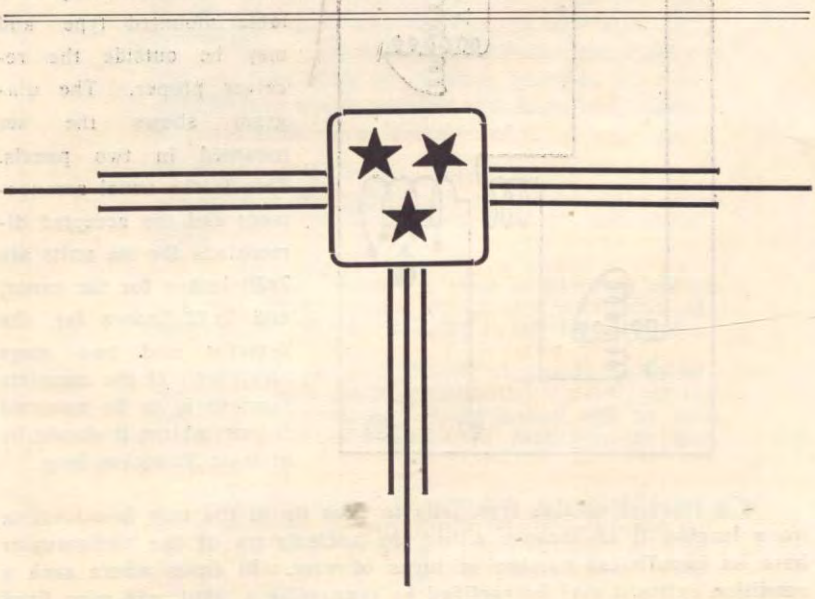
This little book is intended to be of practical help to the amateur experimenter. Circuits which require complicated diagrams and explanations have been omitted, but a number of excellent receiving systems which will give splendid results on all the new broadcasting wavelengths have been included, thus offering the experimenter a wide choice.

The information compiled in these pages is based upon material already published in the Radio Section of the Newark Sunday Call, which has gained a wide reputation among amateur experimenters for the accuracy of its data on radio construction. The hook-ups presented herein are therefore reliable. Each one has been constructed and tested in the Sunday Call's Radio Laboratory. This is a policy which the Call has fol- for two years in order to protect its readers from the waste of time, material and money on "trick cicuits."

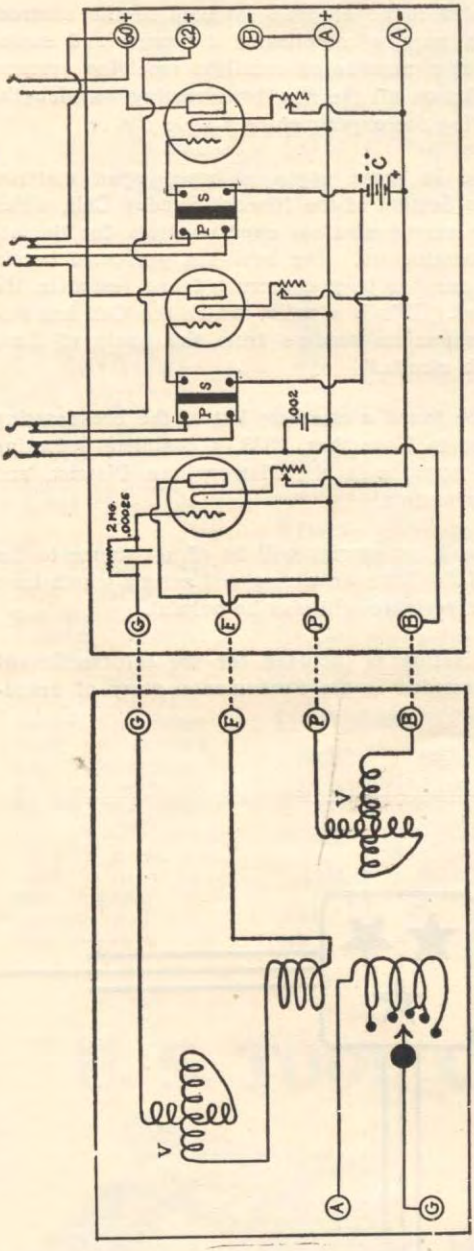
In this booklet will also be found a complete list of the broadcasting stations of the world corrected to November, 1923, a complete operating schedule of the broadcasting stations in the Metropolitan District, and a list of slogans used by broadcasters.

The data on radio parts and accessories will be of assistance to the builder of home-made sets and the hints on wiring and aerials which have been gathered from practical experience will also be helpful.

A brief history of broadcasting is included for the information of those who wish to be well grounded in the fundamental story of broadcasting.



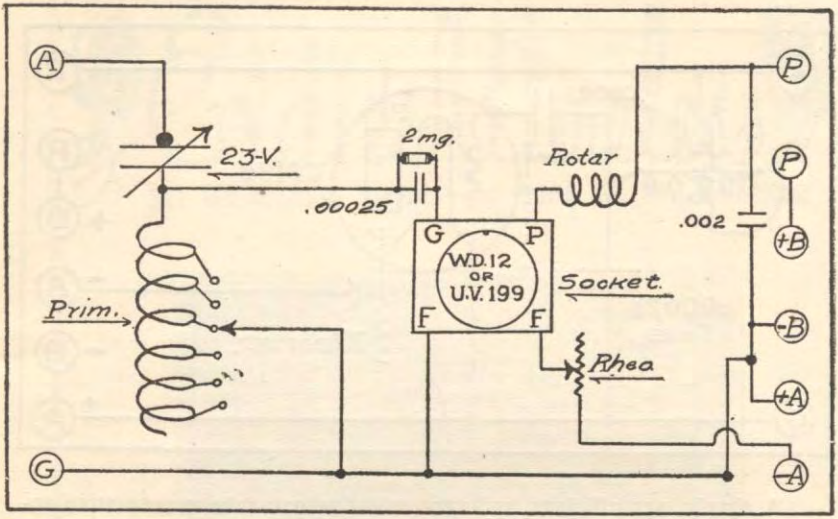
GRID RETURNS FOR DETECTORS AND AMPLIFIERS



The three circuit tuner with a two stage audio audio frequency amplifier has for years been considered the ideal tuner for short wave modulated reception. The tuning elements used in this receiver include the following: Two variometers, one variocoupler and a series aerial condenser if single and ten turn taps are not used on the primary of the coupler. These instruments should be mounted a considerable distance apart to prevent howling. Experience has shown that the best arrangement is to mount the two variometers about 12 inches apart with the variocoupler mid-way between them. The series aerial condenser may be a table mounted type and may be outside the receiver proper. The diagram shows the set mounted in two panels. This is the usual arrangement and the accepted dimensions for the units are 7x20 inches for the tuner, and 7x12 inches for the detector and two stage amplifier. If the complete receiver is to be mounted in one cabinet it should be at least 30 inches long.

If a receiver of this type fails to tune up to the new broadcasting wave lengths it is because either the variometers or the variocoupler have an insufficient number of turns of wire. In cases where such a condition exists it may be rectified by connecting a .0001 mfd mica fixed condenser between the grid of the detector tube and the secondary side of the grid condenser.

TAPPED VARIOCOUPLER CIRCUIT FOR D X



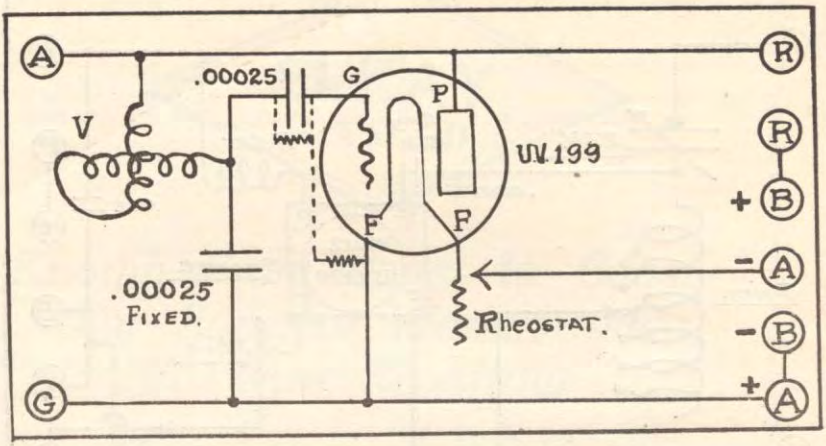
For the fan who wants to hear distant stations, the circuit shown here is suggested. Essentially it consists of a variocoupler, using the rotar coil as a tickler in the plate circuit, and a 23-plate variable condenser in the aerial circuit. About six taps are necessary on the coupler primary. A fixed grid condenser of about .00025 mfds., and a grid leak of 2 megohms are required in the grid circuit. The wiring is correct for any standard tube. Tuning is simple. The wavelength is controlled by the taps and the variable condenser. Regeneration is controlled by the rotation of the tickler coil. It is important that the rotar coil leads be connected in the right direction.

Having the rotar leads connected in the wrong direction will prevent this circuit from regenerating. It is not necessary to use the single taps on the primary of the variocoupler in this circuit. Best results are obtained when using the 180 degree type of variocoupler. A good mica phone condenser, .002 mfds., will sometimes improve this circuit.

RADIO HEADPHONES

The principle upon which radio headphones are built is one of such simplicity that the superiority of one over another is almost entirely a matter of material and workmanship. First of all, a headset should be light in weight and should set comfortably upon the head of the wearer. Otherwise, its use will be little short of a torture, harking back to the days of the Iron Maiden. The phones should be responsive to delicate signals, but should not blast on overtones. On this score, the purchaser should not expect a pair of headphones to stand up and give satisfactory service when employed constantly at a volume sufficient to wake the neighbors next door. For loud speaker work, use a more ruggedly designed reproducing unit.

SIMPLE COLPITS OSCILLATOR RECEIVER



A simple, yet efficient, and very selective one tube regenerative receiver is shown above. It is known as the Colpits oscillator, and when applied to broadcasting reception it is very sensitive. The regeneration is controlled by means of the variometer and rheostat. The variometer should be of a good make that will take care of all the wave-lengths up to about 600 meters. The circuit will not work well without a reliable grid leak which should be about 2 megohms for the average tube. Aerial ground and receiver terminals are shown so that the apparatus can be mounted on a panel.

The common error made by amateurs experimenting with this circuit is to neglect careful adjustment of the detector rheostat in tuning in each station. With each change in wavelength, a slightly different tuning is required on both the variometer and the rheostat. The grid leak requires rather careful adjustment with certain tubes and may need attention when changing from one tube to another. Variable grid leaks are unnecessary. A phone condenser is not required and its use will considerably decrease the efficiency of the set.

CONDENSERS

Condensers used in radio receiving sets are of two general types: (1) fixed and (2) variable. The most satisfactory fixed condenser is the one constructed of alternate layers of copper or tin foil and mica compressed in a manner which will insure positively fixed capacity. Fixed condensers resembling a piece of chewing gum are worthless. Fixed condensers compressed between pieces of metal are not as popular as those compressed between pieces of insulating material. Until recently, the only type of variable condenser was the rotary plate type but recently there has been introduced new types of variable air condensers employing a roll lever and corkscrew motion. Because of the straight-line curve characteristics claimed for these condensers, their appearance on the market is being observed with considerable interest. Here are a few simple rules to observe in the purchase of variable plate condensers: (1) Give preference to condensers having hard rubber insulation; (2) Select a condenser capable of being provided with flexible wire connections from the rotary plates; (3) Best condensers are those having the fewest number of contacts to the insulation material; (4) wide space between the connections from the rotar and stator plates on the insulation material; (5) Adjustable tension governing alignment of plates should be locked.

NEWARK AND BROADCASTING

Although much propaganda has been circulated in favor of two other cities, Newark is entitled to full credit for having started the broadcasting boom which began in the fall of 1921, and from this city spread throughout the world.

The Sunday Call's broadcasting plan was put into operation in Newark in October, 1921, with a play-by-play story of the world series. This was the first time in history that the world series had been broadcast. Following this, the Sunday Call sent out from W J Z a detailed description of each play in all the principal college football games played in the east. This was the first time in the history of radio that a big college football game was described play by play.

With the first of these broadcasts the Sunday Call originated the idea of telling a children's story by radio and "The Man in the Moon" yarns, which are widely known, resulted. Here again the Sunday Call was the pioneer. These features were supplemented by musical programs, talks, lectures and church services.

These were the features to be found "in the air." Of great importance in its effect upon the success of broadcasting as "the national indoor sport" was the Radio Section of the Sunday Call, the first of its kind in the United States. This section became a part of the Sunday Call on October 9, 1921, and has developed into one of this newspaper's institutions. It was alone in the field for several months, after which the metropolitan dailies, the Globe, Mail, Tribune, World, Journal and Times took up radio in their columns.

Newspapers in other cities fell into line and now there is hardly a newspaper in the counry which does not supply radio information to its readers.

As far back as 1908 radio broadcasting was known in Newark and Newark was known as the center of radiotelephony experiments. In that year, A. Frederick Collins, in the course of his research of the oscillating arc as a means of generating high frequency waves sent out experimental concerts from his station on Clinton street. By means of his system, Collins talked from Newark to Philadelphia. These "broadcasts," however, were spasmodic and were known only to a comparatively few people.

Shortly after this, Dr. Lee De Forest, inventor of the three element tube, came to Newark, establishing his laboratory on Boyden place, where the single steel tower, 125 feet high, supporting his antenna was visible from the windows of Lackawanna trains and from many points in the city. DeForest conducted a number of experimental broadcasts in 1909 and 1910. Amateur wireless operators of those days were his only auditors and they recall now how poor was the quality compared with that of W E A F today.

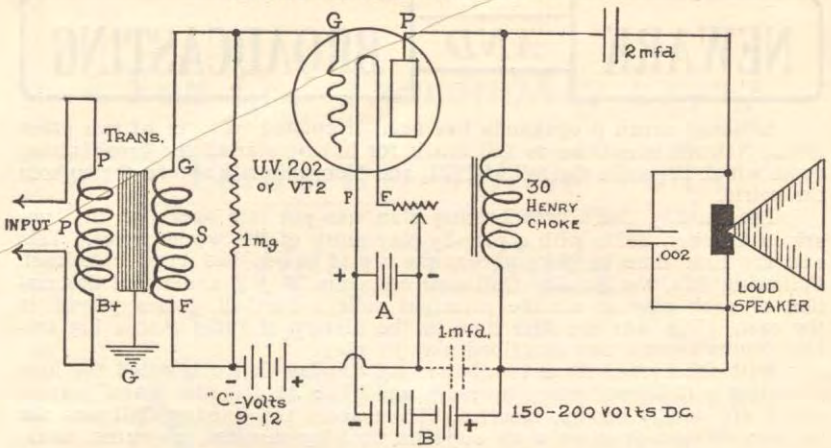
In the fall of 1919, radiophone broadcasting experiments were conducted from the Western Electric station 2 X J at Deal, N. J., and later radiophone communication between 2 X J and 2 X B in New York, another Western Electric station. A little over a year later, the Westinghouse Company began experiments with a station in Pittsburgh (K D K A) from which the first church services were sent out.

GRID BATTERY VOLTAGE.

The following table gives an approximation of the grid biasing potential necessary when various plate voltages are used. This table is approximately correct for all standard tubes:

Plate Volts	Grid Volts
40	.5 to 1.0
60	1.0 to 3.0
80	3.0 to 4.5
100	4.5 to 6.0
120	6.0 to 9.0
150	9.0 to 12.0
200	12.0 to 20.0
250	20.0 to 25.0

THIRD STAGE AMPLIFIER



Here is a power amplifier which may be used in the third stage of any receiver. The loud speaker is not connected in the usual place but a 30 henry choke coil is used instead. The primary of any standard bell-ringing transformer will serve as a choke. A power tube must be used in this circuit. The Western Electric V. T. 2 or the Radiotron 202 will answer this purpose. The amplifying transformer should have a low turn ratio (about 4:1) and should be of the shell type. The resistance across the secondary is for the purpose of cutting down the excess voltage amplification and should have a resistance of about one megohm. The value of this resistance should be varied until the signals have maximum intensity with least distortion. A two mfd. condenser is called for in the diagram but the .002 mfd. condenser, which is shunt across the loud speaker terminals, and the one mfd. condenser, across the B battery, are not essential but often improve the quality of reproduction.

In cases where a power amplifier of this type fails to give the expected increase in volume, there are two probable causes for trouble. The first is insufficient plate voltage. An amplifier which uses a power tube is of little use unless at least 120 volts of B battery are used. A second cause for poor operation is the use of improper grid potential. The adjustment of the grid battery (C battery) is rather critical and it should be arranged so that it could be varied in steps of 1½ volts.

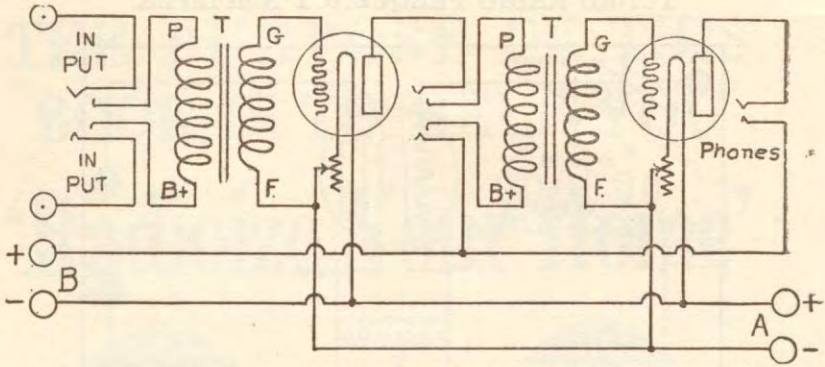
CONCERNING THE COLPITS

In the Colpits circuit, certain precautions must be taken to insure proper regeneration. In the first place this receiver will usually operate best with single wire aerial about 50 to 70 feet long. If the aerial is greatly in excess of this length, a fixed condenser (about .00025 mfds.), connected in series with the aerial, will often improve the results. If the receiver does not tune down to the lowest wavelengths the rotar and stator windings of the variometer should be connected in parallel. The amplifying transformer should be of the shell type.

VARIABLE R. F. TRANSFORMERS.

Variable radio frequency transformers have recently been placed on the market and on the new wavelengths these transformers seem to be very much more satisfactory than the older type.

STANDARD TWO-STEP AMPLIFIER



A standard two step amplifier circuit is shown above. This may be used with any detector tube circuit. Three jacks are included in the circuit for plugging in any stage. Filament and plate battery binding posts are shown as well as the input terminals for the first transformer. The two input connections always link up with the output or phone circuit of the detector tube circuit. This will allow the amplification of any type of receiver, whether it be a vacuum tube set or a simple crystal detector receiver.

In cases where the amplifier apparently passes the current without increasing it, it will usually be found that the "F" terminal of the amplifying transformer is connected to the positive side of the filament battery instead of to the negative as shown. Poor phone jacks and sloppy soldering commonly cause trouble in this circuit.

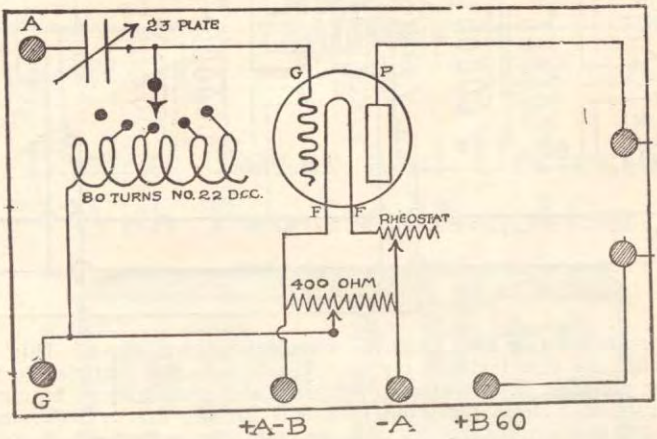
AUDIO FREQUENCY TRANSFORMERS

Very little can be told about the working qualities of an audio frequency amplifying transformer from its outward appearances and therefore the purchaser must rely largely upon the data supplied by the manufacturer. This data will usually be found in the instruction sheet accompanying the transformer and if the transformer is to be used in connection with the standard R. C. A. or Cunningham tubes the measurements should be approximately the same as are advised below. Greatest amplification without distortion will be had if the transformer used in the first stage has a ratio between the secondary and primary windings of not greater than 5:1 and not less than 4:1. In the second and third stages the ratio should not be greater than 4:1 nor less than 3.5:1. The allowable current on each winding should not be less than 10 milliamperes and the voltage breakdown tests should show the transformer capable of standing a potential of at least 300 volts. The useful frequency range of the transformer should be from 60 to 2000 cycles and if an amplification curve is supplied with the transformer it should indicate that there were no sharp resonant peaks between the frequencys already mentioned. The impedance of the primary winding of an amplifying transformer should be in the neighborhood of 11,000 ohms at 1,000 cycles.

TELEPHONE JACKS

Telephone jacks are a constant source of trouble if poor or cheap ones are used in the set. Weak springs and dirty, corroded contacts cause nine-tenths of the failures. These jacks fail to properly pass the amplified currents along to the next stage. The springs on a jack should be strong, so that when the plug is removed, a good electrical contact is made. Jacks insulated by means of fiber washers should never be used. The fiber allows the current to leak through to the other leaves of the jack. These washers should be of hard rubber, bakelite or micarta insulation. Fans should never solder their jacks with soldering paste. In nine cases out of ten, a very sloppy job is made by using too much paste. Solder should be applied with rosin which is a good insulator and does not run or melt, causing short circuits and corroded contacts.

TUNED RADIO FREQUENCY AMPLIFER



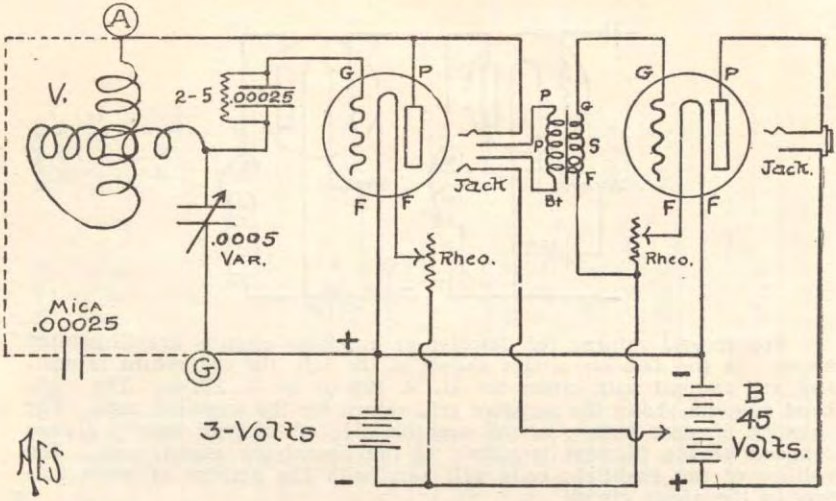
Tuned radio frequency has come to stay and has proven itself extremely valuable in application to three circuit regenerative tuners. It is a consistent DX getter when properly tuned and helps to make the three circuit receiver far more selective. In building this unit, make sure that the instruments are not bunched together. A panel 7x12 is large enough. The potentiometer must be of the best and not of the small rheostat type. The 80 turns of wire on the tuning inductance should be wound on a 3½-inch bakelite tube. Use No. 20 or No. 22 double cotton covered wire, tapping about every twenty turns. Mount the tube in a glazed porcelain based socket if possible. Keep the wiring rather far apart and try not to run grid and plate wires parellel. The variable condenser must be of a low loss type, and not one using fiber or moulded end plates. The binding posts at the extreme right of the diagram connect to the aerial and ground posts of the tuner.

Cramming the parts of this circuit into too small a space will decrease its efficiency greatly. Do not try to build this unit in the same cabinet with the tuning apparatus. Make sure that the movable plates of the variable condenser are connected to the aerial and not to the grid circuit.

RADIO FREQUENCY TRANSFORMERS

The utility of a radio frequency amplifying transformer is entirely dependent upon the characteristics of the curve in which amplification is plotted against wavelength and buying a transformer without first examining this curve is just like buying a cat in a bag. The fact that a radio frequency transformer is rated as useful from 200 to 500 meters does not necessarily mean that maximum amplification will be obtained between these wavelengths and the curve from some so rated transformers has shown that almost 75 per cent of the amplification was confined between the narrow band of wavelengths from 360 to 400 meters. The curve of a radio frequency transformer should show that the transformer gives fairly uniform amplification through the range of desired wavelengths and also that there exist no pronounced resonant points at which very much greater amplification takes place. Some manufacturers have designed three transformers, each with a different curve so that when all three are used in the same receiver, the amplification is practically uniform on all the desired wavelengths.

COLPITS WITH ONE-STEP AMPLIFIER



Here is the Colpits circuit with a one-step amplifier. It is noted for its ability to tune sharply and is a good DX getter when properly operated. An ordinary variometer and a 23-plate variable condenser are the tuning elements. The circuit is used with any type of tube, but is drawn for the U. V. 199 or the U. V. 201-A. The rheostat must be of the best with an extremely smooth adjustment because considerable regulation is necessary when tuning. The .00025 fixed condenser shown connected by dotted lines around the variometer is necessary only where the wavelength of the variometer is too short. The variable condenser must be of the best make obtainable as it controls the regeneration and is also across the high voltage B battery. The grid leak will vary depending upon the type of tube used. About 2 or 3 megohms will take care of most tubes.

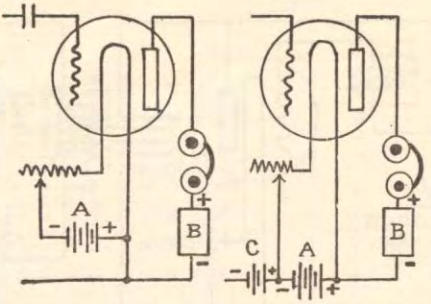
Having a variometer with too high a minimum wavelength will prevent this circuit from responding to the lower wavelengths. If stations below 360 meters cannot be heard, a .00025 mica type grid condenser may be placed in series with the aerial and the aerial post on the variometer. Never use a phone condenser across the primary of the amplifying transformer in this circuit.

COUPLERS

The old style loose coupler with its sliding secondary is no longer considered an efficien piece of radio apparatus, nor is the old type variocoupler with its 90-degree wooden ball rotar. A much more efficient coupler is made today with light bakelite tubes, a secondary coil rotating at a 180-degree angle. With this type coupler tuning is sharper; there are no dead end loses and a greater degree of regeneration is possible.

A properly designed variocoupler should have at least 65 to 70 turns on the primary, with about 50 turns on the secondary. The flexible leads to the rotar coil should be fairly heavy so as to withstand much turning and twisting. The terminals to which the leads of the rotar are fastened should in no way touch the primary wires. In choosing a coupler look for a good mechanical job throughout, and see that the rotar coil is mounted on a true running shaft.

GRID RETURNS FOR DETECTORS AND AMPLIFIERS



Proper grid returns for detector or amplifier circuits are illustrated above. In the detector circuit shown at the left, the gid return is positive and is used with either the U. V. 199 or U. V. 201-A. The right hand diagram shows the negative grid return for the amplifier tube. The negative filament battery or the negative side of the grid battery always connects to the filament terminals of the amplifying transformer. The voltage of the flashlight cells will vary with the amount of plate battery in the phone circuit.

Fans should be careful not to use the flashlight 4½ volt unit as a grid battery in the amplifier circuit. Individual flashlight cells of 1½ volts each should be used. A combination 4½ volt battery with taps for 1½, 3 and 4½ volts is now on the market, and may be used as a grid battery.

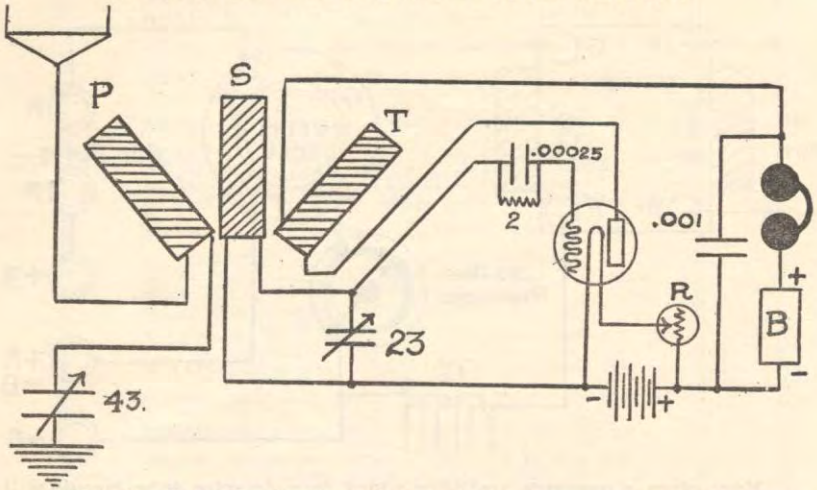
SOCKETS

It was once said by a well-known radio engineer that the only kind of socket to use in a radio set, especially one using radio frequency amplifiers was one with a glazed porcelain base. This type socket has the lowest losses of any kind known. Unfortunately, there are few such sockets available to the public. Hard rubber, bakelite and micarta bases have low losses, but are not as good as the porcelain type. Moulded "mud" compositions are often worthless, because the minute energy of the detector circuit finds its way between the terminals of these sockets and is partly lost. Hard rubber based sockets are considered best; next comes those of bakelite. The shell of the socket should be of metal with a good even key slot. Composition sockets have a tendency to break at the key slot. The spring contacts in the base should be of phosphor bronze or hard springy copper. Nickel plated springs have an unnecessarily high resistance, although hundreds of such sockets are sold. Nickel has a higher resistance than most other metals. There are a few good sockets with copper collared springs.

RHEOSTATS

To control the filament current of a vacuum tube, a variable resistance is required in series with the negative lead from the A battery. This resistance unit is called a rheostat and comes in various designs and values of resistance. Rheostats with vernier adjustment are valuable only when used in connection with a critical or "soft" detector tube. They are not necessary, however, when the following detector-amplifier tubes are used: U. V. 199, U. V. 201-A, W. D.-11 and W. D.-12. When using the first two tubes mentioned, the rheostat must be of either 20 or 30 ohms resistance. This allows the accurate adjustment required in these tubes. A 6-ohm rheostat will satisfactorily control the filament of the W. D.-11 and W. D.-12 tubes when using A battery voltage not exceeding 1½ volts. Rheostats should be selected for their mechanical perfection because this instrument is being constantly adjusted and it must be put together to stay. The material upon which the resistance wire is wound should be of a composition which will not absorb moisture.

STANDARD HONEYCOMB COIL CIRCUIT



A two circuit tickler feedback set employing honeycomb coils is shown above. Separate variable condensers tune the primary and secondary circuits to the wavelength desired. It is a simple circuit, easy to wire and very efficient. For broadcast reception honeycomb coils known as L 50, L 50 and L 75 may be used in the primary, secondary and tickler circuits respectively. By substituting larger coils, any wavelength up to 25,000 meters may be received. The circuit as shown has a negative grid return and is designed for the U. V. 200 detector tube, but if the grid return is made positive by connecting the lower wire of the coil marked "S" to the positive side of the filament battery instead of to the negative of the filament battery, tubes such as the U. V. 201-A, U. V. 199, W. D. 12 and the Cunningham C. 301-A, C. 299 and C. 12 may be used.

A mistake sometimes made by amateurs in wiring this circuit is to have the leads from the tickler coil (marked "T") in the wrong direction. When this mistake is made the circuit will not regenerate. To obtain the right combination experiment by reversing the tickler leads. No harm will be done to the tube by changing the tickler coil leads.

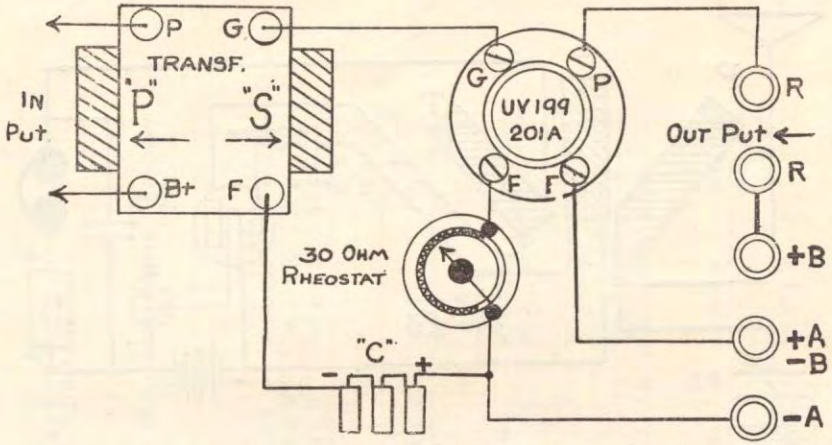
AERIALS

Experiments with different types of receiving aerials resulted in the selection of a single wire aerial about 75-foot long with a 25-foot leadin wire, for all around good reception. This type of aerial should be made up of enamel covered wire of about No. 12 gauge. If this kind of wire is not obtained use No. 12 bare copper wire. The leadin should be included in the same piece as the aerial without soldered joints. The lead will come from one end nearest the house or the receiving apparatus. At each end of the antenna, put two glazed porcelain insulators in series. This will be ample insulation for the receiving aerial in all kinds of wet weather. The height of the aerial should be about 35 feet, and should be erected over a free space and not over a tin roof or trees and bushes.

PLATE BATTERIES

Radio fans gain nothing by buying poor B batteries, now properly known as plate batteries. About the only way to tell a good plate battery is by its reputation. Plate batteries are now available in two types: Storage and dry cell, the former having recently gained wide popularity. When purchasing dry cell batteries, select the standard size 22½ volt unit. Midget 22½ volt units should be used only in portable sets. Where higher voltages are required, buy additional 22½ volt units instead of the 45 volt block. In general the latter is not economical. Be sure that a proper voltmeter test is given by the dealer. When a 22½ volt battery registers less than 17 volts, it should be discarded. Storage batteries are advantageous because they may be charged from the electric light line using a rectifier.

DIAGRAM FOR ONE-STEP AMPLIFIER



Very often a one step amplifier added to a detector tube circuit will bring up the volume of distant stations which are barely heard on the first tube. The circuit above calls for a U. V. 199 amplifier tube but will work just as well as any other type of amplifier tube. Any type of audio amplifying transformer can be used. The input or primary side of the transformer connects to the output posts of the detector. The proper place for the grid battery is shown. The strength of this battery will depend upon the amount of the plate battery used. When 45 volts of plate battery are used the grid battery should be approximately 1½ volts.

The error most commonly made in wiring this unit is to select a poor audio transformer. No amplification is any better than its transformer and care must be taken to choose wisely. Bus-bar wiring makes the best job here as in all other radio circuits.

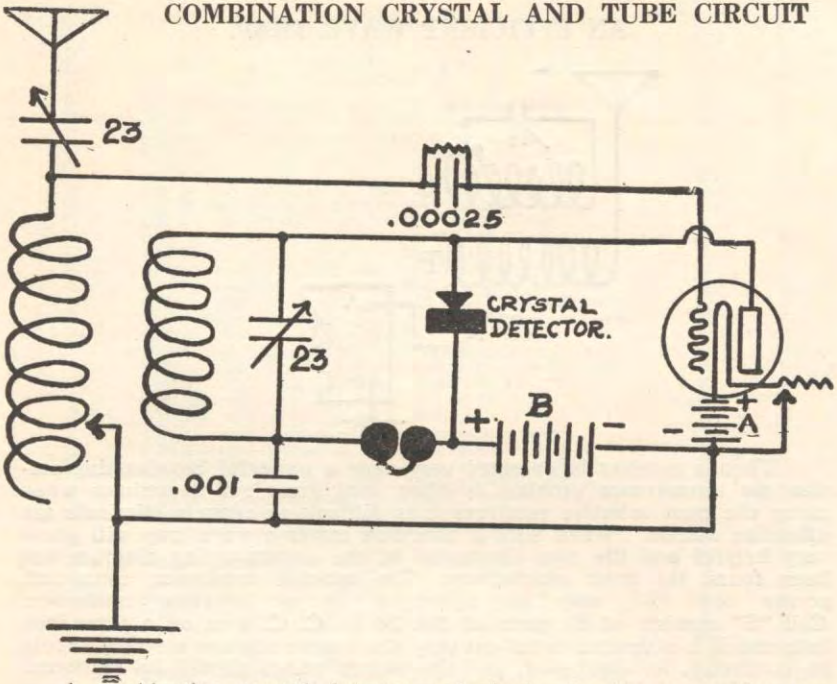
LOUD SPEAKERS

It may safely be said that the best rule to follow in the purchase of a loud speaker is to let the instrument speak for itself. Here the market affords a very wide variety and choice is determined largely by the purchaser's ear and his pocketbook. Loud speakers fall into two main classes: (1) The complete unit consisting of reproducer and horn, and (2) the reproducer alone. In the latter class, a popular instrument is the reproducer designed in such a way that it may be connected to the tone arm of the phonograph, thus utilizing the victrola horn. There are so many different systems of reproduction that a complete analysis would require all the pages in this booklet. Since the operation of this instrument tells the whole story, purchase should be made only after a satisfactory demonstration.

BATTERY CHARGERS

Fans having 110 volt A. C. lighting service in their homes who use a storage battery on their set, should own a battery charger. The chargers come in two different styles, the mechanical vibrator and the bulb rectifier types. Both are safe to use in the home and charge the battery equally well. The rectifier using the bulb is more silent in its operation than the mechanical vibrater type. The bulb type also is less apt to get out of order. The bulb rectifier may take a little longer to charge a battery than the vibrator type due to the fact that it rectifies only one side of the 60 cycle current. Bulb rectifiers come in two sizes, one giving 2 amperes at 6 volts and the other 6 amperes at 6 to 8 volts. The larger size charges the battery three times as fast as the smaller type. With either charger, about 10 cents' worth of current is required to charge a storage battery.

COMBINATION CRYSTAL AND TUBE CIRCUIT



A combination crystal detector and single circuit regenerative receiver often proves advantageous. The crystal can be used on local stations, and the tube for distant stations. This set requires a variocoupler and two variable condensers. When the crystal is in use the rheostat must be turned off and when the bulb is used the catwisker should be taken off the crystal and the tube turned on. The phones stay in their place. When the tube is used, the regeneration is controlled by the rotar of the variocupler.

Getting rotar leads in the wrong direction will prevent this circuit from oscillating. The right direction can be determined by trial. The catwisker wire touching the crystal when the tube is in use will prevent the reception of any stations.

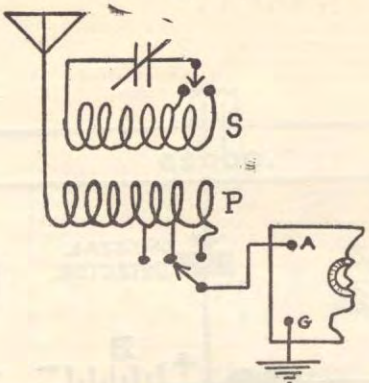
POTENTIOMETERS

A properly designed potentiometer should have a great many turns of resistance wire and should be much larger than a rheostat. The slider should move freely without undue pressure to avoid cutting the fine resistance wire. The wire may be enamel covered or bare, but the turns should be close together. The potentiometer should have a resistance of at least 400 ohms from end to end. A 400 ohm potentiometer will not exhaust a 6-volt, 60 ampere hour storage battery within 5,000 hours. The potentiometer is used to regulate the grid potential of the detector tube or to permit an additional increase of the plate battery voltage.

METERS

Every radio expermenter should aspire to have an accurate voltmeter and ammeter. The voltmeter should have two scales, one reading from 0 to 8 or 10 volts, and the other scale from 0 to 50 volts. The ammeter should read from 0 to 5 amperes. The voltmeter may be used for measuring the voltage of filament and plate batteries. The ammeter may be used for measuring the current consumed by the filament of the tube. An example of how useful a voltmeter is can be appreciated by the following: A 22 volt plate battery measuring less than 17 volts is no longer fit for use in the receiving set; a 45 volt plate battery measuring less than 35 volts is about exhausted and should be discarded. The only way to determine this condition is by means of a voltmeter.

AN EFFICIENT WAVE TRAP.



When a receiver is operated very near a powerful broadcasting station the interference problem is often very great and sometimes when using the most selective receivers it is difficult to entirely eliminate the offending station. When such a condition exists a wave trap will prove very helpful and the type illustrated in the accompanying diagram has been found the most satisfactory. The variable condenser, connected, across coil "S," may be either a 23 or 43-plate condenser. Coil "S" consists of 50 turns of No. 24 D. C. C. wire on a three-inch tube and if it is desired to cut out very short wave stations a switch should be connected, as illustrated, and the switch points should be connected to the 35th and 50th turns. A few turns of tire tape of wrapping paper are wound over coil "S" to insulate it from coil "P," which is wound directly over it and in the same direction. Coil "P" consists of eight turns of No. 18 D. C. C. wire and connections from the switch points are made to the third, fifth and eight turns of this coil.

KILOCYCLES—WAVELENGTH TABLE.

For the convenience of the Broadcast Listener, there is given below a list of all broadcast wavelengths together with the corresponding figures in kilocycles. This latter designation is coming into more general use in station announcements:

Kcy.	W. L.	Kcy.	W. L.	Kcy.	W. L.
1350	222	1080	278	810	370
1340	224	1070	280	800	375
1330	226	1060	283	790	380
1320	227	1050	286	780	385
1310	229	1040	288	770	390
1300	231	1030	291	760	395
1290	233	1020	294	750	400
1280	234	1010	297	740	405
1270	236	1000	300	730	411
1260	238	990	303	720	417
1250	240	980	306	710	423
1240	242	970	309	700	429
1230	244	960	312	690	435
1220	246	950	316	680	441
1210	248	940	319	670	448
1200	250	930	323	660	455
1190	252	920	326	650	462
1180	254	910	330	640	469
1170	256	900	333	630	476
1160	258	890	337	620	484
1150	261	880	341	610	492
1140	263	870	345	600	500
1130	266	860	349	590	509
1120	268	850	353	580	517
1110	270	840	357	570	527
1100	273	830	361	560	536
1090	275	820	366	550	546

INTERNATIONAL MORSE CODE

The space between two words is equal in length to five dots.
The space between two letters is equal in length to three dots.

For the convenience of those who may desire to master the reading of radio telegraph messages the International Morse Code is here given. This is the code used by all radio telegraph stations and is entirely distinct from that used on the wire telegraph. The latter is called the American Morse Code.

The space between parts of the same letter is equal to one dot.
A dash is equal in length to three dots.

A .—	Period	. .. . ..
B —...	Semicolon	—.—.—.
C —.—.	Comma	.—.—.—
D —..	Colon	———...
E .	Interrogation	..——..
F ..—.	Exclamation Point	——..——
G ——.	Apostrophe	.————.
H	Hyphen	—....—
I ..	Bar Indicating Fraction	—..—.
J .———	Parenthesis	.—..—.
K —.—	Inverted Commas	..—--.—
L .—..	Underline	—...—
M ——	Double Dash	...———...
N —.	Distress Call	
O ———	Attention call to precede every transmission	—.—.—
P .——.	General Inquiry Call	—.—.——.—
Q ——.—	From (de)	—.. .
R .—.	Invitation to transmit (go ahead)	—.—
S ...	Warning—high power	——..——
T —	Question (please repeat after interrupting long messages	)— ..——..
U ..—	Wait	.—...
V ...—	Break (Bk.) (double dash)	—...—
W .——	Understand	...—.
X —..—	Error	.....
Y —.——	Received (O. K.)	.—.
Z ——..	Position report (to precede all position messages)	— .—.
A (German) .—.—	End of each message (cross)	.—.—.
A or A (Spanish-Scandinavian) .——.—	Transmission finished (end of work) (Conclusion of Correspondence)	...—.—
CH (German-Spanish) ————		
E (French) ..—..		
N (Spanish) ——.——		
O (German) ———.		
U (German) ..——		
1 .————		
2 ..———		
3 ...——		
4 ....—		
5		
6 —....		
7 ——...		
8 ———..		
9 ————.		
0 —————		

BROADCASTING STATIONS
UNITED STATES

K—THREE-LETTER CALLS

KAO—360—Denver, Colo., Y. M. C. A.
KDN—360—San Francisco., Cal., L. J. Myerberg.
KFI—469—Los Angeles, Cal., E. C. Anthony.
KFV—360—Yakima, Wash., Foster-Bradbury.
KFZ—283—Spokane, Wash., Doerr Mitchell.
KGG—306—Portland, Ore., Hallock and Watson.
KGN—360—Portland, Ore., N. W. Radio Mfg. Co.
KGU—492—Honolulu, Hawaii, M. A. Mulrony.
KGW—492—Portland, Ore., The Oregonian.
KGY—258—Lacey, Wash., St. Martin's College.
KHJ—395—Los Angeles, Cal., Times-Mirror.
KHQ—360—Seattle, Wash., Louis Wasmer.
KJQ—360—Stockton, Cal., C. O. Gould.
KJR—270—Seattle, Wash., Vincent I. Kraft.
KJS—360—Los Angeles, Cal., Bible Institute.
KLN—261—Monterey, Cal., Noggle Electric.
KLS—360—Oakland, Cal., Warner Brothers.
KLX—360—Oakland, Cal., Tribune Pub. Co.
KLZ—360—Denver, Colo., Reynolds Radio Co.
KMC—360—Reedley, Cal., Lindsay-Weatherill.
KMJ—360—Fresno, Cal., San Joaquim L. & P.
KMO—360—Tacoma, Wash., Love Electric Co.
KNJ—250—Roswell, New Mexico, Public Service.
KNT—263—Aberdeen, Wash., Grays Harbor Co.
KNV—256—Los Angeles, Cal., Radio Supply Co.
KNX—360—Los Angeles, Cal., Electric L. S. Co.
KOB—360—State College, New Mexico., N. M. College of Agriculture.
KOP—286—Detroit, Mich., Detroit Police Dept.
KOQ—360—Modesto, Cal., Evening News.
KPO—423—San Francisco, Cal., Hale Bros.
KQI—360—Berkeley, Cal., California University.
KQP—360—Hood River., Ore., Apple City Radio Co.
KQV—360—Pittsburgh, Pa., Doubleday-Hill.
KQW—360—San Jose, Cal., Charles D. Herrold.
KQY—360—Portland, Ore., Stubbs Electric Co.
KRE—278—Berkeley, Cal., Daily Gazette.
KSD—546—St. Louis, Mo., Post Dispatch.
KSS—360—Long Beach, Cal., Prest & Dean.
KTW—360—Seattle, Wash., First Pres. Church.
KUO—360—San Francisco., Cal., The Examiner.
KUS—360—Los Angeles, Cal., City Dye Works.
KUY—256—El Monte, Cal., Coast Radio Co.
KWG—360—Stockton, Cal., Portable W. Tel. Co.
KWH—360—Los Angeles, Cal., The Examiner.
KXD—360—Modesto, Cal., The Herald.
KYI—360—Bakersfield, Cal., Alfred Harrell.
KYJ—360—Los Angeles, Cal., L. J. Meyberg.
KYQ—360—Honolulu, T. H., Electric Shop.
KYW—345—Chicago, Ill., Westinghouse.
KZM—360—Oakland, Cal., P. D. Allen.
KZN—360—Salt Lake City, Utah, Desert News.
KZV—360—Wenatchee, Wash., Wenatchee Co.

K—FOUR-LETTER CALLS

KDKA—326—East Pittsburgh, Pa., Westinghouse.
KDPM—270—Cleveland, O., Westinghouse.
KDPT—244—San Diego, Cal., So. Elect. Co.
KDYL—360—Salt Lake City, Utah, Telegram.
KDYM—252—San Diego, Cal., Savoy Theater.
KDYQ—360—Portland, Ore., Ore. Insti. of Tech.
KDYS—360—Great Falls, Mont., The Tribune.
KDYW—360—Phoenix, Ariz., Smith, Hughes & Co.
KDYX—360—Honolulu, Hawaii, Star-Bulletin.
KDYY—360—Denver, Colo., Rocky Mount. Radio Corp.
KDZB—360—Bakersfield, Cal., Frank E. Siefert.
KDZE—455—Seattle, Wash., The Rhodes Co.
KDZF—278—Los Angeles, Cal., Auto Club of S. C.
KDZH—360—Fresno, Cal., Fresno Evening Herald
KDZI—360—Wenatchee, Wash., Elec. Supply Co.
KDZK—360—Reno, Nev., Nevada Ma. & Elec. Co.
KDZQ—360—Denver, Colo., Pyle & Nickolas.
KDZR—261—Bellingham, Wash., Bell Pub. Co.
KDZT—360—Seattle, Wash., Seattle Radio Assn.
KDZU—360—Denver, Colo., Western Radio Corp.
KDZV—360—Salt Lake City, Utah., Cope-Cornwall
KFAD—360—Phoenix, Ariz., McArthur Bros.
KFAE—360—Pullman, Wash., State Col. of Wash.
KFAF—360—Denver, Colo., West. Radio Corp.
KFAJ—360—Denver, Colo., University of Colorado

KFAN—360—Moscow, Idaho, Electric Shop.
KFAP—360—Butte, Mont., Standard Pub. Co.
KFAQ—360—San Jose, Cal., City of San Jose.
KFAR—280—Hollywood, Cal., O. K. Olsen.
KFAT—275—Eugene, Ore., Dr. J. T. Donohue.
KFAU—270—Boise City, Idaho, In. School Dist.
KFAV—258—Venice, Cal., Abbot Kinney Co.
KFAW—280—Santa Anna, Cal., Radio Den.
KFAY—360—Central Point, Ore., W. J. Virgin Co.
KFAZ—360—Reddley, Cal., C. H. Weatherle.
KFBB—360—Havre, Mont., F. A. Buttrey & Co.
KFBC—238—Phoenix, Ariz., Nielson Rad. Co.
KFBE—360—San Luis Obispo, Cal., R. H. Horn.
KFBG—360—Tacoma, Wash., First Pres. Church.
KFBK—283—Sacramento, Cal., Kimball-Upson Co.
KFBL—224—Everett, Wash., Leese Bros.
KFBS—360—Trinidad, Colo., Chronicle-News.
KFBU—283—Laramie, Wyo., Bishop N. S. Thomas
KFCD—360—Salem, Ore., Salem Elec. Co.
KFCF—360—Walla Walla, Wash., F. A. Walsh.
KFCH—360—Billings, Mont., Elec. Service Station
KFCK—242—Colorado Springs, Colo., C-S Radio Co.
KFCL—360—Los Angeles, Cal., Union Stockyards.
KFCM—360—Richmond, Cal., Radio Shop.
KFCP—360—Ogden, Utah, R. W. Flygare.
KFCQ—360—Casper, Wyo., Motor Service Station.
KFCV—360—Houston, Tex., F. Mahaffey Jr.
KFCY—360—LeMars, Ia., Western Union College.
KFCZ—258—Omaha, Neb., Central H. S.
KFDA—360—Baker, Ore., Adler's Music Store.
KFDB—509—San Francisco, Cal., Mer. Trust.
KFDC—283—Spokane, Wash., Radio Supply Co.
KFDD—253—Boise, Idaho St. Michael's Cathedral
KFDF—360—Casper, Wyo., Wyoming Radio Corp.
KFDH—360—Tucson, Ariz., Union of Ariz.
KFDJ—360—Cornwallis, Ore., Agricultural College
KFDL—360—Denver, Colo., Knight-Campbell.
KRDO—248—Bozeman, Mont., E. H. Cutting.
KFDP—278—Des Moines, Ia., Hawkeye Radio.
KFDR—360—York, Neb., Bullocks Co.
KFDU—250—Lincoln, Neb., Nebraska Radio Co.
KFDV—360—Fayetteville, Ark., Gilbrech & Stinson
KFDX—360—Shreeveport, La., First Bap. Church
KFDY—360—Brookings, S. D., State College.
KFDZ—360—Minneapolis, Minn., H. O. Iverson.
KFEC—360—Portland, Ore., Meier & Frank Co.
KFEJ—360—Tacoma, Wash., Guy Gleason.
KFEL—360—Denver, Colo., Wenner Corp.
KFEP—240—Denver, Colo., Radio Equip. Co.
KFEQ—360—Oak, Neb., J. L. Scroggins.
KFER—231—Ft. Dodge, Ia., Auto Elec. Co.
KFEV—263—Douglas, Wyo., Radio Elec. Shop.
KFEX—261—Minneapolis, Minn., Augsburg Sem.
KFEY—360—St. Louis, Mo., A. S. M. E.
KFEZ—261—So. Louis, Mo., Society of Mech. Eng.
KFFA—242—San Diego, Cal., Dr. R. C. Shelton.
KFFB—286—Milford, Kan., Brinkley-Jones Hospital.
KFFE—360—Pendleton, Ore., East Ore. Radio Co.
KFFJ—360—Boise, Idaho., Jenkinson Furn. Co.
KFFO—229—Hillsboro, Ore., Dr. E. H. Smith.
KFFP—275—Moberly, Mo., First Baptist Church.
KFFQ—360—Colorado Springs, Colo., Marksheffel.
KFFR—226—Sparks, Nev., Jim Kirk.
KFFV—360—Lamoni, Iowa, Graceland College.
KFFX—278—Omaha, Neb., McGraw Co.
KFFY—275—Alexandria, Ind., Pincus & Murphy.
KFFZ—226—Dallas, Tex., Al G. Barnes.
KFGC—254—Baton Rouge, La., Louisiana State Uni.
KFGD—248—Chickasha, Okla., Chickasha Radio Co
KFGF—360—Mt. Vernon, Wash., Buchanan-Stevens
KFGH—360—Stanford University, California.
KFGJ—266—St. Louis, Mo., 138 Infantry, N. G.
KFGL—234—Arlington, Ore., Arlington Garage.
KFGM—233—Abilene, Tex., Daily Reporter.
KFGP—229—Cheney, Kans., Cheney Radio Co.
KFGQ—226—Boone, Iowa., Crary Hardware Co.
KFGV—224—Utica, Neb., Heidbreder Radio Co.
KFGX—250—Orange, Tex., First Pres. Church.
KFGY—224—Baudette, Minn., Gjieneugs Radio Co.
KFGZ—268—Berrien Springs, Mich., Emanuel Missionary College.
KFHB—280—Hood River, Ore., Rialto Theater.
KFHC—254—Norman, Okla., University of Okla.
KFHD—226—St. Joseph, Mo., Utz Elec. Co.
KFHF—266—Shreveport, La., Cen. Christian Church
KFHH—263—Neah Bay, Wash., A. McCue.
KFHI—224—Wichita, Kans., Charles V. Dixon.

KFHJ—360—Santa Barbara, Cal., Fallon Co.
KFHL—227—Oskaloose, Ia., Penn College.
KFHP—246—Kearney, Neb., Radio Bugs Products
KFHQ—242—Los Gatos, Cal., Curtis Bros. Hdwe Co
KFHR—270—Seattle, Wash., Star Electric Co.
KFHS—229—Hutchinson, Kans., R. W. Nelson.
KFHU—261—Mayoville, N. D., M. G. Saleren.
KFHY—242—Trinidad, Colo., R. S. McEwan.
KFIB—244—St. Louis, Mo., Franklin W. Jenkins.
KFIC—224—Denver, Colo., Phil Laskowitz.
KFID—246—Tola, Kans., Ross Arbuckle Garage.
KFIF—360—Portland, Ore., Benson Tech.
KFIK—234—Gladbrook, Ia., Gladbrook Elec. Co.
KFIL—234—Louisberg, Kans., Winlisch Elec Co.
KFIO—252—Spokane, Wash., Northm Central H. S.
KFIQ—240—Yakima, Wash., Yakima Valley Broadcasting.
KFIU—226—Juneau, Alaska, Alaska Elec. Light and Power Co.
KFIV—240—Pittsburgh, Kans., V. H. Broyles.
KFIX—240—Independence, Kans., Reorganized Church of Christ.
KFIY—236—Seattle, Wash., Brott Lab.
KFIZ—273—Fondulac, Wis., Daily Commonwealth
KFJA—244—Brand Island, Neb., Central Power Co.
KFJB—248—Marshaltown, Iowa., Marshal Elec.
KFJC—233—Seattle, Wash., Post Intelligencer.
KFJD—236—Greeley, Colo., Wild Country Pub. Co.
KFJF—252—Oklahoma City, Nat. Radio Co.
KFJH—273—Selma, Cal., Sugar Bowl.
KFJI—252—Astoria, Ore., Liberty Theater.
KFJJ—236—Carrollton, Mo., Radio Shop.
KFJK—233—Briston, Okla., Delano Radio Co.
KFJU—234—Kearney, Neb., Central Power Co.
KFJV—224—Dexter, Iowa, T. H. Warren.
KFJW—226—Towanda, Kan., Le Grand Radio Co.
KFJX—229—Cedar Falls, Iowa, Iowa State Teachers' College.
KFKA—248—Greeley, Colo., Colo. State Teachers' College.
KFKH—226—Lakeside, Colo., Denver Park Amusement Co.
KFLE—268—Denver, Colo., Nat. Education Service

W—THREE-LETTER CALLS

WBL—261—Anthony, Kans., T. & H. Radio Co.
WBS—360—Newark, N. J., D. W. May, Inc.
WBT—360—Charlotte, N. C., Southern Radio Co.
WBU—286—Chicago, Ill., City of Chicago.
WBZ—337—Springfield, Mass., Westinghouse.
WCE—360—Minneapolis, Minn., Findley Elec. Co.
WCK—360—St. Louis, Mo., Stix-Baer-Fuller.
WCM—360—Austin, Tex., University of Texas.
WCX—517—Detroit, Mich., Detroit Free Press.
WDM—360—Washington, D. C., Church of the Covenant.
WDT—405—New York, N. Y. Ship Owners' Radio Service.
WDZ—278—Tuscola, Ill., James L. Bush.
WEB—360—St. Louis, Mo., Benwood Co.
WEV—360—Houston, Tex., Huributt-Still Elec. Co.
WEW—261—St. Louis, Mo., St. Louis University.
WFI—395—Philadelphia, Pa., Strawbridge & Clothier.
WFY—360—Wichita, Kans., Cosrado Co.
WGF—360—Des Moines, Ia., The Reg. and Trib.
WGI—360—Medford Hillside, Mass., Amrad Corp.
WGL—360—Philadelphia, Pa., T. F. J. Howlett.
WGR—360—Buffalo, N. Y., Fed. Tel. & Tel. Co.
WGV—360—New Orleans, La., Inter. Elec. Co.
WGY—380—Schnectady, N. Y., G. E. Co.
WHA—360—Madison, Wis., University of Wis.
WHB—411—Kansas City, Mo., Sweeney School.
WHD—360—Cleveland, O., Warren R. Cox.
WHK—360—Cleveland, O., Radiovox Co.
WHN—New York City, Loew's Theater.
WHX—360—Des Moines, Iowa., Iowa Radio Corp.
WIK—234—McKeesport, La., K. & L. Elec. Co.
WIL—360—Washington, D. C., Continental Elec. Co.
WIP—509—Philadelphia, Pa., Gimbel Bros.
WIZ—360—Cincinnati, O., Cino Radio Co.
WDJ—229—Granville, O., Richard H. Howe.
WJH—273—Washington, D. C., White & Boyer Co.
WJK—360—Toledo, O., Service Equip. Co.
WJX—360—New York, N. Y., DeForest Co.
WJY—405—New York, N. Y., Radio Corp of America.

WJZ—455—New York, N. Y. Radio Corp. of America.
WKA—360—Wilkes-Barre, Pa., Landaus Co.
WKC—360—Baltimore, Md., Zamoiski Co.
WKY—360—Okla. City, Okla., Okla. Radio Shop.
WLB—360—Minneapolis, Minn., Uni. of Minn.
WLH—360—Indianapolis, Ind., Hamilton Mfg. Co.
WLW—309—Cincinnati, O., Crosley Mfg. Co.
WMA—360—Anderson, Ind., Arrow Radio Lab.
WMC—500—Memphis, Tenn., Commercial Appeal.
WMH—248—Cincinnati, O., Precision Equip. Co.
WMU—261—Washington, D. C., Doubleday-Hill Elec. Co.
WNJ—400—Albany, N. Y., Shotten Mfg. Co.
WOC—484—Davenport, Ia., Pal. School of Chiro.
WOE—Akron O., Buckeye Radio Service Co.
WOI—360—Ames, Ia., Iowa State College.
WOK—360—Pine Bluff, Ark., Pine Bluff Co.
WOO—509—Philadelphia, Pa., John Wanamaker.
WOQ—360—Kansas City, Mo., Western Radio Co.
WOR—405—Newark, N. J., L. Bamberger & Co.
WOS—441—Jefferson City, Mo., State Bureau.
WOZ—360—Richmond, Ind., Palladium Ptg. Co.
WPA—360—Fort Worth, Tex., The Record.
WPG—234—New Lebanon, O., Nushawg Farm.
WPI—360—Clearfield, Pa., Elec. Supply Co.
WPM—360—Washington, D. C., T. J. Williams.
WQX—360—Chicago, Ill., W. A. Kushl.
WRC—469—Washington, D. C., Radio Corp. of America.
WRK—360—Hamilton, O., Doron Bros Elec. Co.
WRL—360—Schenectady, N. Y., Union College.
WRM—360—Urbana, Ill., University of Illinois.
WRR—360—Dallas, Tex., City of Dallas.
WRW—273—Tarrytown, N. Y., Larry Radio Lab.
WSB—429—Atlanta, Ga., Atlanta Journal.
WSL—273—Utica, N. Y., J & M. Elec. Co.
WSY—360—Birmingham, Ala., Alabama Power Co.
WSZ—360—Toledo, O., Marshall-Gerken Co.
WTG—360—Manhattan, Kans., Kans. St. Agr. Col.
WTP—360—Bay City, Mich., G. M. McBride.
WWB—268—Canton, O., Daily News Printing Co.
WWI—273—Dearborn, Mich., Ford Motor Co.
WWJ—517—Detroit News, Detroit, Mich.
WWL—280—New Orleans, La., Loyola University.

W—FOUR-LETTER CALLS

WAAB—268—New Orleans, La., Times-Picayune.
WAAC—360—New Orleans, La., Tulane University
WAAD—360—Cincinnati, O., Ohio Mech. Inc.
WAAF—286—Chicago, Ill., Union Stock Yards.
WAAH—360—St. Paul, Minn., Common Elec. Co.
WAAJ—360—Boston, Mass., Eastern Radio, Inc.
WAAK—280—Milwaukee, Wis., Gimbel Bros.
WAAM—263—Newark, N. J., I. R. Nelson Co.
WAAN—254—Columbia, Mo., University of Mo.
WAAP—360—Wichita, Kans., Otto W. Taylor.
WAAS—360—Decatur, Ga., Georgia Rad. Co.
WAAW—360—Omaha, Neb., Omaha Grain Ex.
WAAZ—360—Emporia, Kans., Hollister-Miller Co.
WABB—266—Harrisburg, Pa., Dr. J. B. Lawrence
WABC—229—Anderson, Ind., Fulwider-Grimes Battery Co.
WABD—286—Dayton, O., Parker High School.
WABE—283—Washington, D. C., Y. M. C. A.
WABA—266—Lake Forest, Ill., L. F. College.
WABF—234—Mt. Vernon, Ill., Mt. Vernon Register News Co.
WABG—248—Jacksonville, Fla., Arnold Edwards Piano Co.
WABH—240—Sandusky, O., Lake Shore Tire Co.
WABI—240—Bangor, Me., Bangor Ry. & Elec. Co.
WABJ—240—South end, Ind., Radio Laboratories
WABK—252—Worcester, Mass., First Bap. Church
WABL—283—Storrs, Conn., Conn. Agri. College.
WABM—254—Saginaw, Mich., F. E. Doherty.
WABN—234—La Cross, Wis., Waldo C. Grover.
WABO—252—Rochester, N. Y., Lake View Baptist Church.
WAJV—360—Princeton, Ind., Indian Pipe Line Cp.
WBAA—360—West Lafayette, Ind., Purdue Univ.
WBAD—360—Minneapolis, Minn., The Journal.
WBAF—360—Moorestown, N. J., F. M. Middleton
WBAG—360—Bridgeport, Pa., Dia. St. Fiber Co.
WBAH—360—Minneapolis, Minn., Dayton Co.
WBAN—244—Paterson, N. J., Wireless Phone Corp.
WBAO—360—Decatur, Ill., James Millkin Univ.

WBAP—476—Fort Worth, Tex., Star-Telegram.
WBAU—258—Hamilton, O., Republican Pub. Co.
WBAV—390—Columbus, O., Erner & Hopkins Co.
WBAW—246—Marietta, O., Marietta College.
WBAX—360—Wilkes-Barre, Pa., J. H. Stenger Jr.
WBAY—492—New York, N. Y., A. T. & T. Co.
WBBA—240—Newark, O., Newark Radio Lab.
WBBC—229—Sterling, Ill., Sterling Radio Equip Co
WBBD—224—Reading, Pa., Barbey Battery Service
WCAD—280—Canton, O., St. Lawrence University
WCAE—462—Pittsburgh, Pa., Kauffman & Baer.
WCAF—360—Rodgers, Mich., Mich. Chemical Co.
WCAG—268—New Orleans, La., Daily States.
WCAH—286—Columbus, O., Enertkin Elec. Co.
WCAJ—360—University Place, Nev., Neb. Wes. Uni.
WCAK—360—Houston, Tex., A. P. Daniel.
WCAL—360—Northfield, Minn., St. Olaf College.
WCAM—360—Villanova, Pa., Villanova College.
WCAO—360—Baltimore, Md., Saunders & Stayman
WCAP—469—Washington, D. C., Chesapeake and Potomac Tel. Co.
WCAQ—360—Defiance, O., Tri-State Rad. Mfg. Co.
WCAR—360—San Antonio, Tex., Alamo R. & E.
WCAS—360—Minneapolis, Minn., W. H. Dunwoody
WCAT—240—Rapid City, S. D., School of Mines.
WCAU—286—Philadelphia, Pa., Durham & Co.
WCAV—360—Little Rock, Ark., J. C. Dice El. Co.
WCAX—360—Burlington, Vt., Univ. of Vermont.
WCAY—261—Milwaukee, Wis., Kesselman O'Driscoll.
WCBA—280—Allentown, Pa., C. W. Haimbach.
WCBB—240—Greenville, O., K. & K. Rad. Sup. Co.
WCBD—345—Zion, Ill., Wilber Glen Voliva.
WDAC—360—Springfield, Ill., Illinois Watch Co.
WDAD—360—Lindsborg, Kans., W. L. Harrison.
WDAE—360—Tampa, Fla., Tampa Daily Times.
WDAF—411—Kansas City, Mo., Kansas City Star.
WDAG—263—Amarillo, Tex., J. Laurence Martin.
WDAH—360—El Paso, Tex., Trinity Church.
WDAI—246—Syracuse, N. Y., Hughes Elec. Co.
WDAJ—258—Parsons, Kans., Erwin's Elec. Co.
WDAK—261—Hartford, Conn., The Curant.
WDAL—360—Jacksonville, Fla., Times-Union.
WDAM—360—New York City, Weston Elec. Co.
WDAO—360—Dallas, Tex., Auto. Electric Co.
WDAP—360—Chicago, Ill., Chamber of Commerce
WDAR—395—Philadelphia, Pa., Lit Bros.
WDAS—360—Worcester, Mass., S. A. Waite.
WDAU—360—New Bedford, Mass., Slocum & Kilburn.
WDAX—268—Centerville, Ia., First National Bank
WDAY—244—Fargo, N. D., K. M. Hance.
WDBC—258—Lancaster, Pa., Kirk Johnson & Co.
WBDF—261—Youngstown, O., Robert G. Phillips.
WEAA—280—Flint, Mich., Fallain & Lathrop.
WEAB—360—Fort Dodge, Ia., Standard Radio Co.
WEAE—360—Blacksburg, Va., Polytech Institute.
WEAF—492—New York, N. Y., A. T. & T. Co.
WEAG—231—New York, N. Y., Nichols-Nineline-Bassett.
WEAH—240—Wichita, Kans., Board of Trade.
WEAI—286—Ithaac, N. Y., Cornell University.
WEAJ—360—Vermillion, S. D., Univ. of S. D.
WEAK—360—St. Joseph, Mo., J. B. Abercombie.
WEAM—252—North Plainfield, N. J., Borough of North Plainfield.
WEAN—273—Providence, R. I., Shepard Co.
WEAO—360—Columbus, O., Ohio State University
WEAP—360—Mobile, Ala., Mobile Radio Co.
WEAR—360—Baltimore, Md., Baltimore American
WEAS—360—Washington, D. C., Hecht Co.
WEAT—360—Tampa, Fla., J. J. Fogarty.
WEAU—360—Sioux City, Ia., Davidson Bros. Co.
WEAY—Houston, Tex., Will Horwitz Jr.
WEAZ—360—Waterloo, Ia., Donald Redmond.
WFAA—476—Dallas, Tex., News and Journal.
WFAB—234—Syracuse, N. Y., Carl F. Woese.
WFAF—273—Poughkeepsie, N. Y., H. C. Spratley.
WFAG—360—Waterford, N. Y., Radio Eng. Lab.
WFAH—360—Port Arthur, Tex., Electric Sup. Co.
WFAJ—360—Asheville, N. C., Hi-Grade Wire Co.
WFAM—360—St. Cloud, Minn., Times Pub. Co.
WFAN—360—Hutchinson, Minn., Hutshinson Elec.
WFAQ—360—Cameron, Mo., Mo. Wes. College.
WFAT—360—Sioux Falls, S. D., Daily Argus-Leader.
WFAU—360—Boston, Mass., E. C. Lewis.
WFAV—360—Lincoln, Neb. University of Neb.
WFAY—Independence, Kans., Dan. Rad. Co.

WGAC—360—Brooklyn, N. Y., Orpheum Rad. Stores
WGAD—360—Ensenada, P. R., Spanish-Am. School
WGAH—360—New Haven, Conn., New Haven Elec.
WGAJ—360—Shenandoah, Ia., W. H. Gass.
WGAK—360—Macon, Ga., Macon Elec. Co.
WGAL—248—Lancaster, Pa., Lancaster Elec. Co.
WGAN—360—Pensacola, Fla., Cecil E. Lloyd.
WGAQ—360—Shreveport, La., W. G. Paterson.
WGAR—360—Fort Smith, Ark., Southwest Amer.
WGAT—360—Lincoln, Neb. American Legion.
WGAU—226—Wooster, O., Marcus C. Limb.
WGAW—261—Altoona, Pa., E. C. Albright.
WGAX—360—Washington Courthouse, O., Radio Elec. Co.
WGAY—360—Madison, Wis. Northwest Radio Co.
WGAZ—360—South Bend, Ind., So. Bend Tribune
WHAA—283—Iowa City, Ia., State Univ. of Iowa
WHAB—360—Galveston, Tex., C. W. Thompson.
WHAC—360—Waterloo, Ia., Cole Bros. Elec. Co.
WHAD—280—Milwaukee, Wis., Marquette Univ.
WHAG—222—Cincinnati, O., Univ. of Cincinnati.
WHAH—360—Joplin, Mo., J. T. Griffin.
WHAI—360—Davenport, Ia., Radio Equip. Co.
WHAK—360—Clarksburg, W. Va., Robert Co.
WHAL—248—Lansing, Mich., Capitol News.
WHAM—360—Rochester, N. Y., School of Music.
WHAO—360—Savannah, Ga., F. A. Hill.
WHAP—360—Decatur, Ill., Dewel L. Pitts.
WHAQ—242—Washington, D. C., Semmes Mo. Co.
WHAR—231—Altantic City, N. J., Paramount Rad. Co.
WHAS—400—Louisville, Ky., Courier-Journal.
WHAV—360—Wilmington, Del., Wilmintgon El. Co.
WHAX—360—Huntington, Ind., Huntington Press.
WHAY—380—Huntington, Ind., Huntington Press.
WHAZ—380—Troy, N. Y., Rennselaer Polytech Ins.
WIAB—252—Rockford, Ill., Joslyn Auto Co.
WIAC—360—Galveston, Tex., Galveston Tribune.
WIAD—254—Ocean City, N. J., The Yacht Club.
WIAF—234—New Orleans, La., Gustav A. De Cortin
WIAH—360—Newton, Ia., Continental Rad. Mfg. Co.
WIAI—360—Springfield, Mo., Heers Stores Co.
WIAJ—360—Neenah, Wis., Fox River Valley Co.
WIAK—278—Omaha, Nev., The Stockman Journal
WIAP—360—Paducah, Ky., J. A. Rudy & Sons.
WIAO—360—Milwaukee, Wis., School of Eng.
WIAQ—226—Larion, Ind., Chronicle Pub. Co.
WIAR—360—Paducah, Ky., J. A. Rudy & Sons.
WIAS—360—Burlington, Ia., Burlington Hawkeye.
WIAT—360—Tarkio, Mo., Leon T. Noel.
WIAU—360—LeMars, Ia., American Security Co.
WIAV—360—Binghamton, N. Y., Radio Lab.
WIAW—360—Saginaw, Mich., Radio Elec. Co.
WIAY—224—Washington, D. C., Woodward & Lathrop.
WIAZ—360—Miami, Fla., Elec. Supply Sales Co.
WJAB—360—Lincoln, Neb., American Radio Co.
WJAD—360—Waco, Tex., Jackson's Ra. Eng. Lab.
WJAF—360—Muncie, Ind., The Press.
WJAG—360—Norfolk, Neb., Huse Publishing Co.
WJAJ—360—Dayton, O., Y. M. C. A.
WJAK—254—Greentown, Ind., White, Rev. C. L.
WJAM—268—Cedar Rapids, Ia., D. M. Perham.
WJAN—280—Peoria, Ill., Peoria Star.
WJAQ—360—Topeka, Kans, Copper Publications.
WJAR—360—Providence, R. I., The Outlet Co.
WJAS—360—Pittsburgh, Pa., Pitts. Rad. House.
WJAT—360—Marshall, Mo., Kelley-Yawter Co.
WJAX—390—Cleveland, O., Union Trust Co.
WJAZ—448—Chicago, Ill., Chicago Radio Lab.
WKAA—268—Cedar Rapids, Ia., H. F. Parr.
WKAC—275—Lincoln, Neb., Star Publishing Co.
WKAD—240—East Providence, R. I., Chas. Looff.
WKAF—360—Wichita Falls, Tex., W. S. Rad. Supp. Co.
WKAN—360—Montgomery, Ala., Alabama Radio.
WKAP—360—Cranston, R. I., Flint, Dutee, Wilcox
WKAQ—360—San Juan, P. R., Radio Corp. of Porto Rico.
WKAR—280—East Lansing, Mich., Mich, Agri. Col.
WKAS—360—Springfield, Mo., L. E. Lines Mu. Co.
WKAV—360—Laconia, N. H., Radio Club.
WKAW—226—Beloit, Wis., Turney Cycle Co.
WKAX—231—Bridgeport, Conn., W. A. McFarlane
WKAY—360—Janesville, Ga., Brenau College.
WLAC—360—Raleigh, N. C., N. C. State College
WLAG—417—Minneapolis, Minn., Cutting & Washington Radio Co.

WLAH—234—Syracuse, N. Y., Samuel Woodworth
WLAJ—360—Waco, Tex., Waco Elec. Supply Co.
WLAK—360—Bellows Falls, Vt., Vermont Farm Mach. Co.
WLAL—360—Tulsa, Okla., Tulsa Radio Co.
WLAM—360—Springfield, Mo., Morrow Radio Co.
WLAN—281—Houlton, Mo., Putnam Hardware Co.
WLAP—360—Louisville, Ky., W. V. Jordon.
WLAQ—360—Kalamazoo, Mich., A. E. Shilling.
WLAS—244—Hutchinson, Kans., Gen. Rad. Sup. Co.
WLAT—360—Burlington, Ia., C. A. Bosch Co.
WLAV—360—Pensacola, Fla., Electric Shop, Inc.
WLAW—360—New York, N. Y., N. Y. Police Dept.
WLAX—231—Greencastle, Ind., Greencastle Broadcast Station.
WLAZ—248—Warren, O., Hutton & Jones Elec. Co.
WMAB—360—Oklahoma City, Okla., Okla. Radio Supply Co.
WMAC—261—Cazenovia, N. Y., F. Edwards Page
WMAF—360—Dartmouth, Mass., Col. Edward H. Green.
WMAH—254—Lincoln, Neb., General Supply Co.
WMAJ—275—Kansas City, Mo., Drovers Tel. Co.
WMAK—360—Lockport, N. Y., Norton Lab.
WMAL—256—Trenton, N. J., Trenton Hdwe. Co.
WMAM—360—Beaumont, Tex., Beau. Rad. Sup. Co.
WMAN—286—Columbus, O., Broad St. Bap. Church
WMAP—246—Easton, Pa., Utility Battery Service
WMAQ—448—Chicago, Ill., Daily News.
WMAT—266—Duluth, Minn., Paramount Corp.
WMAV—250—Auburn, Ala., Polytech Inst.
WMAW—360—Wahpeton, N. D., Electric Co.
WMAY—280—St. Louis, Mo., Kingshighway Pres. Church.
WMAZ—268—Macon, Ga., Mercer University.
WNAB—360—Bolling Green, Ky., Park City News.
WNAC—278—Boston, Mass., Shepard Stores.
WNAD—360—Rockport, Mo., Atkinson County Mail.
WNAK—360—Manhattan, Kans., Manhattan Radio Co.
WNAL—360—Omaha, Neb., R. J. Rockwell.
WNAM—360—Evansville, Ind., Ideal Appar. Co.
WNAN—286—Syracuse, N. Y., Radio Tel. Co.
WNAP—360—Springfield, O., Wittenberg College.
WNAQ—360—Charleston, S. C., Charleston R. & E. Co.
WNAR—231—Butler, Mo., C. C. Rhodes.
WNAS—360—Austin, Tex., Texas Radio Corp.
WNAT—360—Philadelphia, Pa., Lenning Bros.
WNAV—360—Knoxville, Tenn., People's T. & T. Co.
WNAW—360—Ft. Monroe, Va., H. Kunzman.
WNAX—244—Yankton, S. D., Dakota Radio Co.
WNAY—306—Baltimore, Md., Ship Owner's Radio Service.
WOAA—360—Ardmore, Okla., Dr. Walter Hardy.
WOAB—280—Grand Forks, N. D., Valley Co.
WOAC—266—Lima, O., Maus Radio Co.
WOAD—360—Sigourney, Ia., Friday Elec. Co.
WOAE—360—Fremont, Neb., Midland College.
WOAF—360—Tyler, Tex., Tyler College.
WOAG—224—Belvidere, Ill., Apollo Theater.
WOAH—385—Charleston, S. C., Palmetto Rad. Co.
WOAI—385—San Antonio, Tex., So. Equip. Co.
WOAJ—360—Parsons, Kans., Ervins Elec. Co.
WOAK—240—Frankfort, Ky., Collins Hardware Co.
WOAL—286—Webster Grove, Mo., W. E. Woods.
WOAN—360—Lawrenceburg, Tenn., J. D. Vaughn.
WOAO—360—Mishawka, Ind., Lyradon Co.
WOAP—360—Kalamazoo, Mich., Kalamazoo Col.
WOAR—360—Kenoska, Wis., H. P. Lundskow.
WOAT—360—Wilmington, Del., Hamp Body.
WOAV—242—Edie, Pa., National Guard.
WOAW—526—Omaha, Neb., Woodman of the World
WOAX—240—Trenton, N. J., F. J. Wolff.
WOAZ—360—Stanford, Tex., Penik Hugh Co.
WPAB—360—State College, Pa., Penn State College
WPAC—360—Okmulgee, Okla., Donaldson Radio Co.
WPAD—360—Chicago, Ill., Wiebolt Co.
WPAF—360—Council Bluffs, Ia., Petersons Co.
WPAG—360—Independence, Mo., Central Radio Co.
WPAH—360—Waupoca, Wis., Dept. of Markets.
WPAJ—268—New Haven, Conn., Doolittle Corp.
WPAK—300—Fargo, N. D., Agricultural College.
WPAL—286—Columbus, O., Superior R. & T. Co.
WPAM—360—Swerbach & Guttel, Topeka, Kans.
WPAP—360—Winchester, N. Y., T. D. Phillips.
WPAQ—360—Frostburg, Md., General Sales Co.
WPAR—360—Beloit, Kans., R. A. Ward.
WPAS—360—Amsterdam, N. Y., J. & M. Elec. Co.

WPAT—360—El Paso, Tex., St. Patrick's Cathedral
WPAU—360—Moorehead, Minn., Concordia College
WPAV—360—Lauriam, Mich., Tinetti & Son.
WPAW—360—Wilmington, Del., Radio Instal Co.
WPAX—360—Thomasville, Ga., S-W Radio Co.
WPAY—360—Bangor, Me., Bangor Radio Lab.
WPAZ—273—Charlestown, W. Va., Dr. J. R. Koch
WQAA—360—Parksburg, Pa., H. A. Beale Jr.
WQAB—236—Springfield, Mo., State Teachers' Col.
WQAC—360—Amarillo, Tex., E. B. Gish.
KQAD—242—Waterbury, Conn., Whiteall Elec. Co.
WQAE—275—Springfield, Vt., Moore Rad. Station
WQAF—240—Sandusky, O., The Register.
WQAH—254—Lexington, Ky., Brock-Amerson Elec. Co.
WQAK—360—Dubuque, Ia., Appel-Higley Co.
WQAL—258—Mattcn, Ill., Cole Tel. & Tel. Co.
WQAM—360—Miami, Fla., Elec. Equip. Co.
WQAN—280—Scranton, Pa., The Times.
WQAO—360—New York, N. Y., Calvary Baptist Church.
WQAQ—360—Abilene, Tex., West Texas Radio.
WQAR—360—Muncie, Ind., The Press.
WQAS—266—Lowell, Mass., Walter Prince Co.
WQAT—360—Richmond, Va., Radio Equip. Corp.
WQAV—258—Greenville, S. C., Huntington & Guerry.
WQAW—236—Washington, D. C., Catholic Univ.
WQAX—360—Peoria, Ill., Radio Equip. Co.
WQAZ—360—Greensboro, N. C., Daily News.
WRAA—360—Houston, Tex., Rice Institute.
WRAB—360—Savannah, Ga., Board of Public Ed.
WRAD—248—Marion, Kans., Taylor Radio Shop.
WRAF—224—Laporte, Ind., Radio Club, Inc.
WRAH—360—Providence, R. I., S. N. Read.
WRAL—248—St. Croix Falls, Wis., No. Power Co.
WRAN—229—Waterloo, Ia., Black Hawk Co.
WRAO—360—St. Louis, Mo., Radio Service Co.
WPAP—360—Winter Park, Fla., Elec. Const. Co.
WRAR—226—David City, Jacob Carl.
WRAS—360—McLeansboro, Ill., Radio Supply Co.
WRAU—360—Amarillo, Tex., Daily News.
WRAV—360—Yellow Springs, La., Antioch Col.
WRAW—238—Reading, Pa., Horace D. Good.
WRAX—268—Gloucester City, N. J., Flexon's Garage
WRAY—280—Scranton, Pa., Radio Sales Corp.
WRAZ—233—Newark, N. J., Radio Shop of Newark
WSAA—360—Marietta, O., P. S. Sprague Co.
WSAB—360—Cape Girardeau, Mo., S. E. Mo. State Teachers' College.
WSAC—360—Clemson College, S. C., Clemson Agri. College.
WSAD—261—Providence, R. I., J. A. Foster Co.
WSAG—244—St. Petersburg, Fla., Loren V. Davis
WSAH—248—Chicago, Ill., A. G. Leonard Jr.
WSAI—309—Cincinnati, O., U. S. Playing Card Co.
WSAJ—248—Grove City, Pa., City College.
WSAK—258—Middleport, O., Daily News.
WSAL—246—Brookville, Ind., Franklin Electric.
WSAN—229—Allentown, Pa., Allentown Rad. Club.
WSAP—263—N. Y. C., 7th Day Adventist Church
WSAR—254—Fall River, Mass., Doughty & Welch Elec. Co.
WSAS—360—Lincoln, Neb., State of Nebraska.
WSAT—268—Plainview, Tex., Plainview Elec. Co.
WSAU—229—Chesham, N. H., Camp Marenfield.
WSAW—275—Canandaigua, N. Y., Curtice & McElwee.
WSAX—268—Chicago, Ill., Chicago Radio Lab.
WTAB—248—Fall River, Mass., Daily Herald.
WTAC—360—Johnstown, Pa., Penn Traffic Co.
WTAD—229—Carthage, Ill., R. E. Compton.
WTAF—292—New Orleans, La., Gallo, L. J.
WTAG—258—Providence, R. I., Kearn Music Co.
WTAK—266—Steubenville, O., Swan-Bower Co.
WTAL—252—Toledo, O., Toledo Radio and Elect. Co.
WTAN—240—Matoon, Ill., Orndorff Radio Shop.
WTAM—390—Cleveland, O., Willard Storage Battery Co.
WTAQ—226—Osseo, Wis., S. H. Van Gorden.
WTAS—275—Elgin, Ill., G. D. Carpenter.
WTAU—360—Tecumseh, Neb., Rugly B. & E. Co.
WTAW—254—College Station, Tex., A. & M. Col.
WWAC—360—Waco, Tex., Sanger Bros.
WWAD—360—Philadelphia, Pa., Wright & Wright
WWAH—360—Lincoln, Neb., General Supply Co.
WWAJ—360—Columbus, O., Columbus Radio Club
WWAX—360—Laredo, Tex., Warman Bros.

ESSEX RADIO ESSEX

WHEN YOU BUY DIRECT YOU SAVE

ESSEX SPECIAL AUDIO TRANSFORMER

MORE VOLUME WITH ANY TUBE. RATIO 5 TO 1

PRIMARY RESISTANCE 900 OHMS AT 500 CYCLES
SECONDARY RESISTANCE, 6150 OHMS AT 500 CYCLES
PRIMARY IMPEDANCE, 5300 OHMS AT 500 CYCLES
PRIMARY LEAKAGE IMPEDANCE, 1080 OHMS at 500 Cycles

ESSEX STANDARD RADIO PHONES
2300 OHMS

The phones with the giant grip magnets. Guaranteed in writing for 1 year.

"25% BETTER

Than you say," writes L. G. Barnes of Mt. Vernon, Ohio. We have hundreds of letters on file.

Complimenting us on the PALL MALL 180 degree variocoupler. That is why we say that the

PALL MALL

is the coupler that makes a good set better.

DON'T SAY B BATTERY OR DRY CELL, SAY

RAY-O-VAC

There is a difference. The Ray-O-Vacs are

Noiseless, have long life, individual cells coated, shock absorber under all cells, water and moisture proof cells rigidly held in place, and the price about the same as an ordinary battery.

MILLIMETER JACK

Have 5 Points of Superiority

1. Pure coin silver contacts.
2. Solid heavy brass base.
3. Phosphor bronze springs.
4. Triple tested insulation.
5. Handsome in appearance.

The millimeter jacks are the result of years of experience in the manufacture of precision instruments.

We Also Carry a Complete Line of Standard Sets and Parts

EXPERIMENTAL DEPARTMENT

When in trouble with your radio set consult our experimental department. The advice of five radio experts is always available and is free. Testing and hook ups also free.

ESSEX MFG. CO.

TWO STORES

117 MULBERRY ST. **867 BROAD ST.**

2ND FLOOR, ENT ESSEX COURT, OPPOSITE LAFAYETTE ST.

CANADA

CFAC—430—Calgary, Alta., G. Melrose Bell.
CFCA—400—Toronto, Ont., The Star.
CFCB—440—Vancouver, Brit. Col., Marconi.
CFCD—400—Winnipeg, Man., Westinghouse.
CFCE—440—Halifax, N. S., Marconi.
CFCF—440—Montreal, Que., Marconi.
CFCH—400—Iroquois Falls, Ont., Abitibi Co.
CFCI—400—Walkerville, Ont., Motor Corp.
CFCN—440—Calgary, Alberta, W. W. Grant.
CFCX—London, Ont., The Advertiser.
CFPC—400—Fort Francis, Int. Rad. Dev. Co.
CFTC—400—Toronto, Ont., Bell Tel. Co.
CFUC—400—Montreal, Que., University of Montreal
CFVC—400—Courtenay, B. C., Roy Russell Brown
CFYC—400—Vancouver, B. C., V. M. Odlum.
CFCZ—400—Montreal, Que., Westinghouse.
CHAC—400—Halifax, N. S., Radio Engineers, Ltd.
CHBC—410—Calgary, Alta, Albertan Pub. Co.
CHCA—430—Vancouver, B. C., G. M. Bell.
CHCB—440—Toronto, Ont., Marconi.
CHCC—400—Edmonton, Alb., Westinghouse.
CHCF—430—Winnipeg, Man., G. Melrose Bell.
CHCQ—400—Calgary, Alta, Western Radio Co.
CHCS—410—London, Ont., London Radio Shop.
CHCX—400—Montreal, Que., B. L. Silver.
CHCZ—400—Toronto, Ont., The Globe.
CHFC—400—Toronto, Ont., John Millen & Sons, Ltd.
CHIC—400—Hamilton, Ont., Westinghouse.
CHOC—400—Vancouver, B. C., Westinghouse.
CHVC—410—Toronto, Ont., Metro Motors.
CHXC—400—Ottawa, Ont., J. R. Booth Jr.
CHYC—410—Montreal, Que., Northern Elec. Co.
CJBC—420—Montreal, Que., Duquis Freres.
CJCA—450—Edmonton, Alta., Journal.
CJCB—400—Nelson, B. C., James Gordon Bennett
CJCD—410—Toronto, Ont., I. Eaton Co., Ltd.
CJCE—420—Vancouver, B. C., Sun.
CJCF—420—Kitchener, Ont., News-Record.
CJCG—410—Winnipeg, Man., Free Press.
CJCH—400—Toronto, Ont., United Farmers.
CJCI—400—St. John, N. B., McLean, Holt & Co.
CJCN—410—Toronto, Ont., Simons, Agnew & Co.
CJCS—410—Halifax, N. S., Eastern T. & T. Co.
CJCY—400—Calgary, Alb., Edmund Taylor.
CJGC—430—London, Ont., London Free Press.
CJNC—400—Winnipeg, Man., The Tribune.
CJSC—430—Toronto, Ont., Evening Telegram.
CKAC—430—Montreal, Que., La Presse.
CKCB—Winnipeg, Man., T. Eaton.
CKCC—410—Hamilton, Ont., Wentworth.
CKCD—410—Vancouver, B. C., Daily Province.
CKCE—450—Toronto, Ont., Canadian Ind. Tel. Co.
CKCK—420—Regina, Sask., G. Melrose Bell.
CKCR—400—St. Johns, N. B., Jones Elec. Co.
CKCS—400—Montreal, Que., Bell Telephone Co.
CKCZ—400—Toronto, Ont., Westinghouse.
CKKC—400—Toronto, Ont., Radio Supply.
CKOC—410—Hamilton, Ont., Wentworth.
CKQC—410—London, Ont., Radio Supply Co.
CKZC—420—Winnipeg, Man., Salton Radio.

ENGLAND

2LO—360—London, British Broadcasting Co.
2ZY—385—Manchester, British Broadcasting Co.
5IT—420—Birmingham, British Broadcasting Co.
5NO—400—Newcastle, British Broadcasting Co.
5WA—395—Cardiff, British Broadcasting Co.
5SC—Glasgow—British Broadcasting Co.

PORTO RICO

WGAD—360—Ensenada, Spanish-American School.
WKAQ—360—San Juan, Radio Corp. of Porto Rico

BRAZIL

SPE—400—Rio de Janeiro, the Pan-Am. Int. Expo.

FRANCE

FL—2600—Paris, Eiffel Tower—French Govt station
SFR—1780 and 450—Paris, Campagnie Francaise de Radiophone Emissions "Radiola."
YN—3100—Lyons, Ecole Superieure des Postes et Telegraphes.

HOLLAND

PCGG—1050—The Hague, London Daily Mail.
PCUU—1050—The Hague, Heussen Laboratory.
PCKK—1050—The Hague, Velthuyzen.
PCMM—1050—Ijmuider, Dutch Government.
PA-5—1050—Amsterdam, Dutch Government.

BELGIUM

BAV—1100—Brussels, Belgium Government.

GERMANY

LP—4000—Berlin, Koenigswusterhausen.

DENMARK

OXE—2400—Lyngby, Commercial Broadcasting Society.

CZCHO-SLOVAKIA

PRG—1800—Prague, Minister of Postes and Telegraphs.
KBL—1000—Kbel, Minister of Postes and Telegraphs.

SWITZERLAND

HB-1—900—Geneva, Swiss Government.
HB-2—1350—Lausanne, Swiss Government.

CUBA

6DW—200—Cienfuegos, Cuba., Eduardo Terry.
6KW—315—Tuinucu, Cuba, Frank H. Jones.
2CX—360—Havana, Cuba, F. W. Borton.
2GT—360—Havana, Cuba, Radio Adv. Co.
2AZ—360—Havana, Cuba, Diario de la Mariona.
2TW—400—Havana, Cuba, R. E. Ramirez.
PWX—400—Havana, Cuba, Radio Corp. of Cuba

HAWAII

KFHS—275—Lihue, Hawaii, Clifford J. Dow.
KYQ—360—Honolulu, T. H., The Electric Shop.
KGU—492—Honolulu, T. H., M. A. Mulrony.
KDYX—360—Honolulu, T. H., Star-Bulletin.

BROADCASTERS' SLOGANS

CFCN—Calgary, Canada, "Voice of the Prairies."
WSB—Atlanta, Ga., "Voice of the South."
KVQ—San Francisco, Cal., "Voice of the West."
WIP—Philadelphia, Pa., "Watch Its Progress."
WOS—Jefferson City, Mo., "Watch Our State."
WJAX—Cleveland, Ohio, "Wave From Lake Erie."
WBAV—Columbus, Ohio, "We Broadcast a Variety."
WCBD—Zion City, Ill., "When God Rules, Man Prospers."
WEAY—Houston, Tex., "Where All the Oceans Meet All the Railroads."
WCAK—Houston, Tex., "Where Eighteen Railroads Meet the Sea."
WGV—New Orelans, La., "Where the Mighty Mississippi Makes a Crescent Near the Gulf."
KFHA—Gunnison, Col., "Where the Sun Shines Every Day."
WOC—Davenport, Ia., "Where the West Begins."
WJAK—Stockdale, Ohio, "Buckeye State."

BROADCASTERS' SLOGANS

WQAE—Springfield, Vt., "Among the Green Hills Vermont."
WDAY—Fargo, N. D., "Biggest Little City in the World."
WQAL—Mattoon, Ill., "Buckle on the Corn Belt."
WIAS—Burlington Ia., "Burlington on the Mississippi."
WMAH—Lincoln, Neb., "Call From the Western Plains."
WCX—Detroit, Mich., "Call of the Motor City."
WLAG—Minneapolis, Minn., "Call of the North."
WQAQ—Abilene, Tex., "Capital of West Texas."
KZN—Salt Lake City, Utah, "Center of Scenic America."
WJAM—Cedar Rapids, Ia., "Cereal City of the World."
WGR—Buffalo, N. Y., "City of Opportunity."
WGF—Des Moines, Ia., "Convention City."
WMC—Memphis, Tenn., "Down in Dixie."
WCAS—Minneapolis, Minn., "From the Flower City of the World."
WAAH—St. Paul, Minn., "From the Land of Ten Thousand Lakes."
WMAF—Dartmouth, Mass., "From the Land of the Pilgrim Fathers."
WGAL—Lancaster, Pa., "Garden Spot of the U. S. A."
WHAB—Galveston, Tex., "Gateway to the Southwest and Treasure Island of America."
WFAM—Hutchinson, Minn., "Gateway to the Ten Thousand Lakes of Minnesota."
WJAR—Providence, R. I., "Gateway of Southern New England."
WOAW—Omaha, Neb., "Gateway to the East and West."
WDAR—Philadelphia, Pa., "Good Morning Glory."
KFFP—Moberly, Mo., "Gospel Messenger of the Air."
WJAN—Peoria, Ill., "Grand View City of Illinois."
WHB—Kansas City, Mo., "Heart of America."
KFBK—Sacramento, Cal., "Heart of California."
WEAU—Sioux City, Ia., "Heart of the Corn Belt."
WCAH—Columbus, Ohio, "Heart of Ohio."
WMAL—Trenton, N. J., "Home of Good Music."
WFAV—Lincoln, Neb., "Home of the Corn Huskers."
WGAW—Altoona, Pa., "Home of the World's Largest Railroad Shops."
6KW—Tuincucu, Cuba, "If You Hear the Koo of the Cuckoo, You Are in Tune With Tuincucu."
KFZ—Spokane, Wash., "In the Heart of the Inland Empire."
WQAM—Miami, Fla., "It's Always June in Miami."
KGW—Portland, Ore., "Keep Growing Wiser."
WIAO—Milwaukee, Wis., "Land of the Sky Blue Water."
WMAY—St. Louis, Mo., "May Every Byway Hear King's Highway."
WOR—Newark, N. J., "One of America's Great Stores."
KGY—Lacey, Wash., "Out Where the Cedars Meet the Sea."
KFCA—Richmond, Cal., "Out Where the West Ends."
WPG—New Lebanon, O., "Pulse of Miami Valley."
WKAS—Springfield, Mo., "Queen City of the Ozarks."
WOAJ—Parson, Kan., "Queen City of the Plains."
WBT—Charlotte, N. C., "Queen City of the South."
KFGD—Chickasaw, Okla., "Queen of the Washita."
WLW—Cincinnati, Ohio, "Queen City of the West."
Portland, Ore., "Rose City."
WJZ—New York, "Radio Central."
KOP—Detroit, Mich., "Safety First."
KFFR—Sparks, Nev., "Sagebrush Canaries."
WBAM—Paterson, N. J., "Silk City of America."
KFDV—Fayetteville, Ark., "Southern Gateway to the Ozarks."
WQAV—Edmonton, Canada, "Sunniest Spot in Sunny Alberta."
WQAV—Greenfield, S. C., "Textile Center of the South."
WHAZ—Troy, N. Y., Transcontinental and International Broadcasting Station Located at the Oldest School of Engineering.
WEAA—Flint, Mich., "Vehicle City."
WGI—Medford Hillside, Mass., "Voice of the Air."
KFAF—Denver, Col., "Voice From the Rockies, Out Where the West Is."
WMAF—Dartmouth, Mass., "Voice From Way Down East."
WQAN—Scranton, Pa., "Voice of the Anthracite."
WEAF—New York city, "Voice of the Millions."
WCAP—Washington, D. C., "Voice of the Nation."

Broadcasting Time Schedule

Class "A" Stations—233 Meters

This Wavelength Has Been Assigned to W R A Z, the Radio Shop of Newark, 76 Springfield Avenue. For operating hours see programs in the Sunday Call

Class "A" Stations—244 Meters

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
9:00 to 11:30 A. M.	WBAN	WBAN	WBAN	WBAN	WBAN	WBAN	.....
12:30 to 5:30 P. M.	WBAN	WBAN	WBAN	WBAN	WBAN	WBAN	.....
10:00 to 12:00 M.	.....	.....	.....	.....	.....	.....	WBAN
2:00 to 5:00 P. M.	.....	.....	.....	.....	.....	.....	WBAN
7:00 to 10:30 P. M.	.....	.....	.....	.....	.....	.....	WBAN
7:15 to 10:45 P. M.	WBAN	WBAN	WBAN	WBAN	WBAN	WBAN	.....

Class "A" Stations—263 Meters

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
11:00 to 12:45 P. M.	.....	.....	.....	.....	.....	WSAP	.....
11:00 to 2:00 P. M.	WAAM	WAAM	WAAM	WAAM	WAAM	.....	.....
12:45 to 2:00 P. M.	.....	.....	.....	.....	.....	WAAM	.....
7:45 to 9:30 P. M.	.....	.....	.....	.....	WSAP	.....	WSAP
8:00 to 10:30 P. M.	WAAM	WAAM	WAAM	WAAM	.....	WAAM	.....

Class "A" Stations—273 Meters

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
11:00 to 12:00 M.	.....	.....	.....	.....	.....	.....	WFAF
7:30 to 9:00 P. M.	.....	.....	.....	.....	.....	.....	WRW
8:00 to 10:00 P. M.	.....	WFAF	WFAF	.....	WFAF	WFAF	.....
8:00 to 11:00 P. M.	WRW	.....	.....	WRW	.....	.....	.....

Class "B" Stations—380 Meters

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
10:25 to 12:30 P. M.	.....	.....	.....	.....	.....	.....	WGY
11:55 to 12:00 M.	WGY	WGY	WGY	WGY	WGY	WGY	.....
12:30 to 12:50 P. M.	WGY	WGY	WGY	WGY	WGY	WGY	.....
2:00 to 2:30 P. M.	WGY	WGY	.....	WGY	WGY	.....	.....
4:00 to 5:30 P. M.	.....	.....	.....	.....	.....	.....	WGY
6:00 to 6:30 P. M.	WGY	WGY	WGY	WGY	.....	.....	.....
6:00 to 6:45 P. M.	.....	.....	.....	.....	WGY	.....	.....
7:30 to 9:30 P. M.	.....	.....	.....	.....	.....	.....	WGY
7:40 to 9:45 P. M.	.....	.....	.....	.....	WGY	.....	.....
7:40 to 10:00 P. M.	.....	WGY	.....	.....	.....	.....	.....
7:45 to 9:00 P. M.	WGY	.....	.....	.....	.....	.....	.....
7:45 to 10:00 P. M.	.....	.....	.....	WGY	.....	.....	.....
9:00 to 10:30 P. M.	WHAZ	.....	.....	.....	.....	.....	.....
9:00 to 11:00 P. M.	.....	.....	.....	.....	.....	WGY	.....
10:30 to 12:00 Mid.	.....	.....	.....	.....	WGY	.....	.....

Class "B" Stations—405 Meters

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
11:55 to 1:00 P. M.	WDT	WDT	WDT	WDT	WDT	WDT	.....
2:30 to 4:00 P. M.	WOR	WOR	WOR	WOR	WOR	WOR	.....
2:30 to 5:00 P. M.	.....	.....	.....	.....	.....	.....	WJY
4:00 to 6:00 P. M.	WJY	WJY	WJY	WJY	WJY	WJY	.....
6:00 to 6:30 P. M.	.....	.....	.....	.....	.....	.....	WJY
6:15 to 7:00 P. M.	.....	.....	WOR	.....	.....	.....	.....
6:15 to 7:30 P. M.	WOR	WOR	.....	WOR	WOR	WOR	.....
7:00 to 8:00 P. M.	.....	.....	WDT	.....	.....	.....	.....
7:30 to 11:00 P. M.	.....	.....	.....	.....	WJY	.....	.....
7:30 to 11:30 P. M.	.....	WJY	.....	WJY	.....	.....	.....
8:00 to 11:00 P. M.	WOR	.....	WOR	.....	.....	WOR	.....
11:00 to 12:00 Mid.	WDT	.....	.....	.....	WDT	.....	.....

Class "B" Stations—455 Meters

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
10:30 to 1:00 P. M.	.....	.....	.....	.....	.....	.....	WJZ
3:00 to 5:00 P. M.			Peoples' Pulpit Association—Sunday Only				
3:00 to 6:30 P. M.	WJZ	WJZ	WJZ	WJZ	WJZ	WJZ	.....
6:30 to 7:30 P. M.			Peoples' Pulpit Association—Monday to Saturday Inclusive				
7:30 to 11:30 P. M.	WJZ	WJZ	WJZ	WJZ	WJZ	WJZ	.....
8:00 to 10:30 P. M.	.....	.....	.....	.....	.....	.....	WJZ

Class "B" Stations—492 Meters

WEAF, American Telephone and Telegraph Co., and WBAY, Western Electric Co., Will Operate Jointly On This Wavelength. For Operating Hours See Programs in the Sunday Call.

Class "C" Stations—360 Meters

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
9:00 to 9:30 A. M.	WLAW	WLAW	WLAW	WLAW	WLAW	WLAW	.....
9:30 to 11:00 A. M.	WHN	WHN	WHN	WHN	WHN	WHN	.....
10:30 to 12:30 P. M.	.....	.....	.....	.....	.....	.....	WQAO
11:00 to 12:00 M.	WBS	WBS	WBS	WBS	WBS	WBS	.....
12:00 to 1:00 P. M.	WHN	WHN	WHN	WHN	WHN	WHN	.....
12:30 to 3:00 P. M.	.....	.....	.....	.....	.....	.....	WBS
1:00 to 2:15 P. M.	WBS	WBS	WBS	WBS	WBS	WBS	.....
2:15 to 3:15 P. M.	WHN	WHN	WHN	WHN	WHN	WHN	.....
3:00 to 5:00 P. M.	.....	.....	.....	.....	.....	.....	WHN
3:15 to 3:45 P. M.	WLAW	WLAW	WLAW	WLAW	WLAW	WLAW	.....
3:45 to 5:30 P. M.	WHN	WHN	WHN	WHN	WHN	WHN	.....
7:00 to 7:30 P. M.	WLAW	WLAW	WLAW	WLAW	WLAW	WLAW	.....
7:30 to 9:30 P. M.	WHN	WBS	WHN	WBS	WBS	WHN	.....
8:00 to 9:30 P. M.	.....	.....	.....	.....	.....	.....	WQAO
8:15 to 10:30 P. M.	.....	.....	WNJ	.....	.....	.....	.....
9:30 to 12:00 Mid.	WHN	WHN	WHN	WHN	WHN	WHN	WHN

THE PURPOSE OF THIS BOOK IS TO HELP YOU

'Radioize Your Home'

N. M. MacLEAN

LOUIS FUNKE

L. Funke & Co., Inc., specialize in this work and will give you dependable equipment and service at all times. Whether for a dry cell or a complete radio installation in the home, our patrons are assured of continued service and complete and lasting satisfaction.

Let Funke "Radioize Your Home"

L. FUNKE & CO., INC.

110 BRANFORD PLACE

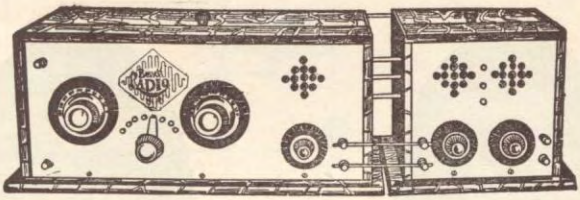
Formerly on Washington Street

TELEPHONE MARKET 0518

OPEN EVENINGS OPEN SUNDAYS

COURTESY Bassett RADIO *SERVICE*

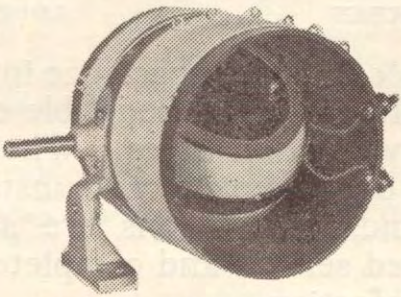
Bassett Tuner and Dectector With Two-Step Amplifier



Selectivity, range, volume and simplicity have been most wonderfully combined in the new Bassett circuit. Best materials and workmanship. Fully guaranteed. Sold complete or separately by units.

the "Ranger" Variocoupler

The "Ranger" Variocoupler is the result of years of radio engineering.



Built upon correct principles to insure maximum range and selectivity. Satisfaction guaranteed.

SERVICE DEPARTMENT

Our Service Department is fully equipped to handle the most technical work. Special sets built to order. **Plans and advice free** to those building their own sets.

Authorized Dealer for All Standard Sets and Parts

OUR REFUND POLICY IS YOUR PROTECTION

BASSETT RADIO SERVICE

514 ORANGE ST.
NEAR ROSEVILLE AVE.
NEWARK, N. J.

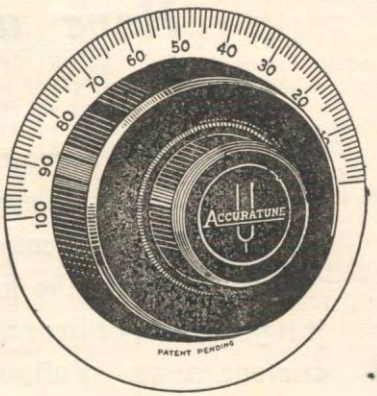
286 GLENWOOD AVE.
BLOOMFIELD, N. J.
PHONE BRANCH BROOK 3452

ACCURATUNE

MICROMETER CONTROL

80 to 1 RATIO

FOR TUNING SATISFACTION



AT ALL GOOD DEALERS

ACCURATUNE

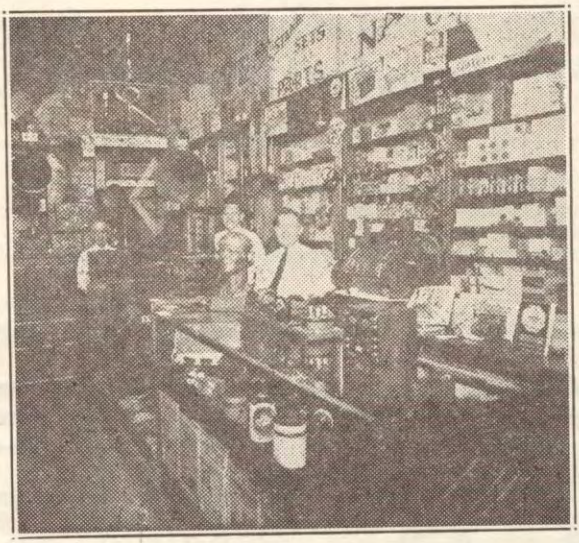
LOUD SPEAKER

$18.00

THE TEST TELLS

Eddie's Wireless

214 Washington Street, near Bank St., Mitchell 2022



The service we render our customers is based primarily on their needs. We help solve their difficulties whether it be the construction or installation of their set or other radio problem. In short we give all—***intelligent, personal service.***

AUTHORIZED DEALER FOR ALL STANDARD RADIO EQUIPMENT AND ACCESSORIES.

Paragon, Grebe, Brandes, Baldwin, Federal, Western Electric, Murdock, General Radio, Magnavox, Music Master, Atlas, Fada, U. S. Tool, Sleeper, Shamrock, Cutler-Hammer, Dubilier, Work-rite, Atwater-Kent, Eveready, etc. ***We stock only Genuine, Standard Tubes.***

ELKAY RADIO

Known From Coast to Coast— For Superior Workmanship in Phone Repairing—

Hundreds of radio fans from North, South, East and West entrust the repairing of their phones to this old reliable house. Why? Because our workmanship cannot be surpassed, and our prices are right.

Repaired As Good As New

PHONES

of All Makes Repaired and Rewound

Phones Magnetized While You Wait

Mail Orders Solicited—Prompt Deliveries

WE CHEERFULLY GIVE A DEMONSTRATION OF ANY STANDARD SET IN YOUR HOME WITHOUT OBLIGATION.

A Complete Line of All Standard Parts and Equipment in Stock, Including Hazeltine's Neutrodyne Circuit Sets, Parts and Expert Service for Same.

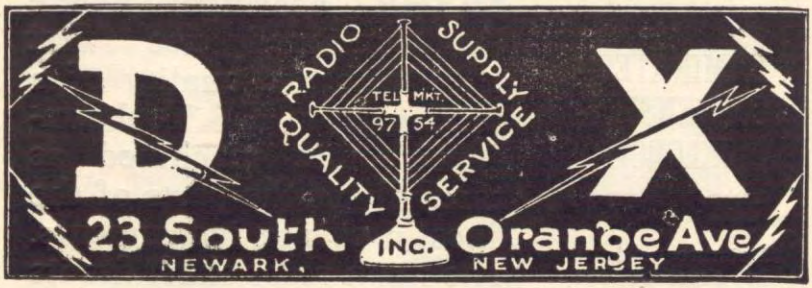
Elkay Radio Co.

14 BRANFORD PLACE

Opp. Branford Theater. Phone Mulberry 1264

Branch Store--Elkay Haraware Co.--40 Belleville Ave.

WIRELESS EQUIPMENT



A Word to the Public

THE D. X. RADIO SUPPLY, INC., is one of the most completely outfitted stores in Newark, N. J., the city that gave wireless its original "send off." Since that time, Radio Merchandising has met with tremendous approval all over the civilized world, growing with leaps and bounds to proportions never dreamed of.

New and finer apparatus is being made and marketed daily, constantly—and right there lies a difficulty—the dealer must keep abreast of the times.

In order to do so, we must at all times carry the very best wireless equipment obtainable at actually low prices. WE WILL DO THAT! and—

Each wireless unit bought at **The D. X. Radio Supply, Inc.**, is fully guaranteed. If faulty or in any way unsatisfactory, your money will be refunded, or another article in exchange—as desired.

Our experimental department, a workshop for our customers who are given expert assistance on technique and practical construction, without charge, has proved a popular innovation. You, too, are cordially invited to make use of it.

—The D. X. Radio Supply, Inc.

U.S. TOOL CONDENSERS

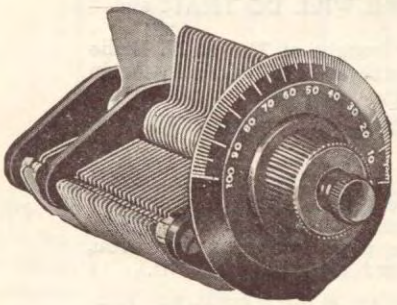
Precisely Lathed Shafts Insure Exact Alignment

LAMINATED-CONDENSITE-CELORON END-PLATES

Moisture need not be absorbed but only retained on the surface of insulating material to allow the escape of radio frequency currents. Moisture vanishes from the surface of **Condensite-Celeron** ends of U. S. Tool Condensers like "water off a duck's back." Also has the highest dielectric and tensile strength.

THE bearings, where continued use **first** tests the quality of a condenser, in **U. S. Tool Condensers** are machined as carefully as the parts of the finest precision instruments. The main rotor shaft fits its bearings with just a micrometer determined space between to give smooth, frictionless turning, but without enough space to allow side or end play. Consequently wear is reduced to insignificance. Another reason why all **U. S. Tool Condensers** are so unconditionally guaranteed.

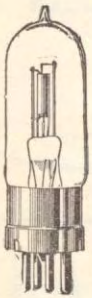
U. S. TOOL CO., Inc.



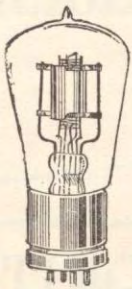
117-119
Mechanic St.
Newark, N. J.

SAVE MONEY!

Have Your Burned-Out Tubes Repaired



Do you realize that burnt-out tubes can be repaired and guaranteed to function as good as new for only half the price?



Send in your burnt-out tube today and we will return it fully repaired within a week.

Our work is reliable and our customers' satisfaction speaks for itself.

We Repair the Following

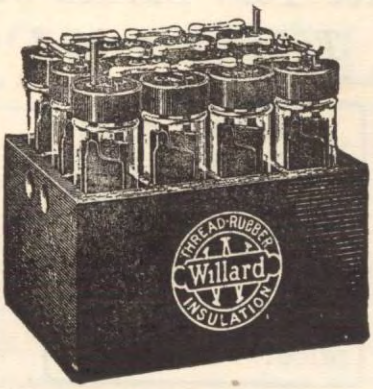
W D-11-12	C 299	D. V. 1	Plain 6 volt
U. V. 199	C 300	D. V. 2	Det. and Amp.
U. V. 200			Moorhead
U. V. 201-201-A	C 301-301-A	D. V. 6	Marconi
U. V. 202	C 302	D V. 6-A	A. P. Relay

Mail Orders Solicited and Promptly Attended to. Dealers' Special Account. Address P. O. Box 22-O, Clinton Hill Station.

H. & H. RADIO CO.

512 CLINTON AVE., NEWARK, N. J.

Willard STORAGE BATTERY



Storage "B" Batteries

IMPROVE ANY SET

THEY CUT OUT NOISES

Due to electrical leakage, internal action or too low voltage

THEY REDUCE EXPENSE BECAUSE

THEY DON'T HAVE TO BE REPLACED, ONLY RECHARGED

Something New!

SINGLE CELL STORAGE "A" BATTERY

TO REPLACE DRY CELLS. COST LITTLE MORE ORIGINALLY AND LASTS INDEFINITELY ELIMINATING CONSTANT EXPENSE OF REPLACEMENT.

Willard Colloid Rectifier Recharges Both of These..... $2.00

STARTER & BATTERY SERVICE

240 CENTRAL AVE.

NEWARK, N. J.

A half million in two years!

GENUINE Shamrock BAKELITE

A Sales Record That Tells Its Own Story!

The radio fan is a wary buyer, and he has good cause to be. He has been presumed on too often in the past by high sounding promises that never materialized. "You can't fool all the people all the time"

The ever-growing number of Shamrock variocouplers and variometers in use is due to a definite policy of the manufacturer: specialization, efficiency and truth.

The entire plant is given over to the manufacture of only these two instruments. As a result they are as nearly perfect as human being can make them. The material and workmanship going into their production is the best that money can obtain.

Each instrument is accompanied by an individual guarantee of complete satisfaction—with no "ifs" or "buts"—or money back.

ASK FOR

SHAMROCK

FOR SELECTIVE TUNING

YOU CAN GET IT AT ANY RELIABLE DEALER

N. J. DISTRIBUTOR

WHOLESALE RADIO EQUIPMENT CO.

37 William St., Newark, N. J.

You Have Tried the Rest
:-: Now Try the Best :-:

DISTANCE-SELECTIVITY-CLARITY

1,000 MILES ON THE

IDEAL D. X. RECEIVER

Everything ready to hook up; panel all drilled; nothing more to buy

Set Consists of the Following Nationally Known and Guaranteed Parts

- 3 Dials
- 2 Switches, 16 contact pts.
- Bus Bar wire
- 1 22½ volt B Battery
- 1 A battery
- Binding posts
- 1 7x12 hard rubber drilled panel

$19.75

WITH GENUINE W. D. 12 TUBE

- 1 W. D.-12 Dry Cell Tube
- 1 Shamrock Coupler
- 1 23 plate moulded cond.
- 1 11 plate moulded cond.
- 1 Remler rheostat
- 1 Standard socket
- 1 Dubilier cond. and leak

Can be assembled in one evening. A picture plan with each purchase. Made in such a way that a 5-year-old boy can read it and understand it. Fully guaranteed.

Demonstration in Your Home of the Leading Radio Receiving Sets Without Obligation

We Are Recognized Agents FOR THE Following Sets and Equipment

SETS	EQUIPMENT	
Grebe	Fada	Sleeper
Paragon	Murdock	Baldwin
Radio Corp.	Acme	General Electric
Tuska	Federal	Westinghouse
Neutrodyne	R. C. A.	Magnavox
And many others.	General Radio	Shamrock
	Cardwell	And all others.

ONE OF NEWARK'S PIONEERS IN THE RADIO FIELD

NEWARK RADIO SUPPLY CO

THE HOME OF GUARANTEED MERCHANDISE

Tel. Market 1663. Open Evenings Until 9. Sundays Till 1 P. M.

MAIL ORDERS SHIPPED SAME DAY.

279 MARKET ST. FORMERLY AT 284 MARKET ST.

NEWARK, N. J.

Nationally Known Radio Parts and Sets

at

REDUCED PRICES

The radio fan will find here at all times an assemblage of nationally known reliable radio parts and sets at greatly reduced prices. Every article guaranteed to give absolute satisfaction.

Some of the Standard Lines

Radio Corporation
Cunningham
Greba
Adams & Morgan
Magnavox
Pacent
Murdock
U. S. Tool Mfg. Co.
Fada Products

C. Brandes, Inc.
Chas. Freshman Co.
Western Electric
Cardwell Mfg. Corp.
General Radio
Federal Tel. & Tel. Co.
Sleeper Corp.
Manhattan Elect. Co.
Crown Radio Co.

GET OUR PRICES ON B BATTERIES BEFORE MAKING PURCHASES ELSEWHERE

Guaranteed Tungsten Lamps for factory, office and household use, 25 to 60 watts..... **19c**

MAIL ORDERS PROMPTLY FILLED

A. J. MORRIS SUPPLY CO.

GOVERNMENT CONTRACTORS OF GENERAL MERCHANDISE

202 MARKET STREET

SUNDAY CALL BLDG. **NEWARK, N. J.**

Two Stores in Newark

WHEN FOLKS LOOK FOR LOW PRICES, THEY KNOW THE RADIO-CYCLE IS THE PLACE TO GO.

Our reputation is based upon the unusually low prices we charge for the best standard radio goods obtainable.

Our salesmen are technical experts, as well as practical advisors in the matter of purchasing the right accessories for your particular set.

Prompt and Courteous Service at Both Stores

68 MARKET STREET

—AND—

37 SOUTH ORANGE AVE.

Telephone Mulberry 1338

Stores Open Till 10:30 P. M. **Sundays 9:30 A. M. to 2:30 P. M.**

SEE OUR ADVERTISEMENTS IN THE SUNDAY CALL FOR PRICES