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RADIO
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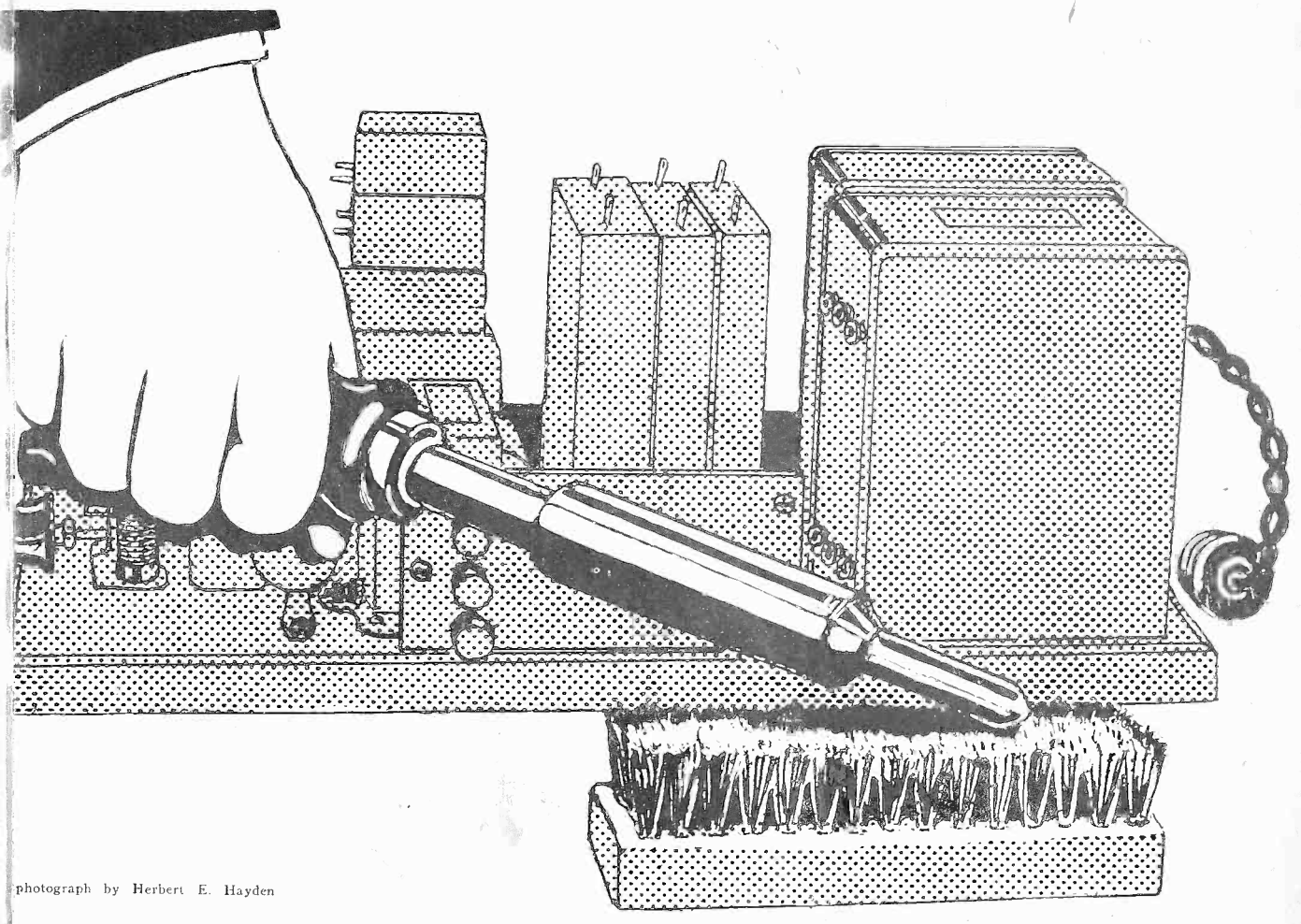
WORLD
America's First and Only National Radio Weekly

The Tyrman Ten

LEAN TIP ON IRON MAKES SOLDERED JOINTS STAY PUT



photograph by Herbert E. Hayden

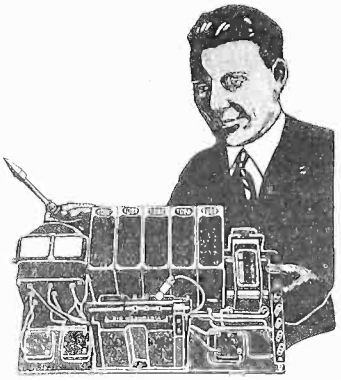
EAN OFF THE TIP OF YOUR IRON ON A WIRE BRUSH NAILED DOWN FOR SECURITY

HE VICTOREEN POWER SUPPLY AND AUDIO AMPLIFIER

New Combination—Beauty of Sound and of Appearance in Reproducers

Victoreen

POWER SUPPLY



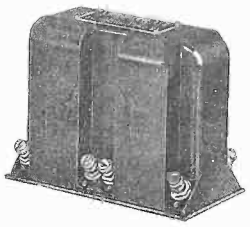
The Finished Product

A new plate supply with maximum of 475 v lts, with provisions for a 210 output, constitutes the Victoreen Power Supply. The power transformer was specially designed to carry the load with ample safety margin, the choke unit was made to exacting specifications to assure most efficient filtering, the output unit was made to conform to requirements of low direct current resistance, with suitably high impedance at the working frequencies, and the resistance unit was specially designed for an absolutely dependable steadiness of voltage output. Made with proper filter condensers and using two UX-281 or 216-B tubes for full wave rectification, this new supply affords amazing depth of tone, richness of volume and flawless reproduction even at enormous signal loads.

The construction of the Power Supply was described by J. E. Anderson in the Oct. 15 and 22 issues of RADIO WORLD. How to build the Victoreen Power Supply with an audio amplifier is described in the present issue by the same distinguished engineer.

The Victoreen 112 audio transformer unit is used in conjunction with the previously mentioned apparatus to constitute one of the finest power supplies and audio amplifiers ever designed.

Everybody who has heard one has gone into ecstacies and has wanted one immediately for himself. Enjoy the fullest and finest that radio has to offer and let the guests you entertain in your home see what a wise choice you make when it comes to selecting a suitable power supply and audio channel. Critical persons who have heard this de luxe outfit simply marvel at the difference between this and the ordinary B eliminator and ordinary audio amplifier. The Victoreen apparatus is most extraordinary in its performance because no pains are spared in the search for perfection, and every piece of apparatus is tested three times and then once more for good measure to make sure that it measures up to the Victoreen standards of flawlessness.



The 112 audio transformer unit

Two transformers in a single casing constitute the 112 unit, which amplifies with perfect naturalness. Use a 112 tube in the first stage and a 210 in the last stage in connection with the Victoreen Power Supply.

The 112 unit may be used as the audio channel in any receiver. Send for booklet and learn how. Your Victoreen parts are obtainable at your dealer.

Victoreen 116 power transformer	$16
Victoreen 216 choke unit	15
Victoreen 115 output unit	10
Victoreen 316 resistance unit	3
Victoreen 112 audio transformer unit	22

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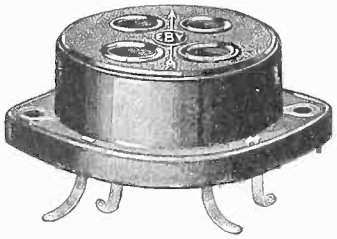

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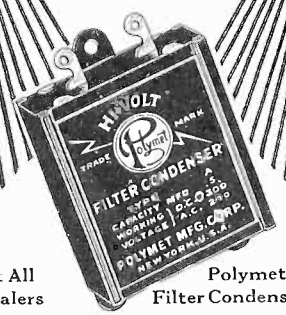

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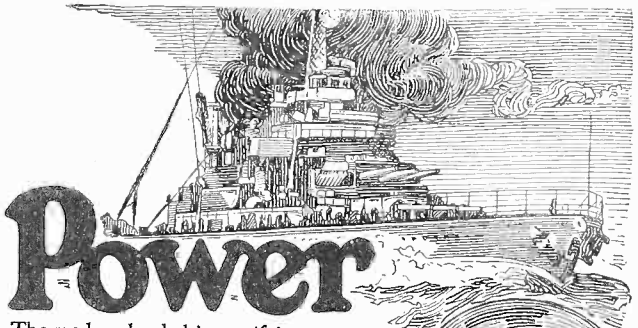

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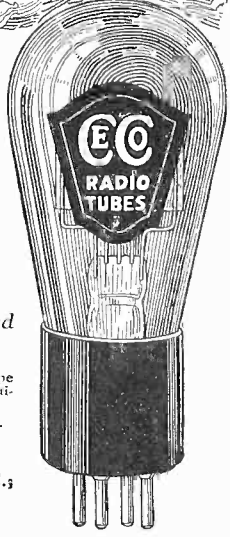

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SIXTH YEAR

RADIO WORLD

REG. U.S. PAT. OFF.

Vol. XII
No. 6

Whole No. 292
October 29, 1927

15c per Copy. $6.00 per Year.

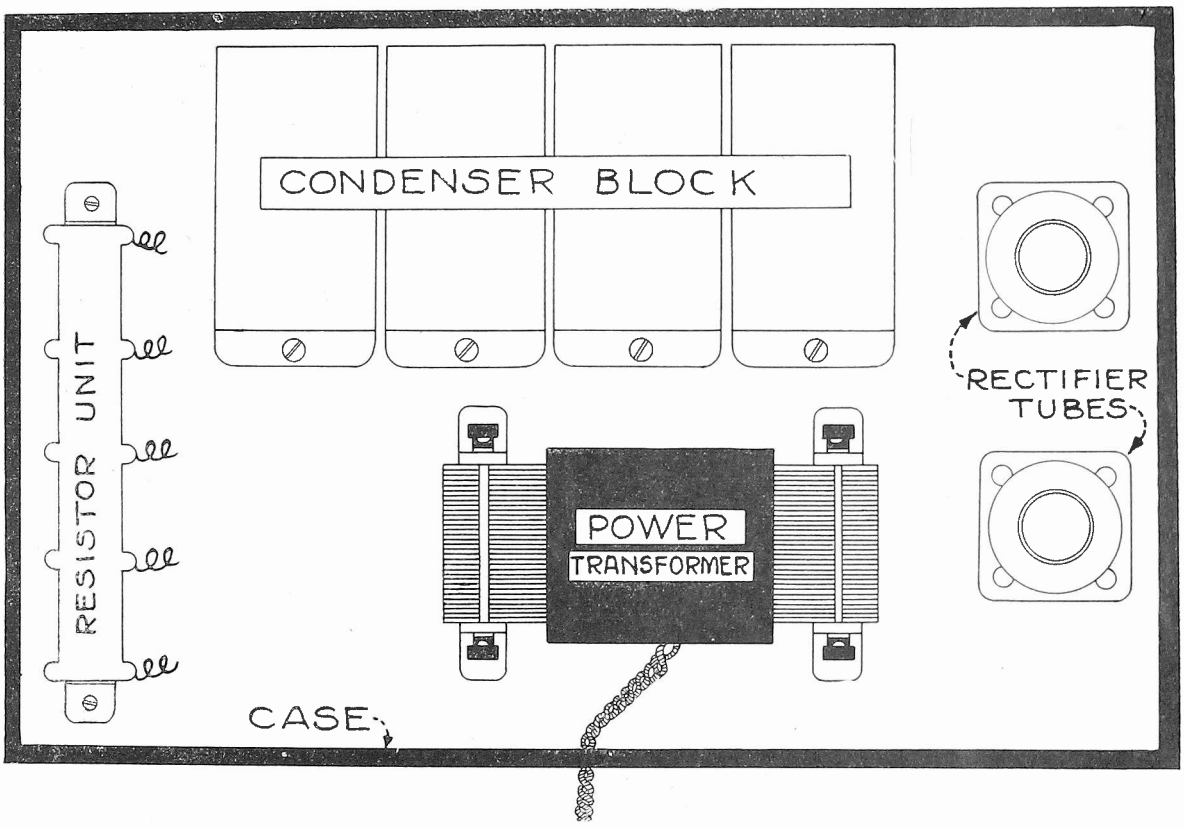
A Weekly Paper Published by Hennessy Radio Publications Corporation from Publication Office, 145 West 45th Street, New York, N. Y.

Phones: BRYant 0558 and 0559

[Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under Act of March, 1879]

You'll Pardon a Little Common Sense!

By Brunsten Brunn



PLAN OF AN ELIMINATOR ASSEMBLY

Ignorant Misplacement of Parts in Some Eliminators Causes Resistance Bank to Melt Condenser Wax, Short-Circuit Leads and then the Unit "Stews"—What's Really What and Why You Should Know and Respect It.

WHEN electric current flows in a conductor having resistance, heat is generated. The amount of heat generated is proportional to the square of the current flowing, to the time it flows, and to the resistance through which it flows. The amount of heat generated in a given time is measured in joules, or in calories. The rate at which the heat is generated is measured in joules per second, or in watts.

Manufacturers of resistors have taken the heat generation into account and they usually specify their product by the wattage as well as by the resistance. The wattage specified is the maximum safe working rate of heat dissipation. If this rate is exceeded the resistor is likely to burn out. For example, if the resistor is rated at 50 watts it will dissipate 50 joules every second without getting too hot, but if it is called on to dissipate 100 watts it may get so hot as to burn out in about a minute.

The maximum wattage of a resistor depends on the kind of resistance element that is used, on the provision made for heat radiation, and on the material on which the heating element is mounted. When the heating element is mounted on porcelain or asbestos, or equivalent, the wattage of a resistor is determined by the fusing point of the resistance element, because porcelain and asbestos are highly refractory and will stand much more heat than ordinary resistance elements. But if the resistance element is wound on the ordinary moulded insulator materials used in radio receiver parts, then the fusing or softening points of these determine the wattage limit, because these melt or soften at much lower temperatures than wires.

Many modern resistance elements designed for use in B battery eliminators are wound on either asbestos or porcelain, and hence they will stand a high wattage.

But the wattage limit of the resistor

element alone is not sufficient to determine whether it is safe to use a given resistor in a given place. It must be taken in conjunction with the other parts of the assembly in which it is used.

Common Sense Needed

If the resistance element can stand a white heat it is apparent that it cannot be placed near any inflammable material, or near any painted, varnished and waxed parts. Even if the resistance element is normally operated at a dull red heat it cannot be placed close to any parts which will be damaged by excessive heat.

This is a point which some B battery eliminator constructors have entirely overlooked. They have taken the wattage rating of the resistor manufacturers and have forgotten the practical conditions of subsequent use. As a result such eliminators have not stood up in use but have burned out.

The ratings of the resistors have been determined in free air where the circulation of the air is unimpeded. If the resistors were rated under the conditions of use, in many cases the rating would not be one-fourth as high. This cannot be held against the makers of the resistor elements, unless they have grossly overrated their products. The trouble must be laid to the designers of the eliminators who have not applied the resistors properly. It is not to be supposed that it is only the little fellows who have been guilty of this engineering misdemeanor. Big fellows have been guilty of just as sizzling errors.

A resistor rated at 50 watts, say, in the open air is put into a B battery eliminator and placed next to a varnished or painted coil, a wax-filled condenser, a balelite moulded case, and no adequate provision made for ventilation or air circulation. What is the result? After twenty minutes of operation an obnoxious odor permeates the room and makes everybody sniff.

"Why, something is burning," somebody suggests with alarm.

A search for the source is instituted. But before the fuming inferno can be located the varnish and paint have been burned off the eliminator, the wax has been melted out of the condensers, the insulation of open leads has been charred, and the bakelite trimmings have been discolored. Perhaps a short-circuit has occurred as a result of the charring of the leads. If the stewing has gone that far before the source of the fumes has been located the chances are that the eliminator has been irreparably damaged.

The designer of the eliminator is told about the sudden end of his creation. He checks his figure and finds a wide margin of safety. Something else caused the trouble, he concludes. The error was not his. But many other reports of the same nature come in and he is finally convinced that all is not well with the design.

The Facts Come Out

He investigates and finds that the resistor element is placed too close to a condenser, a coil, the case of the eliminator, or other part which is not as refractory as the asbestos form on which the resistance element is wound. He also discovers that there is not enough ventilation in the eliminator to carry away the heat. Perhaps the ventilation provided would have been enough had not the eliminator been placed in an airtight container while in use. The designer found little consolation in that when all of his eliminators were subject to the same stewing while in use, no matter where they were placed.

Perhaps the makers of the resistor elements could help the designers of the eliminators by including certain warnings with the resistors. For example, a resistor might be rated at 50 watts with the provisions that it must be mounted in free air and not less than 5 inches from any substance which will be damaged if the temperature reaches the boiling point of water.

It is very desirable to enclose the eliminator in an airtight case just to keep the dust out. Then again it is easier to make the job appear attractive if it is all-inclosed without any visible ventholes. But since this is not good from the efficiency point of view, holes must be cut in the container and dust allowed to get in.

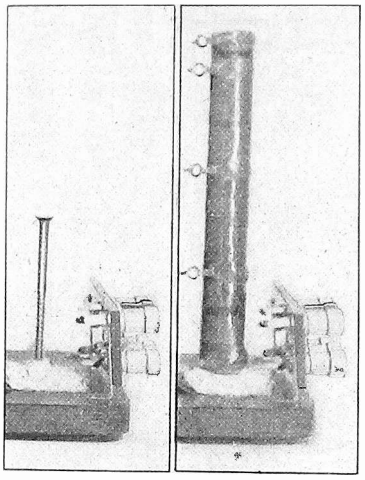
Ways of Disposing of Heat

Home constructors of eliminators may find of interest the things that dispose of the heat which is generated in the resistance element and in the rectifier tubes. Heat is removed by three routes, namely, by radiation, by convection, and by conduction.

Radiation requires no physical medium. The heat energy moves from one point in space to another in the same way that radio waves travel. The transfer of heat energy is always from the hotter to the cooler, and the rate of transfer depends on the fourth powers of the absolute temperatures of the radiating and the absorbing bodies.

Some substances and surfaces radiate much better than others. Also some absorb heat much better than others. Those bodies and surfaces which are good radiators of heat are also good absorbers. Black and rough surfaces are the best radiators and absorbers of heat. Hence radiators and cooling fins on eliminators should be made of such surfaces.

In conduction the heat also moves from the hotter to the cooler body and the greater the difference in their temperatures the faster is the conduction. A physical medium is required for heat conduction. The best heat conductors are usually those that are good electric conductors. Silver, copper and aluminum are very good conductors of heat. Hence these metals should be used for heat dissipators in an eliminator.



(Hayden)

A USEFUL IDEA on mounting resistors in a vertical position. First put a piece of asbestos on the baseboard and drive a long nail through it. Then the hollow resistor is put over the wire, on top of the asbestos. The leads running from the various taps on the resistor, if made of stiff acme celatsite, will hold the resistor upright. The asbestos protects the baseboard from the heat generated in the resistor and the vertical position facilitates the disposal of the heat generated.

DIRECT TO GREENLAND

Washington.

With the installation of the new high powered transmitter at Greenland, direct communication between Greenland and Copenhagen will be possible. Heretofore such communication has been carried on via Iceland.

PHASE CONTROL WELL DONE IN KNICKERBOCKER

By Herbert E. Hayden

Phase is a subject not well understood in radio. Yet it plays an important part in the functioning of a receiver. The amplification depends on it, the quality depends on it, and even the selectivity depends on it.

One stage consisting of a tube and a transformer changes the phase of the signal a certain amount depending on the frequency of the impressed signal and on the various impedances involved. The change also depends on the manner in which the leads to the transformer are connected The angle of shift lies between minus 90 and plus 90 degrees or plus 90 and minus 90, depending on the polarity of the transformer connections. In either connection there is some frequency at which the shift is zero, and at that frequency the amplification is often a maximum.

Comparison of Shifts

In an audic transformer like the Karas Harmonik the angle of shift over the greater portion of the scale is small, and the characteristic of the transformer is therefore a flat curve over most of the audible scale. This is one criterion for determining a good transformer.

When two transformers are used in a circuit, each stage introduces a certain shift in the phase. The plate currents in the primaries of the two transformers will differ in phase by the shift introduced by the second tube and transformer.

Again the last tube and the loudspeaker will introduce another shift in the phase of the signal, and the plate currents in the second transformer and that in the loudspeaker will differ by the shift introduced by the last tube and speaker. The sum of the shifts in the second and the last tubes may be such as to cause the difference in phase between the currents in the primary of the first transformer and that in the speaker to be zero. That means that they are flowing in the same direction at the same time.

Now suppose that the plate currents of all the tubes flow through some common impedance like the resistance of a B battery or the impedance of a B battery eliminator.

Up Goes the Amplification

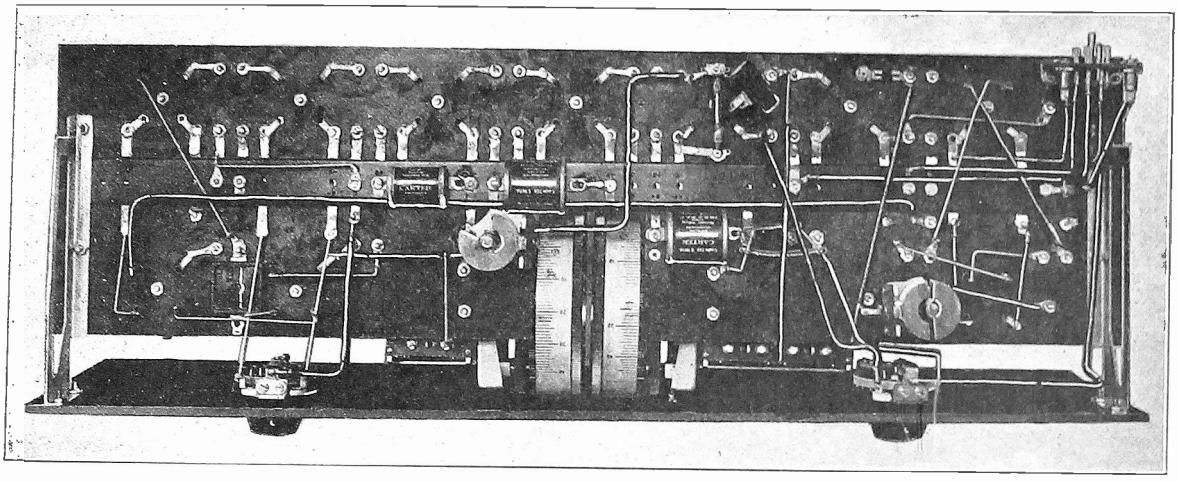
This impedance will be a coupler between the last and the first tube, and since the currents are in phase the circuit will regenerate. The amplification at the frequency where the phase difference between the last and the first tubes is zero will be tremendously great, or there might even be oscillation. Distortion will result. This is a common occurrence if inferior audio transformers are used, hence one should choose only excellent transformers.

Phases in Knickerbocker 4

In the Knickerbocker Four the first primary is set at a certain angle on the shaft of the tuning condenser which makes the inductive reactance just below that which will cause regeneration. As the condenser is turned the coupling is automatically changed so that the subcritical adjustment remains. At no time in the course of the tuning condenser is the phase of the fed-back current such as to start oscillation, and yet it is always such as to yield the maximum sensitivity and selectivity.

Tyrman Ten Efficiency

By Paul R. Fernald
SUPER-HETERODYNE SPECIALIST



THE SUBPANEL OF THE TYRMAN TEN AS SEEN WHEN ONE TAKES A PEEK UNDERNEATH.

A FEATURE of outstanding importance in the Tyrman Ten is the intermediate frequency used in the circuit. The frequency chosen by the designers of the Tyrman Ten is 340 kc as contrasted with 30 to 43 kc selected by many engineers. What are the advantages of this high intermediate frequency over the lower frequencies employed in other sets?

When I say that they are superior quality and a greater freedom from squeals, do not express a sophisticated "I thought so" until you have heard the reasons for the claims. As soon as you have read the defense for the claims you will admit that it is self-evident that quality is better and interference less than when the intermediate frequency is lower.

One thing that militates against the quality of reproduction in a super-Heterodyne is super-selectivity, that is, selectivity which is much greater than is ever necessary to separate two adjacent frequencies which are clamoring for entrance into the charmed circle.

The Selectivity Question

It is a simple matter in a Super-Heterodyne when the intermediate frequency is low to get adequate selectivity. It is an infinitely more difficult assignment to get quality under the same conditions. It is also difficult not to exceed the allowable selectivity. As soon as the selectivity is too high the signal is boomy and is entirely lacking in the higher audio frequencies which put crispness and snap into the reception. Unless the higher audio notes are admitted to the speaker in volume comparable with the volume of the low notes the reproduction will lack naturalness and it will not be pleasing to the ear of the discriminating listener.

In what way does the intermediate frequency affect the selectivity of the receiver, and hence the quality?

The effective selectivity depends directly on the ratio of the highest audible frequency to the intermediate carrier frequency. Suppose that the highest audible frequency be taken as 10,000 cycles.

If the intermediate frequency is 25,000 cycles the ratio of the highest audible frequency to the carrier is four-tenths. The corresponding selectivity let us say is 500. Now if we raise the intermediate carrier to 50,000 the ratio becomes two-tenths and the corresponding selectivity is 250. If the intermediate carrier is 100,000 the selectivity falls to 125 and the ratio to one-tenth.

Now, suppose we use an intermediate frequency of 340 kc the ratio of the highest audio frequency to the carrier is 1-to-34 and the selectivity is 34.

When the Super-Heterodyne designers are at work, they are pulled in two directions at once. The demand for higher selectivity is tugging in one direction and the demand for perfect quality is tugging in the opposite. The designer cannot yield to both if he is to have a real receiver which will satisfy anybody. He must hit on a compromise. If he pays more attention to selectivity than to quality his set is likely to be too selective. If he keeps quality uppermost he is likely to design a set which will have all the selectivity required and still be capable of quality so near the original that only a trained and experienced observer can tell the slightest difference. The wise and consciencious designer naturally will follow this method.

Avoiding Over-Selectivity

There are several ways of building an intermediate channel which will not be too selective. One of these is to choose an intermediate frequency which is high in comparison with the highest audible frequency in the signal to be received. The designer of the Tyrman Ten chose 340 kc as the intermediate frequency for this reason. Perhaps it would not have been necessary to choose a frequency quite so high had it not been for other considerations which entered into the choice. We proceed to one of these which is of first importance.

Anyone who has turned the dials on an ordinary Super-Heterodyne knows that there is an abundance of squeals. These are annoying at first but soon the operator comes to regard them as the inevitable and considers them as symptoms of proper operation. Indeed at certain times of the day when the squeals are absent he thinks that all is not well with the receiver. He forgets that half of the stations are off the air when these squeals are absent.

These squeals are indicative of proper operation of the Super-Heterodyne, all right, but they are not indicative of proper design. The squeals are avoidable and the problem is simply one of design. More particularly it is a matter of choice of the intermediate frequency. If this frequency be chosen high enough there will be no squeals.

Usually it is not practical to choose a frequency high enough to avoid squeals, but one can be chosen which avoids most of them. And this has another advantage. It not only avoids the usual squeals but it also eliminates repetition of the same signal on the dials. It makes the receiver so-called "one spot." The elimination of the squeals and the extra "spot" is due to the same cause, the projection of both the squeals and the "spot" beyond the tuning range of the oscillator in the receiver. Some of the shorter wave stations will appear twice on the oscillator dial when the intermediate frequency is 340 kc, but they will be so far apart that the radio frequency tuner will effectively suppress any squeals which tend to result.

The efficiency of the Tyrman Ten has been achieved by peaking all the intermediate transformers at exactly the same frequency and by matching the coils with the tubes. It has also been greatly increased by the radio frequency amplifier ahead of the modulator. The tuner that goes with this tube has a great deal to do with the elimination of the squeals in that part of the tuning range where the set behaves in "two spot" fashion. The interference does not get by the two tuners. If it cannot get to the mixer tube it cannot give rise to any squeals.

The Camfield Condensers

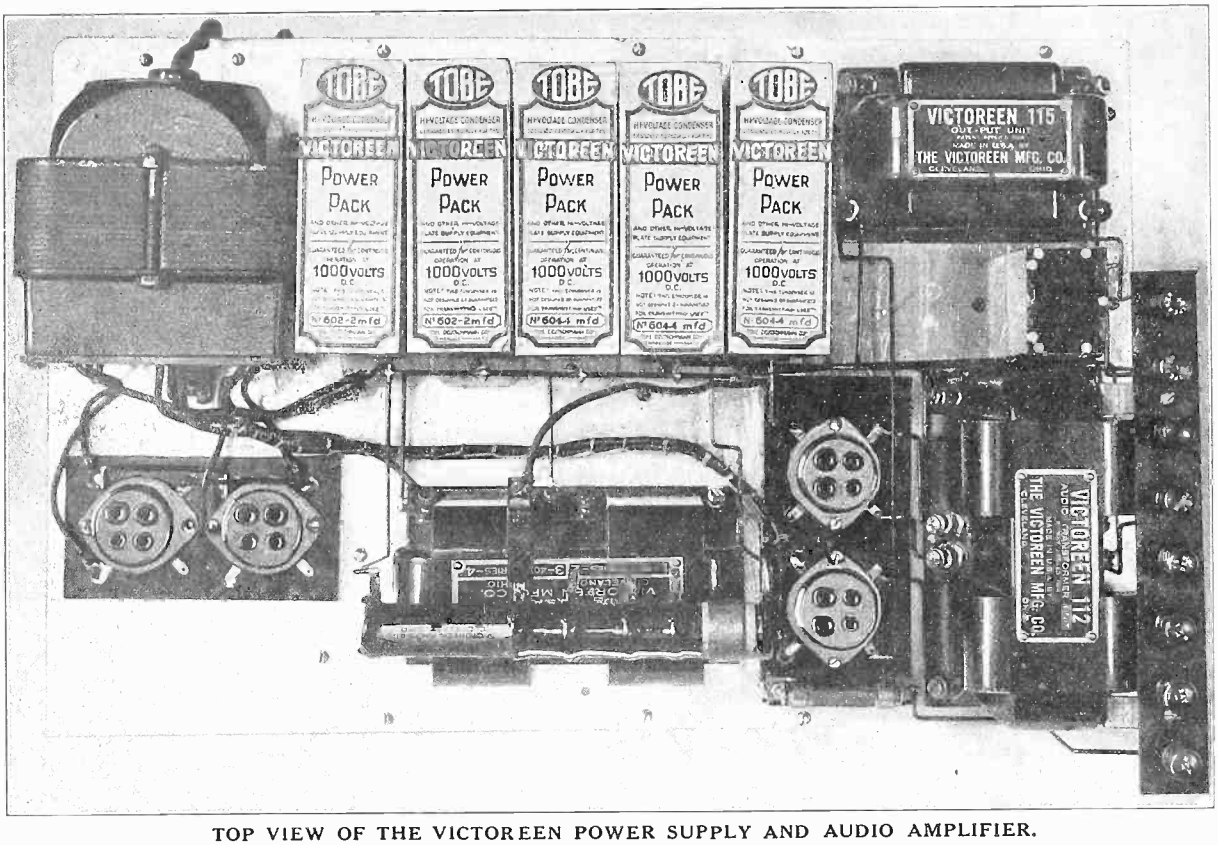
In discussing the efficiency of the Tyrman Ten, due credit must be given to the Camfield variable condensers. These have a positive contact yet turn with gentle smoothness that greatly facilitates tuning. The condensers have an extremely low high frequency resistance and are sturdy in construction. The security and ruggedness of the mechanical construction are such that the condensers will last as long as any piece of apparatus in the receiver.

[*The constructional article was published last week.*]

The Victoreen Power Sup

By J. E. Anderson

Contributing Editor



TOP VIEW OF THE VICTOREEN POWER SUPPLY AND AUDIO AMPLIFIER.

[*The Victoreen Power Supply was introduced by Radio World in the Oct. 15 issue and further data were published in the Oct. 22 issue. This power supply consists of a B eliminator of exceptionally fine design, using a power transformer, chokes, output filter and a resistance network designed by John A. Victoreen. The full-wave method of rectification is used, with two 281 tubes or two 216-B tubes. In the power supply itself one socket is intended for the output tube, which should be a 210. The maximum plate voltage, 475 volts, enables the use of the 210 tube at its best operating point. The results from this power supply, using Tobe filter condensers and output condenser, have been very remarkable, so that experts well able to judge of its performance pronounced them exquisite. The following article, the final one of the series, deals with the addition of a two-stage audio amplifier to the power supply. Thus any radio frequency amplifying and detecting system may be used in conjunction with the circuit network discussed this week. The two-tube Browning-Drake, the three-tube Radio Frequency Fountain of the Unified Diamond, the radio frequency portion of the Universal, of the Aristocrat or of any of the Super-Heterodynes, is well adapted to audio amplification and B elimination by the present system. The highest type of advanced engineering is embodied in the design of the parts and of the circuit network and it is our pleasure unqualifiedly to recommend the construction of the device Mr. Anderson so ably describes in the three articles, particularly the following one, which is unusually interesting.*]

IF you have a receiver of ancient vintage and think that it is giving you quality reproduction, do not make the mistake of listening to a receiver equipped with a first-class power supply and power amplifier, like the Victoreen, because if you do you will lose all faith in your old set, and that would be terrible.

If you have heard a good receiver and have come to the conclusion that your old one is not doing justice to the wonderful broadcast programs, do not make the mistake of listening to the tempter who yodels "just as good" in your ears in trying to sell you something which is below mediocrity. Hear for yourself of what the various amplifiers and power supply units are capable.

If you miss hearing the Victoreen Power Supply Unit and Power Amplifier you have missed hearing an up-to-date combination designed by one who knows every wrinkle in radio and who also knows that in the near future the public will be keen judges as to what constitutes good amplification and good reproduction. John A. Victoreen has designed his power supply and power amplifier in accordance with his laboratory findings, which will be as valuable five or ten years from now as they are to-day.

The Victoreen power amplifier consists of a Victoreen 112 audio transformer unit, one 112 power tube, one 210 power tube, and one Victoreen 115 output unit. These units have been assembled and coordinated for operation with high plate and grid voltages and also for AC filament supply for the last tube.

Good Results

The 112 audio transformer unit consists of two audio transformers in one case. The object of assembling the transformers in one case is to make sure that they are placed correctly with respect to each other and to afford compactness and simplicity. This assembly not only minimizes the space required for the audio amplifier, but eliminates detrimental interaction between the two units and insures a more pleasing appearance.

The performance capability of the unit is such that the amplification is uniform over the entire audible scale from frequencies as low as 16 to as high as 5,000. Even above the 5,000 frequency the amplification is satisfactory for another 5,000 cycles. The cores of the two transformers have ample section so that there will be no saturation of the cores and hence no wave form distortion. The insulation between the two windings is high enough to withstand voltages above 500 volts and the current carrying capacity of the primaries is greater than will ever be required even when high power tubes are used.

The first tube in the amplifier, being a ux112, is operated on the six volt storage battery which supplies the filament current for the detector and radio frequency tubes. An 112 Amperite is put in the negative leg of the filament to limit the current to the normal value of half an ampere.

ly with Audio Channel

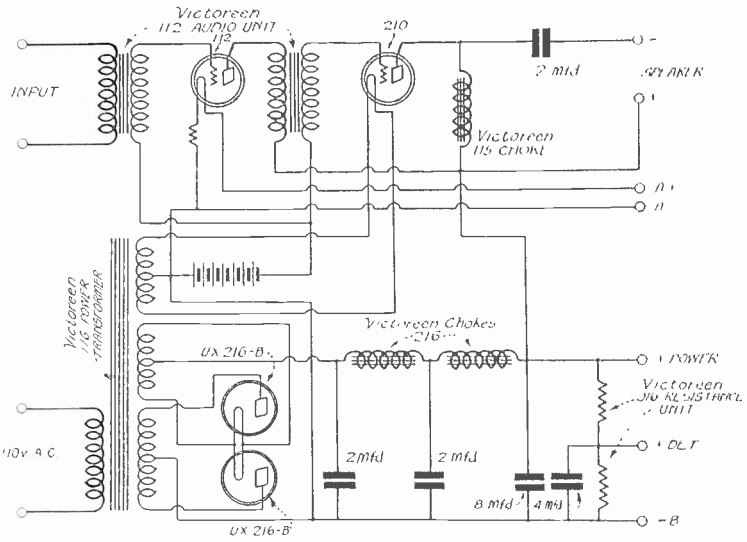
LIST OF PARTS

For the Power Supply

One Victoreen 116 power transformer.
One Victoreen 216 choke unit.
One Victoreen 316 resistance unit.
Two Tobe 2 mfd. 1000 volt DC condensers, No. 602.
Three Tobe 4 mfd. 1000 volt DC condensers, No. 634.
Two Eby sockets.
One baseboard 9x16 inches.
One binding post strip with eight Eby posts (speaker +, speaker —, B + Amp., B—, B + Det., A — and A +.
One 3½x7" hard rubber strip.

For the Power Amplifier

One UX 210 power tube.
Two Eby sockets.
One Victoreen 115 output unit.
One Tobe 2 mfd. condenser, No. 302.
Twelve feet of Acme Celatsite wire.
Two No. 763 Eveready batteries.
One 112 Victoreen Audio Unit.
One hard rubber strip 3½x8½.
One 112 Amperite.



The last tube derives its filament current from a 7.5 volt winding on the Victoreen 116 power transformer. This winding is tapped at the middle point for the grid and plate returns.

Ample Capacity

The output of the 210 power tube is delivered to the loudspeaker through a 2 mfd. or higher capacity condenser, connected in the lead from the plate. Across the speaker and the condenser is a Victoreen 115 choke unit. This unit has ample core and current carrying capacity to handle the direct plate current without saturation and without heating. It also has a high inductance so that the lower audio frequencies are forced through the loudspeaker as well as the higher.

The voltage applied to both the first and the second tubes is the full output voltage of the Victoreen power supply. This is about 475 volts. While this voltage is much higher than recommended for the 112 tube it can be employed provided that suitable grid bias is also used. When this voltage is used the undistorted output of the 112 becomes comparable in magnitude with the output of the 210 tube. If it is not desired to use the high voltage on the 112 tube the plate return from that tube can be connected to one of the lower voltage taps on the Victoreen 316 resistance unit. When this is done the grid bias on the 112 tube must be adjusted to the new plate voltage.

Biases Alike

Since the amplification factors of the 210 and the 112 tubes are about the same, the same plate voltage also requires the same grid bias. The bias needed is about 45 volts for the 475 plate voltage. This voltage is obtained from two small 22.5 volt dry cell batteries connected in series and then to the mid-tap lead to the 7.5 volt heating transformer. A grid battery is used to obtain the grid bias rather than a resistor because it does not have the same detrimental effects on the quality. Any resistance or other impedance in the common lead either produces amplification peaks at some frequencies or it depresses the amplification in certain regions of the scale. A dry cell C battery is a simple way of avoiding part of the common resistance.

Note that the minus A terminal on the first amplifier has been connected to the positive of the C Battery and to the mid-tap on the heating transformer. This point has also been connected to the negative side of the power supply unit. Thus the entire 45 volts of the battery is impressed on both of the grids. This connection differs from ordinary connections in minor details only, and is made possible by the use of the grid battery. This connection does not prevent the use of a portion of the 45 volt C battery as grid bias for other tubes in the receiver, for example, the radio frequency amplifier tubes.

If a lower grid bias is needed for the 112 tube because of the use of a lower plate voltage, this bias also can be obtained from the 45 volt dry battery by connecting the grid return lead of the 112 tube to the proper tap on the grid battery. In selecting the grid battery it is well to keep this possibility in mind and get one which is well provided with taps.

Mounting Advice

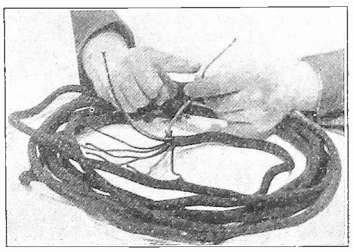
The layout of the Victoreen Power Amplifier and Power Supply Unit is shown in the photograph. In the left rear is the Victoreen power transformer and just below it are the two sockets for the two 216-B rectifier tubes. In the middle of the back row are the Tobe condensers which constitute a part of the filtering system. Just in front of the condensers are the two choke coils (the Victoreen 216 choke unit). A close inspection of this unit will reveal that the Victoreen 316 resistance unit is mounted over this choke unit. At the right of the choke unit are the two sockets of the power tubes and next to the sockets is the Victoreen 112 transformer unit. The assembly of the power amplifier is very compact and all leads are short and direct.

The Victoreen 115 output choke is mounted in the upper right corner and the stopping condenser in series with the speaker is mounted between that and the Victoreen audio transformer unit.

The binding post strip is at the extreme right of the assembly. It contains terminals for plus A and minus A, minus B, detector plus B, power plus B, two for the loud speaker and one for the input. The plate of the detector should be connected to this terminal.

The Victoreen power supply and power amplifier unit is mounted on a ¼ inch aluminum plate 18½ by 11½ inches. This not only serves as a support for the unit but it also serves as a shield and as a heat dissipator. There is always a little heat generated in a power supply unit and aluminum is one of the best conductors of heat.

(*See Oct. 15 and 22 issues.*)



(Hayden)

In a battery cable there is considerable capacity between the various conductors. This capacity minimizes the pick-up to which the cable is subject. The pick-up can be still further decreased by grounding one of the conductors in the cable. This facilitates the by-passing effect and helps to stabilize the circuit.

WEAF Now Sending from Bellmore Plant

The 50 kw transmitter at Bellmore, L. I., which tested under the call letters 2 XZ, has replaced WEAF's 5000-watt transmitter at 463 West Street, New York City. The new management began October 10.

The transmitter received its first public test from WEAF's studio on Sunday morning, August 28, being heard continuously for twelve hours. Previous tests, transmitting portions of WEAF's evening programs from its studio or regular remote control points, were made early in September. Graham McNamee's description of the Tunney-Dempsey fight on Thursday evening, September 22, was broadcast through the new transmitter.

The Completion of the Winner

By Lewis Winner

Technical Editor; Associate, Institute of Radio Engineers

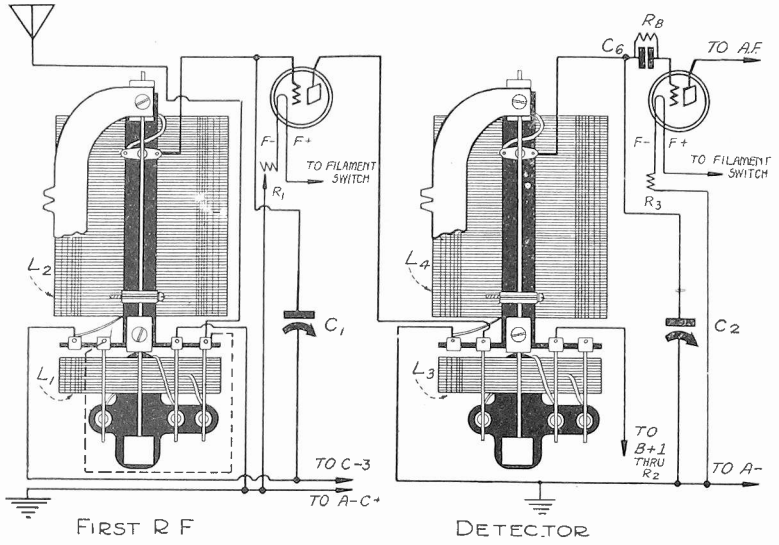


FIG. 7

The exact wiring of the first radio frequency amplifier and the detector circuit is clearly shown in the above picture diagram.

[*Part I of this article appeared in the Oct. 1 issue. Part II was published in the Oct. 8 issue. Part III appeared in the Oct. 15 issue. Part IV was published last week, Oct. 22 issue. Part V the conclusion follows.*]

THE remaining connections in the RF can are then made. The first lug from the rear on the strip of the RF coil is connected to the antenna post on the strip, via a lead run through the lower left (rear) of the RF can. A lead from the terminal right in front of it, or second from the rear on the strip, is run through a hole close to the one carrying the antenna connection, to the ground post on the strip.

One Terminal Unconnected

The same lead is connected to the minus A lead on the rheostat R1. The next terminal is left unconnected. The last one is connected to the rotary plate post of the condenser C1, in this can, and also to a flexible lead, which should be labelled, "C minus RF." This lead is brought out through a large hole in the upper left side of this can. There is one more connection to make on this coil and that is to the grid. The coil terminal will be found on a fibre strip, near the bottom of the frame carrying the movable rod.

The stationary plate post is also connected to this terminal. Through the large hole, through which the C battery connection as been brought, run a nut and bolt with a washer. Scrape off some insulation on the lead so that it makes contact with this nut and bolt. Tighten so that positive contact is made between the metal can and the lead. This is exemplified in Fig. 8. It will be noted that the shield in this way becomes grounded through the C battery.

Detector Connections

The remaining connections in the detector circuit are next attended to. A lead is brought from the front contact on the strip of the detector coil to the rotary plate post of the variable condenser C2, in this can, and also to the can through a wood screw on the right holding the bottom of the can to the sides. A lead is brought from another wood screw which holds the bottom of the can to the ground post. Two terminals still remain unconnected, one being the tap on the primary and the other on the secondary. The tap on the primary is left unconnected, while the secondary connection, which is near the bottom of the sliding rod is brought to a terminal of the girdleak-condenser R8C6 combination, as well as the stationary post of the variable condenser in the can. The other side of the condenser-leak combination is brought to the G post on the socket, with the aid of a stiff piece of bus bar.

The A minus is, of course, also connected to the shield, the lead being made directly from the low side of the ballast R3, in this can, which already has been connected to the minus A.

Now from the minus F post on the detector socket, a lead is brought, through a hole in the lower left hand side of the front part of the detector can to a terminal on the .5 mfd. fixed condenser C12. The other terminal of this condenser is connected to a rod on the plug, which you should label, "B plus 2."

Through a hole in the left side of the detector can bring a lead from det. plate to the RF choke. This same terminal is also connected to a terminal on one of the bridged .00025 mfd. condensers. From the common connecting point of these condensers, e.g., the point where the condensers are held together with a screw to the baseboard, a lead is brought to the minus F post on the detector socket. This lead is also brought through a hole in the left side of the detector can.

Audio Wiring

We are now ready to wire the audio side. The fixed condensers alongside of the transformers will hide the markings on the transformers. It is, therefore, important that the following data are followed. If the transformers are so placed that the words, "1st stage," and "2nd stage," are to the right, the P and G posts will be at the rear, or towards the baseboard, the B and P posts being near the cans. If the transformers are so placed that the words, "1st stage," and "2nd stage," appear to the left, then the P and G posts will be towards the can, while the B and F posts will appear towards the rear of the baseboard. The P post is on the same side as the B post, while the G post is on the same side as the F post. For easier wiring, it is best to place the AFT, so that the F and B posts are towards the can.

The unconnected post of the RF choke is brought to the P post of the first audio frequency transformer as well as the unconnected terminal of the bridged condensers, C4C5. The B post of this transformer is then connected to the rod on the plus plug marked, "B plus 2." This is the same terminal to which the .5 mfd. fixed condenser was connected.

The G post on this first audio transformer is connected to the G post of the first audio tube socket. The F post of this transformer is connected to a terminal on a 1 mfd. fixed condenser C7, and also to a terminal of the .1 megohm grid leak R6. The other terminal of this leak is connected to a flexible lead which should be labelled "C minus first AF." The other terminal of the 1 mfd. fixed condenser is connected to the F minus post on the first audio socket. Another lead is brought from this point to a terminal on another 1 mfd. fixed condenser C8. The other terminal of the condenser is connected to the B post on the second audio transformer, which lead is also continued on to a rod on the plug. This lead should be labelled "B plus 3." The P post on this AFT is connected to the plate post of the first audio tube socket. The G post on the AFT is connected to the G post of the second audio socket.

The F post of this AFT is connected to terminal of a 1 mfd. fixed condenser C9, and to a terminal of the resistor R7.

The other terminal of R7 is brought to a rod on the plug, this being labelled "C minus last AF." The other terminal of C9 is connected to the F minus post of the last audio socket. It is also connected to a terminal on the 1 mfd. fixed condenser C10. The other terminal of this condenser is connected to a terminal of the output choke coil OC, this lead also being connected to the last rod on the plug, which should be labelled "B plus 4."

The other terminal of the choke oil is connected to the plate post of the last audio socket and to a terminal of the 4 mfd. fixed condenser C11. The other terminal of this condenser is connected to a phone tip jack on the plug. The remaining phone tip jack on the plug is connected to the minus A post on this plug.

Wiring for AC Power Tube

Now, there are two posts on the strip, which have not, as yet, been connected anywhere. One post is connected to the F minus post of the last audio socket, while the other is connected to the F plus post of the last audio socket. They are for connection to an AC source, when

(*Concluded on next page*)

Fixed Resistors Starred

Only during the past two years has the fixed resistor assumed its present role of importance in radio work. It is true that fixed resistances had been used, but they were of a type that limited their value to circuits where small loads were imposed. Carbon coated paper and the composition resistor practically dominated the radio field.

The radio public first had its attention called to the importance and value of efficient resistors when the current supply unit and high voltage power amplifier came into widespread popularity. The average experimenter began a search far and wide to find a resistor suitable for this type of work, for he realized that makeshift and inaccurate resistors would not stand up in this service.

Development Work Dates Far Back

No one who has an intimate knowledge of power amplifier equipment and power supply units will question the statement that the resistor, in the last analysis, is the determining factor in the performance of units of this type. The resistor is called upon to absorb voltage surges when tubes are shifted in the receiver while the current to the supply unit is still on. Fluctuations in the incoming line voltage may place an added load on a resistor, which it must carry. Other factors unite to place on the resistor the burden of keeping the power supply unit working at normal, even though outside factors may impose severe and abnormal conditions on it.

That certain resistors have reached their present high state of perfection is no matter of chance or casual planning and production. Although the public has given serious attention to the applications and many uses of resistors in radio work for but a few years, electrical engineers have used and studied resistors extensively even prior to 1890. Many different types of winding were tried, many kinds of binding material were used to coat the wound wire, hundreds of varied methods were worked on to produce a resistor which would give constant, unfailing service without change in resistance value.

Years before fixed resistors were used for radio work, the electrical industry settled the question and adopted a wire-wound type of resistor with the wire embeded in enamel as the resistor which would not deteriorate or change in value with long and constant use.

Early Development Work

A number of methods had been tried prior to 1890 whereby a metallic conductor could be operated as a resistance at high temperature, thus reducing its bulk for a given dissipation. In many of these experiments was the germ of what is now one of the most popular and efficient resistors—a wire protected by a vitreous enamel, so that the wire could be used without exposure to air, which would cause it to oxidize.

Among these early experimenters was Albert T. Herrick, who tried among other materials plaster of paris and portland cement as the insulator binder. He found, however, that the dissipation was reduced. The silicate and sulphates from these substances also combined with the wire at high temperatures, and eventually destroyed the resistance element.

Embedded Type the Solution

Many substances were tried as electrical insulating and binding material to prevent the chemical action of the air on the resistive material. The difficulty lay in eliminating the spaces of dead air between wire and binder. Practically all substances seemed to enter into combination with the wire, as Herrick found. In addidtion to this, most of the materials were brittle and moisture-absorbing. They were also apt to cause ruptures in the resistance wire, due to differences in the expansion coefficients between the binding material and the wire. The problem before research men working was to find an insulator-binder which would protect the resistance wire, yet make intimate bond with it, thereby eliminating dead air space between wire and binder. At the same time, the binder must not destroy or affect the resistance wire. Further, it must be impervious to moisture and all other atmospheric actions.

It remained for H. Ward Leonard to perfect, thirty-five years ago, an embedded type resistor which others had sought in vain, and which was free from the disadvantages considered inherent in earlier type resistances. Since that time, the fixed resistor has found dozens of new and valuable uses, including its many applications to radio work.

Directions for Operating the Winner

(*Concluded from page* 8)

a 210 tube is used in the last stage of audio. The AC winding is connected across these posts, the grid return being made to the minus post of a C battery. The center tap on the AC winding is brought to the plus post of the C battery. By taking out the ballast resistor R5 in the last filament stage, the battery circuit for this tube is broken, thus there is no connection between the battery and the AC side.

Use Flexible Wire

Flexible wiring should be used throughout this set, except in one case and that is where the grid leak and condenser is connected to the grid post on the detector socket. Where soldering is necessary, be sure that the lead is held in place by solder, not paste or rosin. All plate and grid wires should be kept away from each other and run at right angles. The A lines can run parallel though. After the receiver is wired and a careful mechanical as well as electrical inspection has been made, the batteries should be connected. The first RF tube should receive 90 volts, it being possible to use this voltage due to the resistance in the plate lead of this tube, which drops the voltage. To the plate of the detector tube, apply 45 volts. To the plate of the first audio tube apply 135 volts, while the last tube, it being a 112, using dry B batteries, gets 157½ volts. The C bias for the RF tube is from 1½ to 3. The first audio C bias is 9, while the C bias for the last tube is 10½. The C battery for the RF tube is placed in front of the rheostat R1, while the C battery for the first audio tube is placed near the strip carrying the antenna and ground connections. The C battery for the last audio tube is placed outside. Don't use three C batteries connected up in series for the C biases. Each bias should come from a separate source.

Operating the Set

The battery terminal connections are made to the leads of the cable connector, care being taken as to get the voltages according to the labels on the plug. The plug is then attached and the tubes inserted. Be sure that the A and B leads are running to their proper places, this being made certain with a small C battery and phones.

Before turning on the switch, the dials should read zero. Also the left hand rheostat should be placed one-half the way up, while the right hand knob should be placed in the same position. Now turn on the switch. Turn the control knobs slowly to the right, the left one a degree ahead of the right one. Signals should come rolling in with full volume. The volume is controlled with the right hand knob at this point. Until you reach 50 on the dials, the position of the left hand knob remains the same. When tuning in below this point, turn this knob so that it is one quarter of the way up.

Special Antenna Allowance

If you have an average-sized antenna, say about 75 feet, then connections to the primary of the coil stand. However, should you have a longer antenna, the antenna should be connected to the unconnected terminal of the first coil, severing the other antenna connection.

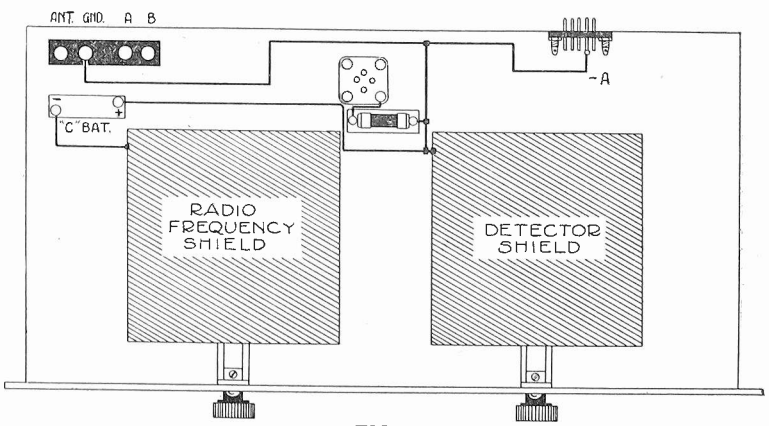


FIG. 8

How the ground connection is made to the shields.

An Electric Push-

Transformers Are Adapted to this Use By Equally Divided Resistance Across Secondaries—Two 71 tubes in Output for Fine Quality Under Heavy Volume

By J. E. Anderson

Contributing Editor

MOST of the present development in receivers is concentrated in the audio end of the circuit. Amplifiers are being designed which can handle great power without overloading, which will amplify the low notes as well as the middle, the high as well as, but no better than, the low. Amplifiers are being designed to work on alternating current exclusively without any hum and without any service troubles. Amplifiers are being designed which will operate the best cone and exponential horn speakers in a manner which makes the reproduced music superior, in some respects, to the original.

The new AC tubes play an important role in the new development as do power tubes of the 71 and 10 types.

One of the new AC tubes that is particularly attractive to the designers is the 27 type. This has a cathode or electron emitting member which is entirely separate from the filament and which is heated by radiation from the heated filament. The filament of this tube can be heated with alternating current without danger of hum. The only way that hum can be introduced in the signal in this tube is the cooling of the filament, and hence of the cathode while the alternating current is zero or below the effective value. Since alternating current of 60 cycles reaches its maximum heating effect 120 times a second, there is little chance of the cathode cooling appreciably in between maxima. This chance is greatly reduced by the fact that all the elements of the tube are in a vacuum so that there can be no loss of heat by convection.

Excellent Amplifier

As the heater type of tube as exemplified in the 27 model is an excellent amplifier as well as a detector it is particularly suitable as the first audio tube in a power amplifier. It is large enough to handle voltages which will overload two 71 type tubes in push-pull relation without itself becoming overloaded. And it steps up the voltage impressed on it so that it will never be necessary to overload the detector feeding it. This is the ideal condition of adjustment in an audio amplifier. The last stage is the weakest link, as far as overloading is concerned, yet that stage is so powerful as to handle more volume than will ever be required of it.

In the accompanying drawing is shown an amplifier which is capable of unequalled quality in tremendous volume, and which contains no batteries. The plate voltage is obtained from a B battery eliminator, the filament current is obtained from two windings on a heating transformer, and the grid bias is obtained from voltage drops in resistances suitably placed in the supply circuit.

AF1 is a high grade transformer capable of even amplification over the audible scale when connected to an ordinary detector tube, or to some signal source of lower impedance. There are a number of types now available to the radio fan.

Across the secondary of the transformer is a 500,000 ohm potentiometer P1 for controlling the volume, in case adequate means have not been provided in the radio frequency amplifier. The potentiometer P1 is especially convenient for controlling the volume when the circuit is used to amplify phonograph pick-up.

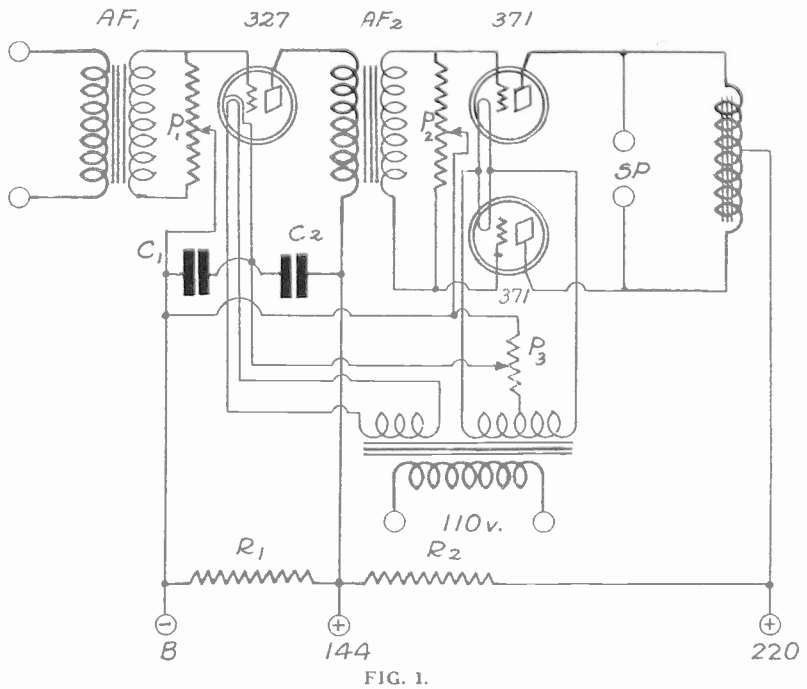


FIG. 1.

The circuit diagram of a two stage, push-pull power amplifier using one —27 tube and two —71 type tubes. No batteries are used in the circuit.

The Heater Tube

Now we come to the heater type tube, the five-element tube. The filament of this tube is connected across the 2.5 volt winding on a step-down transformer. The leads from the transformer should be made of wire heavy enough to carry at least 2 amperes and they should be carefully twisted all the way. It would be desirable in addition to use a grounded shield around the leads.

Two condensers C1 and C2 are connected across the grid return and the cathode and across the plate and the cathode. They serve to by-pass ripple currents across the grid bias resistor and the plate supply. The larger these condensers are the better. They should not be smaller than 2 mfd. each.

While there is more to be said about the first stage let us defer the discussion until we have considered the last stage.

Between the first tube and the last stage is another high grade transformer, AF2. This may be a push-pull input transformer but it is not shown as such in the drawing. An ordinary coupling transformer is indicated and the secondary voltage is divided equally between the two push-pull power tube by means of a potentiometer P2. The total resistance of this potentiometer should be about one megohm and the tap should be taken off at the center. Now it may be that a one megohm potentiometer cannot be obtained. Neither can two equal fixed resistors be obtained without a great deal of search.

Compensate for Differences

This is one way of getting around the difficulty. Use two .25 megohm resistors on either side of a ½ megohm potentiometer. Differences in the two ¼ megohm resistors can be compensated for by the ½ megohm potentiometer in the middle. Differences in the tubes used and the output impedances can also be compensated for with this potentiometer.

The loud speaker is connected from plate to plate of the two push-pull tubes. An inductance coil or audio frequency choke, tapped in the middle is used to supply the plate voltage to the two tubes. The inductance of this coil should be over 100 henrys, and it should be wound with wire which will cause a negligible voltage drop when 20 milliamperes flow through it. Such chokes can be obtained. However, if difficulty should be experienced in finding such inductances two separate and equal chokes can be used.

The filament current for the two push-pull tubes is derived from a five-volt secondary on the heating transformer. This winding should be able to carry one ampere or more. As in the case of the —27 tube the leads from the transformer to the filaments should be made of twisted wire and preferably shielded.

The grid bias for the two push-pull tubes

Pull Audio Channel

LIST OF PARTS

AF1, AF2—Two transformers.
P1—One ½ megohm potentiometer.
P2—One ½ megohm potentiometer and two .25 megohm fixed resistors.
P3—One 1,000 ohm potentiometer or a potentiometer of 2,000 ohms with two sliders.
C1, C2—Two 2 mfd. by-pass condensers, or larger.
L—One high inductance output choke center tapped, or two output chokes of equal value.
R1, R2—One tapped resistor of 10,000 ohms with tap at 6540 ohms.
One heating transformer with one 2.5 volt winding, and one 5 volt center tapped winding.
One —27 type socket.
Two UX sockets.
Seven binding posts.
Heavy twisted wire for filament circuits.

is derived from the voltage drop in the resistance of potentiometer P3 connected in the plate return to the two tubes, that is, to the midpoint of the five volt winding. The value of this resistance should be 1,000 ohms to give the proper bias to the 71 type tubes when the plate voltage is 180 volts.

The grid bias for the 27 tube is also derived from the same resistor. The slider of the potentiometer P1 is connected to the most negative point in the eliminator. The cathode of the 27 tube is connected to a suitable point on potentiometer P3. Any desired bias between zero and 40 volts can be obtained by adjusting the slider on P3. Since the plate voltage on the first tube is 135, a bias of 9 volts is desired on the grid of the tube. The current flowing through P3 is 40 milliamperes. Hence the resistance between B minus and the slider on P3 should be 225 ohms to give the 9 volt bias.

If there is any unbalance in the push-pull stage there will be a signal voltage across this 225 ohm portion of P3, and this will be added to the input on the first tube. This will react unfavorably on the operation of the circuit and may lead to distortion. This can be remedied to a certain extent by increasing the size of condenser C1. But a better way of minimizing the possible trouble is to balance the push-pull stage.

The tap on the 5 volt winding should be strictly in the middle. Similarly the tap on coil L should be in the middle. The two 71 type tubes should be as nearly alike as possible. But in any practical case the chances are that there will be some unbalance. This can be removed by adjusting the slider on P2.

One way of testing whether the last tube is balanced well is to connect an amplifier tube so that its grid circuit is across C1 with the grid to B minus and the filament to the cathode. This test tube should be supplied with filament and plate voltages from an independent source, such as small batteries. It can well be a 99 type tube. A telephone headset is connected in the plate circuit of the small test tube.

Now when there is no signal on the amplifier but with all the power turned on, any unbalance will reveal a slight hum which is composed mainly of 60 and 120 cycle frequencies. The probability is that this is so small that it will be barely audible in the headset, and if it is, it will not be loud enough to make itself heard in the loud speaker.

Technical Analysis

Now suppose a signal of normal intensity is impressed on the grid of the first tube. Any unbalance in the push-pull circuit will now show up in the form of a rather strong signal tone in the headset. This tone can be increased by moving the slider of P2 away from the electrical center. At one point the intensity will be zero or a very low minimum. If this balance point is not found on the potentiometer resistance, the two —71 tubes are hopelessly unlike.

The resistance element of P3 must stand at least 100 milliamperes in continuous service.

The bias for the first tube could be obtained in another way. For example, the cathode could be connected to a suitable point on resistor R1 with the grid return left where it is. There would be no difference in the results, but the method shown is somewhat simpler because a suitable potentiometer can be obtained for P3.

The voltage across the eliminator which supplies the plate power should be 220 volts. This voltage is divided in the radio 40 to 180 between the grid and the plate circuits of the power tubes.

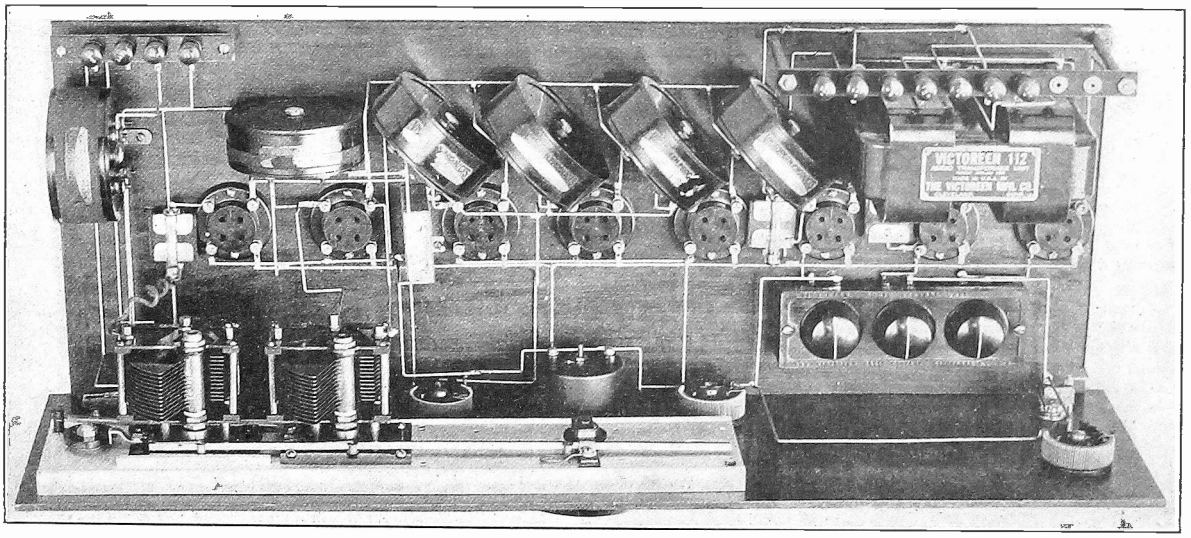
The effective voltage on the plate of the -27 tube is 135 volts with 9 volts on the grid. Hence the plate return from the -27 tube should go to a point on the output potentiomeer R1R2 which is 144 volts above the negative terminal. Since the total voltage is 220 the ratio of R1 to R2 must be 144 to 220-144, or 144 to 76. Or R1 must be 144 over 220 of the sum of the two resistors, that is, .654 of the total.

The total value of the sum of R1 and R2 would depend on the output voltage of the eliminator and on other loads. But suppose that the voltage is 220 and the resistance is 10,000 ohms. The total current through R1 and R2, neglecting the plate current in the first tube, would be 22 milliamperes. This is so large that the plate current in the first tube may be neglected in comparison. Then R1 should be 6,540 ohms and R2 should be 3,460 ohms.

It is probable that a commercial voltage divider having this ratio cannot be obtained. But it is not necessary to cling to the exact values given above. Instead of using a tapped 10,000 ohm resistor, one of 10,000 ohms and another of 5,300 ohms can be used. These bear the correct relation to each other.

The voltage output of an eliminator depends on the current that is drawn from it as well as on the type of rectifier and input voltage. If the voltage across the output is more than 220 when about 50 milliamperes flow it is usually possible to bring it down to the correct value by putting a variable resistance across the line, in parallel with R1 and R2 and adjusting it until the total current drawn from the eliminator is such that the voltage is that specified.

Numerous advantages of an amplifier like this can be pointed out. The first is that batteries are entirely eliminated. Hence there is no battery troubles to worry about. There will be no corroded contacts, no interruption of service due to run down batteries. The net advantage is unequalled quality.



AN EXCELLENT view of the 1928 Victoreen Universal.

HIS VOICE CONQUERS

NORMAN SWEETSER, one of the popular announcers of WJZ. His voice is also heard through many other stations that tie in with the chain of the National Broadcasting Company.

TRAIN CONTROL BY RADIO

Washington.

Adoption of radio for the control of railroad trains was predicted in a recent speech by the Chairman of the Federal Radio Commission, Admiral W. H. G. Bullard, delivered before the Telegraph and Telephone Section of the American Railway Association. Admiral Bullard said that the use of radio in the operation of trains is a feasible proposition and should be developed. He pointed out that the idea was first broached about 12 years ago, and that the now perfected invention makes it possible to utilize the device as a considerable saving.

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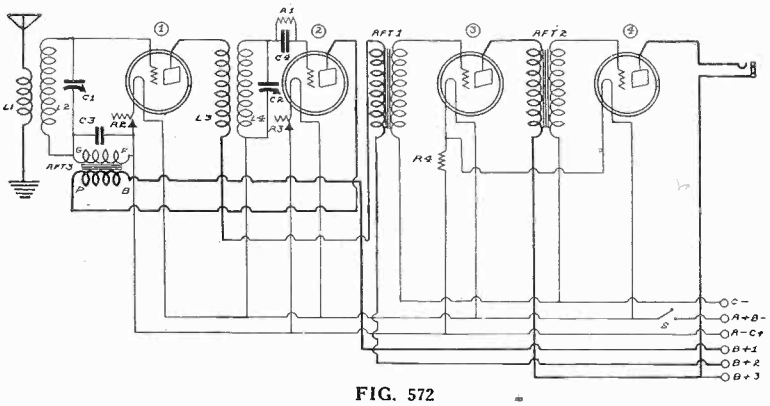

FIG. 572

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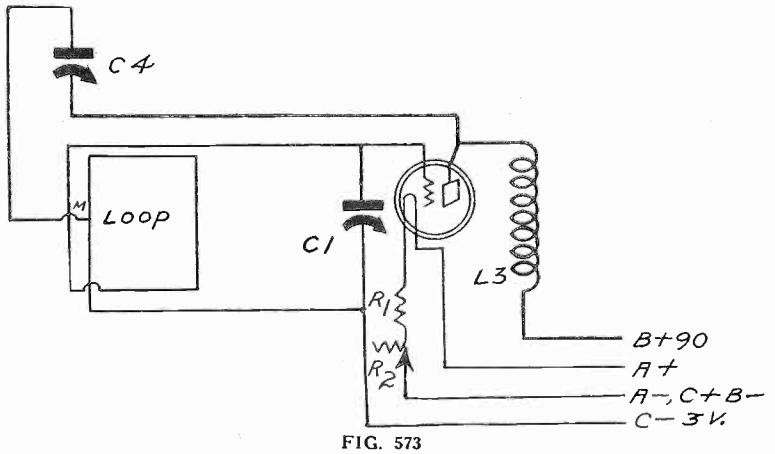

FIG. 573

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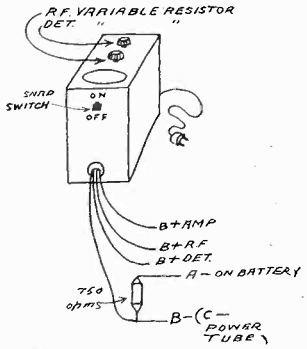

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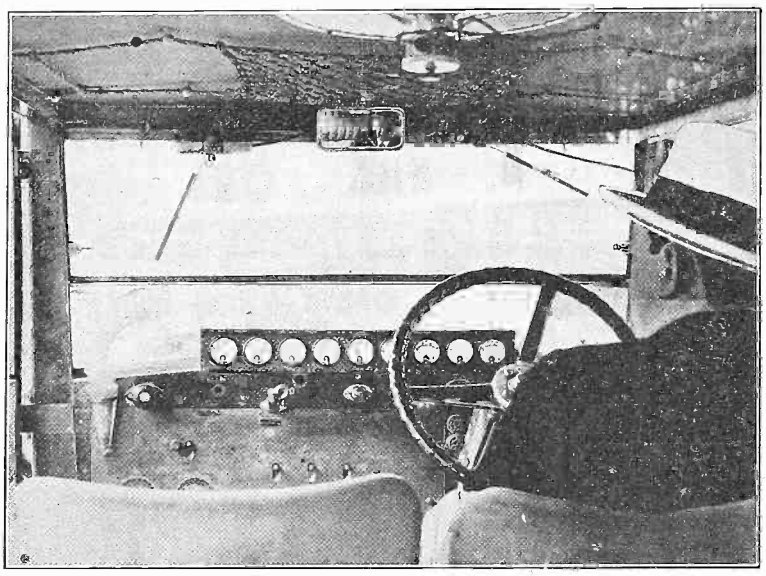

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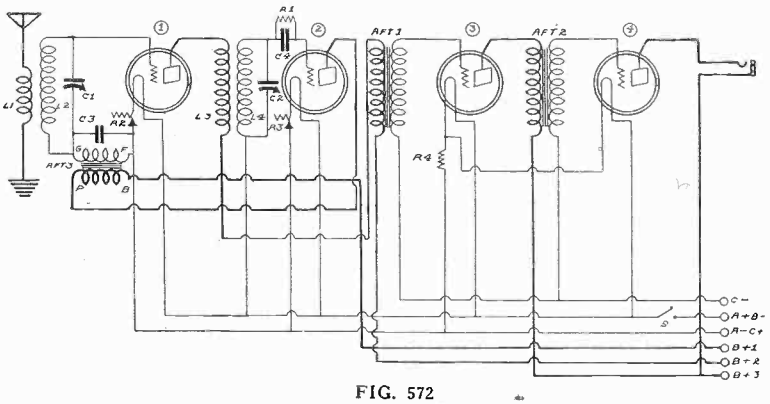

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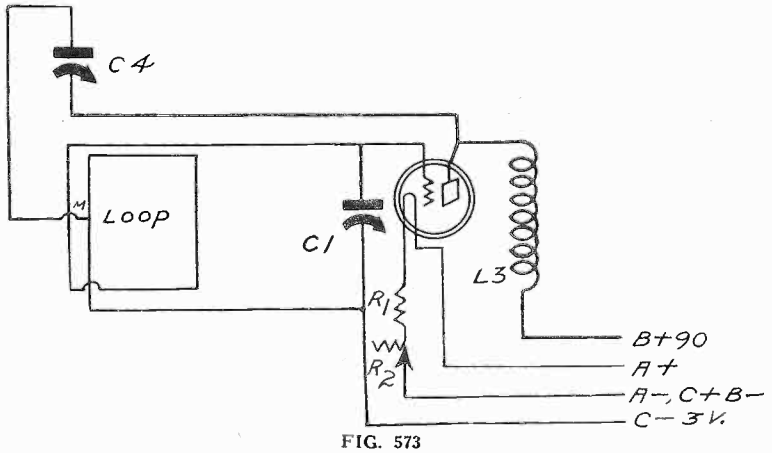

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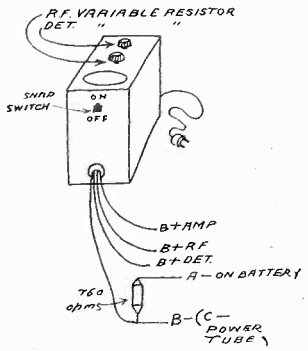

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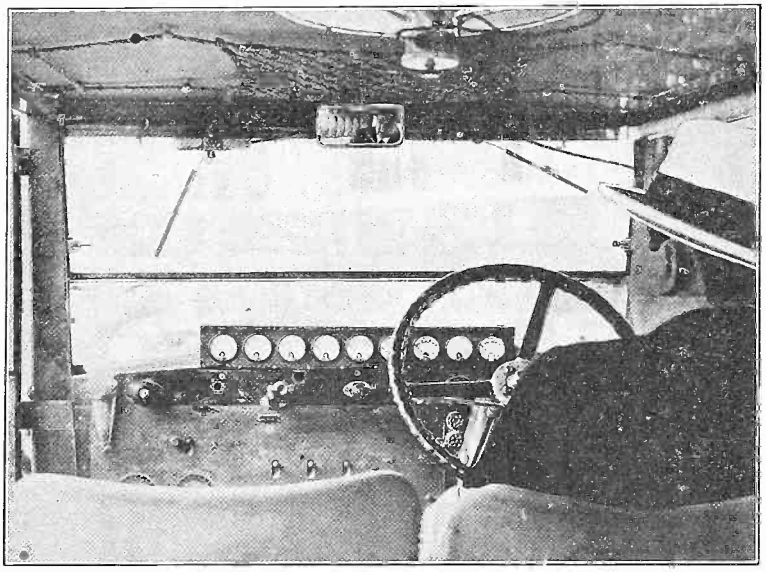

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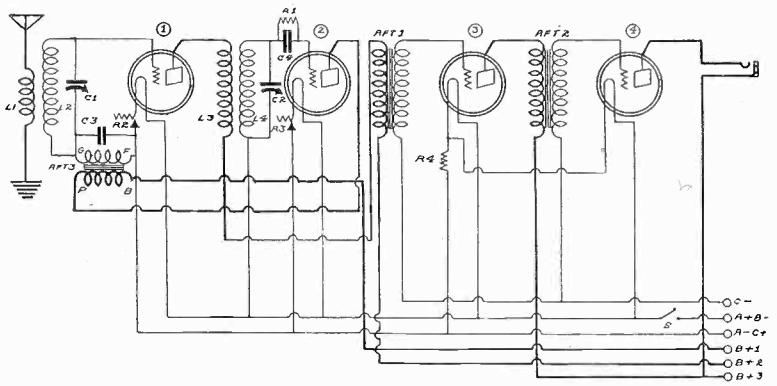

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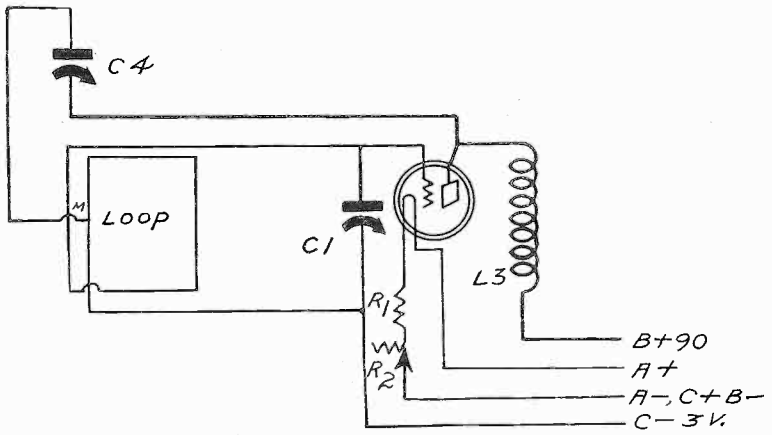

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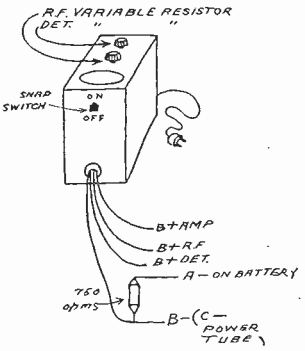

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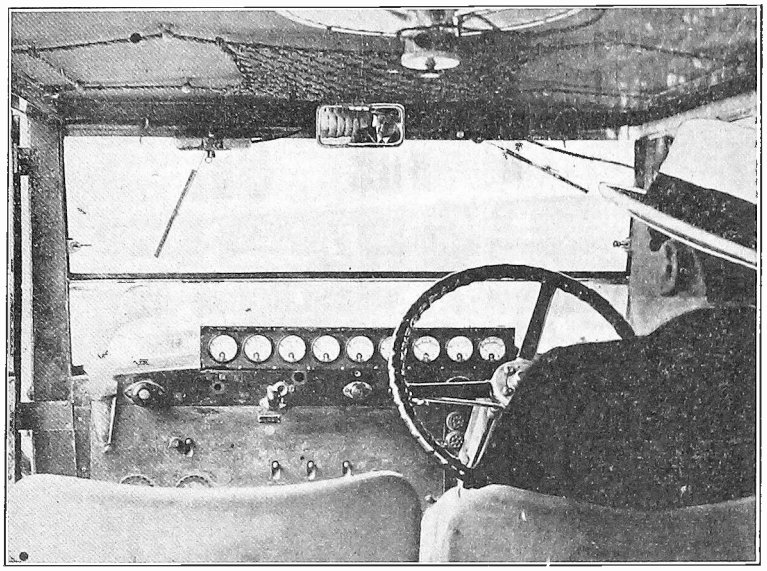

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WAAM—Newark, N. J. (WGBS)	860	348.6	500
WAAT—Jersey City, N. J. WGBB and WEVD)	1220	245.8	300
WAAW—Omaha, Neb. (6 to 7 only).	860	348.6	500
WABC—Richmond Hill, N. Y. (WBOQ)	920	325.9	2,500
WABF—Pringleboro, Pa.	1460	205.4	250
WABI—Bangor, Me.	770	389.4	100
WABQ—Philadelphia, Pa.	1410	212.6	500
WABW—Wooster, O.	1210	247 8	50
WABY—Philadelphia, Pa.	1210	247.8	50
WABZ—New Orleans, La.	1210	247.8	50
WADC—Akron, O.	1250	239.9	1,000
WAFD—Detroit, Mich. (WMBC)	1230	243.8	250
WAGM—Royal Oak, Mich.	1330	225.4	50
WAGS—Somerville, Mass.	1390	215.7	5
WAIT—Taunton, Mass.	1400	214.2	10
WAIU—Columbus, O. (WEAO)	1060	282.8	5,000
WALK—Bethayres, Pa. (Portable)	1490	201.6	50
WAMD—Minneapolis, Minn.	1330	225.4	500
WAPI—Auburn, Ala. (daytime only)	940	319	1,000
WARS—Brooklyn, N. Y. (WSDA, WBBC)	1320	227.1	500
WASH—Grand Rapids, Mich.	1170	256.3	250
WASN—Boston, Mass.	990	302.8	100
WATT—Boston, Mass.	1490	201.6	100
WBAA—West Lafayette, Ind. (WRM)	1100	272.6	500
WBAK—Harrisburg, Pa. (WPSC)	1000	299.8	500
WBAL—Baltimore, Md.	1050	285.5	3,000
WBAO—Decatur, Ill.	1120	267.7	100
WBAP—Fort Worth, Tex. (WFAA)	600	499.7	1,500
WBAW—Nashville, Tenn.	1210	247.8	100
WBAX—Wilkes Barre, Pa. (WBRE)	1200	249.9	100
WBBC—Brooklyn, N. Y. (WARS, WSDA)	1320	227.7	500
WBBL—Richmond, Va.	1210	247.8	100
WBBM—Glenview, Ill. (WUBT, WAAF, WORD)	770	389.4	5,000
WBBP—Petoskey, Mich.	1250	239.9	100
WBBR—Rossville, N. Y. (WJBI, WLTH, WEBJ)	1170	256.3	1,000
WBBW—Norfork, Va.	1270	236.1	50
WBBY—Charleston, S. C.	600	499.7	75
WBBZ—Chicago, Ill. (Portable)	1470	204.0	100
WBCN—Chicago. Ill (WENR)	1040	283.3	500
WBES—Takoma Park, Md.	1010	296.9	100
WBET—Boston, Mass	1240	241.8	500
WBKN—Brooklyn, N. Y. (WWRL, WIBI, WBMS)	1120	267.7	100
WBMH—Detroit, Mich.	1420	211.1	100
WBMS—Union City, N.J. (WBKN, WWRL, WIBI)	1120	267.7	100
WBNY—New York City, N. Y. (WKBQ, WKBO)	1370	218.8	500
WBOQ—Richmond Hill, N. Y. (WABC)	920	325.9	500
WBRC—Birmingham, Ala.	1230	243.8	250
WBRE—Wilkes-Barre, Pa. (WBAX)	1200	249.9	100
WBRL—Tilton, N. H.	650	461.1	500
WBRS—Brooklyn, N. Y. (WCDA, WCGU, WRST)	1420	211.1	100
WBSO—Wellesley Hills, Mass. (WDWF)	780	384.4	100
WBT—Charlotte, N. C.	1160	258.5	500
WBZ—Springfield, Mass.	900	333.1	15,000
WBZA—Boston, Mass.	900	333.1	500
WCAC—Mansfield, Conn. (WDRC)	560	535.4	500
WCAD—Canton, N. Y.	820	365.6	500
WCAE—Pittsburgh, Pa.	580	516.9	500
WCAH—Columbus, Ohio	560	535.4	250
WCAJ—Lincoln, Neb. (KMMJ)	790	379.5	500
WCAL—Northfield, Minn. (KFMX)	1270	236.1	500
WCAM—Camden, N. J.	1340	223.7	500
WCAO—Baltimore, Md. (WCBM	780	384.4	250
WCAT—Rapid City, S. D.	1210	247.8	100
WCAU—Philadelphia, Pa.	890	336.9	500
WCAX—Burlington, Vermont	1180	254.1	100
WCAZ—Carthage, Ill.	880	340.7	50
WCBA—Allentown, Pa. (WSAN)	1350	222.1	100
WCBD—Zion, Illinois (WLS)	870	344.6	5,000
WCBE—New Orleans, La.	1320	227.1	5
WCBM—Baltimore, Md. (WCAO)	780	384.4	100
WCBR—Providence, R. I. (Portable)	1490	201.6	100
WCBS—Springfield, Ill.	1430	209.7	250
WCCO—Minneapolis, Minn.	740	405.2	5,000
WCDA—Brooklyn, N. Y. (WRST, WBRS, WCGU)	1420	211.1	500
WCFL—Chicago, Ill. (WLTS)	620	493.6	1,500
WCGU—Coney Island, N. Y. (WCDA, WBRS,WRST)	1420	211.1	500
WCLO—Camp Lake, Wisc.	1320	227.1	100
WCLS—Joliet, Ill. (WKBB)	1390	215.7	150
WCMA—Culver, Ind.	1160	258.5	250
WCOA—Pensacola, Fla.	1200	249.9	500
WCOC—Columbus, Miss.	1300	230.6	250
WCOT—Olneyville, R. I.	1330	225.4	50
WCRD—Chicago, Ill. (WFKB & WPCC)	1340	223.7	500
WCSH—Portland, Me.	700	428.3	500
WCSO—Springfield, Ohio	1170	256.3	500
WCWK—Fort Wayne, Ind.	1400	214.2	250
WCWS—Bridgeport, Conn. (Portable)	1490	201.6	100
WDAD-WLAC—Nashville, Tenn.	1330	225.4	1,000
WDAE—Tampa, Fla.	1120	267.7	500
WDAF—Kansas City Mo.	810	370.2	1,000
WDAG—Amarillo, Texas	1140	263.0	250
WDAH—El Paso, Texas	1280	234.2	100
WDAY—Fargo N. Dak.	830	361.2	250
WDBJ—Roanoke, Va.	1300	230.6	250
WDBO—Orlando, Fla.	1040	288.3	500
WDBZ—Kingston, N. Y. (WOKO).	1390	215.7	50
WDEL—Wilmington, Del.	1130	265.3	100
WDGY—Minneapolis, Minn. (WRHM)	1150	260.7	500
WDOD—Chattanooga, Tenn.	1180	254.1	500
WDRC—New Haven, Conn.	1090	275.1	250
WDWF—Cranston, R. I. (WBSO).	780	384.4	500
WDWM—Newark, N. J. (WHAP, WMSG)	1270	236.1	500
WDZ—Tuscoa, Ill. (Daytime only).	1080	277.6	100
WEAF—N. Y. City	610	491.5	50,000
WEAM—North Plainfield, N. J.	1250	239.9	250
WEAN—Providence, R. I.	1130	265.3	500
WEAO—Columbus, O. (WAIU)	1060	282.8	750
WEAR—Cleveland, O. (WTAM)	750	399.8	1,000
WEBC—Superior, Wisc.	1240	241.8	250
WEBE—Cambridge, Ohio	1210	247.8	10
WEBH—Chicago, Ill. (WJJD)	820	365.6	2,000
WEBJ—New York, N. Y. (WJBI, WLTH, WBBR)	1170	256.3	500
WEBQ—Harrisburg, Ill.	1340	233.7	15
WEBR—Buffalo, N. Y.	1240	241.8	200
WEBW—Beloit, Wisc.	1160	258.5	500
WEDC—Chicago, Ill. (WCES)	1240	241.8	500
WEEI—Boston, Mass.	670	447.5	500
WEHS—Evanston, Ill.	1390	215.7	100
WEMC—Berrien Springs, Mich.	1260	238.0	1,000
WENR—Chicago, Ill. (WBCN)	1040	283.3	500
WEPS—Gloucester, Mass.	1010	296.9	100
WEVD—Woodhaven, N. Y. (WAAT and WGBB)	1220	245.8	500
WEW—St. Louis, Mo.	850	352.7	1,000
WFAA—Dallas, Texas (WBAP)	600	475.9	500
WFAM—St. Cloud, Minn.	1190	252	10
WFBC—Knoxville, Tenn.	1280	234.2	50
WFBE—Cincinnati, O. (WKRC)	1220	245.8	250
WFBG—Altoona, Pa.	1070	280.2	100
WFBJ—Collegeville, Minn.	1100	272.6	100
WFBL—Syracuse, N. Y.	1160	282.8	750
WFBM—Indianapolis, Ind. (WTAS, WKBF)	1090	275.1	250
WFBR—Baltimore, Md.	1230	243.8	100
WFBZ—Galesburg, Ill. (WRAM)	1210	247.8	50
WFCI—Pawtucket, R. I.	1240	241.8	50
WFDF—Flint, Mich. (WSKC)	860	374.8	100
WFHH—Clearwater, Fla.	820	365.6	500
WFI—Philadelphia, Pa. (WLIT)	740	405.2	500
WFIW—Hopkinsville, Ky.	1220	245.8	500
WFKB—Chicago, Ill. (WCRW)	1340	223.7	500
WFKD—Philadelphia, Pa.	1460	205.4	10
WFLA—Boca Raton, Fla.	1410	212.6	1,000
WGAL—Lancaster, Pa. (WKJC)	1190	252.0	15
WGBB—Freeport, N. Y. (WEVD and WAAT)	1220	245.8	400
WGBC—Memphis, Tenn.	1080	277.6	15
WGBF—Evansville, Ind.	1270	236.1	250
WGBI—Scranton, Pa. (WQAN)	1300	230.6	100
WGBS—Astoria, L. I., N. Y. (WAAM)	860	348.6	500
WGCP—Newark, N. J. (WNJ)	1070	280.2	500
WGES—Chicago, Ill. (WEDC)	1240	241.8	500
WGHP—Mt. Clemens, Mich.	1230	243.8	1,500
WGL—New York, N. Y. (WODA)	1020	293.9	500
WGM—Jeanette, Pa.	1440	208.2	50
WGMU—New York, N. Y., Portable (WRMU)	1490	201.6	100
WGN—Chicago, Ill. (WLIB)	980	305.9	15,000
WGR—Buffalo, N. Y.	990	302.8	750
WGST—Atlanta, Ga. (WMAZ)	1110	270.1	500
WGWB—Milwaukee, Wisc.	1370	218.8	500
WGY—Schenectady, N. Y. (WHAZ)	790	378.5	50,000
WHA—Madison, Wisc. (WLBL)	940	319.0	750
WHAD—Milwaukee, Wis.	1110	270.1	500
WHAM—Rochester, N. Y.	1080	277.6	5,000
WHAP—New York, N. Y. (WDWM, WMSG)	1270	236.1	1,000
WHAR—Atlantic City, N. J. (WPG)	1100	272.6	750
WHAS—Louisville, Ky.	650	461.3	500
WHAZ—Troy, N. Y. (WGY)	790	379.5	500
WHB—Kansas City, Mo. (WOQ)	890	336.9	500
WHBA—Oil City, Pa.	1150	260.7	10
WHBC—Canton, Ohio	1270	236.1	10
WHBF—Rock Island, Ill.	1350	222.1	100
WHBL—Chicago, Ill. (Portable-Carrell)	1470	204.0	100
WHBM—Chicago, Ill. (Portable-Carrell)	1490	201.6	100
WHBN—St. Petersburg, Fla.	1010	296.9	10
WHBP—Johnstown, Pa.	1310	228.9	250
WHBQ—Memphis, Tenn.	1290	232.4	100
WHBU—Anderson, Ind.	1360	220.4	15
WHBW—Philadelphia, Pa. (WIAD)	1360	220.4	100
WHBY—West De Pere, Wisc.	1200	249.9	50
WHDI—Minneapolis, Minn. (WLB)	1220	245.8	500
WHEC-WABO—Rochester, N. Y.	1180	254.1	100
WHFC—Chicago, Ill.	1390	215.7	200
WHK—Cleveland, Ohio (WJAY)	1130	265.4	500
WHN—N. Y. City (WQAO, WPAP)	760	394.5	500
WHO—Des Moines, Iowa	560	535.4	5,000
WHPP—New York, N. Y. (WMRJ)	1450	206.8	10
WHT—Chicago, Ill. (WIBO)	720	416.4	5,000
WIAD—Philadelphia, Pa. (WHBW)	1360	220.4	50
WIAS—Burlington, Ia. (KICK)	630	475.9	100
WIBA—Madison, Wisc.	1250	239.9	100
WIBG—Elkins Park, Pa. (Sunday, day time only)	680	440.9	50
WIBI—Port Washington, N. Y. (WBKN, WWRL, WBMS)	1120	267.7	100
WIBJ—Chicago, Ill. (Portable-Carrell)	1490	201.6	100
WIBM—Chicago, Ill-Portable-Carrell)	1490	201.6	100
WIBO—Chicago, Ill. (WHT)	720	416.4	500
WIBR—Steubenville, Ohio	1200	249.9	50
WIBS—Elizabeth, N. J. (WTRC, WLBX, WMBQ)	1470	204	150
WIBU—Polynette, Wisc.	1380	217.3	20
WIBW—Chicago, Ill. (Portable-Carrell)	1470	204.0	100
WIBX—Utica, N. Y.	1260	238.0	150
WIBZ—Montgomery, Ala.	1300	230.6	15
WICC—Bridgeport, Conn.	1400	214.2	250
WIL—St. Louis. Mo. (WSBF)	1160	258.5	250
WIOD—Miami Beach, Fla.	1210	247.8	1,000
WIP—Philadelphia, Pa. (WOO)	590	508.2	500
WJAD—Waco, Texas	670	447.5	500
WJAG—Norfolk, Nebr.	1350	222.1	250
WJAK—Kokomo, Ind.	1280	234.2	50
WJAM—Cedar Rapids, Ia. (KWCR)	850	352.7	250
WJAR—Providence, R. I.	620	483.6	500
WJAS—Pittsburgh, Pa. (KQV)	1110	270.1	500
WJAX—Jacksonville, Fla.	890	336.9	1,000
WJAY—Cleveland, Ohio (WHK)	1130	265.3	500
WJAZ—Mt. Prospect, Ill. (WMBI)	1140	263.0	5,000
WJBA—Joliet, Ill.	930	322.4	50
WJBB—St. Petersburg, Fla.	870	344.6	250
WJBC—LaSalle, Ill.	1320	227.1	100
WJBI—Red Bank, N. J. (WEBJ, WLTH, WBBR)	1170	256.3	250
WJBK—Ypsilanti, Mich.	1360	220.4	15
WJBL—Decatur, Ill.	1410	212.6	250
WJBO—New Orleans, La.	1140	283.3	100
WJBR—Appleton, Wisc.	1320	227.1	100
WJBT—Chicago, Ill. (WBBM, WAAF, WORD)	770	389.4	100
WJBU—Lewisburg, Pa.	1400	214.2	100
WJBW—New Orleans, La.	1260	238.0	30
WJBY—Gadsden, Ala.	1280	234.2	50
WJBZ—Chicago Heights, Ill.	1440	214.2	100
WJJD—Mooseheart, Ill. (WEBH)	820	365.6	1,000
WJPW—Ashtabula, Ohio	1440	208.2	100
WJR-WCX—Pontiac, Mich.	680	440.9	5,000
WJZ—Bound Brook, N. J.	660	454.3	30,000
WKAF—Changed to WTMJ Milwaukee, Wis.			
WKAQ—San Juan, P. R.	880	340.7	500
WKAR—East Lansing, Mich.	1300	230.6	1,000
WKAV—Laconia, N. H.	1340	223.7	50
WKBB—Joliet, Ill. (WCLA)	1390	215.7	150
WKBC—Birmingham, Ala.	1370	218 8	10
WKBE—Webster, Mass.	1310	228.9	100
WKBF—Indianapolis, Ind. (WFBM, WTAS)	1090	275.1	250
WKBG—Chicago, Ill. (Portable)	1490	201.6	100
WKBH—La Crosse, Wis.	1360	220.4	500
WKBI—Chicago, Ill.	930	322.4	50
WKBL—Monroe, Mich.	1460	205.4	15
WKBN—Youngstown, O. (WMBW)	1400	214.2	50
WKBO—Jersey City, N. J. (WKBQ and WBNY)	1370	218.8	500
WKBP—Battle Creek, Mich.	1410	212.6	50
WKBQ—New York, N. Y. (WKBO, WBNY)	1370	218.8	500
WKBS—Galesburg, Ill. (WLBO)	1380	217.3	100
WKBT—New Orleans, La.	1190	252.0	50
WKBV—Brookville, Ind.	1380	217.3	100
WKBW—Buffalo, N. Y.	1380	217.3	500
WKBZ—Ludington, Mich.	1500	199 9	15
WKDR—Kenosha, Wis.	930	322.4	15
WKJC—Lancaster, Pa. (WGAL)	1190	252.0	50
WKRC—Cincinnati, O. (WFBE)	1220	245.8	250
WKY—Oklahoma City, Okla.	1040	283.3	150
WLAP—Louisville, Ky.	1120	267.7	30
WLB—Minneapolis. Minn. (WHDI)	1220	245.8	500
WLBC—Muncie, Indiana	1430	209.7	50
WLBF—Kansas City, Mo.	1430	209.7	50
WLBG—Petersburg, Va.	1400	214.2	100
WLBH—Farmingdale, N. Y. (Portable)	1490	201.6	30
WLBI—East Wenona, Ill.	1260	238.0	250
WLBL—Stevens Point, Wis. (WHA)	940	319.0	1,000
WLBM—Cambridge, Mass.	1300	230.6	50
WLBN—Chicago, Ill. (Portable)	1470	204.0	50
WLBO—Galesburg, Ill. (WKBS)	1380	217.3	100
WLBT—Crown Point, Ind.	930	322.4	50
WLBR—Belvidere, Ill.	930	322.4	15
WLBV—Mansfield. Ohio.	1450	206.8	50
WLBW—Oil City, Pa.	1020	267.7	500
WLBX—Long Island City, N. Y. (WIBS, WMBQ, WTRC)	1470	204.0	250
WLBY—Iron Mountain, Mich.	1430	209.7	50
WLBZ—Dover-Foxcroft, Me.	1440	208.2	250
WLCI—Ithaca, N. Y.	1210	247.8	50
WLIB—Chicago, Ill. (WGN)	980	305.9	500
WLIT—Philadelphia. Pa. (WFI)	740	405.2	500
WLS—Chicago, Ill. (WCBD)	870	384.4	5,000
WLTS—Chicago, Ill. (WCFL)	620	483.6	100
WLTH—Brooklyn, N. Y. (WBBR, WEBJ, WJBI)	1170	256.3	500
WLWL—Kearny, N. J. (WMCA)	810	370.2	1,000
WMAC—Cazenovia, N. Y. (WSYR)	1330	225.4	500
WMAF—South Dartmouth, Mass.	700	428.3	500
WMAK—Lockport, N. Y.	550	545.1	750
WMAL—Washington, D. C.	1310	228.9	100
WMAN—Columbus, Ohio	1280	234.2	50
WMAQ—Chicago, Ill. (WQJ)	670	447.5	1,000
WMAY—St. Louis, Mo. (KFQA)	1210	247.8	100
WMAZ—Macon, Ga. (WGST)	1110	270.1	500
WMBA—Newport, R. I. (Portable)	1470	204.0	100
WMBB—Homewood. Ill. (WOK)	1190	252	5,000
WMBC—Detroit, Mich. (WAFD)	1230	243.8	100
WMBD—Peoria Heights, Ill.	1460	205.4	250
WMBE—St. Paul, Minn.	1440	208.2	10
WMBF—Miami Beach, Fla.	780	384.4	500
WMBG—Richmond, Va. (WTAZ)	1360	220.4	15
WMBH—Chicago, Ill. (Portable-E. D. Aber.)	1470	204.0	100
WMBI—Addison, Ill. (WJAZ)	1140	263	5,000
WMBJ—Monnesson, Pa.	1290	232.4	50
WMBL—Lakeland, Fla.	1310	228.9	50
WMBM—Memphis, Tenn.	1430	209.7	10
WMBO—Auburn, N. Y.	1360	220.4	100
WMBQ—Brooklyn, N. Y. (WTRC, WIBS, WLBX)	1470	204.0	100
WMBR—Tampa, Fla.	1190	252.0	100
WMBS—Harrisburg, Pa.	1280	234.2	250
WMBW—Youngstown, O. (WKBN)	1400	214.2	50
WMC—Memphis, Tenn.	580	516.9	500
WMCA—New York, N. Y. (WLWL)	810	370.2	500
WMPC—Lapeer, Mich.	1280	234.2	30
WMRJ—Jamaica, N. Y. (WHPP)	1450	206.8	10
WMSG—New York, N. Y. (WHAP, WDWM)	1270	236.1	500
WNAB—Boston, Mass. (Changed to WASN)			
WNAC—Boston, Mass.	850	352.7	500
WNAD—Norman, Okla.	1250	239.9	500
WNAL—Omaha, Nebr. (KOCH and KFOX)	1160	258.5	250
WNAT—Philadelphia, Pa. (WRAX)	1040	263.0	100
WNAX—Yankton. S. D.	990	302.8	250
	(500 Watts, 6 A. M. to 6 P. M.)		
WNBA—Forrest Park, Ill.	1440	208.2	200
WNBF—Endicott, N. Y.	1450	205.8	50
WNBH—New Bedford, Mass.	1150	260.7	250
WNBJ—Knoxville, Tenn.	1450	206.8	50
WNBL—Bloomington, Ill.	1500	199.9	50
WNBO—Washington, Pa.	1420	211.1	15
WNBQ—Rochester, N. Y.	1480	202.6	15
WNBR—Memphis, Tenn.	1310	228.9	20
WNJ—Newark, N. J. (WGCP)	1070	256.3	500
WNOX—Knoxville, Tenn.	1130	265.3	1,000
WNRC—Greensboro, N. C.	1340	223.7	500
WNYC—New York City, N. Y.	570	526	500
WOAI—San Antonio, Texas	990	302.8	2,000

Station	Kc	M	Watts
WOAN—Lawrenceburg, Tenn.	1050	260.7	250
WOAX—Trenton, N. J. (WEAM)	1250	239.9	500
WOBU—Charleston, W. Va.	1120	267.7	50
WOBT—Union City, Tenn.	1460	205.4	15
WOC—Davenport, Ia.	800	374.8	5,000
WOCL—Jamestown, N. Y.	1340	223.7	25
WODA—Paterson, N. J. (WGL)	1020	293.9	1,000
WOI—Ames, Iowa; 5000, daytime, 6 to 6 (WSUI)	1130	265.3	2,500
WOK—Chicago, Ill. (WMBB)	1190	252.0	5,000
WOKO—Peekskill, N. Y.	1390	215.7	250
WOKT—Rochester, N. Y.	1430	209.7	500
WOMT—Manitowoc, Wis.	1350	221.1	50
WOO—Philadelphia, Pa. (WIP)	590	508.	500
WOOD—Furnwood, Mich.	1150	260.7	500
WOQ—Kansas City, Mo. (WHB)	890	336.9	250
WOR—Newark, N. J.	710	422.3	500
WORD—Batavia, Ill. (WBBM), WJBT, WAAF)	770	389.4	5,000
WOS—Jefferson City, Mo.	760	394.5	500
WOW—Omaha, Nebr.	590	508.2	1,000
WOWO—Ft. Wayne, Ind.	1310	228.9	2,500
WPAB—Norfolk, Va.	1430	209.7	100
WPCC—Chicago, Ill., (WFKB. WCRW)	1340	223.7	500
WPCH—Hoboken, N. J. (WRNY)	970	309.1	500
WPDQ—Buffalo, N. Y. (WSVS)	1460	205.4	50
WPEP—Waukegan, Ill.	1390	215.7	250
WPG—Atlantic City, N. J. (WHAR)	1100	272.6	2,500
WPRC—Harrisburg, Po.	1430	209.7	100
WPSC—State College. Pa. (WBAK)	1000	299.8	500
WPSW—Philadelphia, Pa.	1480	202.6	50
WPTF—Raleigh, N. C.	720	416.4	500
WQAA—Parkersburg, Pa.	1390	215.7	500
WQAE—Springfield, Vt.	1200	249.9	50
WQAM—Miami, Fla.	930	322.4	750
WQAN—Scranton, Pa. (WGBI)	1300	230.6	100
WQAO-WPAP—Cliffside, N J. (WHN)	760	394.5	500
WQJ—Chicago, Ill. (WMAQ)	670	447.5	500
WRAF—La Porte, Ind.	1440	208.2	100
WRAH—Providence, R. I.	1500	199.9	250
WRAK—Escanaba, Mich.	1060	282.8	50
WRAM—Galesburg, Ill. (WFBZ)	1210	247 8	50
WRAV—Yellow Springs, Ohio	880	340.7	100
WRAW—Reading, Pa.	1260	238.0	50
WRAX—Philadelphia, Pa. (WNAT).	1040	283.3	250
WRBC—Valparaiso, Ind.	1260	238.0	250
WRC—Washington, D. C.	640	468.5	500
WREC—Memphis, Tenn.	1180	254.1	50
WREN—Lawrence, Kans. (KFKU).	1180	254.1	750
WRES—Quincy, Mass.	1380	217.3	50
WRHF—Washington, D. C. (6 a.m. to 6 p.m.)	930	322.4	150
WRHM—Minneapolis, Minn. (WDGY)	1150	260.7	1,000
WRM—Urbana, Ill.; 1000 watts before 6 p.m. (WBAA)	1100	272.6	500
WRMU—New York, N. Y. Portable) (WQMU)	1490	201.6	100
WRNY—New York, N. Y. (WPCH)	970	309.1	500
WRPI—Terre Haute, Ind.	1440	208.2	100
WRR—Dallas, Texas	850	352.7	500
WRRS—Racine, Wis.	930	322.4	50
WRSC—Chelsea, Mass.	1420	211.1	100
WRST—Bay Shore, N. Y. (WCDA, WRHS, WCGU)	1420	211.1	250
WRVA—Richmond, Va.	1180	254.1	1,000
WSAI—Cincinnati, O.	830	361.2	5,000
WSAJ—Grove City, Pa.	1340	223.7	250
WSAN—Allentown, Pa. (WCBA)	1350	222.1	100
WSAR—Fall River, Mass.	1190	252.0	100
WSAX—Chicago, Ill.	1470	204.0	100
WSAZ—Huntington, W. Va.	1240	241.8	100
WSB—Atlanta, Ga.	630	475.9	1,000
WSBC—Chicago, Ill. (WWAE)	1290	232.4	500
WSBF—St. Louis, Mo. (WIL)	1160	258.5	250
WSBT—South Bend, Ind. (WEMC)	1350	222.1	250
WSDA—New York, N. Y. (WARS, WBBC)	1320	227.1	250
WSEA—Virginia Beach, Va. (WTAR)	1140	263.0	250
WSIX—Springfield, Tenn.	1410	212.6	150
WSKC—Bay City, Mich. (WFDF)	800	374.8	250
WSM—Nashville, Tenn.	880	340.7	5,000
WSMB—New Orleans, La. (WAAT)	930	322.4	500
WSMK—Dayton, O.	1220	245.8	500
WSOE—Milwaukee, Wis.	1010	296.9	200
WSRO—Hamilton, Ohio.	1100	270.1	500
WSSH—Boston, Mass.	870	384.4	100
WSUI—Iowa City, Iowa (WOI)	1300	230.6	100
WSVS—Buffalo, N. Y. (WPDQ)	1130	265.3	500
WSYR—Syracuse, N. Y. (WMAC)	1460	205.4	50
WTAD—Quincy, Ill.	1330	225.4	500
WTAG—Worcester, Mass.	1270	236.1	250
WTAL—Toledo, Ohio (WABR)	1040	283.3	500
WTAM—Cleveland, Ohio (WEAR)	1070	280.2	100
WTAQ—Eau Claire, Wisc.	750	399.8	3,500
WTAR—Norfolk, Va. (WSEA)	1180	254.1	500
WTAS—Chicago, Ill. (WFBM, WKBF)	1140	263.0	500
WTAS—Batavia, Ill. (WORD)	1090	275.1	250
WTAW—College Station, Texas	1090	275.1	3,500
WTAX—Streator, Ill.	970	309.1	500
WTAZ—Richmond, Va. (WMBG)	930	322.4	50
WTFF—Washington, D. C.	1360	220.4	15
WTFI—Tacoa, Ga.	1470	204	50
WTIC—Hartford, Conn.	1430	209.7	250
WTMJ—Milwaukee, Wisc. (WHAD)	560	535.4	500
WTRC—Brooklyn, N. Y. (WIBS, WMBQ, WLBX)	1020	293.9	1,000
WTRL—Midland Park, N. J. (WJBI, WIBI, WBMS)	1470	204	50
WUBR—Appleton, Wis.	1120	267.7	100
WWAT—Chicago, Ill. (WSBC)	1320	227.1	100
WWJ—Detroit, Mich.	1290	232.4	500
WWL—New Oreans, La.	850	352.7	1,000
WWNC—Ashville, N. C.	1090	275.1	100
WWRL—Woodside, N. Y. (WRKN, WJBI, WIBI, WBMS)	1010	296.9	1,000
WWVA—Wheeling, W. Va.	1120	267.7	100
KDKA—East Pittsburgh, Pa.	770	389.4	100
KDLR—Devils Lake, N. D.	950	315.6	50.000
KDYL—Salt Lake City, Utah	1300	23.6	50,000
KELW—Burbank, Calif. (KPPC)	1160	258.5	100
	1310	228.9	500
(1,000 Watts, 6 A. M. to 6 P. M.)			
KEX—Portland, Ore.	1250	239.9	2,500
KFAB—Lincoln, Nebr. (5000 before 7 p. m.)	970	309.1	2,000
KFAD—Phoenix, Ariz.	1100	272.6	500
KFAU—Boise, Idaho (4,000 watts daytime)	1050	285.5	2,000
KFBB—Havre, Mont.	1090	275.5	2,500
KFBC—San Diego, Calif.	1210	247.8	100
KFBK—Sacramento, Calif.	560	535.4	100
KFBL—Everett, Wash.	1340	223.7	50
KFBS—Trinidad, Colo.	1260	238.0	15
KFBU—Laramie, Wyo.	700	428.3	500
KFCB—Phoenix, Ariz.	1230	243.8	125
KFCR—Santa Barbara, Calif.	1420	211.1	50
KFDM—Beaumont, Tex.	620	483.6	500
KFDX—Shreveport, La.	1270	236.1	250
KFDY—Brookings, S. D. (KMA, KWKH)	760	394.5	500
KFDZ—Mineapolis, Minn.	1300	215.7	10
KFEC—Portland, Ore. (KFIF)	1400	214.2	50
KFEL—Denver, Colo.	1210	247.8	250
KFEQ—St. Joseph, Mo.	1300	230.6	1,000
KFEY—Kellogg, Idaho	1290	232.4	10
KFEQ—St. Joseph, Mo.	1300	230.6	1,000
KFH—Wichita, Kansas	1220	245.8	500
KFHA—Gunnison, Colo.	1180	254.1	50
KFHL—Oskaloosa, Iowa.	1410	212.6	10
KFI—Los Angeles, Calif.	640	468.5	5,000
KFIF—Portland, Ore. (KFEC)	1400	214.2	50
KFIO—Spokane, Wash. (KFPY)	1220	245.8	100
KFIU—Juneau, Alaska	1330	225.4	10
KFIZ—Fond du Lac. Wisc.	1120	267.7	100
KFJB—Marshalltown, Iowa	1210	247.8	15
KFJF—Oklahoma, Okla.	1100	272.6	750
KFJI—Astoria, Ore.	1200	249.9	15
KFJM—Grand Forks, N. Dak.	900	333.1	100
KFJR—Portland, Ore. (KTBR)	1060	282.8	100
KFJY—Fort Dodge. Ia. (KFMR)	680	440.9	100
KFJZ—Fort Worth, Texas	1200	249.9	50
KFKA—Greeley, Colo.	750	399.8	200
KFKB—Milford, Kansas	1240	241.8	1,000
KFKU—Lawrence, Kansas (WREN)	1180	254.1	500
KFKX—Chicago, Ill. (KYW)	570	526.0	2,500
KFKZ—Kirksville, Mo.	1330	225.4	15
KFLR—Albuquerque, N M.	720	225.4	15
KFLV—Rockford, Ill.	1120	267.7	100
KFLR—Albuquerque, N. M.	720	416	100
KFLX—Galveston, Texas	1110	270.1	100
KFMX—Northfield, Minn. (WCAL).	1270	236.1	500
KFOA—Seattle, Wash.	670	447.5	1,000
KFNF—Shenandoah, Iowa (KMA).	1110	270.1	1,000
KFON—Long Beach, Calif.	1240	241.8	500
KFOR—Lincoln, Nebr.	1380	217.2	100
KFOX—Omaha, Nelraska (KOCH, WNAL)	1160	258.5	100
KFOY—St. Paul, Minn.	1050	285.5	100
KFPL—Dublin, Texas	1090	275.1	15
KFPM—Greenville, Texas	1300	230.6	15
KFPR—Los Angeles, Calif. (KFQZ).	1290	232.4	250
KFPW—Carterville, Mo.	1140	253.0	50
KFPY—Spokane, Wash. (KFIO)	1220	245.8	250
KFQA—St. Louis, Mo. (WMAY)	1210	247.8	50
KFBQ—Ft. Worth, Tex	920	325.9	1,000
KFQD—Anchorage, Alaska	870	344.6	100
KFQU—Holy City. Calif.	1200	249.0	100
KFQW—Seattle Wash.	1380	218.3	100
KFQZ—Hollywood, Calif. (KFPR)	1290	232.4	100
KFRC—San Francisco, Calif.	660	454.3	1,000
KFRU—Columbia, Mo.	1200	249.9	500
KFSD—San Diego, Calif.	680	440.9	500
KFSG—Los Angeles, Calif.	1090	275.1	500
KFUL—Galveston, Texas	1160	258.5	500
KFUM—Colorado Springs, Colo.	1270	236.1	100
KFUO—St. Louis, Mo. (KFVE) (500 to 1500 Watts, 6 A. M. to 6 P. M.)	1280	234.2	1,000
KFUP—Denver, Colo.	1320	227.1	100
KFUR—Ogden, Utah	1330	225.4	50
KFUS—Oakland, Calif. (KRE)	1170	256.3	50
KFUT—Salt Lake City, Utah	600	499.7	50
KFVD—Venice, Calif. (KGFJ)	1440	208.2	250
KFVE—St. Louis, Mo. (KFUO)	1280	234.2	1,000
KFVG—Independence, Kans.	1330	225.4	50
KFVI—Houston, Texas	1260	238.0	50
KFVR—Denver, Colo.	630	475.9	250
KFVS—Cape Girardeau, Mo.	1340	223.7	50
KFWB—Los Angeles, Calif.	830	361.2	500
KFWC—San Bernadino, Calif.	1350	222.1	100
KFWF—St. Louis, Mo.	1400	214.2	250
KFWI—San Francisco, Calif.	1120	267.7	500
KFWM—Oakland, Calif. (1000 watts daytime)	1270	236.1	500
KFWO—Avalon, Calif.	1370	218.8	250
KFWV—Portland, Ore.	1310	228.9	50
KFXB—Los Angeles, Calif.	190	252.0	500
KFXF—Denver, Colo.	1060	282.2	500
KFXJ—Near Edgewater, Colo.	1390	215.7	15
KFXR—Oklahoma City, Okla.	1400	214.2	15
KFXY—Flagstaff, Ariz.	1460	205.4	25
KFYO—Breckinridge, Texas	1420	211.1	15
KGA—Spokane, Wash.	1150	260.7	2,000
KGAR—Tuscon, Ariz.	1280	234.2	100
KGBS—Seattle Wash.	1480	202.6	100
KGBU—Getchikan, Alaska	1310	228.9	500
KGBX—St. Joseph, Mo.	1040	283.3	100
KGBY—Columbus, Nebr.	1480	202.6	50
KGBZ—York, Nebr.	1410	212.6	100
KGCA—Decorah, Iowa	1480	202.6	10
KGCB—Oklahoma City, Okla. (KGFG)	1390	215.7	50
KGCH—Wayne, Nebr.	1020	293.9	250
KGCI—San Antonio, Texas (KGDR)	1480	202.6	15
KGCL—Seattle, Wash. (KPCB)	1300	230.6	50
KGCN—Concordia, Kansas	1440	208.2	50
KGCR—Brooklings, N. Dak.	1440	208.2	15
KGCU—Mandan, N. Dak.	1440	208.2	100
KGCX—Vida, Mont.	1230	243.8	10
KGDA—Dell Rapids, S. Dak. (Day time only)	1280	234.2	15
KGDE—Barrett, Minn.	1460	205.4	15
KGDJ—Cresco, Iowa	1480	202.6	10
KGDM—Stockton, Calif.	1380	217.3	10
KGDP—Pueblo, Colo.	1340	223.7	10
KGDR—San Antonio, Texas (KGCI)	1480	202.6	15
KGDW—Humboldt, Nebr.	1450	206.8	100
KGDX—Shreveport, La.	1410	212.6	250
KGDY—Oldham, S. Dak.	1450	206.8	15
KGEF—Los Angeles, Calif.	1140	263.0	500
KGEH—Eugene, Ore.	1490	201.6	50
KGEK—Yuma. Colo.	1470	204.0	10
KGEN—El Centro, Calif.	1330	225.4	15
KGEO—Grand Island, Nebr.	1460	205.4	100
KGEQ—Mineapolis, Minn.	1480	202.6	50
KGER—Long Beach, Calif. (KRLO)	1390	215.7	100
KGEU—Lower Lake, Calif.	1320	227.1	50
KGEW—Fort Morgan, Colo.	1370	218.8	10
KGEY—Denver, Colo.	1490	201.6	15
KGEZ—Kalispell, Mont.	1460	205.4	100
KGFB—Iowa City, Iowa	1340	223.7	10
KGFF—Ava. Okla.	1460	205.4	25
KGFG—Oklahoma City, Okla. (KGCB)	1390	215.7	50
KGFH—La Crescenta, Cal. (KMIC)	1340	223.7	100
KGFI—San Angelo, Tex.	1360	220.4	15
KGFJ—Los Angeles, Calif. (KFVD)	1440	208.2	100
KGFK—Hallock, Minn.	1340	223.7	50
KGFL—Trinidad, Colo.	1350	222.1	50
KGFM—Yuba City, Calif.	1420	211.1	15
KGFN—Aneta, N. Dak.	1500	199.9	15
KGFO—Terra Haute, Ind.	1470	204.0	100
KGFP—Mitchell, So. Dak.	1410	212.6	10
KGO—Oakland, Calif.	780	384.6	5,000
KGRC—San Antonio, Texas	1360	220.4	50
KGRS—Amarillo, Texas	1230	243.8	150
KGTT—San Francisco, Calif.	1450	206.8	50
KGU—Honolulu, T. H.	1110	270.1	600
KGW—Portland, Ore.	610	491.5	1,000
KGY—Lacey. Wash.	1240	243.8	50
KHJ—Los Angeles, Calif.	740	405.2	500
KHMC—Harlingen, Texas	1270	236.1	100
KHQ—Spokane, Wash.	810	370.2	1,000
KICK—Anita, Ia. (WIAS)	630	475.9	100
KJBS—San Francisco, Calif.	1360	220.4	50
KJR—Seatle, Wash.	860	348.6	2,500
KJP—Seattle, Wash.	1130	265.3	15
KLDS—Independence, Mo.	1110	270.1	1,500
KLIT—Portland, Oregon	1450	206.8	10
KLS—Oakland, Calif. (KZM)	1220	245.8	250
KLX—Oakland, Calif.	590	508.2	500
KLZ—Denver, Colo.	1120	267.7	250
KMA—Shenandoah, Iowa (KWKH and KFDY)	760	394.5	1,000
KMED—Medford, Oregon	1120	267.7	50
KMIC—Inglewood, Calif. (KGFH)	1340	223.7	250
KMJ—Fresno, Calif.	820	365.6	50
KMMJ—Clay City, Neb. (WCAJ)	790	379.5	500
KMO—Tacoma, Wash.	1180	254.1	250
KMOX—St. Louis, Mo.	1100	299.8	5,000
KMTR—Los Angeles, Calif.	570	526.0	500
KNRC—Santa Monica, Calif.	800	374.8	500
KNX—Los angeles, Calif.	890	336.9	500
KOA—Denver, Colo. (10.000 until 7 p. m.)	920	325.9	5,000
KOAC—Corvalis, Ore.	1110	270.1	500
KOB—State College, N. M. (KWSC, KTW)	760	394.5	5,000
(7,500 Watts, 6 A. M. to 6 P. M.)			
KOCH—Omaha, Nebr. (WNAL, KFOX)	1160	258.5	250
KOCW—Chickasha, Okla.	1190	252.0	250
KOIL—Council Bluffs, Iowa	1080	277.6	1,500
KOIN—Portland, Ore.	940	319.0	1,000
KOMO—Seattle. Wash.	980	305.9	1,000
KOWW—Walla Walla, Wash.	1000	299.8	500
KPCB—Seatte, Wash. (KGCL)	1300	230.6	50
KPJM—Prescott, Ariz.	1400	214.2	15
KPNP—Muscatine, Iowa	1420	211.1	100
KPO—San Francisco. Calif.	710	422.3	1,000
KPPC—Pasadena, Calif. (KELW)	1310	228.9	50
KPRC—Houston, Texas	1020	293.9	500
KPSN—Pasadena, Calif.	950	315.6	1,000
KQV—Pittsburgh, Pa. (WJAS)	1110	270.1	500
KQW—San Jose, Calif.	1010	296.9	500
KRAC—Shreveport, La.	1360	220.4	50
KRE—Berkeley, Calif. (KFUS)	1170	256.3	100
KRLD—Dallas, Texas	1350	222.1	500
KRLO—Los Angeles, Calif. (KGER)	1390	215.7	250
KROX—Seattle, Wash. (KRSC)	1420	211.3	50
KRSC—Seattle, Wash. (KROX)	1420	211.1	50
KSAC—Manhattan, Kans.	900	333.1	500
KSBA—Shreveport. La.	1120	267.7	1,000
KSCJ—Sioux City, Ia. (KWUC) (1,000 Watts, 6 A. M. to 6 P. M.)	1230	243.8	500
KSD—St. Louis, Mo.	550	545.1	500
KSEI—Pocatello, Idaho	900	333.1	250
KSL—Salt Lake City, Utah	990	302.8	1,000
KSMR—Santa Maria, Calif.	1100	272.6	100
KSO—Clarinda, Iowa	1320	227.1	500
KSOO—Sioux Falls, S. D.	1430	209.7	250
KTAB—Oakland, Calif.	1070	280.2	500
KTAP—San Antonio, Texas	1310	228.9	10
KTBI—Los Angeles, Calif.	1040	282.3	500
KTBR—Portland, Ore. (KFJR)	1060	282.8	50
KTHS—Hot Springs, Ark.	880	340.7	750
KTNT—Muscatine, Ia.	1170	256.3	1,000
KTSA—San Antonio, Tex. (formerly WCAR)	1130	265.3	2,000
KTUE—Houston, Tex.	1410	212.6	5
KTW—Seattle, Wash. (KWSC, KOB)	760	394.5	1,000
KUJ—Seattle, Wash.	1500	199.9	10
KUOA—Fayetteville, Ark.	1010	96.9	500
KUOM—Missoula, Mont.	800	374.8	500
KUSD—Vermillion, S. D.	620	483.6	250
KUT—Austin, Texas	1280	232.4	500
KVI—Tacoma, Wash.	1280	232.4	50
KVOO—Bristow, Okla.	860	348.6	1,000
KVOS—Seattle, Wash.	1430	209.7	50
KWBS—Portland, Ore.	1500	199.9	15
KWCR—Cedar Rapids, Ia. (WJAM)	780	384.4	250
KWG—Stockton, Calif.	870	344.6	50
KWJJ—Portland, Ore.	1310	228.9	50
KWKC—Kansas City, Mo.	1350	222.1	100
KWKH—Shreveport, La. (KMA, KFOY)	760	394.5	1,000
KWLC—Decorah, Iowa	1210	247.8	50
KWSC—Pullman, Wash. (KOB, KTW)	760	394.5	500
KWTC—Santa Ana, Calf.	880	340.7	5
KWUC—LaMars, Iowa (KSCJ)	1230	243.8	1500
KWWG—Brownsville, Texas	1080	277.6	500
KXA—Seattle, Wash.	1080	277.6	500
KXL—Portland, Ore.	1360	220.4	50
KYA—San Francisco, Calif.	970	309.1	500
KYW—Chicago, Ill. (KFKX)	570	526	2,500
KZM—Oakland, Calif. (KLS)	1220	245.8	5,000
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Arthur Argenbeight, 130 South St., Chambersburg, Pa.
Joseph DeBay, 370 East Main St., New Britain, Conn.
Edwin Lindberg, 16 Nutton St., Worcester, Mass.

THE RADIO TRADE

De Forest Wins Anew In Feedback Suits

Philadelphia.

In a verdict handed down by Judge Wooley and agreed to by Judges Buffington and Davis of the United States Circuit Court of Appeals, Dr. Lee De Forest, noted radio inventor, was declared the original inventor of the feedback circuit and oscillating tube.

By this ruling priority was denied to the claims of the Government (Alexander Meissner patent); Major Edwin H. Armstrong; the Westinghouse Electric and Manufacturing Company, and the General Electric Company (Irving Langmuir patent).

The controversy regarding this invention has cost hundreds of thousands of dollars and has been going on for five years.. So far, Dr. De Forest has been adjudged the rightful owner of the invention four times.

When asked for a statement regarding the effect of the decision rendered by the Circuit Court of Appeals in Philadelphia, David Sarnoff, vice-president and general manager of the Radio Corporation of America, said:

"The decision by the Circuit Court of Appeals in Philadelphia is to the effect that the two DeForest patents therein involved are for inventions actually made by DeForest. The DeForest Company therefore has a right to use those inventions subject to the rights which had already been granted under those patents to the American Telephone and Telegraph Company and those to whom the latter might extend such rights, among whom are the Radio Corporation of America, the General Electric Company and the Westinghouse Electric & Manufacturing Company.

"The rights of these companies with reference to the DeForest patents is in no way altered by the decision just rendered."

GREAT READER INTEREST HEWS PATH TO SALES

By Herman Bernard

The average annual circulation of RADIO WORLD has increased steadily since that day, more than five and a half years ago, when we published our first issue. Whether radio seasons have been prosperous or lean since then, RADIO WORLD'S circulation has gone steadily forward to prove that our reader interest is independent of seasonal fluctuations. This is a situation that radio parts manufacturers in particular should desire to capitalize, because reader interest is the test of the power of a publication to produce sales for advertisers. You can sell your product because we sell our own to the same customers.

RADIO WORLD'S circulation consists of 75% news-stand circulation and 23% subscription circulation, the other 2% being accounted for by copies furnished to advertisers and others in connection with business that they turn in to us.

Just imagine a magazine's power to sell your products when the readers of that magazine, for the most part, actually put themselves out to the extent of going to a news-stand, asking for a copy of RADIO WORLD and producing 15c with which to purchase that copy. What a man gets for nothing he values at nothing, but he must place a high value on a magazine when he pays for it in time, effort and money, and does this regularly throughout the year.

We have noticed a growing desire among parts manufacturers for publicity for their products. Fifty-two weeks a year, every year, Winter and Summer, without fail, we publish circuits and articles that encourage professional sets builders and other radioists to build sets —which means to buy parts.

It behooves the radio manufacturers to assist us in making known what their products are and how they should be used. We move hundreds upon hundreds of thousands of dollars worth of radio goods each season and the advertising that is placed in RADIO WORLD actually doesn't cost the advertiser anything, if he is a consistent advertiser, because the increased business pays for the advertising.

We feel that every worthwhile manufacturer should be represented in the advertising columns of RADIO WORLD for his own benefit and to that end we appeal only to manufacturers in that category.

An inch a week in RADIO WORLD costs only $416 for an entire year, $1.10 a day.

How to Mount Eby Sockets

The H. H. Eby Mfg. Co., Inc., has simplified the assembly of the new Eby Universal socket on top of a wood or metal panel by packing an insulator in each box. Instructions follow:

"It's a cinch to mount the new Eby socket on top of a wood or metal panel. Drill two clearance holes for the mounting screws, then bend back four soldering terminals in the slots provided. Place the Bakelite insulating plate against the lugs and the socket is ready for mounting. The four contacts protrude far enough to make soldering easy, and are insulated from the metal or wood panel."

Set builders will find this addition of great value.

New Q. R. S. Line Ready

Clarence M. Plechter, known everywhere in the trade as the live-wire man, announces that the well-known line of Q. R. S. tubes is complete and ready for distribution. There is a Q. R. S. tube for every radio and power supply use.

Mr. Plechter is one of the most energetic men in the trade, is full of enthusiasm for the line he handles, and has done wonders with Q. R. S. in the Eastern territory. He reports a vast amount of business booked at the recent Show here and predicts the greatest season in history for his line as well as for radio in general. Full information on this line of tubes may be had from the Q. R. S. Music Co., Chicago.—J. H. C.

The New Combination

of Beauty of Sound and Beauty of Appearance

In Reproducers

By H. B. Herman

Acoustical Expert

A FEELING has grown up in radio circles that quality of reproduction and attractiveness cannot go together in loudspeakers. The idea has been that decorative features on the speaker necessarily destroyed the quality of the reproduced music. It is this feeling which is largely responsible for the two great extremes in radio—the ultra-decorative speaker of doubtful tone and the plain monstrosities of equally uncertain performance.

The ultra-decorative speakers were sold to those who judged performance by appearance and who were willing to accept the less than mediocre in quality in order to get something not hard to look at. The plain speakers were sold to those who had to have top-notch quality irrespective of how the speakers looked.

As to the difference between the tonal performances of the two extremes there was little to choose. Usually both classes of purchasers were satisfied for a while that they had the acme of perfection, as they judged the pinnacle of tone quality, and quite often the so-thought marvelous quality was purely subjective and illusory.

A Glimpse at an Ideal

To be sure there are several speakers on the market which are capable of radiating as good quality as is delivered to them by the amplifier. Some of these speakers are not bad to look at, others are better put behind a screen. But be they good to look at or not, they are pleasant to listen to, provided they are not abused with the output of an atrocious receiver.

The ideal speaker is one which dips deep into the basses and radiates them forcefully, which ascends to the higher registers and brings out the articulation distinctly, which is equally efficient in between the two extremes in frequency. To judge a good speaker when it is connected to a good amplifier, listen to the boom of the kettle drum, the zoom of the bass viol, the bassing of the bassoon. Do these sounds come through as clearly as they do in the original? If they do the speaker is all right on the lows.

To judge the speaker on the highs listen for the hissing sounds such as **th, s, z, sh, f** and **v.** Does the speaker actually radiate these sounds or do you have to supply them where they are missing.

To judge the speaker in the middle range about all that is necessary is to listen for over-emphasized notes, or amplification peaks. Does the sound become unpleasantly loud on some notes, and does the speaker or power tube become overloaded on some notes? The overloading of the last tube may be due to a defect in the loud speaker as this is related to the amplifier and the source of power. If the lows come out forcefully, if there are no unpleasantly loud notes in the middle scale, and if the very high audio frequencies come out to make the reproduction as distinct and as crisp as the original, then the speaker is good.

We return to the question of combining quality with attractiveness. Is the feeling against the possibility of this combination founded on fact? It may have been once but it is no longer. Tone quality in a high degree has been combined with compelling attractiveness in the commercial models of the new Lata Balsa wood reproducer. This speaker neither looks like a loud speaker nor sounds like a loudspeaker, as we have become accustomed to see and hear loudspeakers. It looks and sounds more like the loud speaker of the future.

Work of Art

At the present time, in either of three commercial models, it looks like the work of an artist not yet removed from the easel, and it sounds like a recreation of the original music. Our artist has illustrated one model, the one with pelicans on it.

The quality of the Balsa wood speaker is derived from the extremely light and resilient wood used as the sounding board, from the ample dimensions of the sounding board, from the efficient and powerful unit driving the sounding board, and from the scientific manner in which the vibrations of the armature of the unit are distributed over the sounding surface.

The ample dimensions of the sounding surface insure that the low notes be brought out with full and rich volume. The extreme lightness of the sounding board and its ability to vibrate in sections as required by the frequency impressed insure that the high notes be brought out fully. The freedom from reflections from the edges of the sounding surface insures the absence of any response peaks. The Balsa wood insures good quality.

A DECORATIVE MODEL BALSA REPRODUCER

That Balsa is synonymous with quality is a discovery which more people make every day. Thtat a Balsa speaker scientifically constructed is not a piece of fine art must be admitted. But the coordination of the scientific features of the Balsa speaker with fine art in such a manner as to retain all the quality and yet have the advantages of art is an achievement which will soon be reflected in the better homes the world over.

The Balsa wood sounding board is mounted in an attractive wooden frame, which may either be hung on a wall like a picture or put on an easel standing on the floor. In either type the sounding board is concealed from view with a finely decorated silk or other sheer textile. This decorated screen does not affect the sound radiation from the sounding board behind it because the sound waves can go through it without suffering any reflection or retardation. Even if the sound could not go through, the screen is so light that it could move in unison with the sounding board without affecting the second adversely. In fact, the screen would tend to smooth out any small irregularities in the response characteristic of the sounding board.

Worst Magnetic Chaos Recorded in Potsdam

Berlin.

Instruments in the Meterological Magnetic Observatory in Potsdam have recorded the most violent electro-magnetic disturbances in eleven years. Sun spots, which recur periodically, are held responsible for the unusual results.

Special instruments for studying the relation between radio reception and sun spots evidenced nervousness for several days, but noon on Oct. 12 the fluctuations became violent and continued so for some time. The phenomenon was coincident with intense and spectacular displays of the Aurora Borealis. Telegraph service over open lines and short wave radio communication to northern countries were seriously affected. Long wave communication in all directions and short wave radio toward the equator were not greatly affected by the helio-electric disturbances. Rotation of the sun is the cause of the periodicity.

"Ham" Mania Injures Son, Says Eric Palmer

Washington.

Eric H. Palmer, publicity director for Radio World's Fair held annually in New York and radio editor of the Brooklyn "Daily Times," has applied to the Federal Radio Commission for the cancellation of the transmitting license of his son, Eric H. Palmer, Jr.

So devoted was young Palmer to his radio that he stayed up all night communicating with his fellow amateurs, losing interest in his meals and neglecting to get proper sleep, his father said. From a robust, straight-shouldered lad he became sunken-chested and weak eyed. Nothing but a suspension of his license with the aid of the commission, Mr. Palmer said, would save the boy's health.

A THOUGHT FOR THE WEEK

RADIO has given new significance to the poet's lines:
"Walls do not a prison make,
Nor iron bars a cage."

SIXTH YEAR

RADIO WORLD

The First and Only National Radio Weekly

Member, Radio Publishers Association

Radio World's Slogan: "A radio set for every home."

TELEPHONES: BRYANT 0558, 0559
PUBLISHED EVERY WEDNESDAY
(Dated Saturday of same week)
FROM PUBLICATION OFFICE
HENNESSY RADIO PUBLICATIONS CORPORATION
145 WEST 45th STREET, NEW YORK, N. Y.
(Just East of Broadway)
ROLAND BURKE HENNESSY, President
M. B. HENNESSY, Vice-President
HERMAN BERNARD, Secretary
European Representatives: The International News Co.
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Paris, France: Brentano's, 8 Avenue de l'Opera

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Capt. Peter V. O'Rourke

SUBSCRIPTION RATES

Fifteen cents a copy. $6.00 a year. $3.00 for six months. $1.50 for three months. Add $1.00 a year extra for foreign postage. Canada, 50 cents.

Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order is automatic acknowledgment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address; also state whether subscription is new or a renewal.

ADVERTISING RATES

General Advertising

1 Page, 7¼"x11"	462 lines	$300.00
½ Page, 7¼"x5½"	231 lines	150.00
½ Page, 3¾" D. C.	231 lines	150.00
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⅛ Page, 4⅛" S. C.	57 lines	37.50
1 Column, 2¼"x11"	154 lines	100.00
1 Inch		10.00
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52 consecutive issues	20%
26 times consecutively or E. O. W. one year	15%
13 times consecutively or E. O. W.	12½%
4 consecutive issues	10%

WEEKLY, dated each Saturday, published Wednesday. Advertising forms close Tuesday, eleven days in advance of date of issue.

CLASSIFIED ADVERTISEMENTS

Ten cents per word. Minimum 10 words. Cash with order. Business Opportunities ten cents per word. $1.00 minimum.

Entered as second-class matter March 23, 1922, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

THEY SAY

WILLIAM MARCONI, noted inventor: "Some day electric waves may be used for the transmission of power, should we succeed in perfecting devices for projecting the radiation in parallel beams in such manner as to minimize their dispersion and diffusion into space."

* * *

H. S. MILLER, law examiner at the Patent Office: "Radio's popularity has resulted in a large increase in patent applications. Mostly these concern receiver apparatus. The problem of supplying current to operate radios has received most attention lately. Some of the devices turned out by radio listeners have been ingenious, to say the least."

PICKARD GETS POST ON BOARD; BELLOWS QUITS

Sam Pickard, formerly chief of the Radio Service division of the Department of Agriculture and more recently secretary of the Federal Radio Commission was appointed by President Coolidge to succeed Henry A. Bellows as a member of the Commission. Pickard conducted the first air course from any school, at the Kansas Agricultural College. Later his specially prepared farmer broadcasts were sent out through more than 100 stations.

SAM PICKARD

HENRY A. BELLOWS

Bellows resigned as a member of the Commission of the fourth zone to become effective November 1.

All the commissioners have been serving without pay, due to the failure of the salary bill last March. This was Mr. Bellows' reason for his resigning.

Mr. Bellows was one of the members the Senate failed to confirm. Commissioner Caldwell of New York was the other.

Before Mr. Bellows joined the commission he was director of WCCO, Minneapolis, St. Paul. He will return to that post.

LC (TD) Goes White One Better on Name

Here's a little studio byplay that took place recently during the Columbia Broadcasting System's Intimate Hour.

Maj. J. Andrew White was being informal in introducing Elsie Thiede, and explained to his radio audience that, although the name was spelled T-h-i-e-d-e, it was pronounced as though it were just two letters T D. When he finished this, Miss Thiede explained that she goes in heavier than that for the alphabet, pointing out to the Major that her first name could also be expressed with two letters: L C.

Higher Wavelength Satisfies Argentina

Washington.

Operating on the 425 meter band, which is the highest wave-length allowed by the Ministry of Marine in charge of radio in Buenos Aires, the municipal broadcasting located at the Colon Theatre is receiving excellent reports on its transmission.

This is the first station permitted to use the higher wave-lengths.

KLAN STATION SEEKS 50,000 WATTS

Washington

A request for an increase of power from 500 to 50,000 watts was recently made by station WTFF, Washington, D. C., owned by the K. K. K.

TAYLOR WINS ANNUAL PRIZE OF INSTITUTE

The Liebmann prize of $500 awarded yearly by the Institute of Radio Engineers to the person contributing the greatest advance in the science was given to Commander A. Hoyt Taylor, who is in charge of the Naval Research Laboratory at Bellevue, Md., for his work on short waves and new developments in the application of the Piezo crystal in transmitting sets.

Commander Taylor has been connected with the governmental radio field since 1917, when he joined the Naval Reserve with a commission as a commander. He received his B. S. degree at Northwestern University, Evanston, Ill., and was also awarded the degree of Doctor of Sciences at the Imperial University at Gottingen, Germany. He is a fellow of the American Institute of Electrical Engineers, the American Physicist Society and the American Association for the Advancement of Science, as well as chairman of the Washington Section of the Institute of Radio Engineers.

Radioed Pictures Used With Voice In Contract

Utilizing both the radiotelephone and photoradio links between New York and London, a complete transaction involving the purchase of the motion picture rights to "Broadway" a current popular show running in New York City, was recently completed between Jed Harris, producer of the play who was in New York, and Carl Laemmle, president of the motion picture concern, who was in London.

The only portion of the contract that was transmitted was the last page on which the signatures were to be affixed. This was sent to Mr. Laemmle in London who signed it. Sam Harris, who acted as a witness, also signed it. It was then sent back to New York.

McNamee from Blimp Addresses Listeners

Akron, O.

Those who were fortunate enough to have tuned in to WADC of this city got the thrill of their life when they heard the voice of Graham McNamee, WEAF announcer, coming from the world's smallest blimp the "Pilgrim," which was flying above the city.

A small short wave transmitter installed aboard the blimp carried McNamee's voice to WADC, when retransmitted.

Orators to Be Heard from WIP Sundays

Arrangements have just been completed by the Germantown, Pa., branch of the Y. M. C. A., through its secretary, William H. Crown, to present before the microphone of WIP, from the Germantown Theatre in Philadelphia, every Sunday afternoon at 4 P. M., beginning Nov. 6, prominent orators.

Included are congressmen, doctors, humorists, statesmen, etc. Major Joe R. Handley will inaugurate the series.

Mechanical Man Born; Uses Tubes and "Mike"

By Smith Rawlinson

The Westinghouse Electric and Manufacturing Company has demonstrated an electro-mechanism which is almost human in its characteristics. It obeys the spoken voice or commands given to it by means of other sounds of certain frequencies, and it does it at a distance.

For example, when it is spoken to in the proper tone over a telephone line it will perform any desired and prearranged service. It will start or stop a machine, it will report the level of water in a river or reservoir, it will give the pressure in a steam boiler located far away, or it will give the voltage and current in a distant power plant.

But this automaton is as temperamental as a sploilt child and will do nothing unless it is spoken to in exactly the right tone. The earlier models of the machine respond to the sound of "Open, sesame" but later models respond to the pure tones of exact frequencies generated by tuning forks.

A tuning fork is sounded electrically, say at a frequency of 600 cycles. The electro-mechanism responds at a distant point and performs a certain operation, such as closing a relay, ringing a bell, closing an electric circuit which in turn does something else desired. When this operation has been performed another tuning fork is sounded and a different operation is performed. Then a third fork is sounded and a third operation is executed.

"He" Never Sleeps

This electro-mechanical man never sleeps but is on duty 24 hours a day and is alert every moment. In this respect it does not obey union rules but in respect to other working conditions it is very exacting. While it is very exacting as to frequency of tone it is unerring and instantaneous in its response.

It looks like an audio amplifier and switchboard; in no sense like a man.

There are three of these mechanical men in actual service, all three on duty with the War Department in Washington, D. C. where they are supervising the water level in the three reservoirs supplying the capital city with water.

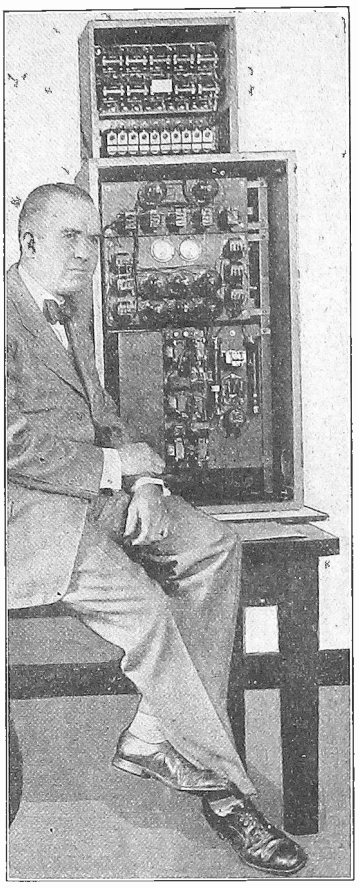
Whenever a supervisor in Washington wishes to know the height of the water in any one of the three reservoirs he simply calls up the mechanical man on duty at that point and makes the proper requests. The mechanical man replies with a series of tones indicating the level of the water. If the reply warrants a stoppage in the pumps taking water from that reservoir a tone of proper frequency is transmitted and the mechanical man stops the pumps.

Now on Regular Phone

Remote control devices similar to this have been used for some time, but previously they have required separate lines between the control point and the station operated. In many cases the cost of such lines have prohibited the installation of the systems.

In the new device, the invention of R. J. Wensley, of the Westinghouse Company, ordinary telephone lines are used because these lines are already installed between the points in question.

Since the telephone companies prohibit the attachment of any devices to their equipment, mechanical or electrical, the system used in connection with the telephone line must operate with sound. The supervisor can lift the hook of the transmitter and send out a certain sound with the aid of a tuning fork, an amplifier and a loud speaker. The loud speakers speaks the tone into the microphone just as a man would speak. Hence there is no connection at the transmitter which violates the rules of the telephone company.



(International Newsreel Photo)

A. J. Wensley, Westinghouse engineer and inventor of the intricate machinery shown, which is known as the televocal system or the mechanical man. This is the latest step in the automatic operation of distant machinery by sound impulses. The operation is quite simple.

The operator obtains his connection with the distant receiver in the usual way. If he gets the right number the sound of the telephone bell lifts the receiver off the hook. A relay is then put into play which gives a series of buzzes which indicates to the calling operator that he has the correct number. He then proceeds to give the mechanical man the commands.

Determined by Frequency

Before him the operator has the equipment for sending three different tones, the desired tone being selected by pushing one of three buttons on the control box. One of them gives a tone of 600 cycles, and when this is transmitted the mechanical man connects the operator with the desired machine. The second has a frequency of 900 cycles, and this one makes the mechanical man report the condition of the machine selected. The third has a frequency of 1400 cycles. When this is sounded the mechanical man is dismissed for the time being.

In the near future a large number of these automatons will be installed for controlling and supervising distant machinery. Everyone of these will displace at least one human being and release him for service elsewhere. One immediate use of the new device will be the control of substations and distant power plants from a central office.

The Electrical Circuit

The sounds used to give the electro-mechanical man are generated by tuning forks electricaly driven. Vacuum tubes play an important part in the operation.

The sounds generated are amplified with ordinary amplifiers and then impressed on loud speakers so that the microphone in the telephone may "hear." Audio frequency tuned circuits are used to separate the different frequencies in the same manner as radio frequency tuned circuits are used to separate two radio stations.

More KWKH Power Opposed by Stations

Washington.

William K. Henderson, owner of station KWKH, of Shreveport, La., against whom proceedings have been brought in the Louisiana court for alleged use of power in excess of that specified by the Federal Radio Commission, appeared before the commission to press his request for an increase from 1,000 to 10,000 watts. Representatives of other stations operating on the same frequency of 760 kilocycles as station KWKH, among them station WHN of New York, opposed the increase in power on the ground that they would be crowded off the channel.

H. P. Chandler for the Department of Justice undertook to examine Mr. Henderson with respect to his alleged violation of the commission's order limiting KWKH to 1,000 watts. Mr. Henderson declined to answer on advice of counsel the ground that he would have to answer those questions in court when his case was called. The Government charges that Mr. Henderson has used 3,000 watts instead of 1,000 watts.

Penalty Is Proposed for Improper Use of SOS

Washington.

A sub-committee of the International Radiotelegraph c Conference tentatively adopted a proposal that improper use of the international distress signal SOS by operators of ships and airplane pilots be penalized.

Representatives of shipping interests opposed the proposal on the ground that in many cases a master of a vessel decides that his ship is in genuine danger only to ride out the storm without accident. Penalization in such cases would be unjust. The objection was overruled by unanimous vote of the committee.

Roosevelt, Taft, Wilson, Harding Records On Air

Armistice day, Nov. 11, will be celebrated at KOA, Denver, by a two-hour evening program. The famous farcical comedy, "Behind the Front," will be given by KOA players as the program's first part.

As the second part, there will be broadcast records of addresses made by four past Presidents of the United States: Theodore Roosevelt, William H. Taft, Woodrow Wilson and Warren G. Harding.

LOOMIS AT KOA

Ernest Loomis and his Victor Recording orchestra are to furnish two dance programs every week for KOA, Denver, during the Winter. They will go on the air each Tuesday from 8:30 to 9:30 P. M., and Friday from 10 to 11 P. M., M. S. T.

Unified Diamond Packs A Powerful Wallop

By the Laboratory Staff

In building the Unified Diamond one has the option of making the set selective, very selective, or ultra-selective, as he sees fit. The best general advice is to follow the circuit diagram as shown. However, some special requirements of selectivity, due to one's location near powerful broadcasting stations, may be readily fulfilled. There are three simple methods of procedure, and one or all of which may be followed:

1. A fixed condenser of .0001 or smaller capacity may be placed in series with the antenna.

2. The entire primaries of the Aero coils need not be used. An easy way to reduce the primaries is to short circuit any unused part. A piece of bus bar may be connected between posts 3 and 4 on the Aero U43 coil, and the B plus lead run to either 3 or 4. In extreme cases the bus may be joined even from post 4 to post 2.

3. The adjustable primary on the Aero coil in the antenna circuit, U963, may be moved farther from the secondary by pressure of the finger.

It must be remembered that all such gain in selectivity is at the expense of volume and of sensitivity. The circuit as originally designed is just what it should be for average conditions. The outline given above takes care of exceptional cases.

Some set builders have the opinion that the resistance coupled audio amplification does not give commensurate volume. In the Unified Diamond the volume is so great that even without high mu tubes in the first and second audio sockets (4 and 5 in diagram), the CeCo type F tube in the output is taxed. Indeed even a type J CeCo tube or equivalent 71 tube, may be used, except that the circuit as described to date is for battery operation exclusively, and it is well to use a semi-power tube like the CeCo type F or equivalent 112 to keep the B battery drain as well as C bias voltage within reasonable limits.

The receiver lends itself to electrification, and systems embodying this will be the subject of future discussions.

(The Sept. 17, 24, Oct. 1, 8, 15 and 22 issues contained important constructional data on this set.)

BAYER JOINS VENUS

Venus Radio Corporation, 142 Liberty Street, jobbers, announces the addition to its staff of Hy Bayer, formerly technical editor of the "Graphic," a New York tabloid. Mr. Bayer will attend to the publicity of this rapidly growing concern and will also assist Sol Angstreich, sales manager and secretary of the corporation, on sales and distribution.

Marconi Back, Tells of New Dream Realized

In an address before an assembly of members of the Institute of Radio Engineers and the American Institute of Electrical Engineers, William Marconi told of the remarkable success of his radio beam system, with which it has been possible to encircle the world. Only five years ago he had demonstrated before a similar gathering with some crude mechanisms how he thought the beam system would work. This time, he showed slides of the huge beam transmitting plants.

He dwelt at length on fading, which he said was the main obstacle in the progress of radio.

"Fading has always been more frequent and more severe on the England-Canada circuit than on any of the others," he continued. "It may be noticed that our Canadian service is also our shortest distance service, that it is mostly across the sea and that the Canadian station is the one which happens to be nearest to the north magnetic pole."

One Out, Other Goes On

"It frequently occurs that when the Canadian communication fades out for some hours on end, the other services to Australia, India and South Africa, which use similar wave-lengths, continue working with undiminished efficiency. It has also been noticed that the times of bad fading practically always coincide with the appearance of large sunspots and intense aurora borealis, usually accompanied by magnetic storms and at the same periods when cables and land lines experience difficulties or are thrown out of action.

"We have also frequently noticed that during these periods signals could be received on a shorter wavelength than the one usually employed, often on a 16-meter wave when a 26-meter wave would not come through.

Under 16 Meters

"As is now generally known very short waves of 16 meters and under can be better received at long distances by daylight and in summer time than during Winter or at night, and we also know that very long waves are not affected by daylight."

"If we assume that long waves may be classed between 5,000 and 30,000 meters, and short waves between 5 and 100 meters, then, by applying the basis of a rule proposed for the consideration of the International Radiotelegraph Conference at Washington, we find that 3,700 wavebands or channels will be practicable and permissible for the short waves, but only 90 for the long waves."

BEAM SYSTEM POPULAR

Washington.

The beam radio system operating between Australia and Great Britain and between Australia and various European countries is proving immensely popular, traffic having more than doubled since its inception.

During the first five weeks from the opening of the service the beam traffic averaged 63,000 words per week. During the second five weeks the traffic averaged 130,000 words per week, and during the third five weeks the average had grown to 152,000 words per week, while during the last five weeks there has been a further increase to an average of 156,000 words per week.

GREBE LICENSED BY HAZELTINE AND LATOUR

The A. H. Grebe Company of Richmond Hill, Queens, N. York was recently awarded a complete license by the Hazeltine Corporation and its subsidiary, the Latour Corporation.

With this license and licenses from the Radio Corporation and its associated companies, the Grebe company becomes fully protected under important patents.

Radio World's CLASSIFIED ADS *for Quick Action*

10 Cents a Word—10 Words Minimum—Cash With Order

DIRECT FACTORY SALE—Wholesale prices. Tremendous Savings. Selling direct to you. Here are some of our many items: 30 Henry Choke, 100 M.A., $2.19; 10 Henry Choke, 400 M.A., $5.48. Power Transformers for all kinds of Eliminators and for all types of A.C. Tubes, at Special Low Prices. EVERY ITEM FULLY GUARANTEED. Promptly shipped, upon receipt of order. Send for free illustrated catalog today. Todd Electric Co., Inc. (Manufacturers) 36 West 20th Street, Dept. D, New York City.

SEND $1 for 8 weeks' subscription to RADIO WORLD, 145 W. 45th St., N. Y. C.

DATA ON how to make a 5,000 mfd. electrolytic condenser, the size of your fist, appeared in the Sept. 17 and 24 issues of Radio World. Send 30c for these issues or start your subscription with Sept. 17 issue. RADIO WORLD, 145 West 45th St., New York City.

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Higher Notes Impeded By Leaky Detection

By Rudmore J. Fawcett

Detection by the grid condenser and grid leak method introduces a suppression of the higher frequencies in the sidebands. This method detects the low frequencies much more completely than the high. The closer the carrier frequency and the modulation frequency, the greater is this effect.

For this reason the first detector in a Super-Heterodyne is not so efficient as a detector which changes the frequency directly from radio to audio frequency. Again in the second detector, where the ratio of the intermediate carrier to the audio frequencies is small, the suppression of the higher audio frequencies is greater than in a detector working between radio and audio frequencies.

But the effect is rather small when detection occurs between radio and audio frequencies. It is negligible in most cases.

The tuner in the radio frequency level has a similar effect on the higher frequencies in the sidebands. And this effect is much greater. In most circuits of high selectivity the suppresion is so great as to impair seriously the quality. The lack of strength of the higher notes can actually be appreciated by the experienced listener. Most listeners can tell that something is missing but have difficulty in locating the void.

Twin Coupler Coils

The Twin Coupler Co., Inc., 26 Cottage Street, Poughkeepsie, N. Y., makes more than twenty-five types of coils, carried in stock for every type of circuit. These cover space-wound tuning coils, short wave kits, space-wound RF transformer, also plug-in type, low-loss three circuit tuners, midget solenoids, flat low-loss, and many others. A complete line of Formalite tubing (a strong hard tube of impregnated paper with a polished finish, light brown or black) is carried in stock, also Westinghouse Micarta panels. After long research on the part of the designer, Twin Coupler coils were specified for the "Everyman 4." Literature may be had from the above concern—J. H. C.

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MAY 14.- The distinction between voltage and power amplification, by Spaulding Spencer. Operating the Six-Tube Adams-Griffin Shielded Set, by Dana Adams-Griffin. (Part II.)

MAY 7.—Part I of the Six-Tube Adams-Griffin Shielded Set, by Dana Adams-Griffin. How to remove squeals in Super-Heterodynes by employing the 54 degree angle method, by John L. Barrett.

APRIL 30.—The Equamatic mixer which can be used with almost any "super" coils, by Herman Bernard.

APRIL 23.—How to measure the cut-off in the resistance AF, by J. E. Anderson. Constructional data on the Melo-Heald, an eleven- tube Super-Heterodyne, by Herbert E. Hayden, (Part II). Part IV of the four-part article on how to obtain best results with the Nine-in-Line Super-Heterodyne, by Lewis Rand.

APRIL 16.—Part I of the description of the Melo-Heald Super-Heterodyne, by Herbert E. Hayden. Part II of discussion on the Nine-in-Line Super-Heterodyne, by Lewis Rand.

APRIL 9.—A five-tube shielded set employing transformer AF, by Herbert E. Hayden. Part II of constructional data on Power Compact, by Lewis Winner. Part II of the four-part article on the Nine-in-Line Super-Heterodyne, by Lewis Rand.

APRIL 2—(Fifth Anniversary Number) Part I of the four-part article on the super-sensitive Nine-in-Line Super-Heterodyne, by Lewis Rand. The three-tube compact, a simple one-dial, three-tube regenerative set by Jasper Henry. Part I of the two-part article on a Power Compact, the B eliminator with a stage of power audio frequency amplification by Lewis Winner.

15 cents a copy—all seven issues for 80 cents

Radio World, 145 W. 45th St., N. Y. City

112A and 71A Tubes Are Put on the Market

When we were introduced to the 71 power tube we were given opportunity for potentional power in the loudspeaker. Shortly afterward the high mu tube came out to make the potential power active. The result was that we could obtain fine quality and great volume with resistance coupled amplifiers.

Introduction of the AC tubes, 26 and 27, followed soon after the high mu tubes, and made possible and practical the operation of receiver from the alternating current mains without the intervention of storage batteries and chargers. Many fine receivers have already been built around these tubes.

As soon as we had become familiar with the characteristics of the AC tubes the announcement of the four-element 22 tube was made. This tube has not yet been put on the market but the manufacturers have promised that it will be before the end of the current year. Samples of the new tube have been distributed among licensed receiver manufacturers in order that they may be able to incorporate the new tube in next season's models. Interesting circuits embodying this tube have already been suggested.

The 112 which was introduced about two years ago as a power amplifier. It is a good semi-power tube and deserves a greater popularity. Perhaps in its new form, as the 112A with .25 ampere filament instead of .5 ampere, it will forge ahead on the sales chart. This tube has been quietly put on the market and has been obtainable for a month. It has the same characteristics as the 112, with the exception of the filament current. A more efficient filament emitter accounts for the doubled filament efficiency.

The same improvement has been introduced into the 71, in the form of the 71-A, which requires only ¼ ampere filament current but otherwise it has the same characteristics as the older power tube.

The 210 tube has long been in the field and just now it is rapidly gaining in popularity. Its high amplification and high power handling capacity account for the swing of the public toward this tube.

A much higher filament wattage is required than for any of the other tubes, but this fact has not deterred users, who usually heat its filament from the power mains through a step-down transformer. The cost is low.

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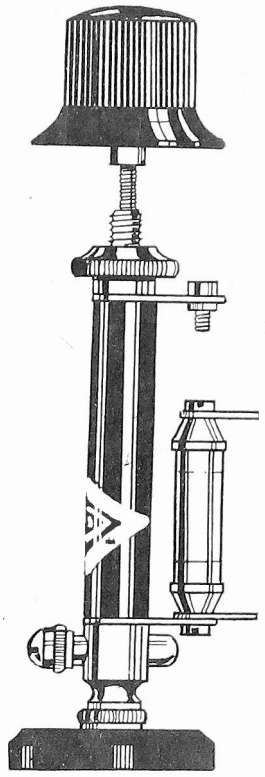

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5. The lugs are adjustable to any position within the sweep of a circle.
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7. The syphon container distributes a constant supply of resistance element, making the reading straight line resistance, and preventing uneven distribution of the resistance element.
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