

RADIO

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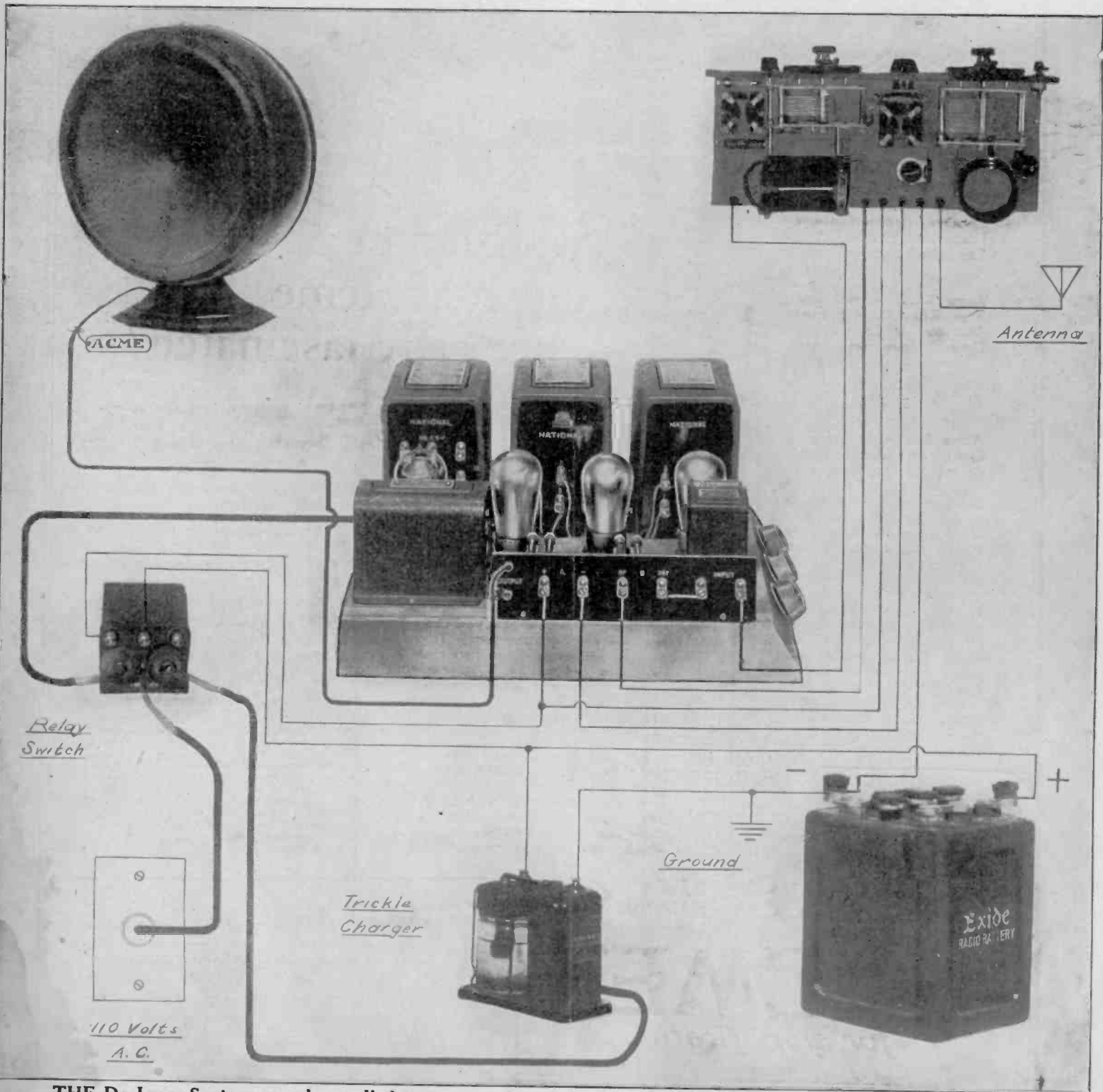
WORLD

America's First and Only National Radio Weekly
Vol. 10 No. 17 Illustrated

Simple Test Meters
Infinite Waves in a Tube
Static Called Sun Talk
Value of Negative Grid

THE DE LUXE SYSTEM—By Arthur H. Lynch

SEE PAGE 3



THE De Luxe System may be applied to any receiver to make it lamp socket operated and supply the audio.

**“Every note -
high and low -
perfectly clear”**



Acme K-1 Enclosed Double Free Edge Cone Speaker, (shown above). Diameter of Cone, 14 ins. Tan metal case.

Price: \$25.00

Acme K-3 Enclosed Single Free Edge Cone Speaker. Diameter of Cone, 11 ins. Green bronze metal case.

Price: \$18.50



Acme Enclosed Free Edge Cones and Acme Reproducing Units, (Designed for use exclusively with the free edge cone) eliminate resonance and preserve the tones, pure, round and clear. A fixed edge cone, to produce the same results, would have to be three times the diameter, too clumsy for your living-room. High notes are reproduced toward the center of the cone; low notes, toward the edge. The laws of vibration make it possible to produce low notes with a small cone, provided the edge is free and enclosed, and provided the reproducing unit is especially designed for use with a free edge cone.

Write us for circular describing full line of Acme products.



**“We listen to
our new Acme
perfectly fascinated!”**

“...With our new Acme Speaker, the voices and music that come in are so clear and beautiful that we just love to listen. It seems as if what we hear are the actual voices and music themselves...”

The wonderful new Acme Loud Speaker successfully reproduces voices and music, in your own home as clearly as they were originally created in the broadcasting studio. It reproduces the voice of the singer in all its thrilling, tender beauty. It brings out the different personality in each voice, so that you can tell one voice from another. It recreates orchestral music so clearly that you can hear each instrument playing. It reproduces low notes and tones as clearly as high notes and tones. You hear the bass and treble, harmony and melody.

All this was not done in a moment, Acme engineers worked five years and made 256 experimental speakers, before they arrived at the new Acme Enclosed Free Edge Cone and Acme Reproducing Unit, which together are responsible for

this great increase in radio enjoyment.

**See this new Acme
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Try out this new Acme for yourself. See if all we have said about it is not true. Compare it with others in the dealer's store. Drop in at your dealer's today and hear this remarkable new speaker. Made by Acme Apparatus Co., Pioneer Radio and Transformer Engineers and Manufacturers, Cambridge Mass., U. S. A.

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ACME APPARATUS CO.,
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Enclosed find 10 cents (stamps or coin) to cover cost of sending me one copy of “Amplification Without Distortion,” 13th edition

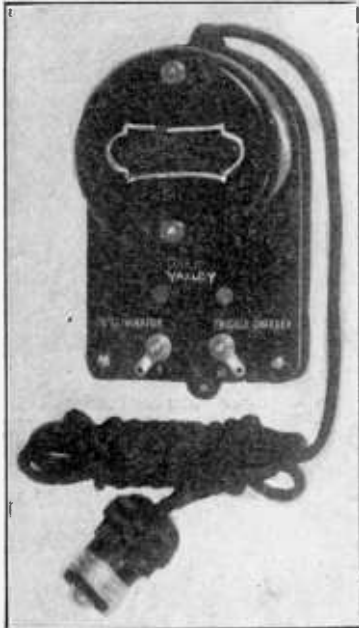
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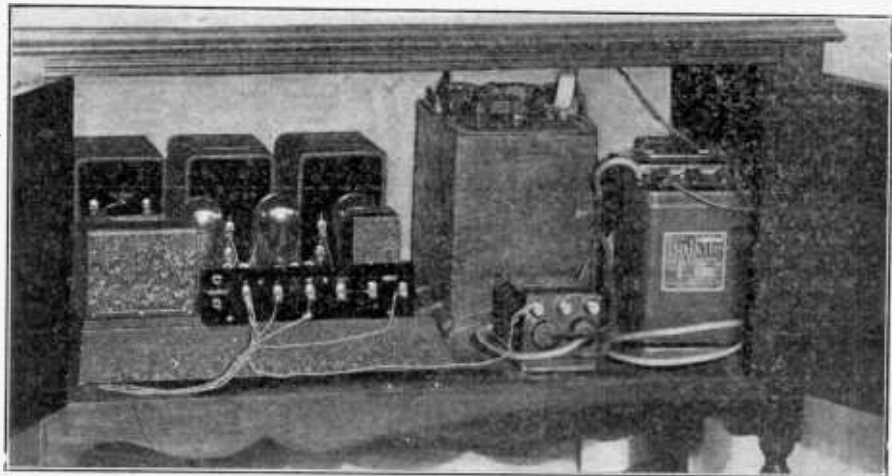
City State

[Entered as second-class matter, March, 1922, at the post office at New York, N. Y., under Act of March 3, 1897]

De Luxe Reception From Lamp Socket with Latest Devices



THE Yaxley automatic power control.



OPENING the doors of the nether compartment of the console that houses the De Luxe Receiver one sees the National-Lynch Power Amplifier and B Supply at left, with terminal strip posts connected to the receiver and to the Brach Controlit. The trickle charger and Exide A battery are respectively to right and rear of the Controlit. The cords of the Acme double free edge cone speaker would be connected to the tip jacks marked "output."

THIS is the third of Mr. Lynch's series of four articles on the design, construction and operation of his De Luxe Receiving System. The first two articles appeared in Radio World for January first and eighth. The final article will appear next week.

In the present article Mr. Lynch, who designed the famous Universal and Aristocrat receivers and was Editor of "Radio Broadcast" for nearly four years, describes various units, easily procurable at most radio shops, for making any radio receiver operate from the electric light socket. To make most of his points doubly clear the author illustrates his ideas in connection with his latest creation—the De Luxe Receiver System.—EDITOR.

By Arthur H. Lynch

IN the past two issues of RADIO WORLD the author has described the construction of the De Luxe Receiver, consisting of the tuner and the lamp socket powered amplifier.

Before wiring the units together and installing them in a console cabinet, an A power supply device for the radio frequency amplifier, detector and first two audio frequency amplifier tubes must be selected.

Many readers no doubt have on hand a good storage battery and charger. While very satisfactory results may be obtained from the use of such equipment, the operation is not entirely automatic as it is necessary to charge the battery periodically. A trickle charger and an electrically operated switch, however, will readily convert an A battery into an economical and serviceable A power unit. A trickle charger is a charger that runs continuously at a very low rate, whenever the set is not in operation. Generally this charging rate is between one-quarter and one-half an ampere. By charging of this nature the battery is always kept in the best of electrical con-

dition and never gets a chance to run down. Furthermore, by the use of one of the new relay switches, the turning off and on of the trickle charger is made entirely automatic, so that the only attention ever required by the A power supply as a whole is the occasional addition of distilled water to the battery. Even this operation is greatly simplified in the new batteries designed especially for trickle charge use, as the electrolyte space over the plate tops is materially increased so that it is necessary to add water hardly more than once a year.

A Batteries

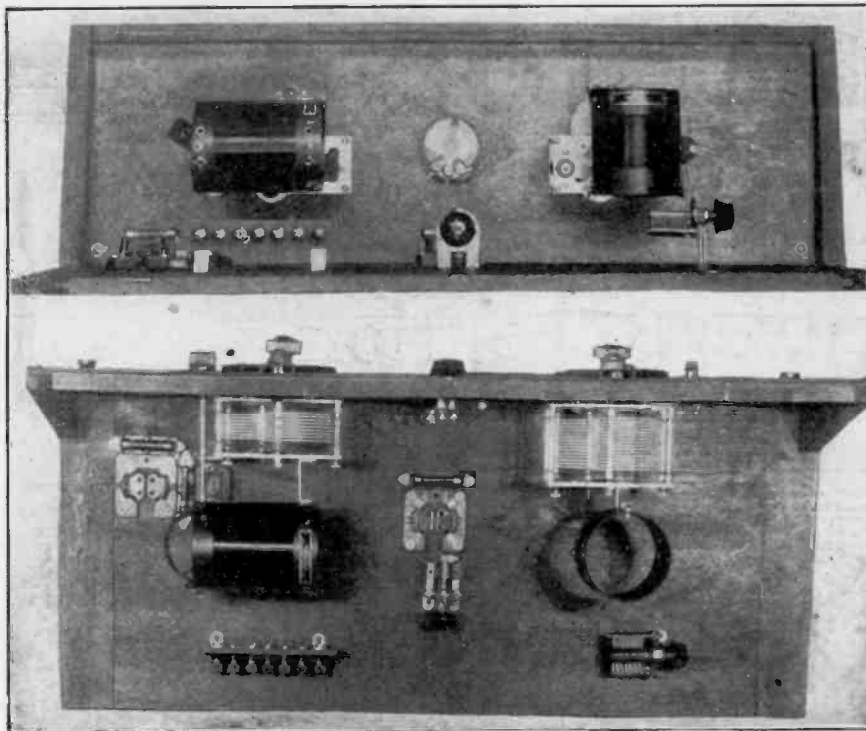
The storage batteries first used for radio work were merely automobile batteries. No thought had been given by the manufacturers to make them spray proof and neat in appearance. Today, however, radio A storage batteries have been developed to the point where they may be placed permanently inside the radio cabinet without any danger of corrosion due to acid spray when charging. And now some manufacturers are going so far as to build charge indicators

right into the battery so that its condition may instantly be observed at any time without the inconvenience of using a syringe type hydrometer.

The small batteries used in radio A power units have been especially designed for the purpose. An unusually large space is provided above the tops of the plates for excess electrolyte to compensate for that loss by evaporation and electro-chemical decomposition during charging. In these cells it is seldom necessary to add water more than once or twice a year.

Trickle Chargers

Trickle chargers are of several different types, the classification being based upon the method of rectification employed. The Balkite trickle charger is of the chemical rectifier variety and is made in two different styles, (1) the plain trickle charger and (2) the combination trickle and high rate charger. The advantage of the combination charger is evident when one stops to think of what would happen if the set were to be left running continuously for several days. The battery would be dis-



THE rear view and the top view of the De Luxe Receiver, the construction of which was described by Arthur H. Lynch in the January 1 issue of Radio World. Lamp socket operation of this or any other receiver is made possible by adopting the design discussed by the author this week.

charged to such an extent that the trickle charger would not be capable of "bringing it up" again. By switching the combination charger to the high rate connection the run-down battery may be fully charged overnight. The only attention required by the Balkite type chargers is the occasional addition of distilled water. Full directions are supplied with each charger, showing how to adjust the trickle charger rate for any type of receiver under different types of service. In determining the charger adjustment it should be kept in mind that the De Luxe Receiver draws only about 1.3 of an amperes from the A power unit, when the dial lights are not burning, and 1.8 amperes when they are burning.

Another type of trickle charger is that employing the new Tungar quarter ampere rectifier tube. This tube is of the filament type and does not require any attention whatsoever. It is used in the Tungar trickle charger and in the Philco and Exide A power units.

Still another device which is receiving wide use in trickle chargers and A power units is the new dry contact rectifier. This unit combines the advantages of no attention, long life, and rugged construction. The theory of the dry contact rectifier is much the same as that of the crystal detector or "rectifier" formerly so much used in commercial radio work. The dry contact rectifier consists of plates or discs of dissimilar metals with specially treated surfaces held together under great pressure. The resistance offered to the passage of an electrical current from one plate to the other is very much greater than that offered to the passage of electrical current in the opposite direction. Thus, when the contact rectifier is connected in an AC line it tends to let current pass in only one direction and thus becomes a "rectifier." Dry contact rectifiers are used in the Elkon trickle charger and the Westinghouse Autopower.

Trickle Charger Control

Master control switches serve three distinct purposes. First, they turn off and on the filament current for the entire set; second, they control the lamp socket power, which in the case of the De Luxe Receiver is the A, B, and C power for

the power amplifier and the B power for the entire set; and third, they control the trickle charger. Formerly, switches of this type, such as the Brach, were manually operated and required, therefore, a readily accessible location in the console cabinet or on the table beside the set. Such a location for the switch was often inconvenient from a wiring and operating point of view, while at the same time detracting from the appearance of the set as a whole.

Now, however, we have the relay controlled master switches which may be placed in any out-of-the-way, yet suitable place, and remotely operated by the filament switch on the panel of the set. This procedure is accomplished by having the relay operated by a magnet comprising a few turns of heavy wire. This electro-magnet is connected in series with one of the filament leads (see front cover) and, when the filament switch on the front panel of the receiver is turned on, the current that passes through the magnet operates the switch, resulting in the automatic disconnecting of the trickle charger and the turning on of the B power supply.

In the case of the De Luxe Receiver, where the volume control and switch are combined, turning the volume control knob gradually reduces the volume from life-like intensity to a mere whisper and then automatically shuts off the power and vice versa.

Manually operated power control switches are supplied with many of the combined trickle charger and A battery power units, such as the Gould, Exide, Philco and Westinghouse. The necessity for a separate switch in such cases is therefore done away with. Relay switches which have been tested by the writer and found to be thoroughly reliable are those manufactured by Brach, Yaxley, Jewell and the Reliable Parts companies.

The Complete A Power Units

The complete A power units, such as the Westinghouse Autopower, Gould Unipower, Philco A Power, and Exide A Power consist of a trickle charger, manually operated control switch, and a special A battery mounted in a compact and neatly finished case. Complete units of this type are generally less expensive

than the component parts, such as charger battery and switch. They are also more compact, neater in appearance and more convenient to use, as the individual parts are wired together within the case.

While the master switches supplied with the complete A power units are of the manually rather than the electrically operated type, this is not necessarily to be considered as a weak point. The manually operated switches are exceedingly serviceable and reliable in every way. The only real difference between the two is matter of location. The manually operated switch must be accessible. The other need not be.

A Eliminators

So far nothing has been said of A power units that work directly from the lamp socket to the radio set rather than in the somewhat indirect manner of the trickle charger and storage battery A power units. The A power units of the battery type give exceedingly satisfactory results, are very inexpensive, and may be obtained in any part of the country.

The writer has, however, done a great deal of experimental and research work with A power units of the "eliminator" type in which no storage battery is employed. The present drawback to the use of such a device is brought about by the high cost of building them and the unavailability of the essential components, in some parts of the country. It is believed, however, that it will not be long before the batteryless A power units will come into rather wide use and for this reason the next article in this series, which will appear in RADIO WORLD for January 22, will deal with the construction and use of the De Luxe Receiver without an A battery of any kind.

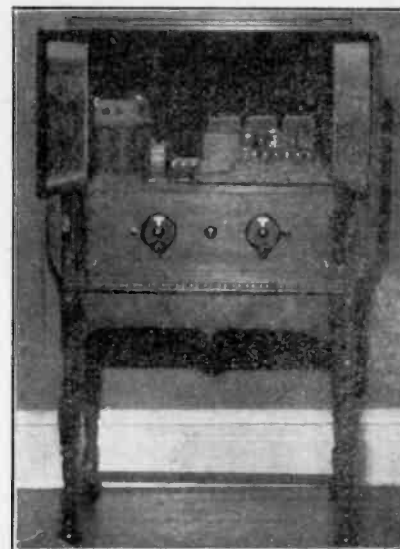
At present, however, it would seem that the A power units of the battery-trickle charger variety is the least expensive and most reliable. In fact, the A power unit used by the author with the De Luxe Receiver in his own home is of this latter type.

Completing the De Luxe Receiver

Having selected a suitable A power unit and control relay, the constructor of the De Luxe Receiver may connect the various component part together in the manner shown on the front cover.

Console Cabinets

A fitting console for a set capable of the excellent performance of the De Luxe Receiver is not so easily found. Many persons spend considerable time and money building an excellent radio set



HOW the lamp-socket-operated De Luxe Receiver appears in the author's home. The console is a Westbrooke, designed by Maj. J. Andrew White.

and then for the cabinet select any cheap box they can procure, with little effort. The result is that the complete job is not fit to grace the living room and the set has to be "hidden away" in some other part of the house. Why not spend a few dollars more for a respectable cabinet and thus obtain a piece of furniture that anyone would be proud to display?

With such points in mind, the writer began to look around for a good cabinet or a cabinet company capable of making a good cabinet. The result was the finding that the well-known sports announcer, Major J. Andrew White, is now designing and manufacturing some most excellent console type radio cabinets. In fact, the result of a visit to the Major's studio-showroom in the arcade of the Bar building at 41 West Forty-third Street, New York City, was the purchase by the writer of the cabinet shown on page 27 of the January 8 issue, for the De Luxe Receiver in his own home. This cabinet is the Westbrooke, of burl walnut.

The Antenna and Ground

With the type of antenna coil used in the De Luxe Receiver it has been found that the most satisfactory length of antenna for ordinary use is about seventy-five feet, not including lead-in. The antenna series condenser should be adjusted so as to cause the two tuning dials to read alike. Once this has been done no further adjustments of this condenser will be required. For this reason it is not mounted on the panel, but inside of the cabinet where its adjustment is not likely to be tampered with by anyone not familiar with its purpose. For best results with a very short antenna (less than 30 feet) the series condenser should not be used, unless the receiver is located close to a powerful local station.

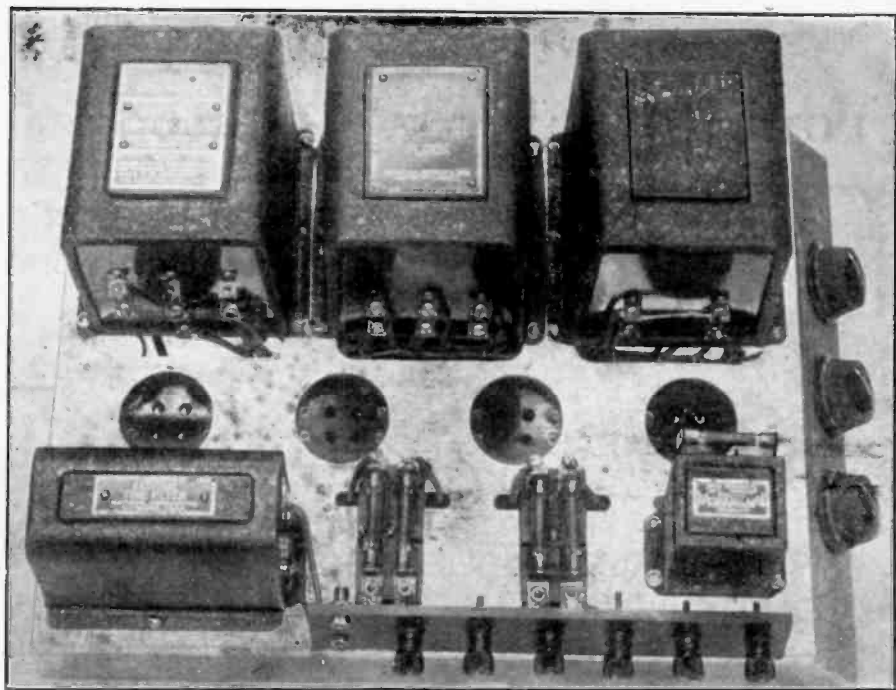
Any type of lamp socket operated receiver requires a good ground. General experience indicates that the most suitable ground connection is obtained by connecting to a cold water pipe with a good ground clamp. The surface of the pipe should first be well cleaned with emery paper or an old file.

Operating the Receiver

Insert the tubes and resistors in their proper places as indicated in the illustrations in the two preceding articles, plug the cord from the relay in a suitable lamp socket or base-outlet, and turn the volume control on full—thus automatically turning on the power to the set. The next step is to loosen the two B voltage control Clarostats and tighten the grid bias control Clarostat (on the amplifier). Then tune in some local station. The tickler coil should be turned to the half-way position so that its axis is at right angles to the axis of the main solenoid coil. When a station is heard in the loud speaker, the detector and radio frequency amplifier voltage controls should be slightly screwed in until the best results are obtained. Care must be used, especially with the radio frequency amplifier voltage control, not to turn the knob too far so as to apply an excessive voltage to the plate of the tube.

When tentative adjustments of the plate voltages have been made, adjust the grid bias voltage control. This Clarostat should be turned in quite far. The proper adjustment is easily found, for if the knob is not turned in far enough, the received signals will be distorted with lack of volume, while if the reverse adjustment is made, a sound will be heard from the loud speaker much resembling the "put-put-put" of a single cylinder motorboat engine. Having found the proper setting for the grid bias control, return again to the plate voltage controls, which will now probably require a slight readjustment.

With the audio amplifier properly functioning, attention can be given to the neutralization of the radio frequency amplifier.



A VIEW of the National-Lynch Power Amplifier and B Supply, as seen at a slant from the top. Power transformer, choke coils, Tobe B block and audio amplifier are included. At right are the three Clarostats, voltage regulators.

This may best be done by turning up the volume control (left) to its maximum point and the regeneration (right) control to a point just below maximum regeneration.

Adjust the right-hand dial to the point where the signal is loudest. Then rotate the left dial up and down the scale to a point above and a point below where the strongest intensity is heard. As the left-hand dial is rotated a squeal will probably be heard. By adjusting the neutralizing condenser, this squeal may be readily eliminated. Once the neutralizing condenser has been properly adjusted it will require no further attention, unless some change is made in the circuit. As a 199 type radio-frequency amplifier tube is employed, the process of neutralizing is quite simple and should not cause any difficulty.

Whenever a station is tuned in, its call letters may be recorded directly on the dials to facilitate tuning to it again at some future time. When it has been tuned in satisfactorily, the volume may be regulated by a variation of the volume

and regeneration controls. In tuning for distant stations the use of regeneration, increasing sensitivity and selectivity, makes such reception easier.

The use of the slow motion vernier dial controls will be found to be of considerable help in tuning for distant stations. For local reception, the coarse motion permits of rapid tuning from one end of the dial to the other. The dial lights, being controlled by an independent switch, need only be used while tuning, thus reducing the power consumed and making their life very long.

As the power consumed by the dial lights is not very great, they may be kept burning at all times when the set is in use, to serve as a pilot light.

For the sake of better acoustical results and ease in tuning, the loud-speaker should be placed in a different part of the room from the set itself. If desired, extension cords may be run to several different parts of the house and the speaker placed wherever it is most convenient at different times.

[Final article next week.]

Socialists Plan a Station To Honor Memory of Debs

The National Executive Committee of the Socialist Party, at a meeting in the People's House, 7 East Fifteenth Street, New York City, recently, decided to erect a broadcasting station in New York or Chicago as a memorial to Eugene V. Debs. It is hoped the call letters WDEBS can be used. It is said the station's object will be "primarily to champion the cause of liberty and social justice in the broad and liberal spirit of Eugene V. Debs."

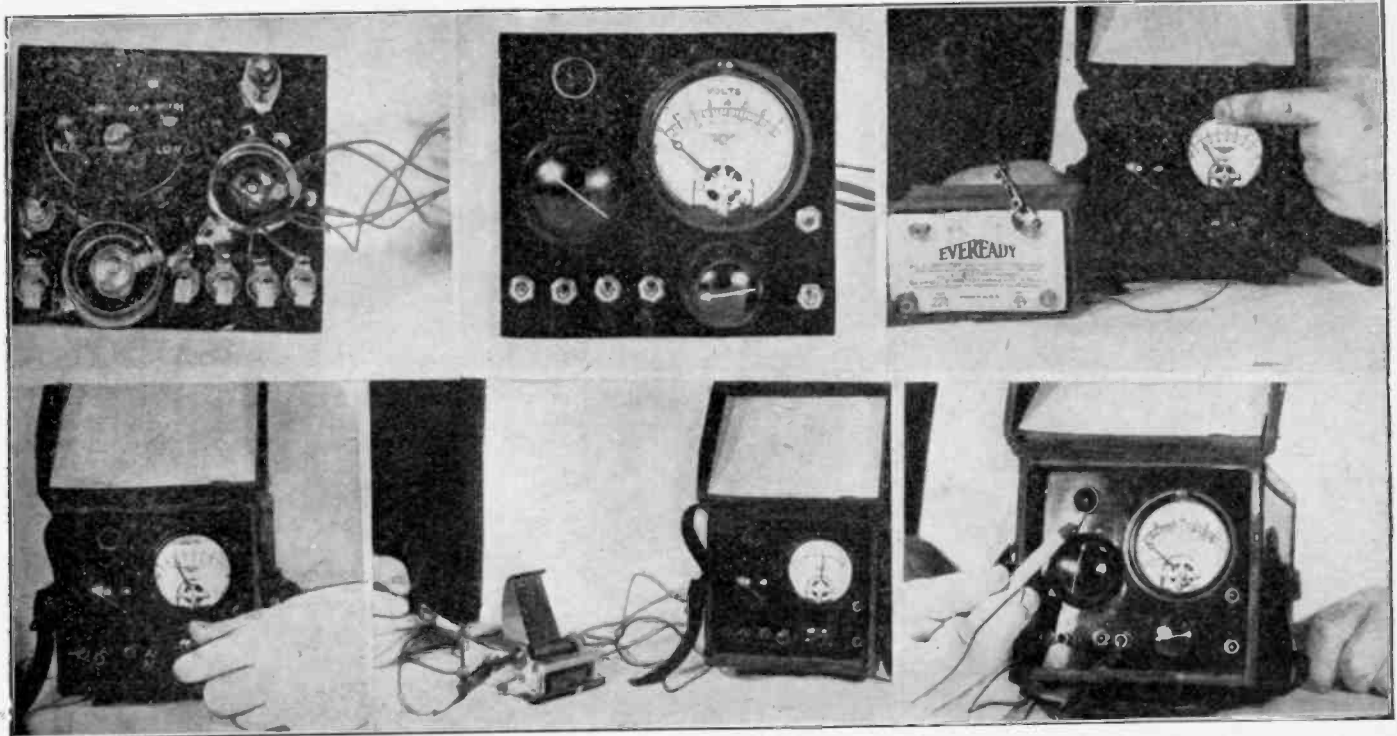
August Claessens, executive secretary of the party, said that the station probably would be in Chicago to obtain wide distribution and probably would give a program combining entertainment and propaganda. A public campaign has been authorized to raise \$200,000 to finance the station. It is planned to administer the

fund and operate the station through a board of trustees representing organizations, movements and ideas for which Mr. Debs stood.

The following have been invited to become trustees: Jane Adams, Sidney Hillman, A. Philip Randolph, James H. Maurer, John Haynes Holmes, Albert F. Coyle, Norman Thomas, Roger Baldwin, A. M. Todd, John Whitlock, Rufus Wood, B. C. Vladeck, Theodore Debs, Victor Berger, Morris Hillquit, George E. Roewer, Harriot Stanton Blatch, Robert Morss Lovett, Harry F. Ward, Samuel Levin, Herbert S. Bigelow, Elizabeth Gilman, William Mitch, Channing Sweet, Joseph S. Baskin, Abraham Baroff, Cameron H. King and Upton Sinclair.

Several have accepted already.

Test Set Pays Its Way Trouble Quickly Located By Meter Hookup



THIS shows the arrangement of a convenient test set that may be used in trouble shooting. The diagram of connections (shown on page 7), is placed in the lid of the case.

By Herbert E. Hayden

Photographs by the Author

A MOST useful thing to have around a radio installation is a test set by means of which the trouble shooting may be done. It is easy to build, not expensive, easy to use, and it may save its cost in a short time in service charges.

LIST OF PARTS

- One voltmeter, small size, double scale (low scale 0-7½; high scale 0-150).
- One Carter 2,000-ohm potentiometer, used as rheostat.
- One Carter four-point inductance switch.
- Six Carter midget phone jacks.
- Two Carter midget phone plugs.
- One Yaxley panel jewel with miniature flash lamp.
- One buzzer.
- One camera (or other) case, 6½x5x4½ inches.
- A bakelite panel 4¾x4 inches.
- 2 Eveready 4½ C bat.

The circuit arrangement of the test set is shown in the accompanying diagram. The circles labeled 1 to 6 are the Carter phone jacks. The black dots numbered 1 to 4 are the stops on the inductance switch and Buz represents the buzzer. The other parts are designated by name.

The voltmeter, the rheostat, the inductance switch, the flash light and the small jacks are mounted on the panel. Before these are laid out the batteries and the buzzer should be placed inside the case and then the panel should be laid out so that no parts mounted thereon will interfere with the batteries and the buzzer. The actual layout in any case can best be determined after all the parts have been collected.

One of the main uses of the set is testing of continuity of leads and of connections. For this purpose there should be a handy indicator which shows when current is flowing. There are three in-

dicators in this set, any one of which may be used as occasion demands.

Suppose the voltmeter is to be used as the indicator. The plugs may be plugged into jacks 1 and six, 2 and six, 3 and six according to the voltage which is necessary to give an indication in a particular case. The test clips are then connected to two points between which there is reason to suspect lack of continuity in the wiring, or vice versa as the case may be. If a reading is obtained, the circuit is closed between the two points, if no reading is obtained the circuit is open. For example, it may be desirable to test the contact between the rotor plates of a condenser and the terminal for those plates. This is a test of the electrical connection made at the bearings in case the condenser is not pig-tailed. The meter should show a deflection when the two test clips are connected between the terminal and the rotor plates. Again it may be desirable to test the condenser for short circuit between the plates. The test clips are then connected to the two terminals of the condenser. If there is a deflection for any setting of the condenser, it is defective. The circuit should be open, and no reading should be obtained. This method is particularly useful for testing the continuity of high resistance windings, such as the primary and the secondary of an audio transformer, or for testing the continuity of high resistances.

In some cases it is desirable to have an audible indicator. Because it is not then necessary to take the eyes off the work while testing. In such cases the buzzer is used. One of the test clip plugs is inserted in jack 4 and the inductance switch is set on stop No. 2. The other test clip plug is inserted into jacks one, two or three, according to the voltage that is required to operate the buzzer through a given circuit. It may be desired to test the connection of a soldered joint to see whether it makes good electrical contact. The test clips are connected to either side of the suspected joint. If the buzzer

operates the contact is good, that is provided that enough voltage is used on the buzzer to make it work on short circuit.

In case it is not desired to use either the voltmeter or the buzzer as an indicator, a red pilot light may be used. This is noiseless and is a much better indicator than the voltmeter, as the light may be seen without actually looking at it. To set the tester for the pilot light the inductance switch is set on stop No. 3, the other connections remaining the same as for the buzzer.

Switch point No. 1 in connection with jack No. 4 may be used for the low scale of the voltmeter, when this scale is to be used as indicator.

When it is desired to use the voltmeter to test the condition of the B battery in the radio set the test clip plugs are inserted into jacks five and six and the test clips are then connected across the battery to be tested. The high voltage will then be recorded on the meter, provided that the high voltage switch on the meter has been set for high. This combination may be used for testing the continuity of primary windings of transformers and of plate coupling impedances when the receiver batteries are connected. One of the test clips is connected to the plate of the tube preceding the winding to be tested and the other clip is connected to the minus post of the B battery, or to the filament of the tube. A reading on the meter shows that the entire plate circuit from tube binding post to filament is continuous.

If the low scale is wanted for testing the condition of the A battery one of the test clip plugs is left in jack No. 5 and the other is inserted in No. 4 while the switch is set on stop No. 1. The test clips are then connected across the A battery or across the filament terminals. The reading on the meter is the voltage between the two points to which the clips are connected.

The object of the 2,000-ohm rheostat is to control the current flowing in the-
(Concluded on page 7)

What About Single Control?

A Discussion of Difficulties and Two Solutions

By Silas Hemstreet

MANY sets having a common control for all the tuning condensers have been built with more or less success. Very often the success is not so great as the care exercised would lead one to expect. The question naturally arises as to the reason for the discrepancy between expectation and performance. There are several reasons.

Let us assume that the tuning circuits are sharp, that is, that both the tuning coils and the condensers are really first-class. The condensers may be of the same make and of the same size and style. That is, they may have come out of the same die. One would expect them to be exactly the same. But they are not, no matter how carefully they may have been made. There are unavoidable differences which creep in during the manufacturing process. They are very small, to be sure, but of sufficient magnitude to cause the two tuned circuits to deviate from each other. When one tuned circuit is in exact resonance with the incoming signal the other circuits are slightly off tune, and the signal is lower than it would be if all the tuned circuits were in exact resonance with the signal carrier.

What is true of condensers is also true of tuning coils in this respect. They may be wound the same way with the same machine at the same time. Yet they will differ slightly, both as to inductance value and distributed capacity. These differences arise in the slight differences in the coil diameter, in the size of the wire used, and in the insulation of the wire. Wire of a given number is not always of the same diameter. It is made by pulling the metal through dies or tiny holes. The diameter of these holes depend on how long the dies have been in use. They increase in size through wear. A wire drawn with an old die is thicker than one drawn with a new one.

Thick and Thin

Hence the wire at one end of a given spool will be thicker than at the other. Slight differences in the materials of a coil will make differences in the characteristics of the coil, and these differences will be introduced into the tuned circuit.

Still another reason why the several tuned circuits in a receiver pull apart while tuning is the minimum capacity of the coil and condenser in place in the circuit. No two tuners can ever be

placed exactly alike with respect to other parts of the receiver. Distributed capacity will be different for the different tuned circuits, and these differences will be different for various settings of the condenser rotors. The practical impossibility of tuning two or more circuits to exact resonance with the same frequency with a single control is obvious.

There is still another cause why the tuned circuits cannot be tuned simultaneously with the same gear, and that is the variations in the tube capacity.

Temperature Counts

The capacity between the grid and the filament of a vacuum tube, which capacity is in parallel with the tuning condenser, varies with the temperature of the filament, with the value of the grid potential, with the value of the plate potential, and with the load in the plate circuit. Any two vacuum tubes will also differ, even if they are of the same make and type. These variations are much greater than the inevitable variations in the coils and condensers of good make.

As long as the differences remain constant no particular harm is done, as their effects may be easily compensated for. It is only necessary to adjust all the inductances of the coils to be alike and also the capacities of the condensers to be the same. The coils may be adjusted by slight changes in the position of the end turns and the condensers may be adjusted by means of small vernier condensers connected in parallel with the main tuning condensers. Suppose that L is the true inductance of one tuning coil, then the true inductance of the other tuning coils should be adjusted to have the same value. Also assume that the capacity of the first condenser is C and that the effective zero capacity of the circuit is C_0 , then the other condensers should be adjusted so that their capacities are also equal to C and that the zero capacity in each case is exactly C_0 . Not only should they be the same but the rate of change of C should be the same for all the tuning condensers throughout the tuning scale, that is, while tuning capacity should be put in or taken out of the several circuits at exactly the same rate. If this is not done the different tuned circuits will not stay in tune with the same frequency.

Two Practical Solutions

The conditions for successful simultaneous tuning of several circuits are many

and exacting. There is no wonder that so many circuits in which the method has been tried have been failures, but rather that some circuits have been as successful as they are.

There are two practical solutions to the difficulty. One involves a loss of sensitivity of the receiver, but a gain in quality and in space. The other method involves the addition of auxiliary tuning controls in the form of balancing vernier condensers.

In the first method the coils are wound with fine wire on small forms, thus intentionally introducing losses into the receiver. It need not, however, introduce any change in the effective selectivity of the set, because a receiver in which the several tuned circuits are not in exact resonance is not selective even though each tuned circuit is very selective. The use of small coils of moderate selectivity make the use of a common control practical than when more carefully made tuning condensers are used.

An Auxiliary Control

In the second method small condensers having a few tens of mmfd. are connected across the tuning coils together with the main condensers. The tuning condensers are then adjusted as nearly as possible for some one frequency, or setting, and then any variations of the different tuned circuits are taken care of by the verniers. This may be used even when the most selective tuners are used, provided that the variation never exceeds the maximum capacity of the midget condensers. This is the simplest way of getting out of the trouble. It does not involve the loss of selectivity, but it has the disadvantage of auxiliary controls.

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By Municipal Station

Philadelphia, Pa.

Eddie Moken and his fellow straphangers recently contributed \$2,600 for next year, for the Pennsylvania Rapid Transit's privilege of broadcasting entertainments from Camden's municipal station WCAM, on alternate Monday nights.

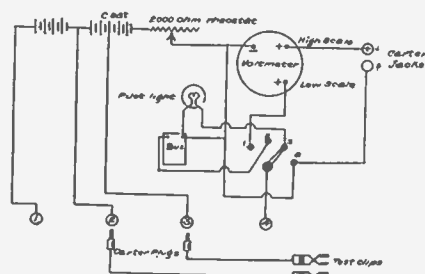
At the weekly meeting of the Camden City Commission, an agreement was reached, whereby the traction company will be permitted the use of the station for twenty-six hours during 1927, at the rate of \$100 an hour.

How to Wire the Simple Meter Test Circuit

(Concluded from page 6)

indicators, mainly to protect the low winding of the voltmeter and the little pilot light. This rheostat is simply a 2,000-ohm potentiometer in which only the middle and one of the side terminals are used.

Perhaps the most difficult part of the construction of this test set is the drilling of the large hole in the panel for the voltmeter. But this may be done as follows: First, describe a circle of the proper diameter on the panel. Then drill small holes along the circumference of this circle as close together as possible without the drill breaking through to adjacent holes. When the entire circumference has been drilled tap out the central portion and clean the edge with a half round file.



HOOKUP for the tester. The 2,000 ohm rheostat and high scale-low scale voltmeter are designated, as well as the numbered points.

The various jacks and the switch points should be numbered for reference. One

method of doing this is as follows. Above jack or stop No. 1 drill a small hole in the surface of the panel. At No. 2 drill two such holes, and so on. The holes need not be any deeper than a 1/32 of an inch. They may be filled in with white crayon or ink for visibility.

Another way of numbering the jacks is to get transfer numbers and transfer these to the panel. Or again neat numbers may be written on white circles of paper and these circles pasted on the panel at the appropriate places.

The constructor of this set should either keep the drawing of this set or else make his own and keep it handy around the test set. It is not possible to remember the various connections very long without it, so the advice had better be heeded.

Is Static A Solar Message?

Pupin Puts Question to Learned Society

Speculates on Possibility of Deciphering the Solar Code—Credits Clerk-Maxwell and Hittorf with the Broadcasting Achievement

Philadelphia, Pa.

Michael L. Pupin, Professor of Electromechanics at Columbia University, New York City, recently delivered the Presidential address at the opening of the convention of the American Association for the Advancement of Science. He said that the heroes of broadcasting are Clerk-Maxwell and Hittorf. Marconi's work was called "a simple inference," while the three electrode tube was "a shrewd application of well-known phenomena." As to what may happen during the next twenty-five years, he said that static and fading and so-called earth currents in cables, which a student of these peculiarities may imagine to be electrical messages transmitted by the actions of the sun, will be deciphered, with the advancement of the electrical communication.

Distributes Honors

"The most important advance in the art of electrical communications concerns the transmission of magnetic action at a distance," stated Prof. Pupin.

"The theory of this transmission was really worked out by the great Scotch scientist Clerk-Maxwell and published sixty years ago, but his great theory was not understood by the telegraph and telephone engineers for over thirty years, and so the art of transmission of electromagnetic action was not advanced.

"That which contributed most to the advancement during the last thirty years was undoubtedly the classical electrical wave experiment by Hertz in 1888 and Marconi's invention of the wireless in 1895.

"The Maxwellian theory of electrical transmission was the light that shineth in the darkness and the darkness comprehended it not; but the Hertzian experiment and Marconi's wireless transmission were nothing more or less than a simple inference from the Maxwellian experiment. These two achievements helped the telegraph and telephone engineer to comprehend Maxwell's light which had been shining in the darkness for so many years.

"The same experiments made me see that light and guided me to the construction of the high inductance telephonic transmission line which was readily un-

derstood by the telephone engineers and speedily introduced into practical operation. All this happened during the first twenty-five years after the invention of the telephone.

Enters 20th Century

"With this precious asset, the art of electrical communications entered the twentieth century. Twenty-five years ago we were justified in predicting for it a glorious future. Today, however, we know that the prophecy of even the most



(Wide World)
DR. MICHAEL I. PUPIN, retiring president of the American Association for the Advancement of Science.

exalted optimist of twenty-five years ago has not come anywhere near the achievements which have actually been accomplished and that the most remarkable fact connected with these great achievements is the fact that they are all based upon a simple phenomenon observed by an obscure German physicist named Hittorf over forty years ago.

"His experiment was this: If in a vacuum tube one of the electrodes is heated to a high degree of temperature, then the smallest electrode-motive force can establish an electrical current through the vacuum, whereas if both the electrodes are cold a powerful inductance coil producing enormous electrical forces is necessary to produce any current at all.

Traced to Source

"This simple experiment never attracted much attention and was soon forgotten. But when thirty years ago Roentgen discovered the X-Rays, those who repeated Hittorf's experiments soon discovered the existence of the tiny electron; and we can say today that the harnessing of the tiny electron is the source to which the whole advancement in the radio art during the last twenty-five years can be traced.

"Those who understood the electrical phenomena connected with the Roentgen rays saw clearly that in the Hittorf tube, electrons were emitted from the hot

electrode and filled the whole space of the vacuum, and there billions of them moved about in a perfectly chaotic fashion.

"When, however, following Hittorf's example, an electrical battery is applied to the vacuum tube, then the chaotic mob directed by the electrical force moves like a perfectly drilled army in beautiful co-ordinated columns. This is the so-called thermionic current, moving exactly the same way as the force increases or diminishes.

The Shrewd Fellows

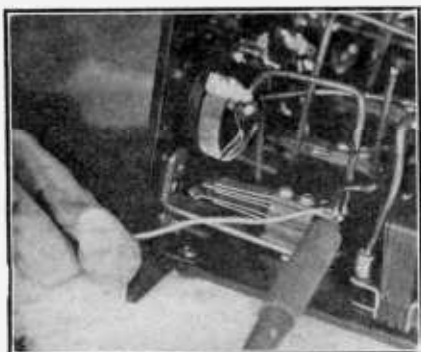
"Several shrewd inventors took advantage of this well-known phenomenon and introduced the, so-called third electrode into the Hittorf tube. This gave us the vacuum tube amplifier and vacuum tube oscillator and the vacuum tube telephonic repeater.

"The vacuum tube amplifier and oscillator have revolutionized the art of wireless transmission. It is entirely a different thing from what it was twenty-five years ago and it is called radio today. Radio broadcasting, which has called into existence an enormous electrical industry, would be impossible without the vacuum tube amplifier and the vacuum tube oscillator."

THE FILAMENT VOLTAGE

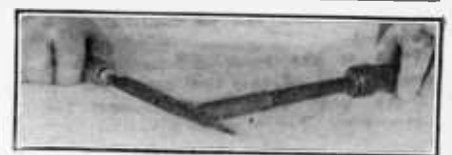
Operating the tube filament below rated voltage brings about a strange effect, as was determined by means of a series of microphotographs of the structure of the tungsten wire after the influence of various applied voltages. It was found that when the filament was operated below the normal voltage as specified by the tube manufacturer, the period of supply of thorium was lengthened. This was to be expected, but it was also found that the tungsten wire, the reservoir for the thorium, underwent a structural change. In this state, the tungsten becomes very brittle and continuous operation below the rated brilliancy or voltage, as expressed in electrical parlance, renders the delicate filament subject to breakage at the slightest physical shock. Operating the tube filament below the rated voltage caused a transition in the structure of the tungsten wire, from a ductile formation to a brittle formation, and greatly increased the hazard of breakage. Once more, everything to lose and nothing to gain, due this time however, to filament operation below the rated voltage. The increased gain in time of the thorium supply is counteracted by the increased hazard of breakage.

It is therefore most important from economical and efficient operation viewpoints to maintain the voltage at the filament terminals at the figure specified by tube manufacturers.



(Hayden)

WHEN SOLDERING a jack, be careful that you do not solder the lugs on the springs together. This can be prevented by prying them far apart.



(Hayden)

ALWAYS FILE down any excess solder which may have accumulated on your iron after it has been idle for a while, due to the accumulation of pits. This hinders the heating up of the iron and consequently makes soldering difficult. The surface of the iron should always be shiny.

Infinite Waves in One Tube

The Super-Heterodyne Modulator Analyzed

By J. E. Anderson

Consulting Engineer

SUPER-HETERODYNE fans have noticed that a given station may be received on two or more different settings of the oscillator dial, and they have wondered why that is so. But after the operation of the Super-Heterodyne is thoroughly understood the wonder is not that a given station comes in at several settings of the oscillator dial but that it does not come in audibly at more settings. The output current of the Super-Heterodyne modulator is very complex and it contains a multitude of frequencies.

The simple theory of the Super-Heterodyne is that two different frequencies intermodulate in the modulator tube (first detector) and that the output circuit contains two chief components, one of which is the sum of the two input frequencies and the other the difference between them. In the run of Super-Heterodynes the difference frequency is used and is amplified by the intermediate frequency amplifier. The Infradyne uses the sum of the frequencies.

All would be well if everything was so simple as this. But the output of the modulator not only contains currents of the summation and difference frequencies, but it also contains the two original frequencies, currents having frequencies which are harmonic multiples of the two original frequencies, and currents having frequencies which are obtained by inter-modulation of the various harmonics, and they are infinite in number.

Most Are Excluded

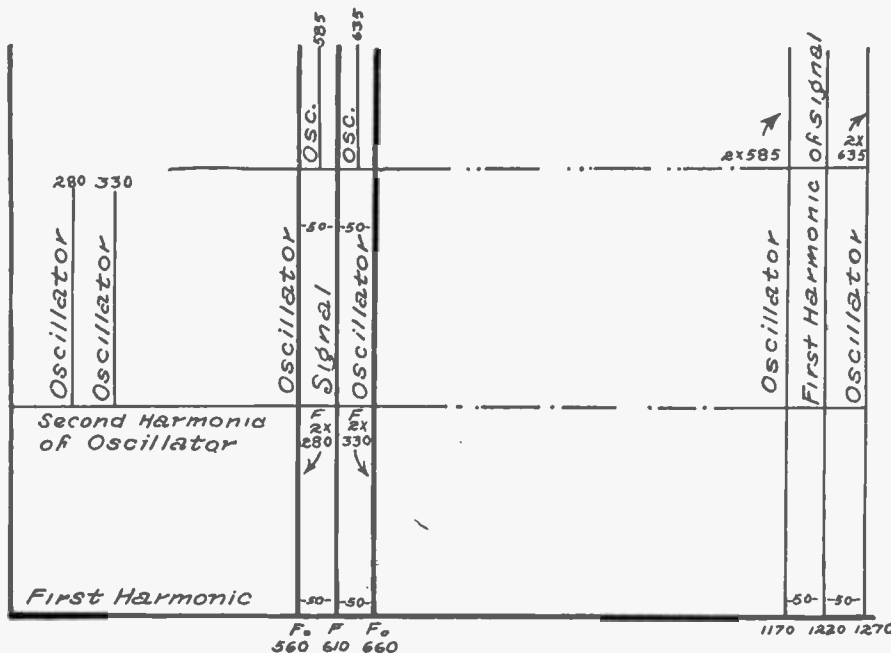
Most of these frequencies are excluded from the final output by the intermediate frequency filter, and they offer no difficulties. The filter can only pass one frequency, but there are innumerable ways of producing this frequency. It must necessarily be a difference frequency, since the two original frequencies are much greater than the frequency which the filter will pass through. Let us see some of the ways in which the intermediate frequency may be produced.

In the first place it may be obtained by subtracting one of the original frequencies from the other. This may be done in two ways, hence the two principal points on the oscillator dial at which a given station is received. This may best be represented by symbols. Suppose the frequency of the intermediate filter is f and that the frequency of the signal to be received is F .

Represent the frequency of the oscillator by F_0 . If the oscillator be adjusted so that $F_0 - F = f$ or so that $F - F_0 = f$, the signal comes through the filter, and thus the two principal points on the oscillator dial are obtained. The first represents the low and the second the high dial settings. Numerical examples may be given to illustrate. If F is 610 kc, f equals 50 kc when F_0 is 660 kc. Also when F_0 equals 560 kc, f is 50 kc.

Oscillator Harmonics Profuse

But the oscillator generates harmonics very profusely, and some of these may be used to combine with the signal frequency F . If the oscillator frequency is adjusted so that $2F_0 - F = f$ the signal gets through. For example, if F_0 is 330 kc the second harmonic is 660 kc and the difference is again 50 kc. This principle is used in the R. C. A. second harmonic Super-Heterodyne. In other Super-Heterodynes the second harmonic can only bring in the



THE modulator tube in a Super-Heterodyne has to handle an infinite number of frequencies, although only three of them figure in the desired reception. These are the fundamental of the signal and the oscillator frequencies and the fundamental intermediate frequencies. The diagram illustrates the origin of some of the other frequencies described in the text.

low wave stations because the others lie beyond the range of the tuner.

Another combination which will bring in a given station is $F - 2F_0 = f$. For example, if F_0 is 280 kc, its second harmonic is 560 kc and this subtracted from 610 kc gives 50 kc.

It is not necessary to stop with the second harmonic. All the harmonics are present in the output of the oscillator. The third is quite strong and is capable of modulating with the signal to make it audible. The combinations for this harmonic are $3F_0 - F = f$ and $F - 3F_0 = f$. On the usual Super-Heterodyne this will only bring in the very shortest waves on the tuner. Suppose F_0 is 550 kc. Then three times F_0 is 1,650 kc and F would have to be either 1,700 kc or 1,600 kc. Both of these are above the broadcast range and would not interfere with any station. If the oscillator can be set at a lower frequency than 550 kc, say at 500 kc, then several of the shortest wave stations in the broadcast band could be brought in with the third harmonic of the oscillator.

Harmonics and Harmonics

The end is not yet. There are also harmonics of the signal frequency F present in the output of the modulator. They are either produced at the transmitting station or in the receiver. These harmonics may also intermodulate with the products of the oscillator and produce the intermediate frequency. In this case we have for the second harmonic of the signal frequency; $F_0 - 2F = f$ and $2F - F_0 = f$. Taking F as 610 kc the second harmonic is 1,220 kc. Then the signal frequency $F = 610$ may be brought in if the oscillator is set at 1,270 kc or at 1,170 kc. These settings are quite noticeable in most Super-Heterodynes, and they are often troublesome. The signal may also be brought in on the third harmonic of the signal frequency. In this case the combinations are $F_0 - 3F = f$ and $3F - F_0 = f$. The third harmonic of 610 kc is 1,830 kc. If then the oscillator be set at either 1,880 or 1,780 the 610 kc signal comes through the 50 cycle filter. This is quite

within reach of most Super-Heterodyne oscillator tuners.

Not only may a given signal be brought in by modulating its fundamental with all the harmonics of the local oscillator and by modulating the fundamental of the oscillator by all the harmonics of the signal frequency, but also by inter-modulating the various harmonics in different combinations. For example the second harmonics of the two frequencies may be mixed to produce the intermediate frequency. In this case the combinations are $2F_0 - 2F = f$ and $2F - 2F_0 = f$. For example if F is 610 kc, $2F$ is 1,220 kc and the signal of frequency F may be brought in by setting the oscillator at 585 or at 635 kc. Another possible pair of combinations is $3F_0 - 2F = f$ and $2F_0 - 3F = f$, and yet another $3F_0 - 2F = f$ and $2F - 3F_0 = f$. Each combination requires a different setting of the oscillator dial to bring in a signal of given frequency.

Why the Squeals Arise

Just a few of the main or strongest combinations have been listed above. It is apparent that the number of combinations that can be formed out of the two frequencies and their harmonics may be increased without number. The only reason that any one signal is not heard at an infinite number of points of the dial is it is too weak to produce an audible effect. But all the combinations are there, all right. Fortunately, the strength of the harmonics decrease very rapidly as their order increases. The second and the third are about the only ones that cause any interference.

Although the higher harmonics cannot bring in the signal so that it can be understood, they are strong enough to produce a squeal in the receiver, and they are the cause of some of the background of whistles characteristic of Super-Heterodynes. In most cases the frequency change required in the oscillator to cut in or out the squeal is very minute, and it only requires a slight touch on the dial to eliminate a whistle. This change does not detune the signal that is desired in the least.

Grid Must Be Negative to Maintain Selectivity

Bias Helps Cure Interference Trouble and Also Reduces the Plate Current Drain On the B Supply—Tuned Circuit Has Chance

By Hari Kahn Bey

If you want more selectivity in your set do not operate the radio frequency amplifiers with a positive or zero grid bias. Use enough negative bias so that at no time in the AC cycle will the grid go positive. When the grid is positive the grid to filament resistance is comparative low, and the more positive the grid is, the less the grid resistance. This resistance is in parallel with the tuned circuit which determines selectivity, and any resistance across the tuning circuit plays havoc with the selectivity of that circuit. The change in selectivity may be noted readily by putting a C battery in the grid return and varying it, making it both negative and positive. The effect is more noticeable in high mu tubes, whose grid resistance for positive grid is very low. For negative grid the resist-

ance is practically infinite and it produces no decrease in the selectivity.

The greater selectivity is not the only gain by making the grid negative. The amplification is also greater, both because the input is greater and because the tube operates over a portion of its characteristic which is steeper and straighter. The saving in plate current is another gain which is incident to a negative grid. For example, the plate current may be reduced to one-fourth of the value, as compared with the plate drain when the grid is slightly positive.

This is a point which those fans who are bothered with interference because of lack of selectivity should take notice of. It is not logical to install wave traps, and loops and regeneration in order to reduce interference and then operate the grids with a positive bias, although this advice is often ignored.

Volume Control Should Be Near Input As Possible

Satisfactory Solution Is To Use a Variable Resistor In Series With
the B Plus Radio Frequency Lead—
Distortion Factors Discussed

By Charles Goldenpaul

American Mechanical Laboratories

The intensity of the powerful signals from present-day broadcasting stations, together with the use of power tubes, radio-frequency amplification and high voltages at the receiving end, has made it necessary to provide some means of reducing the loudspeaker volume when desired. In fact, the ideal state of radio affairs is when the set can handle without distortion more volume than is ordinarily required, and a satisfactory means of throttling down this volume to any desired degree from the full tone of an orchestra down to just a faint whisper, is introduced.

Occasionally radio entertainment has become a nuisance due to blasting, making conversation most difficult, or, again, going to the other extreme, by being so weak as to cause a conscious or subconscious straining of the hearing faculties to distinguish the voice or music issuing from the speaker. After all, the radio entertainment should be of sufficient volume to form the main interest of the listeners, when those listeners are primarily anxious to enjoy radio, or of amply subdued volume, without distortion, so as to form just the desired degree of musical background or setting for conversational or other mental activities.

Quality Must be Preserved

Now, it is one thing to cut down the speaker volume and quite another to do so without impairing the tone quality. There are correct ways and means of reducing volume, just as there are incorrect ways and means. As a general rule, the sooner the volume is reduced in the

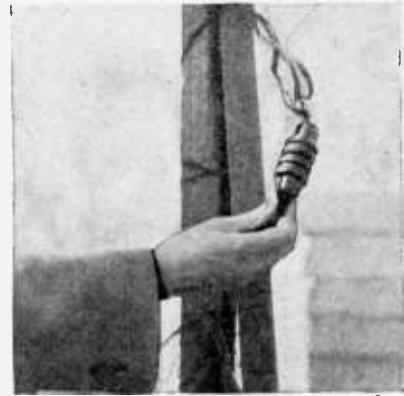
process of reception, the better the results. Thus if the volume control is in the radio-frequency end, the results may be better than if the volume control is placed in the audio-frequency end, after the signals have been over-amplified so as to cause distortion or serious loss of quality.

It is a mistaken idea, yet one that has nevertheless gained very general acceptance, that the simplest volume control is detuning the receiver. Granted that it is the simplest, since it entails no additional attachments and stands for nothing more than turning one or more tuning controls off the point of sharpest tuning, this method often introduces serious distortion, because a clean wave is no longer available and some of the valuable side bands or latent sound components of the signal are ruthlessly chopped off. Also, the variation of the filament current, which is also resorted to as a volume control, is by no means good practice, since the tube functions best only at the given filament temperature or filament voltage, and any reduction is certain to result in insufficient electronic emission followed by distortion which may or may not be noticeable in the reduced speaker volume.

Satisfactory Volume Control

The most satisfactory method, both from the simplicity and the tonal viewpoints, is to vary the plate voltage of the vacuum tubes. In the case of B battery operation, a good procedure is to insert a Clarostat or other dependable variable resistance unit in the B plus lead going to the radio-frequency tube or tubes, or to the detector tube in the event that there is no radio-frequency amplification;

HARMFUL MIXING



(Hayden)

IT IS A good policy to inspect your antenna often. Above we see the antenna wire, entwined with the lead-in of a neighbor's set. Result: Distorted and broken up programs.

In fact, most of the leading radio-frequency receivers now on the market are employing this form of volume control, which permits of bringing the radio-frequency end right up to maximum sensitivity and volume, while just a shade below the oscillating point, if full volume is desired, or down to a mere whisper, still with perfect tone quality.

It will be noted that the control of the radio-frequency tube plate voltage by this means does not call for any alteration within the radio receiver itself, since the control can be inserted in the proper lead without the necessity of troublesome mounting.

The plate voltage of the detector and the audio-frequency tubes may also be controlled, if desired, although once the proper values are attained for good tone quality the voltages should not be changed merely for the purpose of cutting down speaker volume. It is far better practice to let these values remain at their best settings, and to alter the plate voltage of the radio-frequency tubes as already outlined. Some radio authorities recommend a Clarostat for regulating the plate voltage of the power or output tube. This is really unnecessary, since in the first place a power tube should be employed to handle all the necessary volume without choking or distorting; secondly, the utmost plate voltage within the capacity of the tube should be applied, for best results, even with reduced loudspeaker volume; thirdly, the C battery should be adjusted to provide the necessary grid bias for whatever voltage may be applied on the plate of the power tube. Hence a variable plate voltage is hardly necessary nor desired for the last or power tube, although it sometimes serves a good purpose for the preceding audio tube or tubes.

Speaker Output Control

Also, some authorities recommend variable high resistance in the speaker leads or across the speaker itself. These measures are not usually recommended. The place to control speaker volume is at the beginning of the reception process, or at the radio-frequency end. However, if the speaker is placed at some distance from the receiver as in the radio-wired home, a variable resistor may be placed either across the speaker terminals, or shunted as it were, or again in one lead.

The main consideration in controlling the speaker volume is to employ a positive form of variable resistance which not only provides the desired resistance range and current-carrying capacity, but also provides a positive path for the current flow without uncertain contacts, arcs, etc.

B Eliminator Operation

Cost Determined by Simple Meter

By J. Gerard Sheedy

THE cost of operating a B eliminator may be determined quite easily if a suitable meter is available. The cost is proportional to the number of watts that is used, and this is in turn proportional to the voltage and the current in the primary of the supply transformer. Suppose the voltage is 110 volts and the current is $\frac{1}{2}$ ampere. The wattage is then 55 watts. This multiplied by the number of hours the eliminator is running gives the number of watt-hours. Dividing this by one thousand gives the number of kilowatt-hours, which is the quantity that the meter on the wall measures. If the cost of electric energy is 7.5c per kilowatt-hour it is only necessary to multiply the kilowattage by 7.5 to get the cost per hour. In the case assumed above the kilowattage is 0.055, and therefore the cost per hour would be a little over 4 cents.

To measure the AC in the primary an AC ammeter is required. A DC meter will not measure it. There are two main types of AC meters, the thermo-couple type and the wire expansion type. Both of them work on the principle of heat generated by the current to be measured. In the thermo-couple type the heat is generated at the junction of two dissimilar metals, such as iron and nickel. In the wire expansion type the heat is generated in a short length of wire and the heat lengthens the wire.

Calibration of Meter

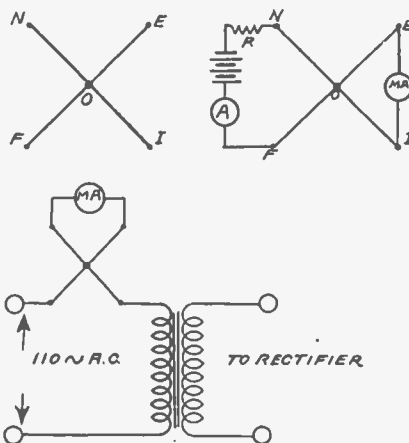
In both types the meter must be calibrated against a known current before it can be used, and for the purpose DC may be used in either case.

The thermo-couple type of meter is perhaps the easier to make by the experimenter. It requires two short pieces of fine wire, one of iron and the other of nickel. Each piece need not be longer than about 2 inches and the diameter should not be greater than that of No. 36. These two wires are crossed at the middle and secured to each other at the junction. This may either be done with a tiny piece of solder or by means of tension one against the other. Fig. 1 shows how they are joined. FE is the iron wire and NI the nickel. If an alternating or a direct current is sent in at the NF terminals a small direct current will flow in the EOI circuit provided a sensitive milliammeter is connected across the EI terminals. This DC flows because the AC heats the junction O.

Before use, the thermo-couple must be calibrated against a known current. This may be done by an arrangement as shown in Fig. 2. Across the NF terminals of the thermo-couple is connected a rheostat R, a storage battery B and a direct current ammeter A, all in series. Across the terminals EI is connected a direct current milliammeter of high sensitivity, say one having a range of 0-1 milliampere.

Current Is Varied

First the rheostat is set so that a small current flows in the primary current, say one-tenth of an ampere. The corresponding reading on the milliammeter MA is taken. The battery then is reversed and another reading on MA is taken for the same primary current. This reversal of the current is important when DC is used for calibration. The rheostat is then re-adjusted so that the primary current is 0.2 ampere and the two readings are taken on the milliammeter. This process is repeated until the total current in the



THE connections for utilizing a milliammeter to measure the cost of operating a B eliminator.

primary is about one ampere. A wider range is not necessary for any B eliminator.

The two readings on the milliammeter corresponding to any given value of primary current are averaged, and the result plotted against the primary current. The

meter is then ready to use in measuring AC.

To measure the current flowing in the primary of the supply transformer the thermo-couple is inserted in series with the primary as shown in Fig. 3. When the current is turned on and the set is working normally, there will be a certain deflection on the milliammeter. Consulting the calibration chart previously made will show what current in the primary is required to give this deflection, and that is the AC flowing.

Measured at Right Place

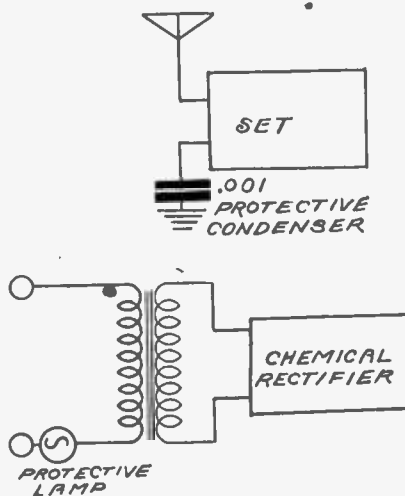
This current is multiplied by the voltage of the line to get the wattage used by the eliminator. The cost is computed as described above.

It is important that the current in the primary be measured when the radio set is working normally, otherwise the current reading will not be the true one.

It may be observed that by measuring the power input on the primary side everything paid for is measured, whereas if the power is measured in the output of the eliminator you learn only what is left after all losses are suffered. There is a considerable difference due to losses in the transformer, choke coils and the rectifier tube.

Bulb in Series Protects Line Feeding a Rectifier

While Chemical Type Cell Is Not Yet Formed the Resistance Is Too Low for Process, Therefore Lamp Glows, But Wanes When Action Is Complete



TWO protective devices.

A certain fan built a chemical rectifier with which to operate his radio set. It was of the lead-aluminum type. After he had assembled it he connected it up directly to the 110-volt AC line. He blew the fuses in his laboratory. He placed larger fuses in the receptacles. When he next connected the rectifier to the line he put the whole house in darkness. He repeated the performance with larger fuses in the house supply leads, and then he decided that something was wrong. Now the question is, what caused the fuses to blow?

Two things may have caused the blow-

out. In the first place it may have been caused by metallic short-circuit of the line which occurred only when he threw the rectifier on the line. This is quite probable, because the set was grounded and when the rectifier was thrown on, another ground connection was produced. These may have been on the opposite sides of the line. By the way, that happens every time that a DC eliminator is connected to a grounded set unless special precautions have been taken.

The second probable cause of the blow-out is the low resistance of a chemical rectifier cell that has not been formed. An unformed rectifier cell of the lead-aluminum type has a very low resistance at first and if it is connected to a line of high voltage a very high current will flow for a while, much more current than the ordinary house electric installation will carry. Hence the fuses blow out.

The low resistance is only temporary, however, that is, its resistance in both directions. After it has been on the line for a while the resistance in one direction becomes very great while that in the other direction remains low. It is this one-sidedness that makes it a rectifier; it stops the current in one direction and lets it through in the other.

To prevent a blow-out when the rectifier-to-be is first put on the line, an electric lamp should be put in series with it. At first this light will glow with normal brilliancy but gradually it grows dimmer. When its brilliancy does not change, the rectifier has been formed and it is safe to operate it without the light, that is, it is safe as long as the input voltage does not exceed the forming voltage.

Year-Round Broadcast Is Assurance for 1927

Aylesworth Forecasts Better Programs, Solution of Artist Problem and Growth of Chain Station System—Pays Tribute to Technical Advance

By Merlin Hall Aylesworth

President, National Broadcasting Co. of America

The year 1927, I believe, will do much to bring broadcasting forward as a distinct and self-supporting industry in the radio family. For the first time, perhaps, radio broadcasting in the United States, untied from the apron strings of outside support, will find itself squarely on its own feet.

Broadcasting is now breaking through the chrysalis of experiment to a permanent, self-sustaining service to the home. The phenomenon, if present indications are valid, will be accompanied:

First, by better programs. For those who have learned through experience the wide acceptance of radio broadcasting by the listening public know also the attention value of a good program. The results will be evident during the present winter season, when commercial, educational and social organizations will vie with one another to put the best possible program on the air.

The second factor will be a longer entertainment season on the air. The technical advances made in the art of radio broadcasting and in the manufacture of receiving devices are such that fair broadcasting results may now be assured for the whole year round. Those who entrust their message to the air now know that they can safely extend their broadcasting season.

Third will be the practical solution of the artist's problem. Thanks largely to radio, the United States has become a great nation of music lovers. Broadcasting, far from decreasing, has definitely

increased the opportunities of the artist. The demand for broadcasting now is and will continue to be for artists with greater repertoires, for novelties on the air, for more and better entertainment. And if the broadcasting structure is made entirely self-sustaining there will be sufficient support for every type and character of entertainment program.

Fourth will be the establishment of broadcasting systems, through wire interconnection or by other means, that will operate more or less upon a national basis, as distinguished from the regional services given by over 500 separate broadcasting stations in the United States.

The National Broadcasting Company is dedicated to all four purposes. As a nation, we lead the world in the day-in and day-out quality of our broadcasting programs, in the number of our broadcasting stations, in the size of our radio industry, and in our development of the radio art.

It is true that the picture here is marred for the time being by the lack of police regulation in the air which has resulted in a vast amount of station interference. But the situation is far from hopeless. The courts are now engaged in adjudicating the fundamental rights of the broadcaster and the legislative branches of our government undoubtedly will agree sooner or later on measures of regulation.

With these problems solved, however, the United States will have created a broadcasting system incomparably better and greater than any that now exist.

WHY OHM IS HONORED

The ohm takes its name from George Ohm, the German physicist who first formulated the law.

Village of 500 Transfers Its 2,000 Watt Station

Oak, Neb., Sells KFEQ to St. Joseph, Mo.—Price Said to Be \$25,000—Wavelength, 267.7 Meters, to Be Retained—Studio to Be in Hotel

St. Joseph, Mo. St. Joseph will have a 2,000-watt radio station in operation soon, the Booster Club of the Chamber of Commerce announced after a luncheon at the Hotel Robidoux. The Booster Club has closed a deal to bring station KFEQ of Oak, Neb., here.

Although the Booster Club did not announce the amount necessary to bring the station to St. Joseph, it is understood to be about \$25,000.

The Oak station has been operated as a 500-watt station, but in October permission was obtained from the department of commerce to increase it to 2,500 watts. It already has been increased to 2,000 watts. It is operated on a 267.7 meter wave length.

The station is powerful enough to reach from coast to coast, and from Can-

ada to Mexico, members of the Booster Club said.

The station is directly owned by John Scroggins, owner of the National Bank of Oak. Oak has a population of less than 500, and the Scroggins station is the most powerful in operation in a town of that size any place in the United States.

When the station is brought to St. Joseph, the Booster Club announced, it will operate under its present license and call letters. The station will be located at the Robidoux Hotel, where a modern studio is planned.

The Booster Club has been working to give St. Joseph a broadcasting station for more than two years. The club once held an option on KGBX, the station operated by the Foster-Hall Tire Com-

Supervisors List Stations' Growth By Radio Districts

Washington.

More than 116 new stations are under construction in the United States, while plans are afoot for the construction of 203 additional broadcasters, according to reports submitted to the Department of Commerce by Radio Supervisors throughout the country. The reports cover the period between December 1 and 15 and show the following increases over reports for the previous two weeks:

New stations have increased from 108 to 127.

Increases in power have increased from 126 to 129.

Changes in wavelength have increased from 93 to 97.

Stations under construction have increased from 102 to 116.

Stations preparing to increase power have increased from 63 to 65.

Stations contemplated have increased from 168 to 203.

The reports by districts follow:

First District, Boston: 9 new stations, 5 with increased power, 14 have changed waves, 9 under construction, 12 stations being planned.

Second District, New York: 19 new stations, 12 with increased power, 12 have changed waves, 4 under construction, 18 are preparing to increase power, and 29 stations are being planned.

Third District, Baltimore: 4 new stations, 6 have increased power, 2 have changed waves, 1 is under construction, 5 are preparing to increase power, and six stations are being planned.

Fourth District, Atlanta: 2 new stations, 7 have increased power, 4 have changed waves, 2 are under construction, and 5 are preparing to increase their power.

Fifth District, New Orleans: 12 new stations, 6 have increased their power, 8 have changed waves, 14 are under construction, 12 are preparing to increase their power, and 21 stations are being planned.

Sixth District, San Francisco: 4 new stations, 10 have increased power, 17 have changed waves, 11 are under construction, 1 is preparing to increase power, and 20 stations are planned.

Seventh District, Seattle: 18 new stations, 12 have increased power, 9 have changed waves, 19 are under construction, 4 are preparing to increase their power, and 17 stations are planned.

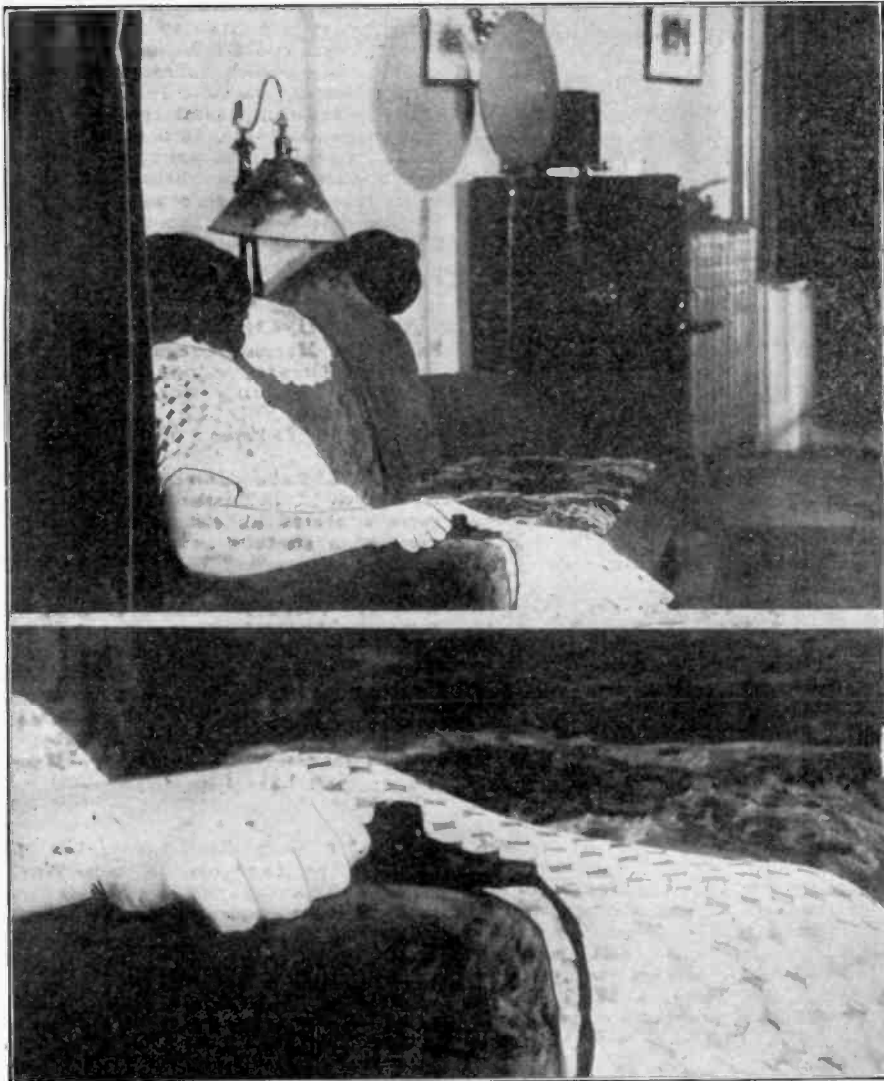
Eighth District, Detroit: 19 new stations, 20 have increased power, 4 have changed waves, 12 are under construction, 3 are preparing to increase their power, and 65 new stations are planned.

Ninth District, Chicago: 40 new stations, 51 have increased power, 27 have changed waves, 44 are under construction, 17 are preparing to increase power, while 33 stations are planned.

Construction of twenty new stations during the first two weeks of December was started in the following cities:

The Radio Shop, Chelsea, Mass.; Young Men's Hebrew Association, New York; Malbrook Company, Woodside, N. Y.; P. D. P. Spearman, Tremont, Miss.; 1st Presbyterian Church, Fort Stockton, Texas; H. H. Hanseth, Eugene, Oregon; W. J. Virgin, Medford, Oregon; Fisher Blend Station, Seattle, Wash.; R. A. Fox, Ashland, Ohio; M. B. Grenier, Canastota, N. Y.; Petroleum Tel. Co., Oil City, Pa.; J. C. Slade, Hamilton, Ohio; D. A. Snick, Mansfield, Ohio; Acme Mills, Hopkinsville, Ky.; Central Radio Co., Muscatine, Iowa; Dr. C. S. Stevens, St. Paul, Minn.; Peoria Heights Radio Lab., Peoria Heights, Ill.; Lamb Auto Elec. Co., Santa Barbara, Calif.; Dobbins Shoe Co., Long Beach, Calif., and J. R. Fouch, Inglewood, Calif.

"RADIOISTE" LEADS LIFE OF REILLY



(Hayden)

IT IS NOT necessary to leave your comfortable chair to vary the volume of the speaker. Instead connect up a Modu-plug to an extension cord and place it on the buffer of the chair and you are all set.

Stations Have Small Chance of Making Any Money

Dreams of Huge Profits Die Away as Income Is Restricted Mostly to Selling a Couple of Hours a Night—Those Outside Chain Are Handicapped

By Thomas Stevenson

Washington.

The secret of why so many stations have been eager to broadcast is explained by the theoretical revenue possible from the sale of advertising. Expert opinion is that many stations will soon be disillusioned and stop broadcasting.

At first glance it would appear that a broadcasting station is a gold mine, requiring only a little work to make it produce tremendous profits. Time on the air is sold at rates ranging from \$25 to \$400 an hour, depending on the size and popularity of the station. An average rate is around \$200 per hour.

With around 8,800 hours to the year at \$200 an hour it would appear that the station was capable of yielding an annual revenue of \$1,760,000.

But—

Few stations broadcast more than eight

hours a day. Instead, most of them are on the air only about six hours daily. This, of course, cuts down the possible revenue from \$1,760,000 to \$438,000 a year.

Going Down!

To produce even \$438,000 revenue it is necessary for the station to sell all of the six hours. While this may be possible for a few stations part of the time, it is considered practically impossible for a majority of the stations to do it all of the time.

The advertiser does not want the time between 6 and 8 p. m. He prefers the time between 8 and 10 o'clock, when the greatest number is listening in.

In effect, this means that the majority of stations is able to sell only those two hours, which reduces the yearly income to \$146,000 if that time is sold 365 days in the year. But broadcasters who have been in the game a long time say two hours a

day is much too high an average. For instance, they point out that two or three days a week no advertising is obtainable. If a station is able to average one hour each day, 365 days in the year, it is doing well, the old-timers say.

That means a probable income of around \$73,000 a year.

Another factor upsetting the calculations of stations which entered the game primarily to make money from selling time is that the big-paying advertisers are national in scope and are spending their money only on chain broadcasting which gives them a national audience.

Isolated Stations Limited

This means that stations not connected in the chain are limited to local advertising from which only a small revenue can be obtained.

To use the words of a man well-known in the field who has given the subject considerable study:

"The chain broadcasters are the only ones that have a ghost of a chance of making any money out of selling time. The rest of them will find it out sooner or later and when they do I believe many of them will close down. If the station is operated for direct profit, it is likely to prove a gold brick."

It is estimated that the maintenance of a good station of 500 watts power calls for an annual outlay around \$100,000. Higher power means greater operating costs.

Some Seek No Direct Pay

There is, of course, a large number of stations which does not expect a direct return from broadcasting but rather counts on good-will and indirect publicity as the reward. In this group are a number of newspapers, radio manufacturers, etc.

The view prevails that there are not six stations in the United States getting a sufficient direct return to pay operating expenses. If, as has been said, many of the new stations have opened merely to make money, the chances are many of them will permanently "sign off" before 1928.

Lincoln Program Set

By Eveready for Feb. 8

The Eveready Hour's famous "Lincoln Program," with Edgar White Burrill again in the role of narrator, will be repeated on the evening of February 8, according to announcement by Eveready Hour Directors. For two years this program, based on Ida M. Tarbell's book, "He Knew Lincoln," has been a Lincoln's Birthday feature of the "Eveready Hour." Each time it has met with tremendous favor among radio listeners and numerous requests have been sent in for its repetition.

Sheet Music for Year

Valued at \$14,000,000

The music published in the United States in 1925 passed a total value of \$15,000,000, nearly \$14,000,000 of which was sheet music, the Bureau of the Census, Department of Commerce, has just announced. The music was all printed in 109 establishments, in 17 States.

The report interests radioists because the music publishers complained to Congress, during the battle for copyright legislation last year, that radio was ruining the sheet music business.

DEMONSTRATES ERLA TUBE

J. Lawrence Hill, distributor of Erla products in Rochester, N. Y., recently demonstrated to the trade in that city the Erla 3,000-S1A tube, with a 3,000 hour life rating.

Radio University

A FREE Question and Answer Department conducted by RADIO WORLD for its yearly subscribers only, by its staff of Experts. Address, Radio University, RADIO WORLD, 145 West 45th St., New York City.

When writing for information give your Radio University subscription number.

I HAVE a couple of National Illuminated Velvet Vernier Type C dials, two .00035 mfd. variable condensers and four -01A type tubes. Please give the circuit diagram of a receiver using these parts. State the constants of the coils, condensers, etc. The detector should be non-regenerative.—Marew Fosdick, Portland, Me.

The circuit diagram of such a set is shown in Fig. 496. The primaries, L1 and L3, consist of 10 turns. The secondaries, L2 and L4 consist of 48 turns. Each primary and secondary is wound on a tubing 3/8" in diameter. About 1/4" space should be allowed between the windings. C4 and C5 are both .00025 mfd. fixed condensers... R1 and R2, which control the filaments of the radio frequency and detector tubes respectively, are of the 20 ohm type. The filaments of both amplifier tubes are each controlled by 1-A Amperites. AFT1 and AF2 are both low ratio audio frequency transformers. PL indicates the bulb in the dials. You will note that the bulb is shunted across the line. A filament switch is inserted in series with the positive side of the A line. C1 and C2 are the .00035 mfd. condensers. C3 is a .00025 mfd. fixed condenser across which is shunted a 2 meg-ohm grid leak. The F posts on both transformers are returned to the minus posts of a C battery. The C battery should be composed of two 4.5 volt batteries, connected in series. This will give you 9 volts. The B plus det. voltage should be approximately 67 1/2; the RF, approximately 90, and the AMP., approximately 135. J is the single circuit jack. This may be supplanted by binding posts or phone tip jacks. The connections of the radio frequency coils should be watched. That is, the beginnings of the primaries should be brought to high potential points such as the antenna and the plate. The endings of these coils should be connected to low potential points, such as the ground and B plus. The beginning of L2 is brought to the rotary plates of C1 and to the A minus post. The end of this winding is brought to the stationary plates of C1 and to the G post on the first socket. The beginning of L4 is connected to the rotary plates of C2 and to one terminal of the filament switch, (before the A plus is reached.) The end of this winding is brought to the stationary plates of C2 and to one terminal of the

grid condenser and leak. The rheostats and Amperites are all inserted in series with the filament minus. It will be noted that the end and beginning of the primary and secondary windings of the first RFT are brought to the ground, which is also connected to the A minus.

CAN TWO more stages of resistances coupled audio frequency amplification be added to the 2-tube set shown in the Radio University columns of the Oct. 30 issue of Radio World? (2) Can -01A tubes be used here? (3) Can a 112 Amperite be used to control the filament temperature of these tubes? (4) Should a separate B battery output be provided for? (5) Can I use C batteries for all three audio tubes?—Edward Kesters, St. Paul, Minn.

(1) Yes. (2) Yes. (3) Yes. (4) Yes, this is a good stunt. (5) Yes. Be sure to use the proper bias, according to the manufacturers' specifications.

I AM going to build the DeForest receiver shown in the Radio University columns of the July 3 issue of Radio World. However I would like to use a crystal as a detector instead of the tube. Please give the necessary changes to make.—William Morrow, City Island, N. Y.

The G post on RFT2 is brought to the high potential point of the crystal instead of to the G post on the socket through the grid leak and condenser. The low potential point on the crystal is brought to the P point on AFT1. The F post on RFT2 is brought to the B plus post on AFT1. No B battery is applied here. Therefore be sure that the B plus terminal is disconnected from the B plus post on the audio frequency transformer. The entire filament circuit is also cut out here. The high potential point of the crystal may be brought to the A minus point. This is the same post of the crystal which was connected to the G post on RFT2.

I HAVE built the five-tube receiver shown in the Feb. 13 issue of Radio World, Radio University columns, and am having some trouble with it. In this set, a stage of tuned radio frequency amplification, a non-regenerative detector and three stages of resistance coupled audio frequency amplification are used. When listening into

the detector output, the results are good. As soon as I attempt to listen in to the amplifier output, a steady whistle is heard. Also the set is difficult to control at this point. What could I do to prevent this? I am using -01A tubes throughout.—Henry Mulroy, Houston, Tex.

Use a separate ballast resistor for the first two audio tubes, such as the Amperite 112, a separate ballast resistor for the last tube and a 20-ohm rheostat for the detector tube. Also use a separate B voltage for the detector tube, about 67 1/2, and a 90-volt B voltage for the RF tube. Test all the resistors and stopping condensers for opens or shorts.

ARE CHURCH services broadcast by KGW, the Morning Oregonian station in Portland, Oregon, during Sunday evenings? (2)—During what time period?—Lee Weber, N. Y. City.

(1)—Yes. (2) From 7:30 to 9:00 P. M.

IN THE Radio University columns of the March 13, 1926 issue of Radio World, there appeared an electrical circuit diagram of a six-tube neutrodyne. Resistance audio coupling is used. I wish to build this set, having most of the parts specified. However, instead of using the automatic filament controls, I would like to use rheostats, which I have, e.g., a 6 ohm for the RF filaments; a 15 ohm for the detector filament; a 6 ohm for the filaments of the first two AF tubes and a 10 ohm for the filament of the last tube. Is this arrangement all right?—Morris Schoen, Salt Lake City, Utah.

Yes.

I HAVE built the 2-tube reflex, described in the May 8 issue of Radio World, on page 9, and have difficulty in controlling the oscillatory action of the tube and getting all the volume that one should get from a set of this type. That is, my friend has built a reflex, using only two tubes and he gets fair volume on the speaker, while the best I can do is fair volume on the phones. He also uses a regenerative RF-AF tube, a crystal detector and a stage of transformer coupling. But, I note he has two rheostats and two B voltage posts. Is it possible to fix up my set so that I may get results that will be equal to those obtained from his set?—Edgar Morrison, Newark, N. J.

Place a twenty-ohm rheostat in series with the negative leg of the RF-AF tube. Break the common B plus lead. Connect each one to posts, and apply about 67 1/2 to the RF-AF plate and about 90 to the AF plate. Place a .001 mfd. fixed condenser from the end of L4 to the A minus. Take C3 out of the circuit entirely. Increase the size of C4 to about .25 mfd. Run a wire from the stationary plates of C2 to the ground.

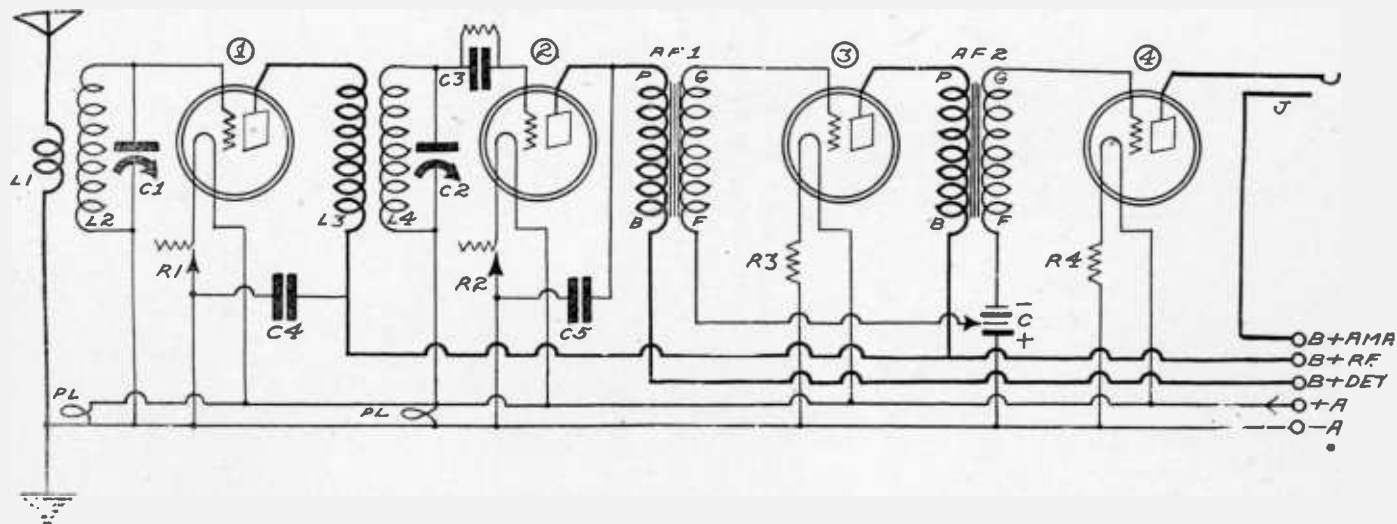


FIG. 496
The circuit diagram of the 4-tube receiver. Minus A lead is unintentionally broken.

I HAVE a four pole, double throw switch. Please give a diagram showing how to connect up this switch so that a trickle charger, A battery and B eliminator can be switched to and from the set and line, by simply pulling the switch from one side to the other. Explain its operation.—Charles Purrell, Long Island City, N. Y.

Fig. 495 shows the diagram. When the switch is turned to the left, the AC line is connected to the input terminals of the trickle charger, while the A battery is connected to the output terminals of the charger. By this action the B eliminator is disconnected from the line, also the A battery from the set. Then by pulling the switch to the right, the B eliminator is connected to the line and the A battery are disconnected from the line and from each other.

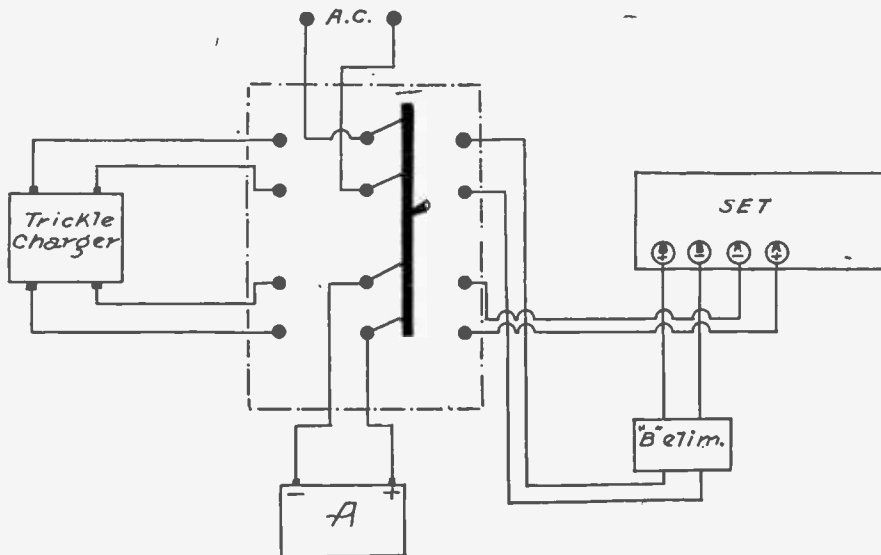


FIG. 495
The circuit diagram showing how a four pole double throw switch may be used for switching in and out the eliminator and trickle charger.

I AM building the one-tube receiver shown under the DX article by J. E. Anderson in the April 10 issue of Radio World, using a three-circuit tuner and a variable condenser to match. I have a .001 mfd. variable condenser. What size tubing, how many turns and what size wire should be used to wind a coil to place in the antenna circuit for tuning. (2)—Using a —01A type tube, is it all right to use a 20-ohm rheostat for filament control? (3)—Will it be O. K. to use a .00025 mfd. fixed condenser and a 3 megohm grid leak? (4)—I am going to add a two-stage audio frequency amplifier. Should I place a radio frequency choke in series with the tickler output. If so, could the Rabco be used?—Reginald Rossens, Utica, N. Y.

(1)—Using a three-inch tubing, wind thirty-three turns. Use number twenty-two double cotton covered wire. (2)—Yes. (3)—Yes. (4)—Yes. Connect C4, which is a .001 mfd. fixed condenser from the plate post of the detector tube to the A minus post.

I WISH to construct the four-tube receiver shown in the Radio University columns of the Dec. 4 issue of Radio World, under Fig. 479. However, instead of using four tubes I wish to use the detector and two stages of transformer audio coupling, leaving the RF stage out. Please state how this change can be effected.—Wallace Murchley, Long Island City, N. Y.

The beginning of the plate winding in the RF circuit is brought to the antenna post, while the end of this winding is brought to the ground post. Therefore the plate and B plus connections are left out. The condenser C2 should be installed in series with the antenna, as per RF stage. Increase the number of turns on this plate coil to fifty-five.

I AM GOING to build the six-tube receiver shown in the Sept. 25 issue of Radio World, Radio University. This circuit consists of two stages of tuned radio frequency amplification, a non-regenerative detector and three stages of resistance coupled audio frequency amplification. Could I substitute the last stage of resistance coupling with a stage of transformer audio coupling, using a 3 to 1 transformer and a power tube?—Forrest Burrows, Shelby, Mont.

Yes. Don't forget the C battery connection.

CAN ANOTHER tube be connected in parallel to the audio tube in the last stage of audio frequency amplification in the three-tube receiver described in the Dec. 25 issue of Radio World, Radio University columns? What changes in wiring would be necessary? (2)—Is it O. K. to connect C3 to the A minus post, instead of to the B plus post?—Julian Morton, Carson City, Nev.

(1)—Yes. the plate of the new tube is connected to the plate of the old one. The

grid of this new tube is also directly connected to the grid post of the old tube. The filament plus post is connected to the filament plus post of the other sockets. The filament minus post is connected to the filament minus post of the other tube A new 1/2-ampere ballast resistor is connected in series with the filament minus posts of the last two AF tubes. The filament of the first audio tube is connected to an individual ballast resistor of the 1/4-ampere type. You will note that the filament of the second audio tube is not connected to the filament circuit of the first audio tube. Instead it is connected to the filament circuit of the new tube. The F posts of the AFT in this circuit is connected to the minus post of a C battery of the nine-volt type. Use 135 volts B battery for the plates of these last tubes. (2)—Yes.

REGARDING THE short wave receivers shown on page five, Nov. 27 issue of Radio World. (1)—What size wire should be used to wind the coils? (2)—How many turns are wound for each? (3)—May a .0005 mfd. variable condenser be used for C1? (4)—What size rheostat is used? (5)—What is the resistance of R2? (6)—What size condensers are C2 and C4?—Jack Hunt, Watrous, Saskatchewan, Canada.

(1)—Number eighteen plain copper or double cotton covered wire. (2)—The same number as stated in the text. (3)—No. Due to the large capacity of this condenser, it will be necessary to use so small a number of turns, that it will be

difficult to cover any large band of waves. (4)—Twenty ohms. Use —01A tubes. (5)—Two megohms. (6)—These are .00025 mfd. fixed type.

I HAVE built the four-tube set de-March 27, 1926 issue of Radio World, and although I get good results from it on locals, when I attempt to tune in distance the tubes squeal. What can I do to stop this action? If this is done, the set will be great.—Lester Herter, Savannah, Ga.

Place the filament circuit of the radio frequency amplifier and the detector tubes on separate controls, either via a rheostat or automatic control. If rheostats are used, the twenty-ohm type is needed. If ballasts are used, the 1/4-ampere type are needed. The filaments of the audio tubes can be placed on one control or individually. Also break the B plus 90-volt lead, allowing it to go to the audio plates only. Connect the plate of the radio frequency amplifier tube to a B plus 67 1/2 post.

WHAT ARE known to be the constituents of Bakelite? (2)—By whom was it invented? —William Fervent, Lansing, Mich.

(1)—A special paper pulp, treated with carboic acid and formaldehyde. (2)—Dr. Bakeland.

WHAT IS vitreous electricity?—Marshall Falter, Burlington, Ia.

It is that electricity produced on the surface of glass when silk is rubbed over (Continued on page 30)

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Name (Write)
Street J. W. LEGG
City and State.....

Deaf Able to Read Sounds From Set by New Device

Ability to Distinguish Different Pitches First Must Be Acquired—
 J. W. Legg, Westinghouse Engineer, Is the Inventor—
 Presence of Oil in Ground Detected

Translating sound vibrations into visible waves, or allowing deaf people to see music or speech, may now be done with the aid of a new device known as the Osiso, invented by J. W. Legg, a research engineer of the Westinghouse Electric and Manufacturing Company, and demonstrated at the company's offices at 150 Broadway, N. Y. City. It is really an oscilloscope, but reduced to portable size. The old type was used successfully during the World War, but due to its bulkiness, huge expense and intricacy of operation, was not used very much since. Legg's device also may be used to locate oil, by sound tappings, and "see" sounds made a great distance away, etc. It can also be hooked up to the output of a radio set or telephone and enable a deaf person to see the music or speech, etc. It is necessary for the deaf person to learn how each sound appears visually so that it can be recognized instantly.

The success of the instrument is due to the use of a tiny powerful magnet. That and the smallest mirror in practical use in the world are the vital parts. The mirror is one three-hundredths of an inch thick. This tiny mirror is mounted on two wires, which are suspended between the poles of the magnet. Theoretically, when a current flows through the wires in a strong magnetic field, the wires will tend to move. The direction of the movements depends upon the direction of and strength of the flow. In the device the sound vibrations are the current which is fed into the wires supporting the mirror. As the wires move, the mirror moves with it, flashing beams of light. Each beam, reflected from the mirror,

takes the same shape at every repetition of the identical sound, while it varies with other sounds. This variation may either be watched or photographed. The Phonoscope, another development like the Osiso, allows greater amplification and also carries a special drum, from which the signals may be read.

Working of Voice Mechanism Filmed

Columbus, O.
 For the first time, Professor G. Oscar Russell of Ohio State University, has photographed the interior workings of the human voice mechanism, during normal speech. Many theories regarding the activities of the organs are expected to be upset pending the developing of the many negatives of the photos taken. The opening up of many secrets are expected to be felt in the radio, telephone and phonograph industry, as well as the voice culture, language, and deaf mute instruction.

The photos are obtained with a full-sized camera, which is linked up to a tube, about the size of a lead pencil, arranged to conform to the contour of the mouth, containing mirrors, lenses and prisms and a special lighting device. The tube was devised by Prof. Russell, while the lighting was the work of Professor Raymond Weeks of Columbia University. Prof. Russell is coming to the phonetics laboratory of Columbia, where he intends to stay for six months to study the voice and continue experiments with the device.

Inventor Demonstrates His Device



(Wide World)

J. W. LEGG, the inventor of the Osiso, speaking into the "Phonoscope," while Miss E. S. McKay reads the waves produced by the small mirror revolving on the drum.



(Wiler)

Top—Director-Announcer R. H. Riner, seated at his desk in the studio of station W.L. Eleanor Horn, staff pianist. Turning the drum, Riner, director of the station.

Middle—The reception room of station W.L. accommodations.

Bottom—Interior of the studio of W.L. decorations is a

Rule of Studio Splendor Spreads South of the Line

Faith of Public and Broadcasters in the Permanence of the Art Attested by Exquisite Decorations—WLAC a Towering Example

The faith of the public in the permanence of broadcasting is attested by the ever-increasing elaborateness of the studios from which the programs are sent out. In the early days the microphone was placed anywhere and the place was called a broadcasting studio. But those were the days when the announcer and the phonograph constituted the staff of "artists."

As radio grew, the demand for better quality arose, and the first place to improve the quality was in the studio. One of the first sources of bad quality from a technical point of view was found to be the echo from the walls of the studio. To remedy this trouble draperies were hung about the walls, so that no sound

would be reflected from them. These draperies first consisted of cheesecloth and cotton batting. They were very efficient but not very artistic. The next step was to employ draperies of artistic design to harmonize with the artistic temperament of the artist performers who had replaced the old phonograph. The improvement at the station always kept ahead the improvement in the receivers which were used to pick up the stations.

One of the latest of the better equipped stations to join the family of broadcasters is WLAC, the "Thrift" station of Life and Casualty Insurance Company of Nashville, Tennessee, operating on a wavelength of 225.4 meters, and on a power of 1,000 watts.

AF Used With Stethoscope In Crime-Detecting Machine

Audio-frequency amplification, so familiar to radioists, was used by Dr. A. P. Link, psychology instructor at New York University, in a demonstration of a crime-detecting machine before the New York Electrical Society.

The combination stethoscope and audio frequency amplifier has an amplification constant of 100,000, and enables an audience to hear the heart beats of the subject put under the test.

Three persons selected from the audience were sent out of the room under sealed instructions. One of the three, chosen by lot, went to a room on the tenth floor of the building, where a letter was taken out of an overcoat pocket. The culprit, acting under instructions removed \$10 and replaced the envelope and a letter it contained. The culprit, whose identity was not revealed to the audience, then returned "to face the music."

Dr. Link then subjected each of the three to the electrical psychology tests. The emotions aroused by the guilt of the "robber" became instantly evident on the records of the apparatus.

An electrical stethoscope, specially devised by the Bell Telephone laboratories, amplifying the heart-beat sounds, enabled the audience to hear the thumping of the

heart. When the young man who had opened the envelope and removed the \$10 was asked questions bearing on the "robbery" his quickened thumping of the heart when the key words were mentioned was instantly audible.

In addition to the quickened heart beat of the one who removed the \$10 from the envelope, "guilty excitement" was also demonstrated in the form of a moving spot of light thrown on a screen in full view of the audience. The spot shot clear across the screen when the person questioned became unduly excited.

Dr. Link explained that excitement lowered the electrical resistance of the skin. This, he said, was especially true when an effort was made to lie or to conceal the truth.

According to Dr. Link, this reaction is entirely outside the control of the person examined. He said this apparatus was "a complete give-away of the emotions which the robber was attempting to conceal." Dr. Link also explained a number of psychological tests, electrical and otherwise, now in use for the selection of employees either for hire or promotion. He said these tests must not be used as infallible guides but as an aid to the general common sense.

DeLuca to Make Air Debut



BENIAMINO GIGLI

MME. RENEE CHEMET

GIUSEPPE DE LUCA

Gigli, tenor (air debut), De Luca, baritone, both of the Metropolitan Opera Co., and Mme. Chemet, French violinist, will broadcast from a WJZ chain in a Victor program Friday, January 14.



affectionately known as "Old Man Bob," on WLAC. Seated at the piano is Miss [name obscured], music is Mrs. Clyde Walters, program [name obscured] the station.

n WLAC, wherein 250 guests may be seated.

AC. The color scheme of the attractive [name obscured] iver and black.

A THOUGHT FOR THE WEEK

WHAT has become of the orator who formerly told his enchanted listeners that "Radio is in its infancy?" Perhaps he has joined that happy band in whose membership is the most widely quoted author ever known—Joseph Miller, Esq.

RADIO WORLD
REG. U.S. PAT. OFF.

The First and Only National Radio Weekly

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

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ADVERTISING RATES

General Advertising

1 Page, 7 1/4" x 11"	462 lines	\$300.00
1/2 Page, 7 1/4" x 5 1/2"	231 lines	150.00
1/4 Page, 8 1/4" D. C.	231 lines	150.00
1/4 Page, 4 1/2" D. C.	115 lines	75.00
1 Column, 2 1/4" x 11"	154 lines	100.00
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26 times consecutively or E. O. W. one year	15%
4 consecutive issues	10%

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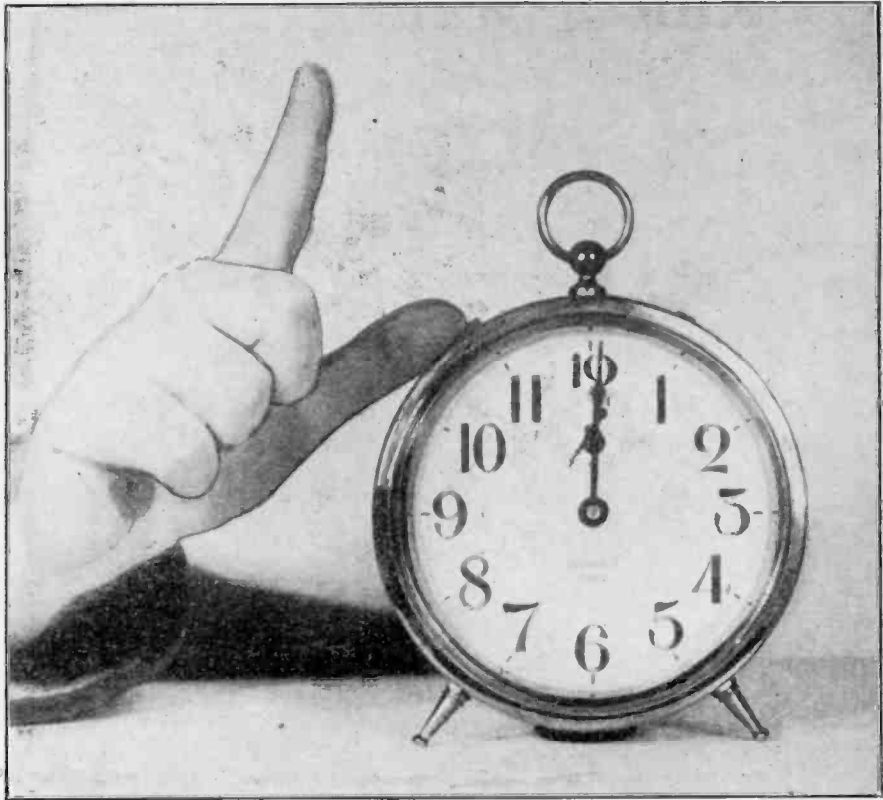
Coolidge Pursued by Radio Jynx

Broadcasting of the recent speech of presentation of the key of the city of Trenton to President Coolidge, at the ceremonies incidental to the celebration of the 150th anniversary of the Battle of Trenton by WOR, Newark, was suddenly halted when an SOS from the British ship Clearton, at a point about 500 miles east of New York in the Atlantic, was received. This was at approximately 10:50 p. m. She had reported that her rudder was gone, adding that immediate assistance was necessary. The ship had left Dec. 26 for Queenstown. Not until 11:27 p. m. was broadcasting resumed. Although most stations immediately went off the air, there were a great many which did not go off until fifteen minutes later.

President Coolidge had already concluded his speech dealing with the sesqui-centennial celebration.

A few weeks previous, broadcasting of President Coolidge's speech at a students' debate was interrupted because the aurora borealis interfered with the remote control land wires.

The Taming of the DX Hound



(Hayden)

*I STOOD by my set at midnight,
As the clock was striking the hour,
And a face rose o'er my shoulder—
And the features were long and dour.*

*I saw HER bright reflection
In the panel of my set,
And a raspy voice inquired:
"Ain't you gone to bed as yet?"*

*How often, O, how often
In the days that had gone by
I had sat by that set at midnight
And heard just the same old cry.*

*How often, O, how often,
I had wished that darned old clock
Could tick like a feather duster,
Nor wake up a wife to mock.*

*And I think of how many thousands
Of care-encumbered men
Have sat by their sets at midnight—
And I've cussed a bit and then—*

*I see the long procession
With me as their faltering head,
Shut off the set and meekly
And as ruefully go to bed.*

—Hank Shortfellow. Per R. B. H.

Consulted by Air, Doctor Gets \$100

On the arrival of the Lamport & Holt freighter Voltaire at Hoboken recently a check for £20, or nearly \$100, awaited Dr. Le Sieur Weir, ship's surgeon which was payment of medical services rendered by wireless in midocean.

When the Voltaire was southbound on her voyage to and from South America which was just completed, she received a radio message from the captain of the British freighter Speaker of the Harrison line, telling of the illness of one of the

officers and asking for medical advice. A description of the symptoms convinced Dr. Weir that the man was suffering an attack of appendicitis and he quickly transmitted suggestions for his relief.

Ten hours later an answer, with thanks, was received, declaring that the officer's condition showed a decided improvement.

The conclusion of the story was written when a check from the president of the Harrison line was delivered to Dr. Weir, who accepted it with thanks.

BUREAU TESTS DRY CELLS

Washington.

Longer life dry cell batteries is engaging the attention of the Radio Laboratory of the Bureau of Standards. Samples of dry cells have been collected from 20 different manufacturers for testing. They will be measured for the dimensions of the various cells and readings made of short-circuit current and open-circuit voltage. The tests will continue for several months.

STATION FOR AMAZON RIVER

Washington.

A broadcasting station of 1,000 watts is to be erected in Manaus, up the Amazon River, according to a report to the Department of Commerce. The station will operate on 100 meters. American fans with sets that tune that low should be able to pick up the station under favorable conditions.

WILL ROGERS BACK TO MIKE

Will Rogers has signed a return engagement for an Eveready Hour to be broadcast this month. About two years ago the cowboy-humorist, who lately as "minister aplenty" set the world laughing good naturedly over American political problems, was a guest of the Eveready Hour. This year he will be supported by the De Reszke Singers, who have been appearing with him in his stage engagements throughout the country.

A PHENOMENON OF METALS

A thermo-electric junction is one in which two dissimilar conductors, when heated or cooled so that a difference of temperature is established between them, creates a difference of potential, causing an electric current to flow. This phenomenon is used to measure current flow by the degree of heat.

Compromise Radio Bill Expected to Pass Soon

Washington.

The demand for compromise in Congress on radio legislation may lead to the adoption of the proposal for a commission to regulate radio with the details of administration left to the Department of Commerce. This is the consensus of experts in the Senate and House who are interested in radio.

The definite statement of Senator C. C. Dill, author of the Dill Bill, that it will be "compromise or nothing" has weakened the position of the White bill supporters. Senator Dill's bill which passed the Senate without a record vote would turn all radio matters over to an independent commission.

Representative Wallace White, Jr., author of the White bill, which passed the House by an overwhelming vote, is equally positive in his opposition to the Dill bill. His bill would place the details of administration of the law in the Department of Commerce with a commission to pass upon appeals.

The general view is that the compromise proposed does not differ essentially from the White bill, which has the support of the President. The controversial point would be as to whether the Commission is to be independent or subject to executive authority.

Senator Dill and Representative White are going over the entire scale in an effort to reach an agreement. They both realize the situation is getting more critical because of the flood of new stations increasing interference to reception.

There seems to be little doubt that a bill of some kind will be enacted before the end of the session.

College Stations Back White Bill

Washington.

Members of Congress have been petitioned by the Association of College and University Broadcasting Stations to enact immediately a radio law. Explaining that lack of regulation has resulted in unsatisfactory conditions because of "wave jumping," the University Broadcasting stations recommend passage of the White bill.

"Owing to inadequate legislation and the resulting inter-station interference," says the Association, "existing conditions in connection with radio broadcasting are very unsatisfactory. Due to wave jumping and the licensing of new stations, the situation is rapidly becoming worse. We, therefore, believe it to be imperative that specific and adequate radio legislation be passed as the present session of Congress.

"We favor the White bill, if provision be made for the creation of an advisory committee of competent engineers who shall act as a board of appeal, and providing, further, that additional appeal may be had to the courts. We also suggest that at least one member of the advisory committee be chosen from the engineering faculty of an institution of higher learning."

Flewelling Suggests Board of Engineers

Considerable speculation has arisen over the possible appointees on a radio commission to govern the assignment of wavelengths if the Dill bill is made a law. E. T. Flewelling, radio engineer of Dayton, Ohio, said:

"Engineers should comprise the board

of control for radio if such a commission is established. The assignment of wavelengths is an engineering matter and should properly be in the hands of engineers, not politicians.

"Granting the necessity for a national figure with diplomacy and tact to act as the arbiter between those differing on the matter of wavelength assignments, the fact remains that only capable engineers with proper training will be able to work over the present wave assignments and iron out some of the heterodyning that now exists."

17 New Stations Make Total 671

Washington.

The total number of stations has been swelled to 671, with the advent of seventeen new broadcasters just licensed by the Department of Commerce, two of which are of 1,000 watts each, and one 500 watts.

During the last days of 1926 seven stations changed their wavelengths, two stations changed their calls, and four stations discontinued operation.

NEW STATIONS

Call	meters	freq.	power
WLBR—Alford Radio Co., Belvidere, Ill.	249.9	1200	50
WAOK—A. H. Andreason, Ozone Park, N. Y.	247.8	1210	100
WMBA—L. J. Beebe (portable) R. I.	249.9	1200	100
WLBX—J. N. Brahy, Long Island City, N. Y.	230.6	1300	250
KKP—City of Seattle, Seattle, Wash.	260	1153	15
WLBU—M. B. Griener, Canastota, N. Y.	220	1363	5
WLBZ—T. L. Guernsey, Dover-Foxcroft, Me.	299	1003	50
KROW—Oregon Broadcast Co., Portland, Ore.	231	1298	250
WLBW—Petroleum Tel. Co., Oil City, Pa.	321	934	250
KGDW—F. J. Rist, Humboldt, Neb.	241.8	1240	100
KGEF—Trinity Meth. Chr. Los Angeles, Cal.	516.9	580	1000
WABQ—United Bdcst. Co., Philadelphia, Pa.	260.7	1150	500
KMED—W. J. Virgin, Medford, Oregon	250	1199	50
WLBV—J. F. Weimer & D. A. Snick, Mansfield, O.	230.6	1300	50
WLBT—Harold Wendell, Crown Point, Ind.	230	1304	100
KOMO—Fisher Blend Station, Seattle, Wash.	305.9	980	1000
KGEH—Eugene Bdcst. Station, Eugene, Ore.	236.1	1270	50

WAVELENGTH CHANGES

WKBO—Jersey City, N. J., from 309.1 M. 970 K. C. to 303.9 M. 986.6 K. C.
WJAR—Providence, R. I., from 305.9 M. 980 K. C. to 483.6 M. 620 K. C.
WIBW—Chicago, Ill., from 220.4 M. 1360 K. C. to 215.7 M. 1390 K. C.
KRLD—Dallas, Texas, from 353 M. 849.4 K. C. to 357.1 M. 839.6 K. C.
WSBT—South Bend, Ind., from 315 M. 951.8 K. C. to 315.6 M. 950 K. C.
KUJ—Seattle, Wash., from 345 M. 869 K. C. to 352.5 M. 850.6 K. C.
KVI—Tacoma, Wash., from 242.5 M. 1237 K. C. to 342.5 M. 875.4 K. C.

CALL CHANGES

KGEA, Seattle, Wash., changed to KUJ.
WOAW, Omaha, Nebr., changed to WOW.

IN SONG AND STORY



PAULINE WATSON, popular concert violinist and lyricist, who appears weekly at WPCH, New York City. Miss Watson illustrates her solos with original versions of the stories connected with the songs.

Full Opera Broadcast Predicted by Johnson

Edward Johnson, brilliant tenor of the Metropolitan Opera, will broadcast his Atwater Kent concert from WEA and fourteen connected stations, on Sunday night, at 9:15 p. m.

The famous Canadian tenor, who has toured the world in concert, has become an enthusiastic radio fan and predicts that it will not be long before the operas will be broadcast in full from metropolitan centers, resulting ultimately in opera becoming America's most popular form of dramatic entertainment.

Mr. Johnson believes the large operatic organizations will soon arrive at a realization of the publicity value of nation-wide broadcasting and that this radio development will in time effect an increasing number of opera companies. He also predicts that larger cities will in time support municipal opera, as European cities have done for years.

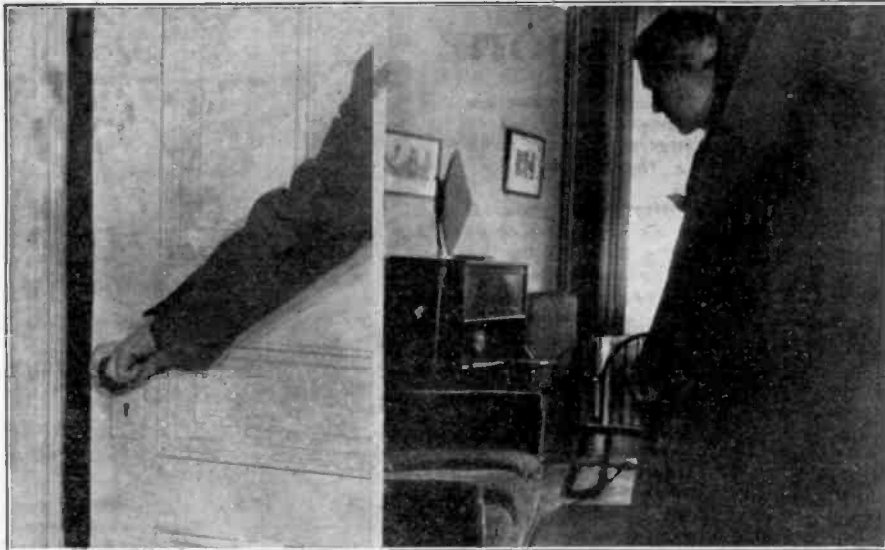
"Never before has a nation made such strides in bringing music to the people," said Mr. Johnson, "and never before has there been such an imperative desire for the finer things that older civilization and culture have given.

"Radio, phonographs and reproducing pianos have brought music into almost every home, and the result is that choral societies, orchestras and bands have sprung up by the hundreds. I returned from ten years in the old world to find fifteen symphony orchestras of the first rank.

"I believe the next important step in radio development will be the broadcasting of complete operas. Tendencies in this direction are already apparent. All the leading opera singers are now broadcasting operatic arias, and the broadcasting of synopses of operas of one hour duration is proving most popular. Opera will surely be broadcast when subsidized to reach more people.

"American audiences are higher intellectually than European audiences. The American audience finds pleasure in bringing its own fancy to bear on its music. For this reason the American public would be particularly receptive to the broadcasting of opera. The radio listener must fancy his own colors, characters, settings to gather his own picture of what the music interprets. This all takes thought and gives rise to great flights of imagination, and American people are accustomed to think more and give freer reign to their imagination."

DOOR OR DRAPE CONTROLS VOLUME



(Hayden)

WHEN YOU do your listening in a room adjoining the one where the speaker is, if the signals are too loud, you do not have to go in the other room to remedy this. Just vary the position of the door which separates the two rooms. The same effect can be had with curtains or draperies.

Ludlow Plays Stradivarius In Broadcasts from WJZ

WJZ was one of the first broadcasting stations in the country to obtain the services of an internationally known concert artist as a member of the studio personnel. He was Godfrey Ludlow, recognizedly, one of the most talented contemporary violinists. Born in Australia, he received his early musical education there and at the age of ten was awarded the Gold Medal for New South Wales. At fourteen he left Australia, to spend three years in Prague and two years in Vienna studying under the great master, Sevcik. When he was seventeen, he passed the highest violin examination in the world and entered the Maester-Schule (Master School) of the Imperial and Royal Academy of Music at Vienna.

In a two-year tour of Europe he made no less than five command performances before the crowned heads of the countries he visited. He went to London when he was nineteen and made his debut appearance at Queen's Hall; he created such a furore in London musical circles that his debut was followed within a week by a special command performance at Buckingham Palace. After a brief concert tour of the United Kingdom, he went to Russia and studied with Leopold Auer.

He was returning through Dresden in the Summer of 1914 when he was seized as a prisoner of war and placed in the Ruhleben Prison Camp, where he remained for more than four years. Immediately upon his release in 1918 he returned to England and toured Great Britain with Dame Nellie Melba.

Ludlow went to New York in 1924, and made a most favorable debut at Aeolian Hall immediately upon arrival.

Mr. Ludlow owns the priceless De Rougemont Stradivarius. This violin, which Ludlow plays in all of his recitals through WJZ, was made by Antonius Stradivarius, in the famous violin town of Cremona, Italy, in 1703. Ludlow attained fame as a violinist in Europe and after the war made his way to London, where he began his search for a violin worthy of his ability. A London dealer who knew of the whereabouts of the De Rougemont Stradivarius undertook a special trip to Brighton, England, where the instrument

was obtained from a vault of the family whose name it bears, where it had lain for almost a century, and upon being brought to light the violin was sold to Mr. Ludlow. Little is known of the travels of this violin from its date of manufacture to the time it came into the possession of the De Rougemont family in the early part of the 19th Century, but history tells us that late in the 18th Century the violin was played in Berlin, and again in the early part of the 19th Century it was played before the French Emperor at Versailles.

When Ludlow and leading connoisseurs in New York City had occasion to open the instrument they found that the four interior supporting blocks remained just as Antonius Stradivarius left them when he glued the violin together 224 years before. Of course, the neck, fingerboard and tailpiece are all modern to fit the requirements of the present-day hand, as in the days of Stradivarius, the manual measurements were much smaller. The head and all other tone-producing parts remain intact, even to the rich, colorful varnish for which the master was so famous.

Pianist Finds Radio Faster Than He Is

Washington.

Even those most intimately associated with radio cannot seem to realize the lightning speed with which it travels. An illustration of this point is contained in a story recently told to Acting Secretary of Commerce Stephen Davis, who takes delight in repeating it.

A pianist at Albany, N. Y., whose music is broadcast through WGY, Schenectady, is fond of listening to himself play by radio and when he sits down to perform he usually has a pair of phones over his ears.

One evening, not long ago, he thought he would listen to the radio and directly the piano at the same time, so he put on

Forecasts for the Radio Need Real Weather Genius

There's nothing unusual about forecasting the weather; it is done for practically every newspaper in the nation. But the forecasting of radio weather is a bit unusual.

"Good volume and distance to the east Monday night; poor distance and probably fading to the south; probably poor distance west and southwest."

"Reception uncertain Thursday night; probably poor distance with static and fading."

These are typical of the radio weather forecasts which "The Milwaukee Journal" publishes daily in connection with its regular weather forecast column. An attempt was made by that paper to have the weather bureau of Milwaukee predict radio reception as it does weather, but the chief of the bureau frowned on radio forecasting as too uncertain.

However, the Milwaukee meteorologist, W. P. Stewart, is interested in radio forecasting and is co-operating with "The Journal" in its new undertaking. He believes that ultimately, weather may be forecast from radio reception, rather than radio reception from weather.

The forecast is made by R. G. Lynch, a member of The Journal editorial staff, and is based on a system worked out by Eugene Van Cleef of Ohio State University. The weather bureau supplies a map of high and low pressure areas, based on observations made at seven o'clock each morning. The radio forecast is prepared from this, with the bureau's weather forecast as a guide to probable movement of the pressure areas as indicated by the noon readings.

The radio forecaster keeps a file of the weather charts, with forecasts and results noted on the reverse, for future guidance.

Fundamental Suppressed, Yet the Ear Can Hear It

The pitch of a tone having many harmonics is not entirely determined by the fundamental, but rather by the frequency difference of the harmonics.

This is proved by the fact that if the fundamental is completely suppressed the ear still hears it when listening only to the overtones of that tone. Distortion enters and the fundamental is reproduced in the ear. For example, if the fundamental is 100 cycles and if the sound is rich in harmonics, the 100 cycle fundamental may be completely suppressed and still the ear will hear it while listening to the harmonics only.

only one ear phone. After playing a few minutes, he exclaimed in astonishment: "My God, they're both coming in together."

Schenectady is 17 miles from Albany. The radio signals went to Schenectady by land wires and back by radio, a distance of 34 miles. He was sure his musically trained ears would detect a slight difference between the time of the radio and the piano.

4-A-WEEK FOR SPECHT

Paul Specht's orchestra, broadcasting from Twin Oaks restaurant in New York City, is on the air four different periods each week.

Has Index Voice But Fails to Land Announcer's Job

Portland, Ore.

Even with radio announcers life is not all paradise.

There are hundreds of fans who think they can do the job better than it's being done and who do not hesitate to write their "honest" opinion concerning the advantage to the station of employing them.

One of the most remarkable letters that has come to a certain Chicago station in a long time was received a few days ago from Lincoln, Neb. The writer stated that his announcing would absolutely make WMAQ a peer among stations.

"It's my voice," he explained, "and also my mind."

"To me the voice is the index of the mind. It portrays my personality and mind qualities."

Apparently other qualities are needed for announcing, for Robert Whitney is still at the microphone as chief announcer for WMAQ.

German Fans Ask

Curb on Advertising

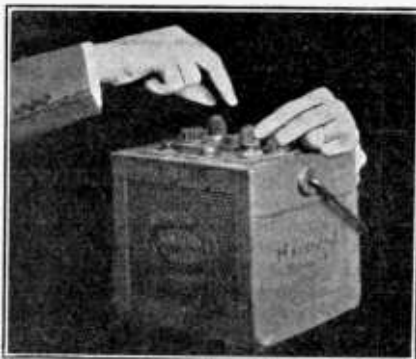
Los Angeles, Cal.

Persons who own radio sets in Germany are forced to pay 50 cents a month for their pleasure. This fee is levied by the government and is enforced to the letter. KNX, the "Evening Express" radio station, reports that stations over there are trying hard to keep advertising matter off the air so that fans, who in a way pay for their entertainment, can have the best.

MAXWELL PREDICTED WELL

About 50 years ago J. Clerk Maxwell predicted by mathematical reasoning the existence of radio waves, or rather of electro-magnetic waves. His theory is now the foundation upon which radio is laid.

FIRMNESS PAYS



WHEN CONNECTING up leads to the storage A battery, be sure to screw the nut down tightly. A poor contact causes flickering of filaments.

11-Week Trip Reduced to 4 Hours By Radio

Joseph B. Forbes of the Crescent Athletic Club, Brooklyn, N. Y., vice-president of the Stille Slicing Machine Company, made a trip in four hours the other night, covering territory which had taken him eleven weeks to cover. The quick tour was made by radio.

Sitting before the loud speaker in the home of Eric H. Palmer, of the Freed-Eisemann Radio Corporation, Mr. Forbes went to all the cities via radio, hearing in rapid succession Chicago, Cleveland, Detroit, Cincinnati, Omaha, Minneapolis, Kansas City, Davenport, Fort Worth, Dallas and Los Angeles, principal stopping places on his recent business trip, and he "visited" them again between 9 P. M. and midnight, with the exception of Los Angeles, which was after 9 P. M.

KFI and WFAA were on the air at the same time, but their transmission was so true that they were easily separated. The crooning ukelele player at KFI carried well over the great distance, an indication of the remarkable reception that marked that night. KFI's dance music carried stronger.

Three Stations In South Join "Red Network"

The National Broadcasting Company extended its facilities to radio listeners in the Southern portion of the United States through the addition of three stations, WSM, Nashville Tenn.; WHAS, Louisville, Ky., and WSB, Atlanta, Ga. Beginning January 4 these stations were linked with the National Broadcasting Company's Red Network for the broadcasting of the Eveready Hour, which is broadcast every week on this evening from 9:00 to 10:00 o'clock, Eastern Standard Time (8:00 to 9:00 P. M., Central Standard Time) through WEAF, WEEI, WJAR, WTAG, WGR, WFI, WGY, WRC, WCAE, WTAM, WWJ, WSAI, WGN, KSD, WOC and WCCO simultaneously.

The three Southern stations which will cooperate with the National Broadcasting Company in this latest extension of its facilities have been outstanding in their own territories, and the new hook-up will place at their disposal new program material of high quality. All three stations will broadcast the Eveready Hour as a regular weekly feature and WHAS and WSB will also regularly transmit the entire Capitol Theatre program on Sunday evenings from 7:20 to 9:15 P. M. (Eastern Standard Time) (6:20 to 8:15 P. M. Central Standard Time). For the present National Broadcasting Company programs will be sent to this Southern extension only on Tuesday and Sunday nights.

WSM is owned and operated by the National Life and Accident Insurance Company on a wavelength of 283 meters (1.080 kilocycles) with 1,000 watts power. WHAS, owned and operated by the "Courier Journal and Louisville Times," uses a 400 meter wavelength (750 kilocycles) with 500 watts power. WSB is owned and operated by the "Atlanta Journal" on a wavelength of 428 meters (700 kilocycles) with a 1,000-watt transmitter.

Asheville Begins Work On Up-to-Date Station

Asheville, N. C.

Construction of a studio and mechanical operating room to house Asheville's new municipal radio broadcasting station was started recently on top of the Flatiron building. At the same time a wire ordering shipment of the transmitting apparatus was sent to the Nashville insurance company from which the 1000-watt station was optioned some time ago. Bids were asked on construction of two galvanized steel towers to support the huge aerial. These were the latest developments in regard to the radio broadcasting project organized a short time ago by the Asheville Chamber of Commerce. They were authorized by directors of the civic organization in meeting recently, after they had been recommended by the recently-appointed board of governors of the radio station, F. A. Barber, E. A. Jackson, Jr., and Carl R. Bamford.

An effort will be made to place the transmitting outfit in commission within thirty days, F. Roger Miller, manager of the Asheville Chamber of Commerce, said.

Appointments of J. Dale Stentz, former business manager of the Southern Methodist assembly at Lake Junaluska, as program director, and of Albert W. Shropshire now assistant operator for WSB, the Atlanta Journal, as chief operator.

were also made by the directors upon recommendation of the board of governors.

Decisions to go ahead with the establishment of the station despite the fact that only a little more than \$20,000 of the \$35,000 needed for the purpose has been raised, was reached by the directors after they agreed the opportunity. Five thousand dollars additional is expected to be raised very soon. The remaining \$10,000 will have to be raised before the station starts operation, it was announced.

Frank A. Barber, chairman of the radio committee of the Asheville Chamber of Commerce, is now completing arrangements with the National Broadcasting chain to secure their programs here for relay purposes. This would entail the placing in Asheville of two direct wires from their studios giving the city direct contact with the finest programs produced in the world. Even the smallest and cheapest sets in the city will be able to receive these by this arrangement.

Another meeting of the Chamber of Commerce radio committee was held to check up on the funds collected and pledged for the installation of the broadcasting station here. Frank A. Barber, chairman of the committee, said that \$12,000 is still needed for the radio fund and

that the campaign will continue until the \$35,000 is collected as the station will not be put into operation until the full amount is in hand.

J. Dale Stentz, program director for the station in Asheville, (call letters WWNC), was in Atlanta studying the operation of WSB. Mr. Stentz spoke and sang over the station and was heard by a number of Asheville residents. He will get information from the officials of WSB and will confer with J. T. Shropshire, assistant operator there, who has been employed as chief operator for WWNC. Mr. Stentz will also visit Nashville, Washington, and New York City stations and will be joined in New York by Mr. Barber.

The station has been shipped from Nashville, and every old part on the plant which has been improved has been replaced by the newest devices. Mr. Stentz said that he will devote a great portion of his time upon returning to Asheville to the organization of talent in this section for programs. He plans to organize a male chorus for radio.

RESINOUS ELECTRICITY NEGATIVE

Resinous electricity is another name for negative electricity. It may be produced by rubbing the surface of such a body as shellac or sealing wax with flannel.

ZERO POTENTIAL IS REAL DX

The earth is arbitrarily taken as the zero point of electric potential. Theoretically, zero potential is the potential of a point infinitely distant from all bodies possessing electricity.

THE RADIO TRADE

Town's Big Idea On Service Grows

Binghamton, N. Y.

The Radio Service League, established about a year ago to furnish free radio service to its members, has moved to new and larger quarters, 30 Leroy Street. The object of the league is to cater to the radio owner, keeping his set in condition by regular inspection. In its new location, the league will carry a complete line of high grade radios, featuring the Gillfillan, as well as a complete line of batteries, tubes, speakers, and all radio accessories. The league gives a membership in the league with every radio set sold entitling the holder to free inspection and service by thoroughly trained radio mechanics. The service department of the league is in operation until 11 o'clock every night, giving service at a time when it is most needed.

1927 to Break Record, Say Jardine and Kent

Secretary of Agriculture William M. Jardine, largest user of radio broadcasting, and A. Atwater Kent, largest manufacturer of radio receiving sets, believe that the new high records established for radio in 1926 will not merely be equalled but will be outdistanced in 1927.

The momentum attained in radio production and broadcasting in the closing months of '26 was not due primarily to seasonal conditions, in the opinions of these two experts, but was the result of a steady acceleration in radio demand that will continue through the new year.

"Radio has definitely proved its effectiveness in spreading information and education," says Secretary Jardine. "The increased use of radio by the department is proving of utmost value and its field of usefulness is constantly widening. The demand for high grade informational programs, as shown by the thousands of letters received by us each week, grows greater every day."

"As a proven utility, with a practical and cultural value even greater than its value as an instrumentality for entertainment, the field for radio has been immeasurably widened during the past year," declares Mr. Kent, whose factory is now well into the production of its second million sets. "The demand for efficient, high-grade sets was never so general nor so great as it is today."

As a broadcaster, Secretary Jardine sponsors 22 weekly programs, broadcast through more than 100 stations. These programs cover a greater variety of material and fill a greater number of hours on the air than the combined offerings of any other half-dozen radio users. The "fan-mail" resulting from these programs runs into many thousands of letters a week.

Mr. Kent, famous as a broadcaster himself, through his series of Sunday evening programs by grand opera and concert stars, also was a pioneer in the production of single dial sets, now generally demanded by radio users. From a production of 6,628 sets in his first year as a radio manufacturer, ending May 1, 1923, his output has grown to 600,000 sets for the present business year, his one-millionth set having been turned out December 3, 1926.

Links Phonograph and Radio

A decided joy to every radio fan who owns a phonograph is an apparatus that

picks up the delicate electrical impulses from the receiver and transforms them into mechanical vibrations which are enlarged and transmitted through the phonograph needle to the mica diaphragm of the reproducer. It should do electrically what the disc record does mechanically. It can be plugged into the set in place of the loud speaker, and is ready for instant use; neither special fittings or batteries are required. It fits any phonograph and works on any set. Such an apparatus in the form of a complete unit is being offered by Blan, The Radio Man, of 145 East 42nd Street, New York City, at a low price, on a money-back, if not satisfied, guarantee. Blan is one of the oldest-established radio men in New York and is well known to thousands of radio fan commuters, whom he serves faithfully and well on their daily trek through Gotham.

Engineers Service Co. Opens Audition Studio

For the benefit of radio fans in and near the Metropolitan area and for out-of-town fans who occasionally come to New York, the Engineers Service Co. have opened a large studio at 25 Church Street, New York City. Here, amid comfortable and luxurious surroundings, a real demonstration of the "Ensco" three-foot cone speaker is given. The acoustics of this studio are only equal to those of the average home and there are many drawbacks due to the location, downtown, surrounded by all kinds of interference and the magnetic disturbance due to the steel structure of the office building housing the studio. Nevertheless, the results attained are exceptional and one has to hear in order to believe. All are cordially welcomed and a visit here is certainly worth while to those in search of tone quality. This concern announces that they are now in full production on the new "Ensco" cone unit the direct drive distortionless unit for large cones, and that kits are now shipped out immediately on receipt of order. The "Ensco" kit is sold on a money-back guarantee and contains complete parts for building this wonderful three-foot cone speaker which can be built by anyone in a very short time.

NOT A BABY PARADE



(Hayden)
A MILK bottle on top of a wood stick, used to hold the antenna wire, makes a good aerial insulator.

Federal Budget For Radio Put at \$7,830,000

Approximately \$7,830,000 is requested of Congress in the annual budget to cover radio operations and the purchase of new equipment for the governmental departments during the fiscal year 1928.

Among the amounts chargeable to radio are naval requests for about \$5,000,000, under an item totaling \$18,800,000 for all engineering appliances, and salaries in the naval communication service, chiefly radio, amounting to \$126,200. The naval research laboratory, devoting about half its efforts to radio research, seeks a total of \$200,000 for the year.

The signal corps of the army asks for \$2,225,552, but that amount includes moneys for wire and cable operation as well as the army's radio service. This figure covers salaries, equipment and supplies.

The department of commerce requests a total of \$220,000 for enforcing the wireless communication laws, provided no new law gives this service more work to do. This includes \$45,000 to cover salaries of employees in the department; \$142,000 for field supervisors and inspectors, and the balance, \$33,000 for equipment and supplies. Another department of commerce item is \$9,000 for enforcing the wireless law on steamships. The bureau of standards requests \$49,800 for research work on radio.

A considerable sum will be expended in equipping the airplanes with radio beacons and communicating service out of the moneys appropriated for the upkeep of the national airplanes carrying an amount in excess of three million dollars.

A special appropriation of \$5,750 is sought to pay the share of this government in the expenses of the International Radio Telegraph bureau at Berne.

Music House in Atlanta Adds Radio Department

Atlanta, Ga.

The Cable Piano Company, one of the largest music houses in the country now has a radio department in its Atlanta branch. E. W. Dahlberg, for 15 years connected with the sale department of the Victor Talking Machine Company is the head of this department.

Cable is dealer for the following lines: R. C. A. Radiolas, Cleartones, Atwater Kent and Victrola combinations.

One of the features of the department headed by Mr. Dahlberg is the thoroughly modern service department, employing four men and four automobiles, ready for instant attention to calls at any hour day or night.

AN ACTIVE CITY

Newark, N. J.

Newark as a radio manufacturing center has been recognized throughout the country for some time, and in this city will be found a hundred or more concerns making parts and complete radio sets. Besides the parts line and set manufacturing, Newark also has several storage battery manufacturing plants.

NEW CHAIN STORE OPENS

Camden, N. J.

Another new chain store of the Central Radio store combination, recently opened at 552 Federal St. This is the fifth store of this rapidly expanding organization, which was made possible through the consolidation of the Central Jobbing Company and Wirtshafter Brothers of Philadelphia.

A. D. Silva Is Appointed Farrand Vice-President

C. L. Farrand, president of the Farrand Manufacturing Company, announces the election of A. D. Silva as vice-president in charge of engineering for the Farrand Company. Mr. Silva was chief engineer for the Atwater Kent Company.

Mr. Silva for ten years prior to the World War was transformer engineer for the General Electric Company. During the war he served as captain in the Signal Corps and was stationed at the Signal Corps research laboratories in Paris, where he developed a means of wireless communication between army tanks. At the close of the war he was retained in the Government service as chief engineer of the Signal Corps at Camp Vail.

Federated Associations to Meet Soon in St. Louis

The Federated Radio Trade Associations consisting of a large group of state and territorial radio trade associations, has selected the Coronado Hotel at St. Louis, Missouri, as the headquarters for its annual meeting and election of officers February 14, 15.

This will be the second annual convention of this group of associations and is expected to be largely attended by the trade from all sections of the United States, because of its central location and of the interest of trade associations in this national body.

The officers of the association are Harold J. Wrape, president of the St. Louis Radio Trade Association; A. M. Edwards, secretary of the Michigan Radio Trade Association, and H. H. Cory of the Northwest Radio Trade Association, as secretary and treasurer.

Victor Stock Sold So Public Can Buy

The Victor Talking Machine Company, the largest concern of its kind in the world, was sold to the banking firms of Speyer & Co. and J. & W. Seligman & Co. in a transaction which calls for payment of \$40,250,000 in cash if all the stock is acquired.

Eldridge R. Johnson, president of the Victor Company, announced that, owing to the condition of his health and his desire to be relieved of business cares, he had given the bankers an option on the purchase of all his common stock at \$115 a share, and the bankers said a similar offer would be made to all other shareholders. His holding will require a cash payment of \$28,175,000, it was estimated.

Boys As Repair Experts Make Off With \$195 Set

Anthony and Valentine Tramontane, seventeen and nineteen respectively, were arrested recently as the authors of a new method of stealing radio sets. They were found carrying off a \$195 set from the home of Mrs. Mary Sicks, 637 East 219th St., N. Y. City.

Mrs. Sicks said the boys came to her representing themselves as employees of a neighborhood shop, said they found some imperfection in the set and took the set, supposedly to the shop for repairs. The police said that the boys admitted thus taking four sets and pawning them.

ONE SET TO 27 PERSONS

The United States has one receiving set to every twenty-seven inhabitants. Production is progressing so rapidly that a large increase is expected by the end of the winter season.

TRADE NOTES

St. Louis, Mo.

A new radio store has been opened by C. O. Burklin and G. Patton, pioneers in the radio field in St. Louis, at 620 Pine street.

They are agents for the Rauland, Crosley, Stewart-Warner and Amplex radio receiving sets.

They also carry a line of standard radio equipment and electrical appliances for the home.

* * *

St. Paul, Minn.

Organization plans for a Northwest Radio Retail Dealers' Association were recently discussed by radio dealers at a meeting at The Saint Paul. Minneapolis retailers were invited.

A constitution was drawn up and officers elected. The St. Paul dealers recently withdrew from the Northwest Radio Trade Association.

* * *

Newark, N. J.

The Halsey Supply Corporation of 232 Halsey street, wholesalers and factory representatives for a score or more radio and automotive equipment manufacturers, has recently entered in its fourth year in business. The concern recently moved to its new address, where enlarged quarters were obtained to carry a complete line of stock of various products manufactured by many of the country's leading firms. In 1922 the firm started in the radio and automobile equipment field, carrying but a few essential lines, and its business has grown with great rapidity.

* * *

Kansas City, Mo.

A chain of radio stores, planned to reach a total of twenty, is being organized by the Trego Radio Mfg. Co. Two of the stores already are operating here and a third has been opened in Omaha. The stores will be outlets for the company of which Mrs. Nellie E. Trego is president.

* * *

Montpelier, Vt.

F. W. Barrett recently opened a new store in St. Johnsbury which will be run in conjunction with his store here. Mr. Barrett has been in business in this city for the past seven years operating a store selling auto supplies and radios. He has obtained a 11-year lease on a new store in St. Johnsbury in the new block that has been erected on the corner of Railroad street and the Avenue. The new store will carry about the same line of goods as the one here in Montpelier and Mr. Barrett expects to divide his time between the two places.

* * *

Cornwall-on-Hudson, N. Y.

A radio station in Pennsylvania picked up a trans-Atlantic radio message from the yacht, Warrior, which was 600 miles east of Gibraltar, sent by Frank Velton to his mother here. He stated that his next stop was Naples. Trade folk listened.

* * *

Los Angeles, Cal.

Plans for an expansion program are being completed by the Precision Electric Manufacturing Company, it was announced recently.

Approximately 1000 battery eliminators will be turned out daily in the new plant, which will have a floor space of at least 100,000 square feet. The radio power unit is the only product of the kind manufactured west of Chicago, it is said.

Present output is about 1500 sets monthly, but this volume is not sufficient to care for the growing demand, according to Mr. Gage. It is planned to employ 500 workers in the new plant at a monthly payroll of \$100,000. At present, about fifty workers are employed.

Literature Wanted

THE names of readers of RADIO WORLD who desire literature from radio jobbers and dealers are published in RADIO WORLD on request of the reader. The blank below may be used, or a post card or letter will do instead.

RADIO WORLD,
145 West 45th St., N. Y. City.

I desire to receive radio literature

Name

Address

City or town

State

- Dr. Charles H. Christel, 3301 Telegraph Ave., Oakland, Cal.
- William Wyne, 5466 Park Ave., Montreal, Quebec, Canada.
- Alva K. Richards, 2633 Spruce, Kansas City, Mo.
- Inman A. Rouce, R. A. Box 10, Hitchcock, Okla.
- E. L. Taylor, 137 East 8th St., Hialeah, Fla.
- Olive Gillespie, Pulaski, Ga.
- W. J. Fleischer, Marion, O.
- Eugene A. Lewis, Lock Box 38, 1, Kittery, Me.
- B. E. Howell, Section Base 9, Cape May, N. J.
- Edward F. Brounell, 91 Burnett St., Providence, R. I.
- Harry Holford, 1844 East Hamilton Ave., Trenton, N. J.
- B. J. Haynes, R. F. D. 2, Box 151, Portsmouth, N. H.
- Morris Germain, 951 Jennings St., Bronx, N. Y. C.
- Harry Rodhers, 1710 Greenmount Ave., Baltimore, Md.
- R. L. Winham, 1922 Moore Ave., Anniston, Ala.
- Ray S. Carpenter, 518 Park Ave., Williamsport, Pa.
- R. Yeomans, 30 Water St., South Natick, Mass.
- W. C. Robinson, 119 West First St., Duluth, Minn.
- L. W. Martin, Box 334, Manchester, Ia.

NEW CORPORATIONS

- Koenig and Koch, Glendale, N. Y., radio shop, \$5,000; C. and M. Koch, A. Koenig. (Attorney, T. F. Dugan, Ridgewood, N. Y.)
- United Radio Stores, Inc., South Bend, Ind., deal in radios, \$50,000; Clyde L. Smith, Henry J. Tweed, Ronald P. Neville, L. L. Hamman, Eugene Mays. (Incorporated under the laws of Indiana).
- Hy-Vag Read Co., Newark, N. J., manufacturers radio tubes, etc., 1,500 shares, no par value; Daniel B. Smith, H. Nelson Potts, William H. Osborne, Jr., Newark, N. J., (Attorneys, Pitney, Hardin and Skinner, Newark, N. J.)
- Radio Sales Corp., Milburn, N. J., \$125,000; Mark S. Marks, Harry Marks, Sydney Marks, Milburn, N. J. (Attorney, Sydney Marks, Milburn, N. J.)
- Holmes Radio Corp., Brooklyn, N. Y., \$10,000; M. H. Shulman, N. Zash, E. Herreilberg. (Attorney, A. I. Goldstein, 258 Broadway, N. Y. C.)
- North Jersey Radio Service, Inc., Hackensack, N. J., \$125,000; DeTurck and West, Hackensack. (Incorporated under the laws of New Jersey).
- Wells Motor Company, 78 Broadway, Asheville, N. C., dealing in automobiles, automobile accessories, radios and real estate; \$100,000 divided into 1,000 shares of par value at \$100 each; J. S. Wells of Leicester, F. Frank Wells and Ralph Wells of Asheville. N. C. (Incorporated under the laws of North Carolina).
- Matheson Radio Company, Inc., Gloucester, Mass., \$50,000; John J. Matheson, Ralph G. Matheson and William J. MacInnis, Gloucester, Mass. (Incorporated under the laws of Massachusetts).
- North Jersey Radio Service, Inc., Hackensack, N. J., \$125,000; E. E. Eisele, George E. Lawson, Hackensack, N. J., Louis V. Franke, Maywood, N. J. (Attys., Deturke & West, Hackensack, N. J.)
- Cleveland Radio Broadcasting Corporation, 5454 South Shore Drive, \$25,000; Ralph G. Mathews, Roy R. Smith, Gordon A. Dewitt. (Attys., Montgomery, Hart & Smith, 959, The Rookery, Cleveland, O.)
- F. C. Grummond Co., Binghamton, N. Y., \$15,000, 50 shares preferred stock \$100 par value, 200 shares common of \$50 par value; F. Charles, Rena W. Grummond, Warren D. Jennings, John V. Gosney. (Atty., Warren D. Jennings, Binghamton, N. Y.)
- Orator Mfg. Co., New York City, N. Y., radio accessories, \$100,000; V. H. Kraus, A. J. Lakaiti, L. Feingold. (Atty., J. L. Stoneham, Long Island City, N. Y.)

CAPITAL INCREASES

- Midwest Radio Specialty Corporation, Chicago, Ill., increased capital stock from \$7,500 to \$12,500. (Atty., Samuel Berenbaum, 105 West Monroe St., Chicago, Ill.)

Around the Trade Circuit

Lincoln, Neb.
 KFAB, the Nebraska Buick Auto Company broadcasting station, has recently been very successful in reaching distant points, during its regular broadcast periods. Quincy F. Roberts, American Vice-Consul in charge of the American Consular Service at Apia, Western Samoa, reported that he picked up an entire midnight program. A special test program was then arranged with Mr. Roberts and the U. S. Naval Radio station NPU, at Pago Pago, American Samoa. The regulation power and wavelengths were used, so that any one else

desiring to listen in could do so. The entire program was received with remarkable volume, according to a cablegram which was received the next day.

* * *

Pierre, S. D.

Due to the great increase in the number of radio receiving sets in this state, the tax commission has found it necessary to include radio in a special classification in the listing blanks. In the past, radio's have been included in the class of personal and miscellaneous effects. In the new class, they appear as a kind of property of the state, their value being determined according to a true estimate. This new classification is the only new addition to the listings in the form this year.

* * *

Vermilion, O.

Hazen B. Thompson has rented the Englebray rooms next to Vermilion Laundry and opened a radio salesroom and repair shop. He has been repair man for

radio dealers and owners practically ever since this instrument made its appearance in Vermilion.

* * *

San Francisco, Cal.

In less than one year after opening its San Francisco store, the Pacific Wholesale Radio, Inc., has had to seek larger quarters.

Formerly located at 835 Larkin street, the company has moved into an attractive new building at Folsom and Seventh streets.

* * *

Spokane, Wash.

White's radio service store, for more than a year at S163 Lincoln Street, this city, is now in new and larger quarters at W507 Riverside Avenue, where one-fourth of the street level floor space and all the basement are given over to housing radio equipment and repair shop. Roy R. White is owner of the store.

CARTER Parts Specified for LYNCH De Luxe Receiver

A
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Carter parts are specified for this efficient amplifier.

Whenever you find a circuit that's popular and a success, you'll find Carter parts specified. In fact, much of the success of any circuit is due to the careful selection of parts.

If you're not now using Carter parts, try them. You'll find, like thousands and thousands of others, that Carter parts perform with a consistency and persistency unequalled.

Any dealer can supply

(Pat. 1-30-23)



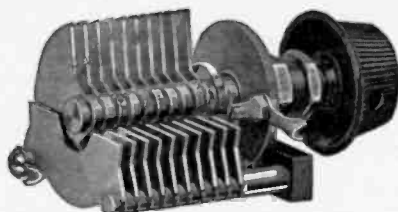
Full Size

65c

"IMP" Battery Switch

In Canada: Carter Radio Co., Ltd., Toronto

CARTER RADIO CO.
 CHICAGO



PRECISE 940 MICRODENSER

Series Antenna Balancing Condenser
 Especially Designed for the Browning-Drake Receiver

Selected and Specified by

Arthur H. Lynch

for the De Luxe Lamp Socket Receiver
 100 Mmf. Capacity, \$1.75

A Precise Laboratory Quality Instrument
 Also made in 10, 20, 30, 55 and 135 Mmf. Cap.

PRECISE MANUFACTURING CO.
 ROCHESTER, N. Y.

New York Office: 126 Liberty Street

KHQ Gets New Station; Will Use 5,000 Watts

Spokane, Wash.

A new 5,000-watt Western Electric broadcasting equipment, which will make it possible to tie-in on the Pacific Coast chain programs, is being installed by KHQ, according to an announcement by Louis Wasmer, owner.

"The new equipment will put KHQ, on a par with stations KFI in Los Angeles, KFSD in San Diego, KPO in San Francisco and a little above the capacity of KGW in Portland," stated Mr. Wasmer.

"The operation of the plant will be automatic. Among the new wrinkles will be a complete and elaborate signal system between all studios. The announcer will have a separate room for nothing but announcing. A system of red and green lights will be visible on each microphone. When the green light burns the signal means silence in the studio while the announcer is at work. At the completion of the announcement the announcer throws a small switch, which makes the red light glow. When this light is on, the mike is alive and means broadcast."

NATIONAL POWER AMPLIFIER

Designed in collaboration with Arthur H. Lynch and James Millen, it gives perfection of quality to any set and supplies all the B-Current, too. Price Completely Assembled and tested, without tubes

\$89.00

Send for Bulletin
 116-RW

NATIONAL CO., INC., W. A. READY, PRES., CAMBRIDGE, MASS.



Cross Started His Career As Mere Fill-in Artist

Milton J. Cross is the oldest announcer in years of service with WJZ, having entered the field in October, 1922, and probably is close to the top in that class with all of the radio announcers in the world, as WJZ is generally acknowledged to be the second oldest broadcasting station in the world.

Cross was born in New York City in 1897, being graduated from the DeWitt Clinton High School. He later completed the Musical Supervisors Course of the Damrosch Institute of Musical Art. Following this, he toured for several seasons with the Paulist Choristers, during which he covered the entire Eastern half of the United States. He left that organization to engage in concert and church work as a soloist and sang in the First Presbyterian Church in New York and as a member of the quartet of the Progressive Synagogue. His reputation for this type of work brought him before the microphone of WJZ in its early days when the transmitter was located in Newark, N. J. He was one of the pioneer broadcasters and as the executives of the station were looking for an announcer who could "fill in", the post was offered to him. Cross had the foresight to realize the potentialities of radio as an entertainment factor and accepted.

He is six feet two inches tall, weighing 208 pounds and has blue eyes and dark brown hair. His wife is also talented musically and frequently accompanies Cross on the piano as well as appearing in concert as a solo pianist. They have one child, a little girl just over a year old.

Classical events are Cross's specialty, where his musical training stands him in good stead. Confining his announcing to only the classical concerts, he is usually able to obtain a copy of the program to be played at each event several days in

advance. He then goes to work to familiarize himself with the compositions to be rendered, the lives of their composers and all of the interesting details, so that when he comes before the microphone, he is able to give the listeners a good verbal introduction to the piece to be heard and if it is necessary for him to "plug the air" for a time, with the many interesting facts with which he has stocked himself to give out, he never becomes boring. When broadcasting an opera, Cross has been known to spend 15 or 20 hours in the Music Department of the New York Public Library, piecing out the score, comparing the lyrics, studying the life of the composer and comparing the opera to be broadcast with the same man's other works. When his studies have been completed he faces the microphone with the full knowledge that there is little about the opera that he doesn't know. His remarks reflect that knowledge and in turn the applause mail which follows the broadcast shows that the radio audience appreciate the industry of Cross on their behalf as much as the opera itself. Cross is a hard worker, and feels that he is being rewarded by being placed by a great majority of the listening public at the top of the ladder.

Station Advertises Program Heavily

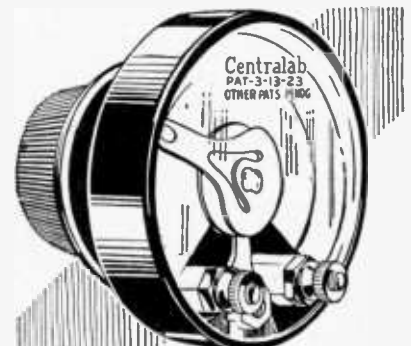
As one of the first cases in broadcasting history, advertising of a program for the entire evening in the newspapers at the regular advertising space rates has been initiated. The new Grebe station WABC, was the inaugurator. Recently the newspaper syndicates announced that they

would, hereafter, absolutely refuse to disseminate any programs, with the specific names of the artists or operatives of these artists in special hours. Only the word "music," "lecture," "dance program," etc., would be allowed to go through. This, of course, tends to give no specific information to the fans and in the opinion of many, takes up valuable space only. Many say it resembles a time table with the time only, the exact stopping places being omitted. This, of course, is of value to the person who knows the route by heart, and has no regard for such. The same applies to the radio program, many folks knowing what appears every week. However these people are in the minority.

Many stations are already following WABC's system, and according to the multitude of letters, telegrams, etc., received, it is a huge success, and more than pays for the ad.

DIFFERENCE OF DAY AND NIGHT

The signal ratio between day time and night is sometimes as high as a thousand to one. That is, if the same distance is to be covered during the day time it is necessary to increase the amplification one thousandfold.

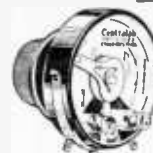


STANDARD Centralab RadiomM

INSURES clearer, louder reception with most any radio circuit. It holds perfectly the sensitive regenerative position which immediately precedes the oscillation point.

Dependable, noiseless in adjustment, and full resistance variation with a single turn of the knob. Resistance values remain exact for life of set. **\$2.00** for any resistance.

SWITCH TYPE Centralab RadiomM



With Switch
\$2.30

Has an "A" battery switch, also controlled by the knob, giving a double purpose control. Is variable from zero to 500,000 ohms. Also furnished in Modulator, for tone volume control in all audio circuits.

Specified by Arthur H. Lynch
for the Two-Tube De Luxe Receiver
Described in This Issue

CeCo Type H

Special Detector

Fil. V. 5.0
Fil. Amp. 0.25
Plate Volts. 67.90

Improves reception especially on DX or distant stations.

Price **\$2.50**

CeCo BX Type

199 (UX base) gives Clearer Production with increased Volume. Used in the De Luxe Receiver as a Radio Frequency Amplifier, and chosen by Mr. Lynch after Careful Tests.

RATING
Filament, volts ... 3.0
Filament, amperes ... 0.25
Plate, volts ... 20-90

Price **\$2.00**

The Tube of Longer Life

CEC

A Type for Every Radio Need

C. E. Mfg. Co., Inc.
Providence, R. I.
Largest Plant in the World Making Tubes Exclusively

CENTRAL RADIO LABORATORIES

13 Keeffe Ave., Milwaukee, Wis.

Makers of a full line of variable resistances for 69 makers of leading standard sets.



NOW



LYNCH METALLIZED EQUALIZORS

to
Simplify Receivers
—for use in filament circuits in place of rheostats.

Made in all sizes for use with all types of tubes.

LYNCH EQUALIZORS

(For Filament control)

- Type 0 for use with one MU-20 or one MU-6 type tube at 6 volts.
- Type 1 for use with four UX 201-A tubes or equivalent at 6 volts. 1 Ampere.
- Type 2 for use with one UX 112, UX 171 or two UX-201A tubes at 6 volts. 1/2 Ampere.
- Type 4 for use with one UX 201-A or UX 200-A type tube at 6 volts. 1/4 Ampere.
- Type 2/3 for use with six UX-201-A tubes or equivalent at 6 volts. 1.50 Ampere.
- Type 4/3 for use with three UX 201-A tubes or equivalent at 6 volts. 3/4 Ampere.
- Type 25 for use with two UX-199 or UX-120 type tube at 6 volts. .12 Ampere.
- Type 35 for use with one UX-199 tube with series rheostat.
- Type 50 for use with one UX-199 tube or equivalent at 6 volts. .06 Ampere.
- Type 4/5 for use with five UX-201-A tubes or equivalent at 6 volts. 1.25 Ampere.

PRICE \$1.00

(Including Better-Built Mounting)

Dealers—Write us!
ARTHUR H. LYNCH, Inc.
Fisk Bldg., Broadway and 57th Street
New York, N. Y.



Chart Shows Selectivity

Frequency Plotted Against Amplification Determines the Ability of a Receiver to Discriminate

By *Alfred N. Goldsmith*

Chief Broadcast Engineer, Radio Corporation of America

The recent attitude of the Government (resulting from an admission that the present radio law is inadequate for the control of broadcasting wave frequency assignments) has led to the appropriation by many broadcasters of wave frequencies hitherto refused to them, and, in many cases, unsuitable for use by them. In a number of the larger cities, so many stations have crowded into the lower frequency (longer wave length) portions of the assigned broadcasting band that only a highly selective receiver will successfully discriminate between such stations in the home of the listener.

To a large extent, the same interference conditions exist in a considerable portion of the rural area of the United States; and there can be no doubt that the selectivity requirements of radio receivers are considerably more rigorous than has heretofore been the case.

Fig. 1 shows in simple graphical form approximately what can be achieved in the way of selectivity in modern receiving sets of various types. It is assumed that the receiver in each case is tuned to a frequency of 660 kilocycles (wave-length of 455 meters). The signal field strength required to produce a standard signal of comfortable intensity in the loudspeaker has been plotted as the ordinate of the curves at this point. As the signal frequency is altered (leaving the receiving set tuning unchanged), the corresponding field strengths required to produce the same standard signal in the loudspeaker are successively plotted.

As will be seen, the single circuit re-

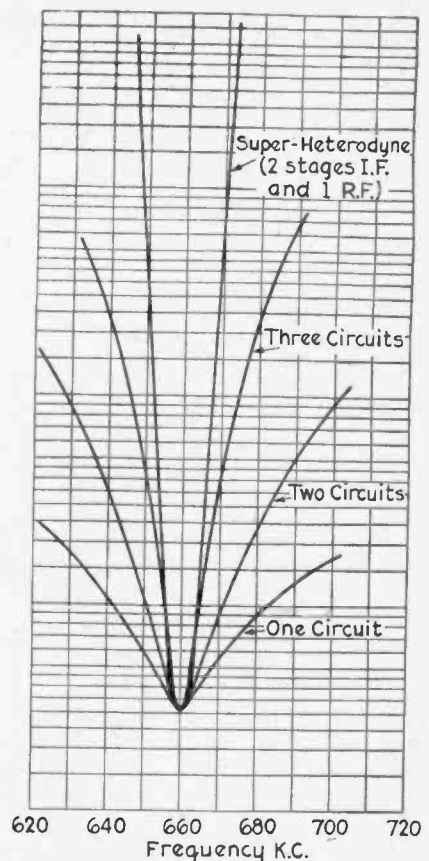
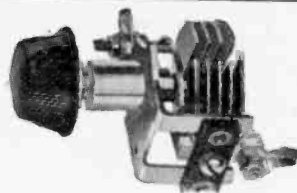


FIG. 1
The chart shows selectivity measured over about 80 kc. (80,000 cycles). The frequency is shown at the bottom line, while the perpendicular represents relative values of amplification. The higher the point, the greater the amplification.

ceiver requires but little increase in the field strength of an undesired signal, as much as 50 kc. removed from the original frequency, to cause the loudspeaker to reproduce it with standard signal strength. The two-circuit receiver, on the other hand, requires a considerably greater field strength of an interfering signal 50 kc. off the desired frequency to reproduce an equal disturbance.

When the selectivity curve for the three-circuit receiver is examined, it will be seen that signals as much as 50 kilocycles removed from the desired frequency will be practically excluded unless their intensity is extremely high. This is true in even greater measure for a Super-Heterodyne receiver with one stage of tuned radio frequency and two stages of intermediate frequency tuning. Under present broadcasting conditions, the ideal curve would be a flat-bottom curve with vertical sides, the width of the bottom being 10 kilocycles (and extending from 655 to 665 kilocycles in the case under consideration). In all the preceding curves, receivers having high efficiency radio frequency tuning stages, electrically separated from each other by one-way amplifiers, have been assumed.

It is clear from the preceding that the trend of receiver design, based on present-day selectivity requirements, has set strongly toward multi-tuning-stage amplification (at radio frequencies and intermediate frequencies).



"HAMMARLUND, JR."

The high-ratio shielded midget condenser, especially selected by Mr. Arthur Lynch for use in the

De Luxe LAMP SOCKET RECEIVER

Featured in RADIO WORLD


Made in four sizes for any circuit where a small variable capacity is advantageous.

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For Better Radio
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PRECISION PRODUCTS

ELKAY EQUALIZORS



selected personally by Arthur H. Lynch for the Two-Tube De Luxe Receiver described in this issue and made by The Lambert-Kaufman Radio Co. (Dept. W.), 62 Franklin St., New Haven, Conn. Write for prices and tables of values.

Deaf Write to Damrosch They Enjoy His Concerts

Discounting the thousands of people with natural hearing who claim to enjoy the programs that Walter Damrosch broadcasts during the Balkite Hour, he still thinks that his lecture recitals and the New York Symphony Orchestra programs would still be worth the great effort it takes to plan them.

"In letters to me from radio listeners," Mr. Damrosch points out, "there is an unusual number of notes from people who can't hear well. Let us take one letter at random. It comes from Bald Eagle Lake, White Bear, Minn. It says: 'To those who, like myself, because of deaf-

ness, can no longer enjoy the concert hall, you render a service not possible in any other way. You are giving us the finest type of musical performance possible and one which I thought I had to forego for the rest of my life. To people like myself who thought all hope of enjoying the beautiful and worthwhile things of music gone forever the arrival of the New York Symphony and yourself on the air means the greatest thing that could ever come into our life.

"Giving enjoyment such as this justifies any effort on my part to broadcast music. I am sure."

Engineer Risks Life, Repairs Aerial

Newark, N. J.

Thousands of radio lovers who had their sets tuned to WAAM one stormy evening recently listened to the program of dinner music in ignorance of the fact that William Riedel, assistant engineer of this station, was risking his life to repair an aerial so that the program might go on uninterrupted.

The storm tugged at the aerial until

the aerial fell. Riedel, insulating himself with gloves, volunteered to go up on the roof of the studio and repair the damage, thus running, according to Elmer Lewis, chief engineer, 98 chances out of 100 of being electrocuted.

Riedel, however, survived the experience and the program of dance numbers went over the air without a single listener outside being aware.

WHENCE THE TERM HENRY

The henry comes from the name of Joseph Henry, an American discoverer of induction phenomena. The henry is a unit of induction in the electro-magnetic system of measure. It is equal to one billion absolute units, or centimeters. It is a length which is exactly equal to the distance from the North pole to the equator along the meridian of Paris.



The AIRGAP SOCKET
"It gets that last mile"

The only socket which makes a difference in a circuit noticeable to the ear.

At all dealers or direct postpaid
UX or Standard Type 60s

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Write for full information regarding the cabinet, personally picked by Arthur H. Lynch for his own De Luxe Lamp Socket Receiver.

CHELTENHAM CABINET MAKERS, Inc.
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Of course
Arthur Lynch designed the
De Luxe Lamp Socket
Receiver
for use with



CeCo TUBES

SPECIFIED BY

ARTHUR H. LYNCH

FOR THE TWO TUBE
DE LUXE RECEIVER

Type H—Special Detector.....\$2.50
Type BX—199.....\$2.00

Ready to Mail in Special Mailing Carton
Upon Receipt of Money Order.

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role in
the



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Lamp Socket Receiver

IN almost every circuit sponsored by RADIO WORLD... in over 80 nationally known B-eliminators. CLAROSTAT, the greatest variable resistor, is functioning daily—silently, smoothly and powerfully.

Invaluable to Fans! "THE GATEWAY TO BETTER RADIO" — 32 pages covers everything... reception, transmission, amplification, and battery elimination. Send 25c in stamps or coin to

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American Mechanical Labs., Inc.
285 N. 6th St., Brooklyn, N. Y.

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\$4.50

MODEL - R 4

for 4 volt Batteries

MODEL - R 6

for 6 volt Batteries

Electrify your radio. Let the SET SWITCH operate "A" Trickle Charger and "B" Eliminator automatically with light socket current.

Over 75,000 used within the first four months—adopted standard by every leading set and power supply manufacturer.

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LIGHTNING ARRESTERS

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JAYNXON TONE BRIDGE
 NO TUBES
 NO BATTERIES
 Attached instantly
 if you use a
 Power Tube you
 MUST protect
 your speaker
\$10
 Your greatest Radio
 Need. Order NOW.
 JAYNXON LABORATORIES
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"PHASATROL"
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 A True Balancing
 Device for All Radio
 Frequency Sets
 A Revolutionary Innovation
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FREE
 NEW RADIO CATALOG
 Write Today to
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 MORE THAN a score of new kits—all the latest
 and best—with specified parts to build them—
 at prices that mean big savings for you. And all
 the latest parts and accessories as advertised in
 current radio magazines. The
 largest, most
 up-to-date
 radio stock in
 the world.
 Yours to
 choose from
 in this new
 catalog.
 Write
 for
 your
 copy.



BLUE PRINT and Book, DIAMOND OF THE AIR. Specify whether 4-tube (\$1.00) or 5-tube (50 cents). Guaranty Radio Goods Co., 145 West 45th Street, New York City.

How About Using Term "Condensance"?
 The terminology of radio is getting more precise all the time. It is no longer good form to speak of a resistance when its meaning is the device which has resistance. One must speak of a resistor. A resistor is a device which resists, or which has resistance. Similarly, one must not speak of inductance when the meaning is the physical device which has inductance. Inductor is the proper term to use. An inductor has inductance. Whether it "induces" or "inducts" is not important.
 The term capacity of a condenser is no longer good form, some experts hold. The modern term is capacitance. The term is a bit artificial but it has an ending like the endings of the majority of electrical terms of a corresponding significance. To be consistent, the term condenser should be dropped for capacitor. Or another possibility for getting consistency is to call the tuning device condenser and then speak of condensance.
 We already have the terms conductor and conductance to match the terms resistor and resistance. We also have the term admittance so there must be an admittor. What is it? Likewise we have

the term susceptance and therefore there should be a susceptor.
 The terms reactance and reactor are already established. The term impedance is also well-known, but what about the impedor? Consistency does not always seem to lead to acceptable terms.

Cable Versus Radio Business
 SYRACUSE, N. Y.
 A review of the effect of radio communication on telegraph and cable operation, issued recently by the Western Union Telegraph company, shows the company's revenues have increased yearly since 1919, when radio communication entered a practical commercial stage, with exception of 1921 when every business suffered heavy depression.
 The present volume of business is nearly three times what it was in 1915. The war stimulated use of the telegraph for communications and transfers of money, but the increase is reported due in large part to intensive merchandising of the service.
 The same development has been followed in the case of cables, but not with the same result, the statement says, because radio has absorbed some of the growth. It was pointed out, however, the radio has developed as well as taken business. The business of the radio companies is only 25 per cent. of the Western Union cable business.

NA-AID
 Sockets and Details
 UX POWER TUBES installed in any set without rewiring by Na-Aid Adapters and Connectorals. For full information write Alden Manufacturing Co., Dept. S-28, Springfield, Mass.

HARD RUBBER
 SHEET - ROD - TUBING
 Special Hard Rubber Parts Made to Order
RADION and HARD RUBBER PANELS, ANY SIZE
 Send for Price List
 WHOLESALE RETAIL
 NEW YORK HARD RUBBER TURNING CO.
 212 Centre Street New York

SHORE
 TRANSFORMERS AND
 CHOKES FOR EVERY
 RADIO POWER NEED
 Special Transformers Made to Order
 Our Prices Are Right—
 Write and Be Convinced
SHORE ELECTRIC CO., Inc.
 124 Cypress Avenue, New York City

MINGINS HEADS GAROD
 Leicester M. Mingins president of the Twentieth Century Radio Corporation, Brooklyn, has been elected president of the Garod Corporation, Belleville, N. J., manufacturers of the Garod electric powers receivers.

Samson Dual Impedances
 represent latest development for fine tone quality. Connect like transformer.
SAMSON ELECTRIC CO.
 CANTON, MASS.

SEE JAY POWER UNIT
 Here to Stay
 A combination alkaline element battery and trickle charger all in one. Price, shipped dry with solution, \$16.00. Tube extra, \$1.00. 100-volt with chemical charger, \$12.00. 140-volt, \$17.00.
 Write for our illustrated 32-page booklet and Send No Money. Pay Expressman.
SEE JAY BATTERY COMPANY
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FILL OUT AND MAIL NOW
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Please send me RADIO WORLD for.....months, for which please find enclosed.....
 SUBSCRIPTION RATES:
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 Six Months..... 3.00
 One Year, 52 Issues..... 6.00
 Add \$1.00 a Year for Foreign Postage; 50c for Canadian Postage.
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RADIO WORLD'S QUICK - ACTION CLASSIFIED ADS.
 10 CENTS A WORD
 10 WORDS MINIMUM.
 CASH WITH ORDER.

SEND FOR PAMPHLETS OF THE GOODMAN TUNER—In use for years and still good. Tested and approved by many technical laboratories. L. W. Goodman, Drexel Hill, Penna.
THE BROWNING-DRAKE CIRCUIT—Text and illustrations covering this famous circuit starting with our issue of Aug. 14. The 3 numbers sent on receipt of 45c. RADIO WORLD, 145 W. 45th St., N. Y. C.

R. C. A. Broadcasts New Weekly Feature

The Radio Corporation of America launched a series of broadcasts and presented the "Radiotrons" in their first air performance from WJZ and the stations of the National Broadcasting Company's Blue Network, WBZ, KDKA and KYW, January 6. This will be a regular weekly broadcast from the stations.

The "Radiotrons" will be composed of a group of popular air entertainers and include in their ranks the famous Shannon Quartette. The members of this organization are Wilfred Glenn, Elliott Shaw, Lewis James, Franklin Baur, Frank Black, pianist; Lew Rederman, violinist; Sammy Herman, xylophonist, and Irving Kaufman, comedian.

In the opening broadcast, the "Radiotrons" presented an hour's program composed of vocal solos, quartettes and duets, instrumental solos and ensemble numbers, in which the entire group of entertainers were heard.

FREMONT CLUB ELECTS

The Fremont Radio club, Fremont, O., recently held its second meeting in the city hall, and elected officers as follows: R. A. Heitbrink, president; C. B. Forest, secretary, and Clarence Cox, treasurer. The charter members who have been

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KARAS ELECTRIC CO.

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RABCO

R.F. CHOKE

Cat No. R-240

50c. each—

Three for \$1.00

Keeps R.F. currents out of the audio amplifier. Essential to good tone quality. Use three in every set. Instructions enclosed. Order now at this money-saving price. A dollar bill will do. Satisfaction guaranteed or your money refunded.

RADIO BUILDERS CO.

124 Cypress Avenue

Bronx, N. Y.

working to obtain new members reported encouraging results. One man reported having obtained 30 new members. Further plans for locating radio interference in Fremont were discussed.

U. S. STEEL BUYS FINDERS

The Radio Corporation of America has received what is said to be the largest single order for radio compass installations and direction finders from steamship interests affiliated with the United States Steel Corporation, involving more than \$250,000. Much of the equipment is for

vessels of the Interlake Steamship Company, Pittsburgh Steamship Company and M. A. Hanna Company.

LOOK UP DOWN

SUPERHETERODYNE SPECIALIST
SETS—TUBES—BATTERIES—SERVICE
FREE Handmade Leatherette Log and Data Book.
Send Ten Cents to Cover Mailing Cost.
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2630 Broadway, N. Y. C., Phone: Trafalgar 5979

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*in Super Sets means
Volume Selectivity
and Satisfaction.*



Victoreen Rheostat
Zero temperature coefficient. Increased number of turns of wire. Third terminal to simplify wiring. Five resistances—2, 6, 10, 20, 30 ohms—\$1.20 each. Victoreen Potentiometers—200, 400, ohms—\$1.50 each.



VICTOREEN R-F TRANSFORMERS
Tuned to a precision within one-third of one per cent—made by a pioneer radio manufacturer. Two types—No. 170 for use with regular tubes; No. 171 for dry cell tubes. Price \$7.00.



AUDIO CONTROL UNIT
Permits minimum number of panel controls and consists of 2 rheostats of proper ohmage mounted on the bakelite base. Controls the second detector and audio tubes. Use Type 3-B for 201 A tubes. Use Type 3-B-1 for power tube. Price—\$4.50 each.



MASTER CONTROL UNIT
This one dial unit has been so constructed that by means of compensator controlling the antenna condenser, adjustment is permitted up to a 20 degree variance in capacity, with a 360 degree vernier motion. Used in circuits employing two or more condensers of the same capacity. Easy to mount—no change in wiring necessary. Two condenser type—Price \$16.50. Each addition condenser—Price \$4.50.

The George W. Walker Co.
6528 Carnegie Avenue
Merchandise of Victoreen Radio Products
Cleveland, Ohio

B S T 5 \$40.00



IMMEDIATE DELIVERY

New model cabinet Du Pont Duco finish; base 21" long by 8" wide, height 9 1/4", top 21" by 6". Five-ply walnut veneer

DIRECT FROM FACTORY TO YOU SAVES HALF AND IS GUARANTEED

I take great pleasure in telling you that my B.S.T. 5-tube set is working splendid in every way, and the cabinet itself is beautiful, and admired by all my friends.

THOMAS HARTLE,
155 Perry St., Paterson, N. J.

This highly sensitive, powerful and selective BST-5 radio receiver has all up-to-the-minute improvements. Heavy aluminum automobile type chassis, shielded against stray currents and distortion. Flexible grip, Universal type sockets, eliminating microphonic noises. Has provision for battery eliminator and any power tube. Fahnestock clips on sub-panel for adjusting C battery, has voltages for power tube. Efficient on either long or short aerial, including indoor aerial. This BST-5 sets a new standard for true tone values and selectivity. This BST-5 gives greater volume than many six-tube sets and consumes less current.

Shipment made same day we receive your cheque or P. O. Money Order for \$40.

RADIO WORLD Guarantees the Responsibility of This Advertiser

GUARANTY RADIO GOODS CO.

145 West 45th St., New York

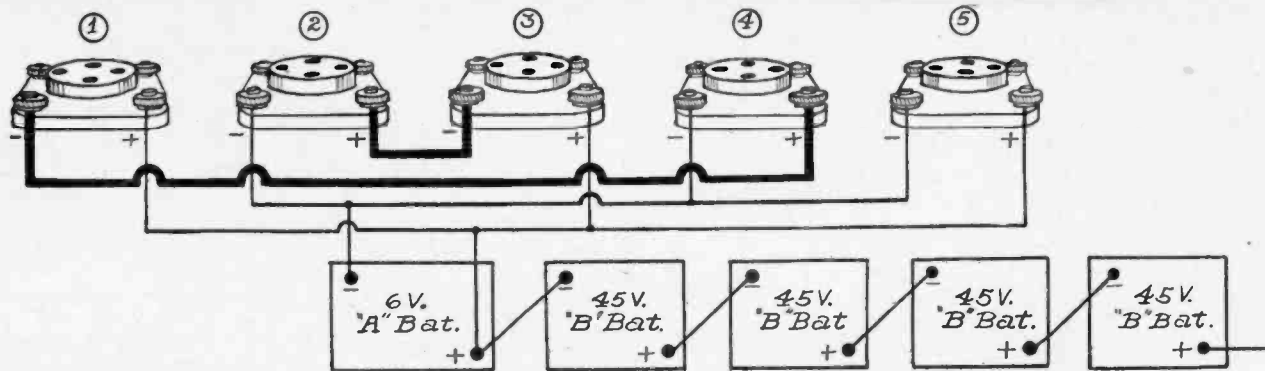


FIG. 497

The filament circuit layout, requested by Ivan Clocker

Radio University

(Continued from page 15)

it. It may be really defined as positive electricity.

* * *

I WISH to build a set which employs a stage of tuned radio frequency amplification, a detector and three stages of resistance coupled audio frequency amplification. The —99 tubes are used in the RF, detector and first two AF stages, while a —71 is used in the last stage. I would like to use a 6 volt battery light the filaments of all the tubes. Please

show a simple arrangement.—Ivan Clocker, San Francisco, Cal.

The circuit diagram of such a layout is shown in Fig. 497. The filaments of the detector and first audio tube and the radio amplifier and the second audio tube are each connected in series. The filament of the last tube is directly connected to the A battery. That is, the filaments of the first four tubes are divided into three volt sections, of two apiece.

* * *

I HAVE built the 4-tube receiver shown in the Radio University columns of the Dec. 11 issue of Radio World, Fig. 481, and have not had very satisfactory results. If I connect the set up as a straight 4-tube set, the results are good, but as soon as the reflex action is used, the volume decreases and it is also difficult to control. It seems to me as if the first tube does nothing in aiding reception here. How can this trouble be cured?—James Charleston, Mexico City, N. M.

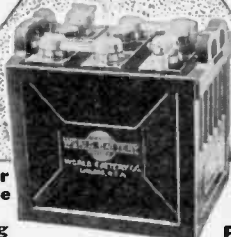
Try taking the fixed condenser across the secondary winding of the audio transformer in this RF stage, out. Test the windings of this transformer for an open or short. Try placing a radio frequency choke coil, such as the Rabco, in

RADIO — BARGAINS

FREE RADIO CATALOG & GUIDE of 1927 ideas 164 pages of special hook-ups with illustrations. Shows savings up to 50% on standard radio parts, sets, kits. Be sure to get this thrifty book before you buy. Also please send address of another radio fan. Write letter or postal NOW. BARAWIK CO., 560 Monroe St., CHICAGO, U. S. A.

DESIGNED to OUTLAST

World Storage "A" Battery



Two-Year Guarantee Bond in Writing

NEW LOW PRICES

Famous the world over for reliable, enduring performance. Solid Rubber Case lasting protection against acid or leakage.

Approved and Listed as Standard by Leading Authorities

Including Radio News Laboratories, Popular Sci. Inst. Standards, Pop. Radio Laboratories, Radio Broadcast Laboratories, Radio in the Home and Lefax, Inc.

Send No Money

Just state number wanted and we will ship same day order is received, by express C.O.D. Pay expressman after examining batteries. 5% discount for cash with order. Remember, you save 50% on World Batteries—so send your order today.

WORLD BATTERY COMPANY Dept. 17 1219 S. Wabash Ave., Chicago, Ill.

- Solid Rubber Case Radio Batteries
- 6-Volt, 100-Amperes \$10.00
- 6-Volt, 120-Amperes \$12.00
- 6-Volt, 140-Amperes \$13.00
- Solid Rubber Case Auto Batteries
- 6-Volt, 11-Plate \$10.00
- 6-Volt, 13-Plate \$12.00
- 12-Volt, 7-Plate \$14.50

Set your radio dial at 288.3 meters for the World Storage Battery Station WSBC. Variety—new talent—always interesting. Jerry Sullivan, Dir. and Announcer, "Chi-CAW-go"

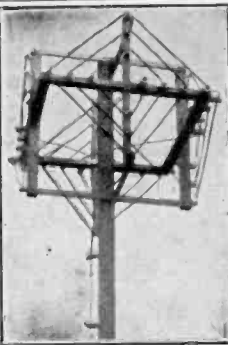
KDKA WSBC WEAF WJW

Radio Mailing Lists

- 27428—Radio Dealers, Retail, Per M..... \$7.50
 - 2680—Radio Mfrs., Per List..... 20.00
 - 2687—Radio Jobbers, Per List..... 22.50
 - 1847—Radio Jobbers rated \$5,000 and up, Per List..... 15.00
 - 1060—Radio Mfrs. Complete Sets, Per List..... 10.00
- and any other Radio List you want. Ask for detailed price lists all guaranteed 98% correct.

Trade Circular Co., Inc.

166 W. Adams Street Chicago



DX ONE POLE ANTENNA

Patent Pending

More Distance -- More Volume -- Selectivity

Has twice the antennae input of any other type. Saves battery current, is 100% self-directional, makes your receiver much more selective. Can be erected anywhere. Simply installed, rugged construction. Takes practically no room.

DX Antenna Kit Complete \$13.50

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—To offer a year's subscription FREE for any one of the following publications with one year's subscription for RADIO WORLD

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Enclosed find \$6.00 for which send me RADIO WORLD for twelve months (52 numbers, beginning.....) and also without additional cost, Popular Radio, or Radio News, or Science and Invention, or Radio Dealer, or Radio (San Francisco), or Radio Age, or Boys' Life (or \$10.00 for two yearly subscriptions). (No other premium with this offer.)

Indicate if renewal.
Offer Good Until
February 14, 1927

Name
Street Address
City and State

series with the G post on this audio transformer. Try changing the positions of the tubes about, also reducing the B battery voltage. Place a .00025 mfd. fixed condenser from the plate return lead (through the transformer) to the A minus post, in the detector circuit. Also place a .0005 mfd. fixed condenser from the end of L3 to the A minus lead post. Be sure you have made the proper grid returns, according to the tubes used. That is, if you are using —01A tubes, return the grid of the first tube to the A minus, while of the detector to the A plus.

WHAT ARE damped waves?—Luman Melman, Jersey City, N. J.
They are waves, which rapidly diminish in height, until they cease to exist.

CAN PRESSURE be compared to voltage?—John Murren, Lexington, Ky.
Yes. It may also be compared with potential, steam or air pressure.

WGN Plans to Improve Programs This Year

Improvement of programs, development of new entertainment features, and increased power facilities are three of the items of the 1927 program at WGN, Chicago.

Many new features that first appeared during 1926 will be repeated in 1927, and the entire studio staff is bending its efforts to arrange for a score or more of interesting broadcasts during the new year.

Advertising Executive Joins N. B. A. Personnel

Announcement was made by officials of the National Broadcasting Company of the appointment of Frank A. Arnold as director of development. For the last nine years he was an officer, director and

stockholder in the Frank Seaman Advertising Agency, one of the largest organizations of its kind in New York City. Mr. Arnold was also one of the lecturers at the Harvard School of Business Administration for six successive years. He traveled extensively in connection with business investigation and promotion work, making trade and business surveys, in Europe, Cuba, Porto Rico and Mexico and also visiting nearly every state and territory of the United States.

Merlin H. Aylesworth, president of the N. B. C., said:

"The director of development will be concerned not only with existing fields of activity and improved methods of operation as reflected by public opinion, but also in discovering new opportunities for the practical application of radio, based on personal reactions from representative groups."

4, 5 OR 6 TUBE KIT

BERNARD KIT \$40.00
4-TUBE DIAMOND KIT 30.00
All Specified Parts for the DE-LUXE LAMP SOCKET RECEIVER STREAMLINE CONDENSERS, .0005, \$1.75 Complete Line of CE-DOTUBES.

ANY POPULAR KIT YOU WANT
Write for Particulars
Bruno Rezenatrol Hammerlund-Roberts HI-Q New
Karas Equamatic S-M Shielded Six.
B. C. L. RADIO SERVICE, INC.
221 Fulton St. (R.W.) N. Y. C.

New, Improved Diamond of the Air
Mfd by the Clapp-Eastham Co. Licensed under Armstrong Patent No. 1,113,149 for Bruno Radio Corp. Complete Kit of Parts, with Blueprint, ready to wire, as Specified by HERMAN BERNARD, \$37.50.
THE WONDERFUL CANNONBALL CONE, \$7.95

AEROVOX Fixed Condensers and Resistances
"Built Better"
AEROVOX Products are used by more than 200 manufacturers of Radio Receivers and "B" Eliminators.
AEROVOX WIRELESS CORP.
60-72 Washington St., Brooklyn, N.Y.

Standard

Specified by leading engineers in all popular circuits as the one perfect form of tube filament control. Insist on Amperite—the only automatic variable filament resistance. Beware of substitutes and imitations. There is only one Amperite and nothing else will do. Eliminates hand rheostats. Simplifies wiring. Types for all tubes. Price \$1.10 mounted (in U. S. A.). At all dealers. Write for Free Hook-Ups and construction data to Dept. R. W. 2.
Radiall Company
50 FRANKLIN ST., NEW YORK
AMPERITE
REG. U. S. PAT. OFF.
The "SELF-ADJUSTING" Rheostat

4 - TUBE DIAMOND BLUEPRINT
The Entire Wiring Shown in Simplified Picture Diagram Form **\$1.00**
Copy of Nov. 28 issue, containing Herman Bernard's article on how to build the set, 15 cents extra.
Send money order, check or stamps. None sent C. O. D.
All orders filled promptly.
RADIO WORLD
145 West 45th St., New York City

HOW TO BUILD THE BERNARD, the beautiful 6-tube thumb-tuning set, fully described and illustrated in the Oct. 16 issue. Send 15c for a copy. Namepieces for affixing to front panel free to all on special request. Radio World, 146 W. 45th St., N. Y. City.

The BRETWOOD Variable Grid Leak Is a Remedy for Distortion



Precision Range, 1/4 to 10 Megohms

Much of the distortion present in radio receivers is due to an overloaded detector tube. Too much power for that lone tube to handle with fidelity. The Bretwood Variable Grid Leak permits control of the grid circuit so that the maximum efficiency **without distortion** is achieved. Put a Bretwood Variable Grid Leak in your set and marvel at the difference!

"THE RESULTS ARE ASTONISHING"

NORTH AMERICAN BRETWOOD CO.
Dear Sirs:

Dec. 26.

I feel as it is my duty to write and tell you that I bought a Bretwood grid leak and got fine results. I placed it in the same position as a regular fixed grid leak.

THE RESULTS WERE ASTONISHING. I was quite a while adjusting it to its proper position. It means true tone, clarity, volume and many more DX receptions.

I have tried many other makes of all kinds and sizes, but **THIS ONE IS THE BEST YET.**

Most people will write credentials praising results from instruments they have tried on sets that anything at all would improve, but my set, I thought, could not be improved on. I was dumfounded, for now I know I own a perfect set.

You may use this letter for advertising, also name and address for references of any kind.

From a well-satisfied user of a Bretwood Grid Leak.

(Signed) **GEORGE SORTWELL,**
18 Eng. House, 1915 W. Wash. St., Indianapolis, Ind.

NORTH AMERICAN BRETWOOD CO.,
143 West 45th Street, N. Y. City

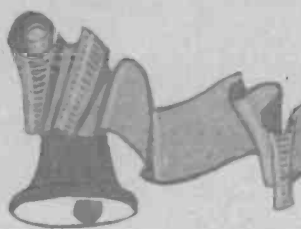
Enclosed find \$1.50, for which send me one Bretwood Variable Grid Leak (or \$2.00 for leak with grid condenser attached) on five-day money-back guarantee.

NAME

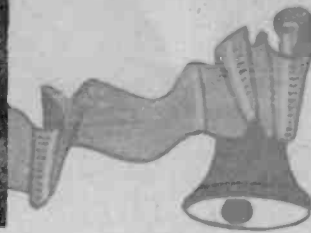
STREET ADDRESS

CITY and STATE.....

(Inquiries Invited from the Trade)



New and Improved **FRESHMAN MASTERPIECE**



\$119.50

Genuine R. C. A. Radiotrons are recommended for use with Freshman Masterpiece Receivers.

THIS wonderful radio, in its handsome genuine mahogany cabinet, opens the door to the world's finest entertainment—operas—dance music—lectures—sports of all kinds; just take your pick. A large cone speaker of great volume and superb tone is built right in the cabinet.

OPERATES BY ELECTRICITY

By installing the Freshman "A B C" Power Supply this new set works right from your light socket
Write for our new 48-page book illustrating and describing all Freshman Masterpiece Products

Chas. Freshman Co., Inc.

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2626 W. Washington Blvd.

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World's Greatest Radio