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261

RADIO WORLD

REG. U.S. PAT. OFF.

America's First and Only National Radio Weekly

A VERSATILE METER
Range, 0 to 1 to 0 to 20 m. a.
0 to 1 to 0 to 500 Volts

HYPNOTISM PRACTICED OVER AIRWAY!



(Wide World)

WILLIAM HALL and **Geo. Marshall** of Springfield, Mass., (left to right), who received hypnotic messages, sent out by Professor **Gerald Fitzgibbons** from **WBZ**, having sterilized needles inserted in their arms, by **Doctors C. A. Bonner**, superintendent of the **Boston Psychopathic Hospital**, and **A. W. Stearns** (left to right) in an attempt to see how strongly the subjects were affected. No utterances of pain were heard when the needle insertions were made, giving evidence that the subjects were in a hypnotic state, and that the tests were successful.

(See page 18)

<p>SEARCHING ANALYSIS OF GRID BIAS</p>	<p><i>Expert Advice On Connections Of All Coils</i></p>	<p><i>How Current Flows In Any Vacuum Tube</i></p>	<p>CURES FOR TROUBLES IN UNIVERSAL</p>
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 Make Woolen Doll Toys from Old Socks, by Herbert E. Hayden.
 The Preparation of Butterflies for Trays, by Dr. E. Bade.

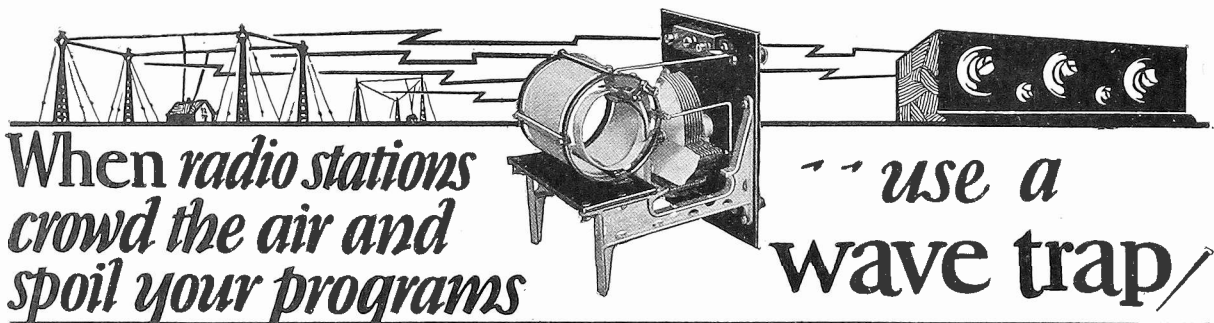
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A THOUGHT FOR THE WEEK

If anybody knows anything that affords more for the money than radio will he kindly speak up?

Vol. XI. No. 1 Whole No. 261 March 26, 1927

RADIO WORLD

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

Broadcasting Hypnotism

WHILE experiments in the realm of the unknown are often treated with doubt bordering on contempt, it is nevertheless very interesting to watch the groping attempts to ferret out the secrets of the mind's power and to penetrate the mystery of life hereafter.

An earnest effort to determine whether hypnotism by radio is practical was made under the auspices of WBZ, the Westinghouse Company's station in Springfield, Mass. Professor Fitzgibbons stood at the microphone in Springfield while two subjects sat in the studio of WBZA, the Westinghouse sister station in Boston. Thus a hundred miles separated the mesmerizer and the human tools with which he worked.

Serious attention was given to the experiment and leading professors, specializing in the realm of the mental, were present in Boston as witnesses. While their report is not conclusive, they point out that they did not have a satisfactory opportunity to determine the genuineness of the demonstration. Nevertheless, two of the subjects reported that they were actually hypnotized, while the third one, who was a mere volunteer, and whose presence was unknown even to the professor, reported that the mesmerism failed as to him.

The whole country was interested in the experiment, most particularly the radio fans, eager to know whether the newer art might be combined with the older.

The power of mind over matter is something which is only beginning to reach some stage of real development. Its application in the past has been made largely through the agency of religion, but the years to come will no doubt develop hidden resources of the mind under the operation of the will—not only as to the effects of one's mind upon himself, but upon others.

FEATURES IN THIS ISSUE

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Ye Gods, How I'm Frightened Before the Microphone. By Theophile Spencer (illustrated)... p. 19

The Better Policy on Patents

THE Radio Corporation of America has entered into an agreement with the Zenith Radio Company whereby the Zenith Company is licensed to manufacture receivers embodying some of the R. C. A. patents. This is surely a step in the right direction and no doubt other companies will be accorded similar licenses.

The manufacture of radio receivers is a very difficult business at best, and made doubly so by the patent situation. The possession of valuable patents by the R. C. A. and allied companies, such as the Westinghouse Electric Mfg. Co. and the Western Electric Company, has led all too often to critical cries of monopoly by competitors who seem to be unaware that a patent is nothing if not a monopoly. In exchange for the public disclosure of the details of his device the patentee is granted by the Government an exclusive right, i.e., a monopoly or patent for a term of years.

As the R. C. A. cannot market all the sets that are to be sold, it is reasonable that the independents should prefer to obtain licenses and pay the rightful owners of patents, rather than to go into business on the assumption that a substantial structure can be erected on pillars of infringement.

Heretofore the R. C. A. has been holding these patents with too tight a fist and if it would release its grip somewhat in one hand, even while extending the palm of the other, the industry would be rendered more stable.

Church Attendance and Broadcasts

WHEN churches began broadcasting their services a great cry arose from several sources that the church would suffer; that present churchgoers would prefer to sit in the comfort of their homes and listen to the services as they came in over the radio.

But these have proved groundless fears. Attendance at church has not fallen off; if anything, it has grown in churches that have been broadcasting.

We know now that while radio may not have increased the number of churchgoers, it certainly has been the cause of a new, tremendous interest in religion. Every week finds more people listening in on church services than the previous week.

It has awakened millions of people from a lethargic consideration of religion and of church music to a state where they eagerly tune in on church programs. People who previously were dormant and ignorant concerning the tenets of a religious life are now discussing with great interest what religious belief has to offer.

Something Special

RADIO is fast developing the special purpose tube. The latest one is a short wave transmitter tube, particularly for amateurs, and following closely after the introduction of a high mu tube by the two largest manufacturers.

It would seem that the cup of special purpose tubes has been filled to overflowing. Nevertheless, consistent with the practice of the past, the tube manufacturers will no doubt have surprises in store for us during months to come.

One of the novelties in the present season was the three-in-one tube, really three tubes in one evacuated glass envelope.

This was something on the style of the Loewe tube invented by Dr. Siegmund Loewe of Berlin and brought here last Summer by the doctor's brother, whose attempt to procure an American market for it failed.

The special purpose tube does much to improve both transmission and reception.

Its use in transmission considerably antedates that in reception. Now we have special radio frequency amplifiers, like those announced by CeCo, special detector tubes of soft and hard types, high mu tubes for direct coupled audio, like resistance and impedance coupling, and power tubes from the 112 and 220, which are in the same class, to the 210, which is an ultra power tube for reception.

The development of the special purpose tube marks one of the great strides in recent radio advance.

FEATURES IN NEXT WEEK'S ISSUE

- "An AC Power Plant," by Lewis Winner. How to build a B eliminator, with one stage of double impedance audio, the filament of this tube being heated by AC.
"Facts Every Radio Experimenter Should Know," by J. E. Anderson. You can derive a great deal more fun building sets and testing them when you are equipped with the information contained in this article.
"A Two-Stage Resistance Coupled Audio Amplifier—and Plenty of Volume," by Herman Bernard.
"A Fine Portable Set," by Jasper Henry.
"Adventures of a Set Manufacturer," being the intimate biographical story of how success was won under adverse conditions, and with a novel scheme.

The Versatile Meter

Reads 0-1 to 0-20 M. A., 0-1 to 0-500 Volts

By *J. E. Anderson*
Consulting Engineer

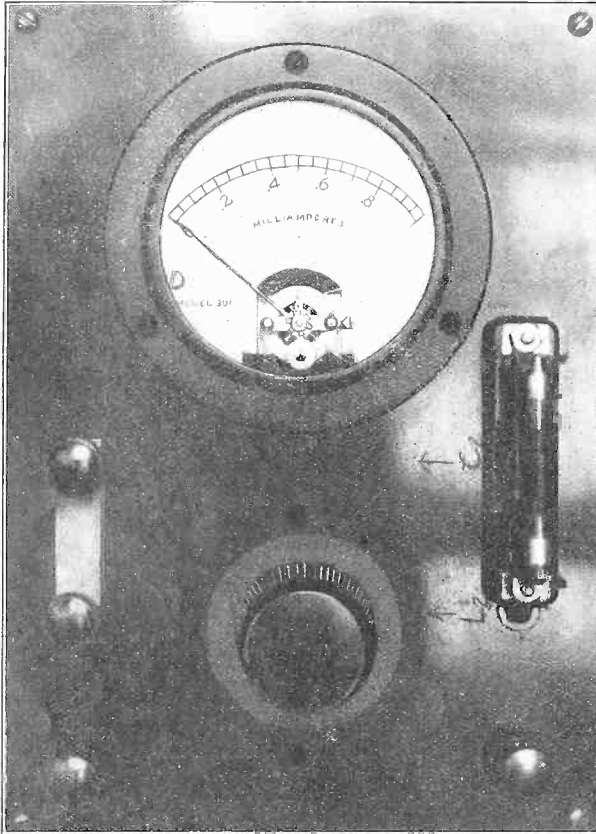


FIG. 1

Front view of the volt-ammeter described by J. E. Anderson. The milliammeter is capable of measuring currents in any desired range from 0-1 to 0-20 milliamperes.

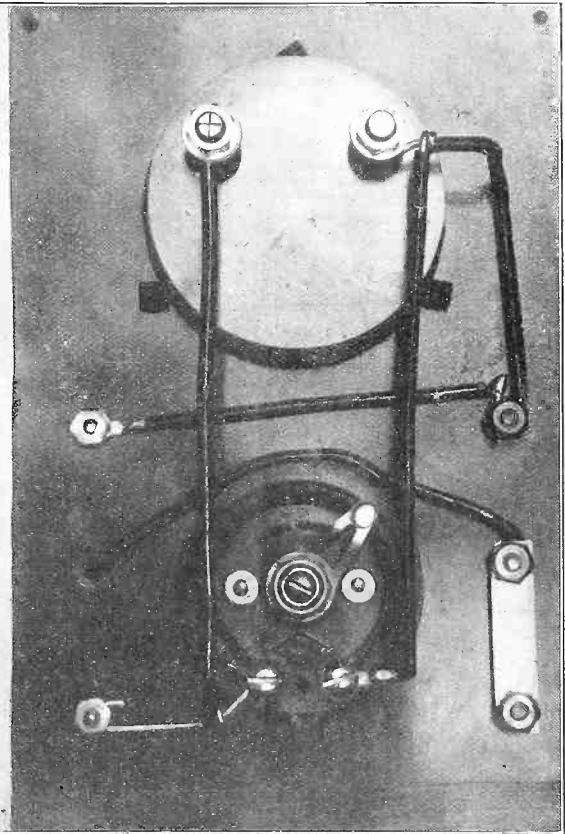


FIG. 2

Under-the-panel view of the volt-ammeter. Note the simple wiring connections. The rheostat appears at lower center, the meter on top.

Measures Output of B Eliminators and Even Relative Value of AC

TWO very useful things to have around a radio set are a high resistance voltmeter and a sensitive milliammeter. The high resistance voltmeter can be used for measuring the voltage output of B battery eliminators, the voltage drops in resistances, and the effective voltages on tubes.

The sensitive milliammeter can be used for measuring the plate current in any and all of the tubes in the receiver, for adjusting the grid bias of amplifier tubes, and even for measuring alternating currents with the aid of a crystal or other rectifier.

To make a milliammeter applicable to a great variety of current measurements it is necessary not only that it be sensitive to small currents but also that it have a wide range. That is, it must be capable of accurately measuring not only currents of less than one milliamperere but it must be capable of measuring currents up to about 50 milliamperes with the same accuracy.

No meter with a single range is capable of doing this, so it will be necessary either to have several single range meters or to have calibrated shunts with a sensitive single range meter. The sensitive meter then becomes the equivalent to several meters of as many ranges as there are available shunts.

Uses 0-to-1 Milliammeter

A suitable meter for this purpose is a milliammeter having a sensitivity of 0-1 milliamperere. This meter will measure quite accurately currents less than one milliamperere and greater than 50 microamperes. It is easy to extend the range of this meter to cover any desired current. For example, it may be made into a 0-2 milliamperere meter by shunting the terminals with a resistance equal to the resistance of the meter itself. Or the range may be extended to 0-5 milliamperes by shunting the terminals with a resistance of one-fourth the value of the resistance of the meter. For example, if the resistance of the meter is 40 ohms, and a 10-ohm resistance is put across the terminals of the meter, the range is extended from 0-1 to 0-5. Similarly, the range may be extended to 0-10 by shunting the terminals with a resistance of one-ninth the resistance of the meter itself. In the case assumed this would require

Series and Parallel Resistances Give the Instrument Its Flexibility

a shunt resistance of $40/9=4.44$ ohms. In the same manner any desired range can be obtained.

When accurate measurements are desired, each of these shunts should be fixed, separate and accurately adjusted. For many purposes it is not required to measure the current to any great degree of accuracy but merely to obtain an approximate indication of the correct value of the current. In that case the main requirement of the shunt is that it shall have approximately the correct resistance. It must not be too large because then the meter will be overloaded on heavy current, and it must not be too small, because then the indication will not be large enough on small current values.

Use of 20-ohm Rheostat

A most convenient arrangement is to connect a rheostat of about 20 ohms across the terminals of the meter. The resistance of this may then be adjusted to suit any required range within the limits

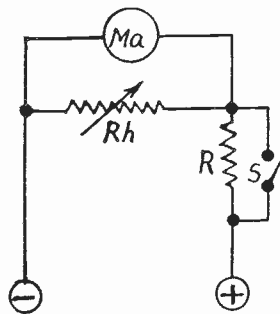


FIG. 3

Schematic diagram of volt-ammeter. Ma is a milliammeter having a range of 0-1 milliampere. Rh is a 20-ohm rheostat for extending the range. R is a high resistance to be used when meter is used as voltmeter. S is a switch or short-circuit strap which is connected across R when the instrument is to be used as ammeter. When instrument is used as a voltmeter the rheostat Rh should be open so that the milliammeter gets all the current.

of the rheostat. This rheostat can be calibrated so that any predetermined range may be obtained by merely setting the rheostat at the proper mark. This will be accurate enough for most purposes.

The same 0-1 milliammeter in conjunction with a calibrated resistance of about 100,000 ohms can be used as a high resistance voltmeter which is capable of giving true readings of voltages in B eliminators and drops across moderately high resistances. If the calibrated resistance is 100,000 ohms, the milliammeter in question will form a 1,000 ohms per volt voltmeter. The high resistance must, of course, be connected in series with the milliammeter. The accuracy of this high resistance voltmeter depends on the accuracy of the calibration and on the temperature variation of the resistance unit.

For most practical purposes of voltage indication an ordinary coupling resistor of correct rated value is accurate enough. A metallized resistor is preferred. The meter may be calibrated against any ordinary voltmeter and dry cell batteries. It is not safe to trust the rated resistance of the resistor. A calibration curve should be obtained covering the entire range of the voltmeter.

Watch the Room Temperature

When using this voltmeter the temperature of the room should be about the same as at the time of the calibration. If the meter is calibrated in a room of normal temperature the indication will not be correct if it is afterward used in a cold room or in an exceedingly hot room. Some variation is allowed, however, without any appreciable errors in the readings.

It is very convenient to mount the meter, the shunt rheostat, the series resistance and terminals on the same panel. How this was done in one case is shown in the accompanying photographs. Fig. 1 shows the 0-1 milliammeter at the top of the panel. Directly below the meter is the rheostat knob and in the lower corners are the two terminals. At the right middle is shown a pair of resistance clips with the 100,000 resistor. On the opposite side of the panel are two extra binding posts connected with a short-circuit strap, which merely short-circuits the high resistance on the opposite side. When the strap is in place between the two binding posts the instrument is a milliammeter; when the strap is removed the instrument is a high resistance voltmeter.

The current range of the meter depends on the setting of the rheostat, as was explained above. The resistance of this

LIST OF PARTS

- One milliammeter, 0-1 range.
- One 20-ohm rheostat, with knob.
- Four binding posts.
- One resistance mounting.
- One 100,000-ohm fixed resistor (for O-100v); one 250,000-ohm (for O-250v); one 500,000-ohm (for O-500).
- One 5x7-inch panel and cabinet.

rheostat in this case is 20 ohms and with this any range between 0-1 to 0-20 can be obtained, depending on the setting. A 10-ohm rheostat would make it possible to extend the range still further, but then the lower ranges could not be adjusted so well.

How Range is Affected

The voltage range of the meter depends on the value of the resistor placed in the clips. A 100,000-ohm resistor makes the range 0-100 volts. A 250,000-ohm resistor makes the range 0-250 volts. A 1,000-ohm resistor would make the range 0-1 volt. The accuracy of the meter is about the same for all ranges.

In Fig. 2 is shown the bottom side of the panel, which clearly shows the electrical connections, also shown in diagrammatic form in Fig. 3.

The mounting panel, which is made of hard rubber, is placed on a mahogany cabinet of suitable size. The panel is

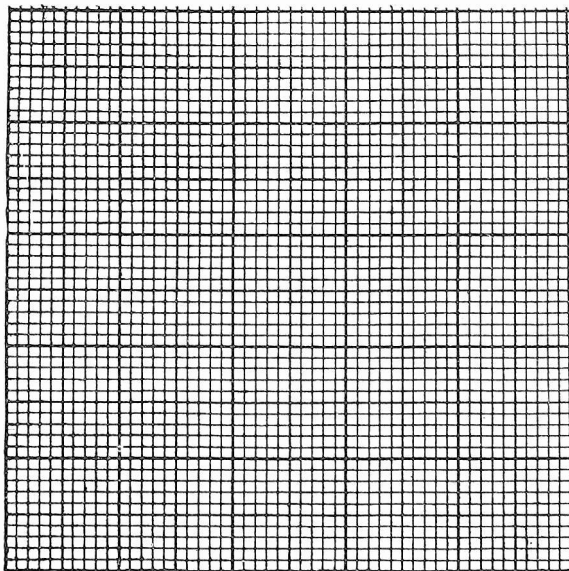


FIG. 4

This cross-section piece may be used in calibrating the resistance of resistors. The current values may be written on the bottom and the resistance values on the perpendicular. The horizontal is called the abscissas and the vertical the ordinates.

5x7". Measurements of relative AC values, e.g., the audio frequencies, may be made with the 0-1 milliammeter by first rectifying the current, using a crystal. The circuit for accomplishing this is shown in Fig. 5.

Resistor Calibration

The calibration of a resistor consists merely of measuring its resistance under certain conditions and recording the results in convenient form. The resistance of any resistor varies with temperatures, and since current heats a resistor, the resistance varies with current. Now a resistor may either be calibrated against temperature or against current, or both. Suppose that we wish to calibrate a resistor against current. We first choose a convenient normal temperature, such as the temperature of the room in which we work. Then the resistor may be calibrated against current by measuring its resistance when different values of current flow through it. Before each reading

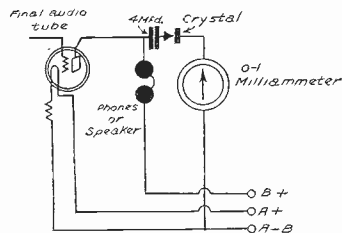


FIG. 5

How to measure relative values of alternating current with a DC milliammeter of 0.1 milliampere full-scale deflector. If the needle kicks below zero reverse the meter connections. Note that you can listen in while measuring.

is taken by the experimenter, time should be allowed for the resistance element to assume the final temperature, that is, to allow the current to heat it up until the temperature will rise no more, so long as the current remains constant. The time required depends on the type of resistor and may vary between a few seconds and a few minutes. When equilibrium has been established the current ceases changing.

For the calibration it is necessary to have a sensitive milliammeter, a voltmeter of suitable range, and a battery, the voltage of which may be varied from

a few volts up to a hundred or more, depending on the value of resistance to be calibrated and the current which it is expected to carry.

Connect the milliammeter in series with the resistance to be calibrated and the battery. Adjust the battery voltage until the current in the meter shows the desired value, say 0.1 milliampere. Measure the voltage of the battery used with the voltmeter and read the current accurately. Divide the voltage by the current and obtain the resistance of the resistor at that current. Repeat at other suitable values of current, such as 0.2, 0.3 milliampere, etc., up to 2 or 3 milliampere, or to the safe limit of the resistor.

Plot the Result

Then make a plot of the resistance against the current and draw a smooth curve through all the points observed. From this curve the resistance of the resistor at any other current value with-

(Concluded on page 26)

How Current Flows Inside and Outside of a Vacuum Tube

By Radcliffe Parker

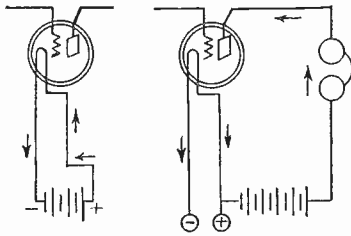


FIG. 1

FIG. 2

The filament current (left) flows from negative to positive inside the battery, but otherwise outside the battery. The same is true of the plate battery current (right). The circuit is completed for the B current through the vacuum in the tube, and this flow is known as the "space current."

THE meaning of electric current has undergone a change during the last twenty-five years. It was formerly assumed that something flowed in the conductor and that that something moved from the positive to the negative poles of a battery or generator. Inside the battery or generator the flow was, of course, in the same direction but from the negative to the positive. Now an electric current is known to be a stream of electrons moving in the wire or other conductor. This stream does not move from positive to negative, but in the reverse direction. It would be logical to re-define the poles of a battery or generator so that the electrons would move from positive to negative, but this change would necessitate a complete revision of electrical conventions. Now an electron is negatively charged; it would be necessary to call it positive.

Any extensive change in the conventions would introduce endless confusion for a long time, and rather than to pay such a heavy price to correct a mistake, it is more convenient to distinguish between an electric current and a stream of electrons. We still retain the old definition of an electric current and say that it flows from positive to negative. Then we say that the electrons move in a stream in a direction opposite to that of the current, that is, they move against the current like a school of fish swimming upstream. Yet the electrons constitute all of the current. This way of looking at it does not necessitate changing any of the old conventions about current and accompanying phenomena, and everybody knows what is meant. Thus "current" is purely a fictitious conception but it is very convenient to talk and read about the fiction.

The Filament Battery

When a battery is connected across the filament of a vacuum tube the current flows through the filament in the direction shown by the arrows in Fig. 1, that is from the positive pole to the battery to the negative. Inside the battery the current flows from negative to positive to complete the circuit.

Around the heated or incandescent portion of the conductor in the evacuated space there are many free electrons. These electrons shoot out from the filament to a certain distance and then return again. The hotter the filament, the more electrons shoot out from it and the

farther they go before they return. No doubt as they shoot out and fall back they also drift toward the positive end of the filament under the influence of the filament battery. That is, they do a hop, skip and jump act from the negative to the positive ends.

Now suppose that a plate battery be inserted in the circuit as shown in Fig. 2. The plate of the tube becomes a positive pole, while the filament as a whole is a negative pole. The electrons around the heated filament now come under the influence of the plate. They are attracted to it. Those which venture too far away from the filament get caught by the plate and cannot return. The higher the plate voltage is the more the free electrons attracted to the plate. Billions of them reach the plate every second. This stream of caught electrons constitutes the plate convection current, or simply the plate current. This current flows from the plate to the filament, according to the old convention. The arrows in Fig. 2 show the direction.

How Current Divides

Part of this current goes down the positive leg and part down the negative leg of the filament. However, much more of it goes down the negative leg due to the fact that the voltage between the negative leg and the plate is greater than the voltage between the positive leg and the plate.

It will be observed that, that part of the current which flows down the negative leg is added to the filament current and that which flows down the positive leg is subtracted from it. Therefore, when the plate battery is turned on the negative end of the filament gets hotter than the positive end. It would seem that the average change in the filament temperature should be nil, but, actually, the effect of the application of the plate battery is to decrease the total effective filament current by an amount that will visually change the filament temperature. There is very little difference between the cases where the negative of B is connected to the positive A and where the negative of B is connected to the negative A.

There is never any alternating current in the plate circuit of a vacuum tube; the current is always in one direction, from the plate to the filament inside the tube and from the filament to the plate outside the tube. There may be an alternating component of the plate current, which merely means that the direct current rises and falls at a certain rate, like the tides in the ocean. When one speaks of the alternating current in the plate circuit of a tube one means the variation in the level of the direct current. This is known as pulsating or fluctuating D.C.

D.C. and A.C. Readings

For example, if the direct current in the plate varies regularly between 11 and 1 milliamperes about the mean value of 6 milliamperes, then the alternating component of the plate current has an amplitude of 5 milliamperes and its effective value when its form is regular is about 3.5 milliamperes.

If the frequency of the variation in the direct plate current is large, say over 20 vibrations per second, then a direct current meter placed in the plate circuit would give an indication of 6 milliamperes, or the mean value of the varying

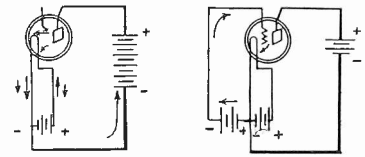


FIG. 3

FIG. 4

Diagram illustrating the flow of current in the filament and plate circuits (left). In the vacuum space the plate current flows from plate to filament. At right is diagram illustrating the flow of grid current. When the grid is positive the current flows from filament to grid in the external circuit and in the vacuum space it flows from the grid to the filament.

plate current. If an alternating current meter is placed in the plate circuit the indication will be about 7 milliamperes. That is the heating effect of the entire fluctuating but direct plate current. That would be the important thing in choosing transformer and loudspeaker conductors, because they would have to carry this current continuously without undue heating of the insulation or of the wire itself.

The important thing from the point of view of drain on the B battery is the 6 milliamperes direct current or mean value of the plate current. The important thing from the point of view of output in the loudspeaker is the 5 milliamperes direct current. That alone is effective in producing a sound.

Three Plate Currents

Thus in the plate circuit of a tube we have to distinguish three different currents: First, the mean value of the fluctuating current, which determines the rate of discharge of the B battery; second, the root mean square of the total plate current, which determines the heating of the load conductors; third, the alternating current component of the plate current, which determines the sound output power. But the plate current in a tube is never alternating as a whole. It always flows in the same direction.

Under certain conditions there may also be a grid current flowing. This is exactly the same as the plate current and is produced in the same manner. When the grid goes positive with respect to the filament, the grid becomes a miniature plate and it attracts electrons. This causes a grid current to flow from the filament to the grid outside the tube and in the reverse direction in the vacuum space. When the grid becomes very much positive it robs the plate of some of its electrons and, consequently, the plate current decreases while the grid current increases.

WATCH RESISTOR VALUES

When purchasing resistors for use in eliminators, be sure you have some inkling as to which portion of the circuit they are to be used in. That is, there are some portions of the circuit in which the resistor is required to drop quite a bit of voltage, also this voltage is to be fed into many tubes. Such a resistor would have to be quite a heavy current carrier. Still there are other portions of the circuit, where a comparatively few volts are dropped, and only one tube is supplied, at small current.

WORK WITH LEFT MAKES IT RIGHT



(Wide World)

THE ENGINEERS of the Westinghouse Electric and Manufacturing Company recently installed a machine in Bloomfield, N. J., to test radio tubes at the rate of 30,000 a day, designing it to be operated by girls seated on both sides. Experience alone developed the fact that one of the girls lagged considerably behind her partner. This upset the schedules and kept the faster girl within the limit set by the slower one. Some of the best minds on intricate calculus, high frequency and personnel administration missed the point (discovered by the elevator operator) that one of the girls had to be left-handed. And so Mary Weiser (at left) got the job and things went right.

30,000 Tubes Are Tested Daily By New Machine

The Westinghouse Lamp Company, at Bloomfield, N. J., has installed an automatic device for testing radio tubes. This machine tests 30,000 tubes a day, whereas the most skilled human operator can not test more than 2,000 tubes in a ten-hour day. Moreover, where the human operator errs occasionally, the machine seldom goes wrong. During the several months that the machine has been in service it has attained a record for accuracy of 99.9 per cent., but the 1 per cent. error is not chargeable to the machine, but to the accidental introduction of defective tubes into the good stock, according to the engineers.

The tester consists of a revolving disk, about 3 feet in diameter, which carries sockets for tubes on one of its faces.

Tests Are Automatic

As the disk revolves the tubes are connected successively to connections which test them for the various characteristics; and if a flaw is found the tube is pushed out by an electro-magnetically acting plunger located in the rear of the machine.

Tubes that are so bad that they can not be repaired are automatically shot into a chute that takes them to the scrap heap; but those that can be reclaimed

are laid on moving belts which convey them to operators for further treatment. Perfect tubes are also placed on a belt and are carried to the wrapping department.

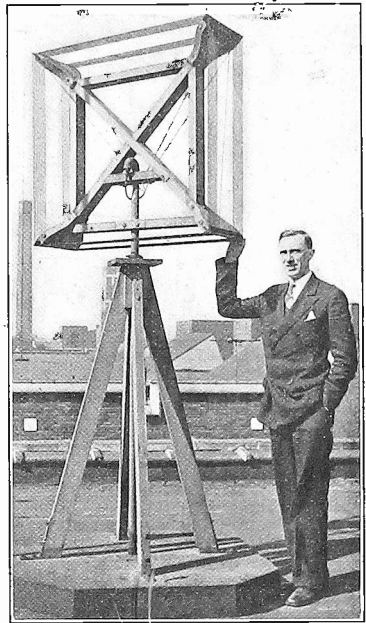
The machine tests the tubes for the following short circuits, broken filaments, emission, gassiness, and high and low plate current.

Sensitive Relays Used

Some of these tests involve the use of extremely small currents, and special sensitive relays are employed to operate the ejecting mechanism. Each test is a positive one, and each testing mechanism operates to eject tubes in case they should be damaged during the process of testing. Hence, when the machine lays a tube on the conveyor belt for the wrapping room, that tube is a good one.

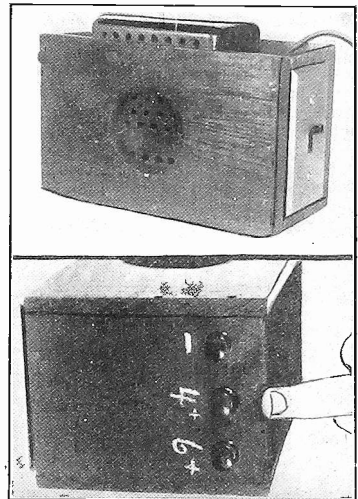
The machine is so arranged that it requires two girls, seated side by side, to feed it. After it was placed in operation, the fact developed that one of the girls should be left-handed and one right-handed. A search soon disclosed a left-handed operator. The machine is being arranged to be fed automatically in order to bring it up to its full productive capacity.

ARMY TESTS LOOP



(Underwood & Underwood)
CHARLES B. ROBINSON, U. S. Army radio engineer of station WVT, demonstrating a directional loop antenna, designed to pick up signals of from 1,000 to 3,000 meters. It is controlled from the operating room by a steering wheel.

AN EXTRA VOLTAGE



(Hayden)

A TRICKLE CHARGER used on 6-volt batteries may also be used to charge 4-volt batteries. A small box should first be built to house the charger. A toggle switch should then be inserted and large holes on both sides of the box, drilled (top photo). Opposite the toggle switch installation three posts should be mounted and marked as in bottom diagram. The four volts are obtained by inserting a 10-ohm rheostat and adjusting until the reading is 4 volts.

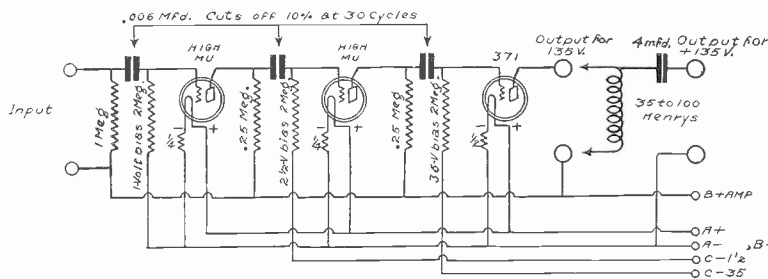
PHASE DEFINED

Phase may be explained as the total angle or time measured from some arbitrary point. It may be measured in weeks or quarters, as for the moon, or in degrees, as is done in electrical work.

The Importance of Bias On Radio Frequency and Audio Tubes

By Roger M. Wise

Chief Engineer, E. T. Cunningham, Inc.



THIS diagram of a three-stage resistance-coupled audio amplifier brings out some hitherto neglected points. The 1 meg. resistor in the plate circuit of the detector tube (input) often absolutely stops motorboating. Note that all plates are connected to B+ Amp. in this instance 180 volts. Under such circumstances the 1 volt drop in the filament resistor gives the first audio tube that much negative bias, a 1½-volt dry cell makes the second AF tube bias 2½ volts, while 36 is the bias on the last tube. The DC resistance of the choke coil is assumed to be 800 ohms and the drop 16 volts hence 164 applied volts on the final plate.

DURING 1926, one of the most important tube developments was the introduction and the widespread use of the power tubes—or tubes having higher ratings than the ordinary general purpose receiving tubes, and designed especially for use in the last stage of the broadcast receivers, and with which you are all familiar.

The four types of power tubes introduced were sufficient to meet the wide variety of conditions existing in the different designs of broadcast receivers.

There is one interesting point that has come to our attention during the past season, in connection with the fact that one of those types requires only a moderate input voltage—the CX-112. Under ordinary conditions that tube is used at 135 volts plate, and with nine volts grid bias, so that if an input signal voltage having a peak value of nine volts is supplied, full output is obtained from the tube. The other three types, the 220, 371 and 310, require considerable higher biases, and correspondingly higher voltage inputs.

Preliminary Bias

This difference in input signal voltage requirements is ordinary negligible, especially in the case of receivers designed for the use of power tubes and in which the recommended C voltage is provided for all of the audio amplifier tubes. However, many users desire to add a power tube to receivers of older design in which all C or grid biasing voltage were omitted. In adding the power tube, the power grid bias was usually provided at the same time, and with a tube of the 112 type this is usually sufficient to secure satisfactory results. If, however, a tube requiring a higher signal input, such as the CX-371, is used, a bias must also be added to the preceding audio amplifier tube as well. If this is not done that tube will overload and introduce objectionable distortion before the power tube is operating at full volume.

The reason for this condition will be realized when it is considered that to provide a peak voltage swing on the grid of from 27 to 40 volts, a swing of from one to two volts is required on the first audio tube. In the absence of a grid bias this would result in the flow of grid current, thus imposing an uneven load on the input transformer to this stage.

Where Distortion Arises

It has been widely believed that the grid bias can be omitted in the case of resistance-

coupled amplification, simply because when overloading does occur, due to the flow of grid current in one of the amplifier stages, the voltage drop caused by the flow of this current through the grid leak results in the building up of a momentary biasing voltage. The flow of grid current always results in distortion, and to avoid this, all stages of the resistance-coupled amplifier should be biased, and especially when a power tube is to be used in the output stage.

In view of the foregoing it is not surprising that when a choice of power tubes is made for use in receivers in which the first audio stage is not properly biased, the 112 type is preferable. In other cases (where the signal voltage required for full output on other types can be supplied by the first audio stage) the CX-371 type may be more satisfactory in that greater maximum power output is obtainable.

Power Tube Filament

In connection with our laboratory tests on representative sets and accessories, tested during 1926, we noted a few exceptions to the otherwise gratifying tendency on the part of manufacturers to use tubes at the correct voltages. I would like to mention a few instances which may be of interest to you.

In one case the filament control arrangement was unusual. The volume control rheostat also controlled the detector, and two audio tubes by means of a double rheostat winding. At the lowest setting, that is, for minimum volume, the radio frequency amplifiers were operated slightly below three volts, the detector and two audio tubes at five. As the volume control was raised the voltage on the radio frequency amplifier tubes was increased to five volts, and at the same time on the other the voltage was increased to the full battery voltage of six volts. Fortunately, the 301-A and similar types of tubes will stand voltage overloads well, but the conditions are not so favorable when a power tube is substituted in the last stage of the receiver.

Another case was that of a B eliminator in which the usual taps for detector, and amplifier were provided, with an additional high voltage tap for the plus B. The high voltage tap had a range of voltages, specified on the binding post, which would indicate that it was suitable for operating the types of power tubes designed to operate on plate voltage from 135 to 180. As a matter of fact, with a line voltage of 115 volts AC, the lowest voltage obtainable from the

tap was approximately 180 volts, and under some conditions it went up as high as 350 volts.

Tube Overloading

As a result, unless the instructions were very complete with that B eliminator, the consumer would probably severely overload the power tube, resulting in short life, and unsatisfactory performance. The instructions furnished with it were rather brief and did not cover that point satisfactorily.

There has been less tendency to use the dry cell tubes as radio frequency amplifiers at 90 volts plate, and without a bias, than was the case in past years. Operating those tubes under such conditions is an unfavorable condition for maximum life. The plate current requirements are approximately five milliamperes for operation at that voltage, while the average emission obtained on our regular production is only eight milliamperes. In other words, practically the full emission current is required to furnish the plate current. If there is a slight drop in the emission at any time during a life, or if the filament voltage is slightly low the plate impedance rises and the performance is less satisfactory than is the case when the proper grid biasing voltage is provided. This is of interest because there is an increasing tendency to use that tube for series filament operation from rectified AC current as a solution to the problem of eliminating the A battery.

Options Presented

We wish to urge that either the proper bias be used with such tubes, or that they be operated at a lower plate voltage than 90 volts in the radio frequency stages.

One further instance noted was that of a power amplifier device. With this unit a test showed that the 310 tube used was supplied with a plate voltage of 425 volts and that the plate current was allowed to flow through the speaker windings, thus placing the speaker windings at 425 volts above ground. Thus the insulation of these windings is depended on to protect the operator from a possible shock, certainly an undesirable condition.

Turning to the subject of audio amplifier design, I wish to consider briefly the subject with which you are all familiar—that is audio amplification, comparing briefly transformer, impedance, and resistance coupling. I have only a few comments to make on the transformer coupled system.

The advantages of that system are well known, one being that the general purpose types of tubes operating at ninety volts are very satisfactory. Also voltage amplification obtained in each stage is high because of the amplifying action of the transformer. A disadvantage is the fact that with the smaller audio transformers the frequency range is somewhat limited. These were quite satisfactory for voice reproduction, but not entirely satisfactory for reproduction of all of the frequencies encountered in musical selections.

Many Limitations Overcome

By going to a more expensive design, using a larger core, and a greater number of primary and secondary turns, many of those limitations have been overcome. The frequency range has been extended down in the low frequency range and by care in arrangement of the coils and the windings of the coils, distributive capacity has been

kept low enough so that the upper frequency range has also been extended.

At the same time the price, weight, and bulk of the transformer have increased in proportion and some manufacturers have not found it feasible to use the latest and most improved designs of audio transformers because of considerations of cost, with the result that they sacrifice tone quality which cannot be compensated for up by the use of a suitable tube in the last stage or improved types of speakers.

With impedance coupling with the general purpose tube types, the voltage amplification obtained is not high enough. Aside from that, the results are very satisfactory. The frequency range is good, both with regard to high and low frequencies, if a well designed choke is provided.

Needs High Inductance

With tubes having a higher amplification constant such as the CX-340, the difficulties with impedance coupling become much the same as with transformer coupling, if the lower frequencies are to be faithfully reproduced. When you consider that the internal impedance of the tube may rise to a value of perhaps 100,000 ohms, and that an inductance capable of furnishing an impedance several times that value must be provided in the plate circuit in order to offer sufficient amplification at the lowest frequencies it is desired to reproduce, it is evident that a design as bulky and expensive as is the case with audio transformers must be provided.

In the case of resistance coupling, in the past the greatest objection has been that a higher plate voltage is required, 135 to 180 volts, or even higher. Therefore, resistance coupling under these conditions slightly simplifies the audio amplifier design in that it eliminates the added voltage taps of 90 volts for the first audio and 40 volts for the detector, it being possible to operate these tubes at the same plate voltage.

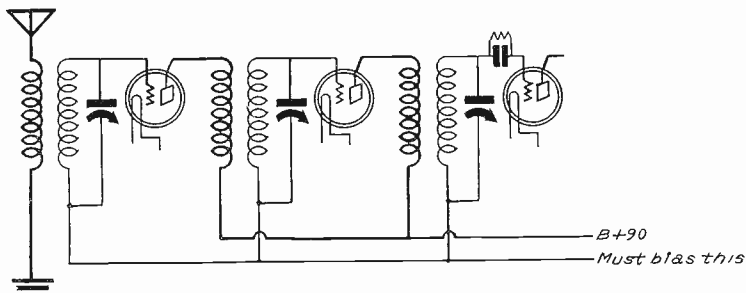
Low Plate Current Drain

The plate current drain is low with that type of tube, and there is no limitation as to the low frequency reproduction—that is, no practical limitation. The lowest audible frequency is 16 cycles per second or thereabouts and it requires only reasonable care in design to build a resistance coupled amplifier which will have a practically flat frequency characteristic down to that value. How near to 16 cycles we need go is a question that I will not take up, except to note that if the low frequencies are not desired it is relatively easy to arrange the amplifier to cut off at any desired frequency.

The passing of the low frequencies depends only upon having a sufficiently large blocking condenser in the amplifier, and in keeping the grid leak used in the input of the succeeding stage high. At the high frequency end there are limitations with resistance coupled amplification which have not been discussed fully in current popular descriptions of that circuit. These limitations apply particularly to the use of tubes having a high amplification constant, which are necessary in order to obtain good voltage amplification with resistance coupling, and have been explained by Dr. J. M. Miller in one of the bulletins of the Bureau of Standards. In this publication it is shown that the use of a resistance load in the plate circuit of a tube results in a large increase in the effective input capacity of the tube, thus placing a capacity load on the preceding tube which may be high enough to cause a decrease in the amplification obtained at very high audio frequencies.

High Internal Capacity

The input capacity of the tubes, as measured in our laboratory is, with the tube in place in the socket and with the usual wiring, but with the filament cold, on the order of 15 mmfd., part of that being grid-filament capacity, and part grid-plate capacity. In operation the effective capacity, at the input terminals of the tube, is the sum of the grid filament capacity, plus the



WHERE a plate voltage of 90 is used on radio frequency amplifying tubes particularly the —99 type, either negative bias should be put on the grids or the plate voltage should be reduced.

grid plate capacity, plus also the grid-plate capacity multiplied by the voltage amplification obtained from the tube and associated circuit. In other words, if a voltage amplification of twenty per stage is obtained, the grid to filament capacity 5 mmfd., and the grid to plate capacity is 7 mmfd., the total input capacity will be $5+7 \times 20$, or slightly more than 150 mmfd. This has been checked out experimentally with some CX-340 tubes and it is found that it rises from a value of 15 mmfd. without any load in the plate circuit up to 250 mmfd. with a quarter megohm in the plate circuit and to higher values at still higher plate loads, depending somewhat on the circuit wiring.

However, 10,000 cycles is certainly the highest frequency needed for good audio quality, and up to that point the effect of this capacity load is not serious. The voltage amplification begins to drop slightly at 5,000 cycles, and is noticeably lower at 10,000 cycles, but in view of the general practice of using a condenser across the speaker terminals to bypass the higher frequencies, it would not seem that this slight decrease in amplification at these frequencies is at all objectionable.

Bias For Each Stage

In popular types of resistance coupling amplifiers some features of proper circuit design have been overlooked. One of these is in connection with a point that I have already mentioned, namely, that if a power tube is used in the last stage a fairly high signal voltage must be applied to the grid of the preceding tube in order to obtain full output from the last stage, this, with resistance coupled amplification, running in the neighborhood of two or three volts peak swing. Since the grid current of the CX-340 tube at zero grid bias may be on the order of a half a microampere, and with one or two volts positive, would reach 50 or 100 when not limited by the grid leak resistance, it is evidently quite impossible to drive the grid very far positive with the resistances in the circuit that are normally provided. Therefore, distortion will start in the preliminary stages of a resistance coupled amplifier before the power tube in the last stage is working up to full volume, unless each stage of the amplifier is provided with a grid bias.

Before taking up the details of the circuit design further, I will mention some of the constants of the tube which will simplify that discussion. The amplification constant which has been chosen is 30. Under operating conditions the plate impedance is 150,000 ohms.

High Input Impedance

The recommended value of plate circuit resistor is 250,000 ohms, or higher if preferred. With 135 volts plate the grid bias should be from one volt to one and a half volts on each tube, the higher value being necessary when a CX-371 tube is used as the output tube. With one and a half volts bias a peak swing just sufficient to slightly overload that tube can be obtained.

The bias should not be higher than necessary as a small voltage impressed on the grid of a tube of this type is equivalent to

thirty times that voltage acting in the plate circuit; therefore, if the grid voltage is too high, the plate current will be cut off and distortion introduced by the amplifier. It is desirable to keep the input circuit impedance of each stage as high as possible to prevent too much of a load being thrown on the preceding tube, with a decrease in the total amplification obtained from each stage. For that reason a grid resistor, or grid leak, of 2 megohms is recommended.

With those values of grid leak and plate resistor, a blocking condenser of .006 mfd. is ample in size to pass frequencies close to the lower limit of audibility. The drop at thirty cycles is about 10 per cent.

A Source of Motorboating

If larger blocking condensers are used the lower frequency range can be still further extended, but there is danger in making the amplifier too efficient at very low frequencies, because of the fact that when common B batteries are used, by-pass condensers across them being ineffective at these frequencies, the tendency towards blocking, or "motorboating," becomes pronounced because of the coupling between stages introduced by the resistance of the battery. If the blocking condenser is kept fairly small that tendency is not so pronounced.

In plotting the plate current, grid voltage curves and the load curves we find that with the values mentioned the amount of distortion introduced by the tube itself is well below five per cent, and under most conditions is entirely negligible. The voltage amplification obtainable per stage is about twenty. With that combination of voltages and resistors any type of power tube can be used in the output stage; either the CX-371, requiring a high signal voltage, or the 112 requiring a more moderate value. The (high mu) tube is also capable of operating the power tubes used in the power amplifier units.

Keep to 180 Effective Volts

If the plate voltage supply to the tube is raised as high as 425 volts and a one megohm resistor provided the effective plate to filament voltage will not exceed 180 volts, the maximum recommended for that tube, and will result in a higher voltage amplification per stage. The average plate current is about a quarter milliampere, depending upon the exact circuit constants and bias used.

The resistance units available now are satisfactory from the viewpoint of holding their resistance values throughout their life; they are small and compact and will result in a more favorable condition for design where compactness is an object.

Solves Problems

It is hoped that the introduction of this tube will solve some of the problems of the manufacturers who wish to extend the frequency range of their audio amplifier and are not willing to go to the expense of using the large audio transformers which also require considerable space in the completed receiver.

(Address delivered before the Radio Manufacturers Association, Inc., at Chicago.)

Getting Best Results From the New Four-Tube Universal

By Herman Bernard

Associate, Institute of Radio Engineers

FOR those who have built RADIO WORLD's Universal four-tube receiver, described in the March 12 and 19 issues, and who want to check their work against the expected results, the following suggestions are made:

If a growling sound is heard when you put your hand near the left-hand Karas dial, then the radio frequency stage has not been properly balanced. The system of neutralization employed in the new Universal is one very simple of adjustment. You may begin by having the balancing condenser, C4, at minimum setting, i.e., with plates entirely out, and put your hand on the dial when the set is tuned to some station with maximum volume. Gradually turn the knob of C4, which is at the left-hand rear of the baseboard, until you may touch the dial of C1 and get no foreign sound whatsoever. Be careful not to use any more of the capacity of C4 than is absolutely necessary, as too much neutralization may reduce the amplification noticeably.

The efficiency of the set depends considerably on the proper adjustment of the balancing condenser, because if the set is not neutralized it will be awkward to tune, and if it is over-neutralized distant reception will be difficult to obtain.

Watch the Coil Polarities

In regard to stability, another important fact to remember is that the coil polarities should be correctly established. If you are using home-made coils and following the data for their construction given in the March 12 issue, then you will follow the rule that the beginning of the primary of the antenna coupler goes to the antenna, and the end to ground and minus A, the beginning of the secondary (which adjoins the end of the primary) goes to the rotor plates of C1, while the outside terminal of the secondary, representing the end of that winding, goes to the grid of the first tube. The same polarity system prevails in regard to the interstage coupler. The beginning of the primary, L3, goes to the plate of tube 1, and the end of the primary to B plus 90, while the rotor plates of C2 are connected to the beginning of the secondary and the end of the secondary goes to one side of the Bretwood De Luxe Variable grid leak and the grid condenser. These facts were explained in the constructional article but are emphasized because some constructors obtain results inferior to their expectations, due to hastily connect-

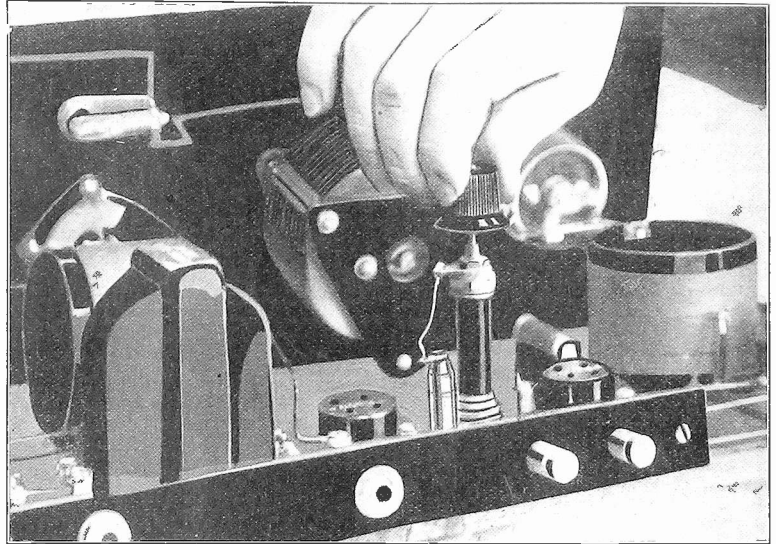


FIG. 11

When the Bretwood variable grid leak knob is turned to the right the resistance decreases and when it is turned to the left the resistance increases. The higher the resistance the less the leakage.

ing the coils, without regard to the directions.

The regeneration condenser, C5, has a capacity of 15 mmfd., and this is quite sufficient to obtain regeneration even on the longest wavelength in the broadcast band, due largely to the inclusion of half of the secondary L4 in the plate circuit. Nevertheless, if the inter-electrode capacity of the tube you are using as a detector is considerably off average then some higher value condenser will have to be used for C5.

Effect of Detector Tube

Such a possibility is purely theoretical, as the construction of several of these receivers in RADIO WORLD's Laboratory developed no need whatsoever for any different capacity than the one specified. C5 in the laboratory set was General Radio type 368-A Microdenser. Those who have other condensers of the neutralizing size at their command will find that those condensers with about 5 or 7 plates will easily fill the bill.

As the capacity of the elements of the detector tube has an important bearing on the operation of the regenerating condenser, it is suggested that the constructor abide by the CX-300A, which is an alkali vapor tube and is extremely sensitive, noticeable particularly on weak signals.

With the radio side of the receiver properly taken care of there is no reason why distant reception should not be readily obtained. In four locations in New York City, on which tests were made subsequent to the publication of the March 19 issue, and hence representing new results, Chicago stations were tuned in right through locals. In fact, the receiver was designed for the express purpose of cutting through locals and bringing in stations about 1,000 miles away, even when strong locals are going full blast. Of course, after the local stations shut down the DX hunter will reach out much farther.

The sensitivity of the radio side of the receiver depends on a variety of components, some of the most important of which were discussed in the foregoing paragraphs. However, one should not lose sight of the advantage derived from using a variable grid leak, because it has an effect on the biasing of the detector tube.

Greatest Sensitivity

The variable grid leak affords the opportunity to attain the setting which affords maximum sensitivity. A good way to set the leak permanently is to leave it at any experimental setting and wait until you tune in a distant station that comes rather faintly. Then crowd your regeneration condenser as much as possible without causing the tube to spill over, or if it does spill over, come back and try again. Then you will find that the grid leak will act with vernier effect on oscillation, and when turned to settings of higher resistance, i.e., turning the knob

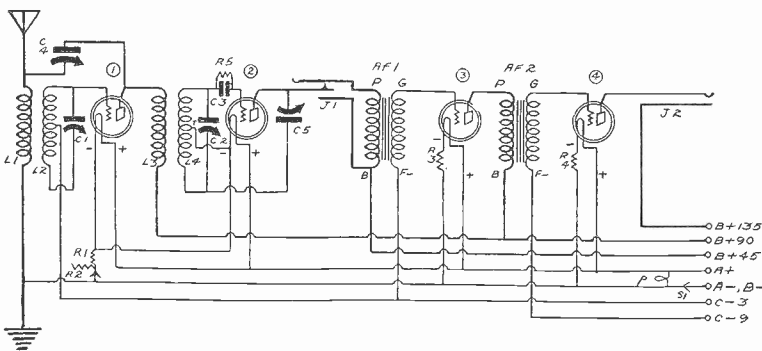


FIG. 10

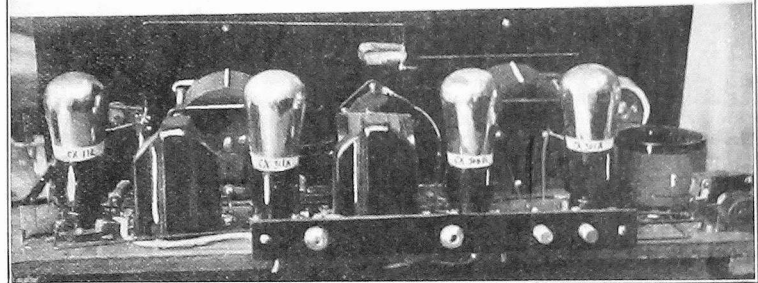
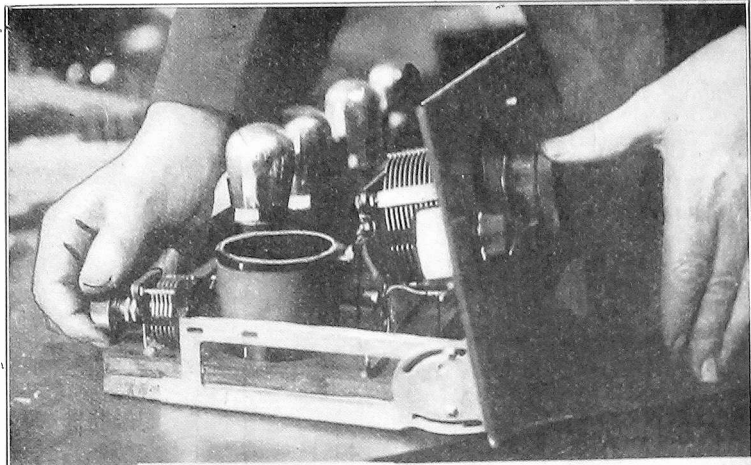
The circuit diagram to be used in conjunction with the trouble-shooting text.

LIST OF PARTS

- L1L2, L3L4—Two General Radio 200-600 meter coupling coils, type 277-D.
- C1 C2—Two General Radio .0005 mfd. variable condensers, type 247-F.
- R5, C3—One Bretwood de luxe variable grid leak with .00025 mfd. grid condenser attached.
- C4—One General Radio 50 mmfd, micro-condenser, type 368-B.
- C5—One General Radio 15 mmfd., micro-condenser, type 368-A.
- J1—One Electrad single circuit closing jack.
- J2—One Electrad single open circuit jack.
- R1, R4—Two 112 Amperites, with mountings.
- R3—One 1A Amperite, with mounting.
- R2—One General Radio 6-ohm rheostat, type 301.
- S1—One Yaxley battery switch, No. 20 (window and pilot light, P, optional.)
- AF1—One General Radio audio transformer, 1 to 2.7 ratio, type 285-D.
- AF2—One General Radio audio transformer, 1 to 2 ratio, type 285-L.
- 1, 2, 3 and 4—Four General Radio sockets, type 349.
- Two Karas Micrometric dials.
- Two Eureka dial pointers.
- One 7x21-inch Lignole front panel.
- One 8½x20-inch baseboard.
- One pair of Benjamin adjustable sub-panel brackets.
- One 6-lead Birnbach cable.
- Two binding posts, Ant. and Gnd.
- One metal strip for securing cable to baseboard.
- One hard rubber or Bakelite strip, 10½x 1½ inches.
- Two angle brackets to mount strip.

ACCESSORIES

- Three Eveready 45-volt standard heavy-duty Layerbilt B batteries, No. 486.
- Two Eveready 4½-volt C batteries.
- One 7x21-inch Corbett sloping cabinet.
- Two CX-301A tubes for sockets 1 and 3, one CX-300A for socket 2 and one CX-112 for socket 4.
- One Octacone loudspeaker.



FIGS. 12 AND 13

The neutralizing condenser is set at minimum capacity and a low wavelength station tuned in. Placing the hand at the C1 dial will cause the set to growl. Turn the neutralizing condenser until the growl disappears. In some installations no signals will be obtainable at minimum capacity setting of the neutralizing condenser, in which case start with plates one-quarter or half way in. The lower photo shows the rear view of the set with balancing condenser at right.

to the left, will cause the tube to spill over. Then come back about a half turn and get rid of the oscillation by a new adjustment of the regeneration condenser. Then you will have your set at a point of maximum sensitivity for detector action. The leak setting need not be changed thereafter. The same rule of set-once-and-leave-alone applies of course to the neutralizing condenser C4, and that was the reason for keeping that, too, off the front panel.

The audio channel is very simple and is standard, except that the jack, J1, is reversely connected. The reversed connection is shown in Fig. 10, while the obverse method was diagrammed in Fig. 1, published March 12. Of course, those who want to listen in on earphones and do not want to use a phonograph pickup should follow the diagram as shown in the March 12 issue. In this respect, you have your option. If you want to listen in on earphones you can drill a hole in the rear panel so that the plug will fit into the jack which is mounted on the rear strip.

Transformer Ratios

In the audio circuit be careful to connect the transformers properly. These connections are marked in the diagrams. The transformers are of low ratio. It is not necessary to use any higher than 1-to-3 and as a rule it is preferable to have the lower ratio in the first stage. This advice is given on the assumption that a lower ratio is obtained by means of a large primary rather than a diminished secondary. The rule, however, is subject to exceptions and one of the excep-

tions appears in the present case. General Radio transformers are used. Type 285-D is in the first stage, although it is of 1-to 2.7 ratio, because it has a high primary impedance. It is designed for use in conjunction with special detector tubes like the CX-300A. The proper matching of the load impedance with the tube impedance (which does not mean equalizing them) gives greater amplification, and for that reason the safer and better course in this case is to follow with an extremely low ratio transformer, e.g., General Radio 285-L, which has a ratio of 1-to-2. Under no circumstances should a high ratio transformer be used in the second stage, because this might cause an audio frequency oscillation to be set up because of radio frequency oscillation in the detector tube. The stability of this receiver or any other regenerative receiver depends to some extent on the proper constants in the audio channel. If you run into any trouble like audio oscillation, high pitched whistles, steady squeals, sparking across the secondary of the second audio transformer, strong grid current or the like, try increasing the C bias and also try a leak of about 0.1 to 0.5 meg. across the secondary of the second audio transformer.

The Logging Feature

The set may be logged and this log may be referred to in tuning in stations that do not fix their dial settings in your memory, but some consideration must be given to the fact that C5 has a slight tuning effect. In other words, the dial setting for C2 will change slightly as C5 is changed. The greater the utilized capacity of C5, the smaller the utilized capacity of C2 in tuning in any given

wavelength. However, this is nothing serious, for in all cases the C1 setting will be constant and the C2 setting, as obtained from previous experience, may be used on all subsequent tuning, and then C5 turned until the station comes in, so the net results is that you log the receiver perfectly, after all.

No Signals

If no signals are heard it is because of self-oscillation. Overcome this by turning C4 to the highest capacity setting necessary for bringing in signals. The stations come in unfaillingly at the proper setting, though growling may accompany the signal, in which case follow previous directions for getting rid of this. The body capacity effect positively will disappear completely, provided, of course, a suitable dial is used, e.g., Karas Micrometric. The dial must be completely insulated at all points, so that the hand can touch no metal part.

If regeneration fails, increase or decrease the plate voltage and try readjusting C4, as the balancing condenser has a compensating effect upon the regeneration condenser.

Regenerative Novelty

In some instances higher capacity settings of C5 will cause regeneration, in other instances the lower settings, but in general it will be a case of the one or the other at all times. It makes no practical difference which method prevails. Where the higher capacity creates regeneration the aiding phase is being utilized, while in the other case reversed feedback is relied on for regeneration stifling, i.e., regeneration is obtained by offering minimum bucking effect, instead of maximum aiding effect.

The Proper Coil Connections

Give Stability and Cut Capacity Coupling

By Brunsten Brunn

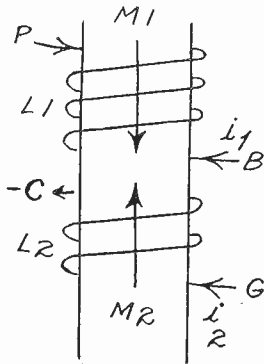


FIG. 1

The directions of the coil fields and the proper way to connect an RF transformer are shown at left, while at right is a pictorial representation of the same method of connection. The rule applies where more than one RF transformer are used in a circuit

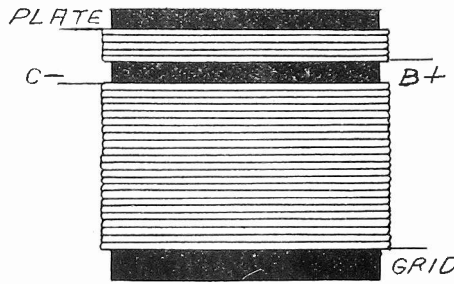


FIG. 2

any other transformer, the terminals should be connected as shown in Fig. 1. P should go to the plate of the first tube, B should go to the plate battery, F should go to minus C and G to the grid of the succeeding tube. This gives the most stable connection where the circuit contains more than one such transformer. There is also another advantage and that is that the capacity coupling between the primary and the secondary is the least. Not only is the capacity least but the current through this capacity is the least for a given capacity and frequency. The reason for this is that the two terminals which are at the greatest potential difference are farthest apart in space as well.

Fine Wire For Primary

An important consideration in the design of radio frequency coils is the size of wire in the primary winding. Many have thoughtlessly made this of heavy wire in order to reduce the resistance in the circuit. This coil may have a resistance of an ohm or two while it is connected in series with the plate resistance which may be from 5,000 to 50,000 ohms. Obviously, nothing can be gained by reducing the resistance of the primary winding. Much, however, can be gained by making the primary of fine wire. The finer the wire is in this winding the less will be the eddy currents, which are induced in it by the current in the secondary. Thus fine wire in the primary will materially increase the selectivity of the secondary, or in other words, reduce the resistance in the secondary. Still another advantage is gained by using fine wire, and that is the reduction of distributed capacity between the two windings. The finer the wire in the primary is the less will be the capacity between the windings, since capacity is largely a matter of dimensions. Reducing the capacity will increase the voltage that is induced in the secondary and, hence, will increase the sensitivity of the set. Still another advantage of fine wire is the space required. Fifty turns of No. 40 wire, say, can be placed on the coil without any appreciable increase in the dimensions, whereas, the use of No. 20 wire would require increased space even if only a few turns were used in the primary winding. Even if the wire is as fine as No. 40 a good many turns could be put on the winding form before the added resistance could be appreciable in comparison with the plate circuit resistance of the tube.

400 Tourists at Durban Hear Programs of WG Y

Stopping over at Durban, South Africa, 400 American tourists from the Royal Mail liner Asturias listened to an entire program broadcast from WG Y, the General Electric station at Schenectady, N. Y., one recent morning. The signals came direct and therefore traveled a distance of approximately 8,500 miles.

Walter Damrosch's lecture on "Tannhauser," David Lawrence's political talk and popular melodies by dance orchestras were heard. The program was picked up on the short wavelength by the radio station at Durban and then relayed to the folk aboard the vessel. The program was received with much enthusiasm.

FOR a proper understanding of the subject of coils and phase relations it is necessary to know something about Lenz's law.

Suppose that a sensitive current meter be connected in series with a coil of wire. If a bar magnet is suddenly inserted into this coil and brought to rest there will be a deflection of the current meter, showing that the act of introducing the bar magnet produces a current in the coil.

As soon as the magnet comes to rest the current stops. Now, if the magnet is suddenly withdrawn there will again be deflection of the meter, but this time it is in the opposite direction from the first deflection.

The current set up in the coil exerts a back force on the bar magnet, that is, the induced current opposes the motion of the magnet. That is Lenz's law, or an application of it.

Effect of Second Coil

Now suppose that instead of a bar magnet we use a second coil which is carrying a steady current. There is a magnetic field about this coil just as there is about the magnet. In fact, the coil carrying the steady current is an electro-magnet. When this is brought up suddenly to the coil which is connected across the current meter there will be a deflection of the meter. Again when the current-carrying coil is withdrawn from the other coil there will be a deflection in the meter, but in opposite direction. In this case also the current, induced in the coil and meter by the motion of the steady current-carrying coil, exerts a back force on the moving coil which is always opposing the motion. This also comes under Lenz's law.

If two coils are placed close together and if there is a varying current in one of them, then there will be induced a current in the second coil, provided the circuit is closed, and this current will be in such a direction as to oppose any change in the current in the first coil. For example, if the current in the first coil is alternating it is continuously increasing and decreasing.

Secondary's Retarding Effect

The current in the secondary, provided that this coil is closed, also will be alternating, but the current in the secondary will retard the current in the primary.

The effect of the current in the secondary is always to oppose any variation in the current in the primary. This also comes under Lenz's law. Whatever may be the cause of the interaction, the current in the secondary will always be such as to keep the magnetic field unchanged.

If the magnetic field in the primary is increasing, the current in the secondary decreases so as to keep the total magnetic field the same. Likewise, when the magnetic field in the primary decreases, the current in the secondary increases so as to keep the total magnetic field constant. This applies to the case of the moving bar magnet as well as to the cases of alternating current in the primary and to a moving electromagnet.

As an illustration of this law consider Fig. 1. This may well represent any ordinary radio frequency transformer having two windings, L1 and L2. Suppose that an alternating current is flowing in the primary L1, and that at some instant the direction of the current is such that the magnetic field may be represented as to direction by the arrow M1, that is, inside the coil. The current in the primary induces a current in the secondary, or an emf if the circuit is open, and the direction of this induced current or emf is such that its magnetic field is opposed to that of the primary. The arrow, M2, indicates the direction of the magnetic field in the secondary and this is opposed to M1. The direction of the currents in the two coils is indicated by the short arrows attached to the wiring. The direction of the two winding is the same but the directions of the current are opposite.

Fields Are 90 Degrees Apart

From this explanation it must not be taken that the two fields are 180 degrees apart in time. They are only 90 degrees apart. This means that when the intensity of the magnetic field or of the primary current is maximum that of the secondary is zero, not minimum. At the instant that the primary current is maximum there is no change in the magnetic field, and hence, no current is induced in the secondary at that instant. When the primary current is zero the magnetic field about it changes most rapidly and then the induced current in the secondary is maximum for that reason.

When connecting a radio frequency or

Chain Programs Stir Up Debate Among Fans

An article giving the address made by Merlin H. Aylesworth, president of the National Broadcasting Company, before the Engineers Society of Western Pennsylvania, has evoked a great deal of comment by readers. In his address Mr. Aylesworth spoke of the development of chain broadcasting and of the steps National Broadcasting Company engineers were taking to learn how to handle sound in the air. Below are a few of the letters received.

EDITOR RADIO WORLD:

Referring to an article on page 19 of your publication of February 19, by the President of the National Broadcasting Co., as one of the 27,000,000 listeners, I would like to know if this gentleman thinks these listeners are going to enjoy being told that they must listen to a particular program or not listen at all. That is about the condition today. You sit down in front of your set in the evening, turn on the current, etc., and you get the N. B. C. Move over a few points on your dial and you get the N. B. C., and repeat this any number of times with same results. On this account I, for one, have about lost all interest in radio, and have heard any number express themselves express themselves the same way.

Very truly yours,
E. C. COCHRAN,
Memphis, Tenn.

* * *

EDITOR RADIO WORLD:

In reference to the article that appeared in your issue of February 19, entitled "An audience of 27,000,000," let me state that I am in whole-hearted accord with the idea behind the National Broadcasting Company.

An organization so vast in its scope must select its programs very carefully and insure those who tune in on one of the stations of its chain of a pleasant time while listening-in. And so far as the programs that the National Broadcasting Company has put on the air have been of surpassing quality. I do not believe that there is any single broadcasting station that can equal the programs which this company produces. I would like to see other such chains formed throughout the country.

Very truly yours,
J. E. O'CONNOR,
New York City.

* * *

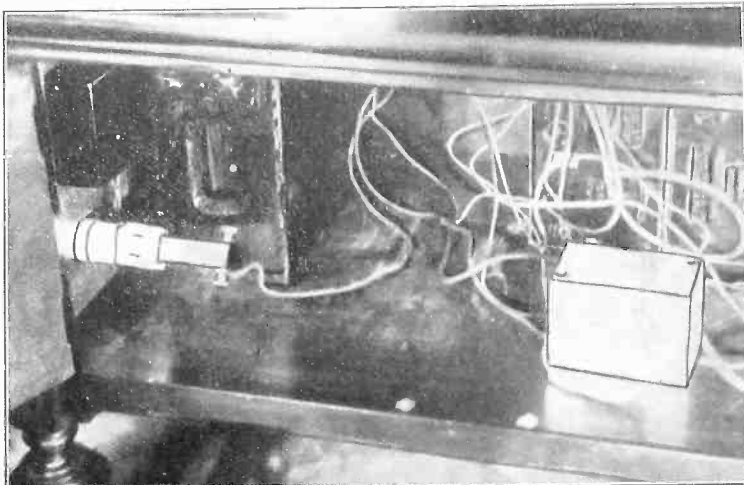
EDITOR RADIO WORLD:

There appeared in your issue of February 19 an article by the President of the National Broadcasting Company indicative of the service that great companies are able to give the public. And for the radio the National Broadcasting Company is one of the best things that ever happened.

The broadcasting station's sources of revenue are those companies which advertise through it. Naturally, advertisers look for stations that broadcast programs which will hold the interest of those who listen-in. But having a program that will unfailingly hold the interest of the fan costs money, more money than the ordinary station can afford to spend. It requires an organization of the size and wealth of the National Broadcasting Company to offer these programs to the radio public. The eagerness with which the radio public tunes in on the chain programs attests to the popularity that they have achieved.

Very truly yours,
E. WILLIAM ENGLISH,
Seattle, Wash.

UNIVERSAL PLUG IS HANDY



(Hayden)

HOW A three-way plug may be conveniently mounted in the bottom of a console for use with a trickle charger, B eliminator and a lampsocket antenna, (extreme lower left hand corner in photo). The lamp socket antenna is protruding with the wire attached. The two slots seen are for the B eliminator, while two more slots underneath, are for the trickle charger. The dry batteries seen are for extra C bias.

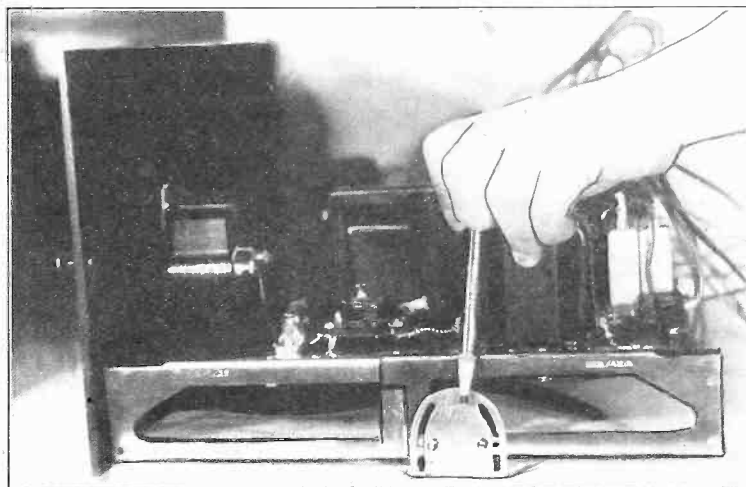
GUNNING FOR STATIONS



(Herbert Photos)

MICHAEL BLAN, known as "Blan the Radio Man," who operates a radio store at 145 East 42nd St., N. Y. City, demonstrating the latest in antennas. It consists of a wooden pole, wound with approximately 140 turns of wire. It may be used on either the roof or indoors.

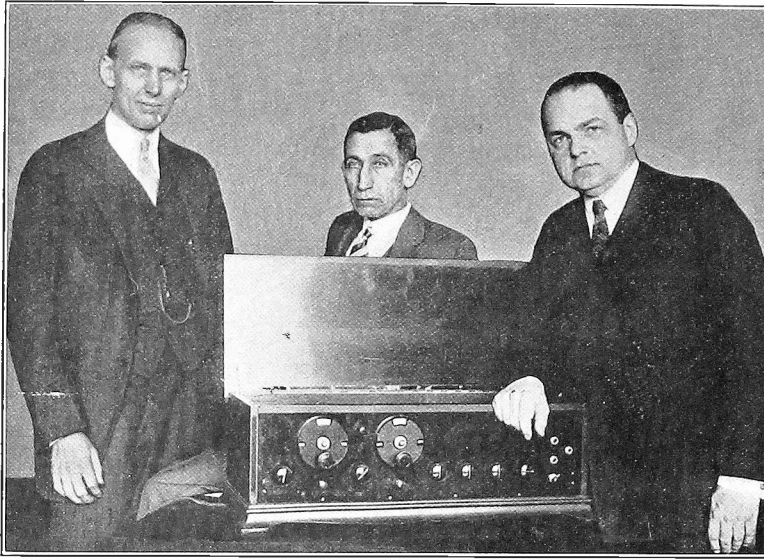
BRACKETS CONNECTED "IN SERIES"



(Hayden)

WHEN BUILDING a receiver into your phonograph or cabinet which requires a baseboard that is about twice the depth of the average, a pair of folding brackets may be used, one pair to a side. The joint piece (see pencil) may be used to hold the baseboard a little higher than the panel bottom, to clear a ridged cabinet.

ON THE JOB EARLY



(Underwood & Underwood)

HENRY A. BELLOWS, of Minneapolis; **Eugene O. Sykes**, of Jackson, Mississippi, and **Orestes H. Caldwell**, of Bronxville, N. Y. (left to right), three of the five members of the newly-created Federal Radio Commission at an informal meeting in Washington.

Board Organizes for Work; Sykes Temporary Head

Washington.

The Federal Radio Commission, created by the new law, met for the purpose of organizing. Though only three of its members may be present it intends to proceed with plans for radio control in accordance with the authority granted it.

Some discussion has arisen as to whether the board has been disqualified from operating because of the failure of Congress to appropriate salaries for it. Such is the contention of Representative Bloom of New York. He assumes that the law makes it incumbent upon the President to authorize rules and regulations under which radio may be supervised in an orderly manner until such time as Congress may provide funds for the commission.

Hoover Says Otherwise

But Secretary Hoover, who is vested with large responsibility under the new law, does not agree with Mr. Bloom. And his stand seems to have been adopted by the members of the commission, for they do not appear to doubt their right to proceed with administration of the law as directed by Congress.

There are 733 commercial stations and more than 17,000 land, ship and amateur stations, which under the new order must take out new licenses. That not all of these can hope to obtain permission to continue broadcasting under present crowded air conditions is the trend of opinion.

The new law provides that stations may continue to broadcast under the licenses previously granted them until April 24, by which time new licenses must be obtained.

Opposition Expected

That the commission will meet with opposition in the courts is the opinion of some, but following the meeting which they held it was stated informally that the radio situation would be "cleared up" soon and that there would be no obstacles to reissuance of licenses on April 24.

It is the intention of the commission to permit amateurs to continue as at present, but to consider carefully applications for licenses by all others.

The three members of the commission who attended the meeting were E. O. Sykes of Mississippi, Orestes H. Caldwell of New York and H. H. Bellows of Minnesota. After a conference with S. B. Davis, legal officer of the Department of Commerce, the three members elected Mr. Sykes temporary chairman. He will perform the duties of chairman until the return from China of Rear Admiral W. H. G. Bullard next month.

Biggest Year Ahead, Due to Law, He Says

Although the new radio law automatically cancels all existing radio licenses for amateur, ship and broadcasting, there will be no interruption of broadcasting or commercial radio operation, George H. Kiley, vice-president of the Farrand Manufacturing Company explained in a discussion of the bill.

"The radio commission will undoubtedly grant licenses for shorter periods of time than the maximum three years they are allowed, thus continuing the cases of many broadcasters until the commissioners have sufficient time for a careful study of the individual situations," he said.

An improvement in the condition of the radio trade as a result of the new law was forecast by Mr. Kiley in a review of radio sales.

"Radio is on the threshold of the biggest year in the history of the industry," he said.

PUBLIC HEARINGS BY BOARD

In an effort to obtain full data on public preferences on how to solve the problem of air congestion the Radio Commission will hold public hearings in Washington, D. C., March 29 to April 1, inclusive.

Bureau Gets Task of Air Police Force

Washington.

The new Radio Commission has organized a department which will police the air and keep broadcasters on their assigned wavelengths. M. S. Strock will be at the head of this division, which will function at the Bureau of Standards. He has assembled there apparatus powerful enough to pick up any station at any time and tell whether it is off its wave.

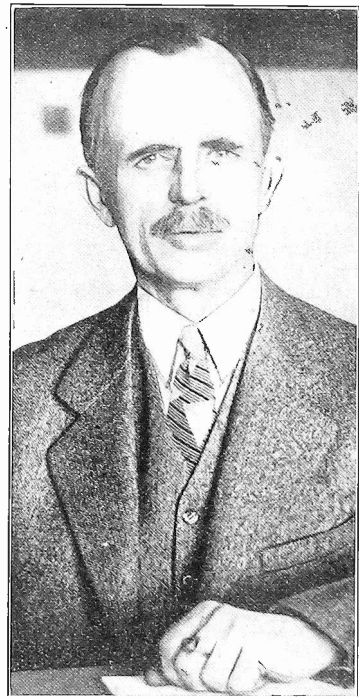
The great number of stations now broadcasting makes this a most important task. Good radio reception is dependent on each station keeping to its own wavelength and not interfering with any other station's.

It has been the practice, for some time, of some of the larger broadcasting stations to test every fifteen minutes and make certain they are exactly on their own wave. The proximity of the waves of various stations makes it easy to slip off into someone's else territory. As a means of increasing accuracy by demonstrating good examples, Mr. Strock has been asked by some of the larger stations to keep tabs on them and then to publish reports of their showings.

The past year saw a considerable amount of "pirating" of wavelengths, and legitimate broadcasters were powerless to do anything about it. But under the new law retribution will be meted out quickly.

No policy of policing wave bands has been devised as yet but it will probably contain some means of disciplining those who stray accidentally or intentionally from their wavelengths.

The commission will probably reduce the number of broadcasting stations. Under the new law all licenses are to be revoked and the commission can refuse renewal to as many as it sees fit.



(Wide World)

WILLIAM D. TERRELL, Chief of Radio Supervision, who has just been designated as Chief of the Radio Division.

Board Expected to Close Some Existing Stations

Two Members of New Commission Have Favored That Plan a Long Time and Authors of Law Say Authority Exists

By Thomas Stevenson

Three questions are being asked by everybody about the new Federal Radio Commission. They are:

(1) Will the Commission really make an attempt to limit stations so as to cut down interference and make distance reception possible?

(2) Has the Commission the authority to take such a step?

(3) How long would it take the Commission to rid the air of interference?

Perhaps it would be impossible for anyone to give positive answers to these questions at present. The Commissioners themselves say they don't know what will develop, and they should be in the best position to make predictions.

What Members Said

But if there is any doubt in the minds of the Commissioners, it does not exist among a number of observers acquainted with the Commissioners and the broadcasting tangle. Men whose interests are tied up in broadcasting have gone to considerable trouble to classify and index the men selected for the Commission in an effort to discover some clew of their possible future activities.

If past performances count for anything, there is every reason to believe that a majority of the Radio Commissioners will advocate a strict limitation of stations to a point where interference will be abolished.

The views of three of the Commissioners are well known in this respect. Orestes H. Caldwell, the New York Commissioner, is a strong advocate of station limitation. It is said of him that he is a "Hoover man" because he has opposed attempts to remove radio regulation from the Department of Commerce.

Caldwell's Previous Views

It is said that Mr. Caldwell has placed himself on record as favoring a drastic limitation of stations. His statements were made at a time when there were only 530 stations. At present there are more than 700 stations. He is also said to be in favor of high power, if not super-power, on the ground that it is necessary to provide adequate service to rural districts.

John F. Dillon, the San Francisco Commissioner, is credited with holding views somewhat similar to those of Mr. Caldwell. Practical experience has shown Mr. Dillon the desirability of station limitation and necessity for the use of high power. Mr. Dillon is on record as having expressed these views.

Henry A. Bellows, the Commissioner who hails from Minneapolis, is said to be of the same opinion. Mr. Bellows knows the impracticability of a large number of stations operating without interfering with one another. In his mind it has been a question of whether power should be limited, stations required to divide time four or five ways, or a number of stations discontinued.

Favors High Power

Mr. Bellows is said to hold the view that high power is necessary, that certain stations should have full and entire use of a wavelength and that, therefore, some of the existing stations must be put out of business.

Judge Eugene O. Sykes, of Mississippi, has no advance views on the problem he

is to tackle. Judge Sykes admits that he doesn't know very much about radio.

Although Rear Admiral William H. G. Bullard is considered an authority on radio there is no record of him having expressed views on the broadcasting tangle.

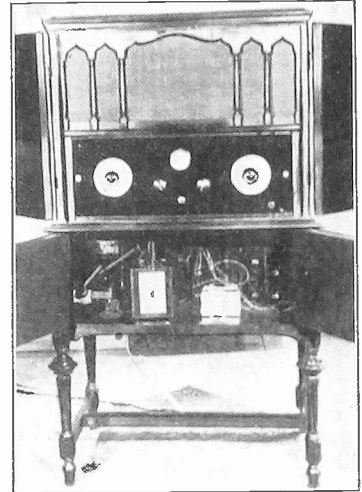
If the Commission refuses to grant licenses to any of the existing stations, court action is almost sure to follow. The question of the constitutionality of the law will be raised and injunctions sought to restrain the Commission from preventing the operation of any station until the matter is tested in the courts.

Hold Authority Exists

Both Senator C. C. Dill and Representative Wallace White, co-authors of the radio law, believe that the Commission has the authority to discontinue the operation of a number of stations if it finds such a step to be in the "public interest, necessity or convenience."

It is believed that it will take most of the Summer for the Commission to work out a definite plan for the limitation of

OUTSIDE IS BETTER



(Hayden)

A MODERN type upright console with the speaker enclosed on top, worked still better, however, with the speaker placed externally. Moral: Keep the speaker outside and play safe.

stations and to put it into operation. A number of hearings will be held first to determine future policy and second the means of putting the policy into effect.

How Senator Watson Saved Caldwell from Rejection

Indianapolis.

Senator James E. Watson of Indiana is publicly congratulated by the Broadcast Listeners Association of Indianapolis for his stand in urging the appointment by President Coolidge of O. H. Caldwell as the long term, five year member of the Federal Radio Commission recently created by the U. S. Congress to supervise and control the operation of broadcasting stations.

"The Broadcast listeners of Indiana have received merited recognition on the Radio Commission, since Mr. Caldwell is the son of Dr. W. Hampton Caldwell of Indianapolis, and was for many years a resident of Indianapolis, where he was graduated from Shortridge High School," says Andrew J. Allen, Secretary of the Indianapolis Broadcast Listeners Association. "At Purdue University, where he was graduated in 1908, Mr. Caldwell specialized in electrical and telephone engineering and was one of the editors of the Purdue Exponent and of the Purdue Engineering Review. Upon being graduated from Purdue, he went to Chicago, where he succeeded Dr. Lee DeForest as technical editor of the 'Western Electrician,' and its successor, 'Electrical Review.' For many years Mr. Caldwell was associate editor of 'Electrical World,' New York City, and is the present editor of both 'Electrical Merchandising' and the McGraw-Hill radio magazine, 'Radio Retailing,' which positions he has held since the establishment of the publications.

"The distinction of having an electrical graduate from Purdue University on the new Federal Radio Commission was saved to the State of Indiana in the closing hours of Congress by the action of the Senate's Interstate Commerce Commission, of which Senator Watson of Indiana is chairman. Senator Watson refused to accede to the demand of Senator Dill of Washington, that the name of Mr. Caldwell be rejected on account of editorials appearing in his magazine, 'Radio Re-

tailing,' criticising the original Dill Radio Bill. Senator Watson's committee passed Mr. Caldwell's name without prejudice and President Coolidge appointed him to serve during the important formation period of the new Radio Commission."

Mr. Caldwell has the grade of Member in the American Institute of Electrical Engineers, and is on the Radio Committee of American Engineering Council. He is a director of the New York Electrical Board of Trade, and is chairman of Surveys for the General Merchandising Committee of the National Electric Light Association. He is a member of numerous electrical bodies including the Society for Electrical Development, New York Electrical Society, New York Electrical League, Illuminating Engineering Society, and is a member of the honorary society Tau Beta Pi, and the Lotos Club, New York.

Speedway Lore Poured Into the Air Highway

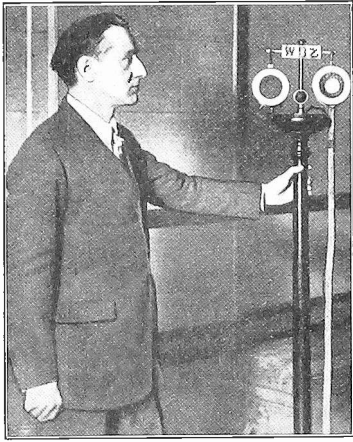
Los Angeles.

One of the very novel programs given at KNX was a 30-minute period of speedway lore. John W. Swallow, automotive editor, was at the microphone for the Culver City Speedway and introduced various drivers and officials. Chet Mitterdorf's band played numbers designed to instill the thrill of the board track races into the hearts of listeners. A make-believe race was also staged to try and put a race right into the fire-side for listeners.

The mail response was so tremendous, that the authorities of this station are already thinking of running a more elaborate program of this type very shortly. Some fans who broke in during the middle of the program and heard the description of the studio race, wrote in stating that they actually thought the description of real-honest-to-goodness race was being broadcast.

HYPNOTIZED via Radio, Two Insist Subjects Mesmerized 100 Miles Away

By Dr. Louis B. Blan



(Wide World)

PROFESSOR GERALD FITZGIBBONS who from WBZ, Springfield, Mass., via radio hypnotized two men in Boston, 100 miles away, according to one version of the fascinating experiment.



(Acme)

TWO men said they were hypnotized by Prof. Fitzgibbons. They are shown lying across chairs in a state of rigidity. It was possible during their trance to sit upon these bodies, without any pain or injury to them.

AN experiment on the effectiveness of hypnotism by radio was conducted in Boston and Springfield, Mass., by WBZ. Prof. Gerald M. P. Fitzgibbons, who stood at a microphone in Springfield, 100 miles from Boston, tried to mesmerize two men who sat in the studio of the Hotel Brunswick, Boston. The test failed to convince satisfactorily the psychologists, brain specialists, physicians, radio experts and newspapermen who witnessed it, but was called a success by Prof. Fitzgibbons.

Two of the three subjects, one a former Northampton neighbor of President Coolidge, appeared at times to have been hypnotized by the Professor. The third subject, Aaron Dashoff, of Fall River, a student at Harvard, sitting with the other subjects, exposed himself to the same hypnotic influence, unknown to the professor and the other subjects. He asserted he was entirely unaffected.

The witnesses were certain that the student did his best to concentrate on the message of Prof. Fitzgibbons. He sat with his eyes closed, complying with the orders that were coming from the loudspeaker, but when addressed said he had not been affected at any time. The physicians afterward stated they were doubtful as to the genuineness of the hypnosis into which the other two subjects declared they had been thrown.

Man in Store Reports

In Springfield a fourth subject underwent the experiment in a radio store and the result in his case seems to have been more successful than in the others. The store he was in was situated about a mile away from the microphone through which the hypnotist spoke. As the orders came from the loudspeaker he seemed to obey them readily.

In New York an announcer at station WPCB decided to co-operate in the experiment and declared that he was put to sleep by the hypnotic tests.

In Boston the subjects apparently partially mesmerized by radio were William L. Hall, 24 years old, and George Marshall, 23 years old. Both had had pre-

vious sessions with Prof. Fitzgibbons, during which he had successfully hypnotized them.

As the three subjects sat before the loudspeaker in the Hotel Brunswick studio, Prof. Fitzgibbons, from his station in Springfield, ordered them to gaze into the loudspeaker and concentrate deeply on his words.

"Breathe deeply now," he said, and they swelled out their chests until they reached tremendous proportions. "Deeper!" yelled the Professor, "deeper!"

Radio Voice Cajoles

"And now," he continued, "when I count two you will roll your eyes upward into your head, with a fixed determination not to let them down. At the count of three you will close your eyes, breathe deeply, and you will become sound, fast asleep. You will hear no sound but my voice, and you will not wake up until I clap my hands."

The voice over the radio now became soft and cajoling, soothing to the minds of his subjects.

"You are now asleep," it said. "You are drowsy. Take deep breaths. When I count one hundred you will be in a very deep sleep, in which you will hear no sound but my voice."

Here it was that Marshall and Hall apparently were overcome by the will of the hypnotist and succumbed to slumber. Their bodies were relaxed, their heads drooped forward and their arms hung loosely. But Dashoff seemed entirely unaffected.

The subjects were then told by the Professor that they were to have a humorous dream, and in a few moments Hall and Marshall commenced to laugh heartily.

Brush Away Mosquitoes

He told them next that they were in the South and that huge mosquitoes were pursuing them and buzzing about their heads. And again these same two subjects responded properly. They thrashed

their arms about them, endeavoring to chase away mind-made mosquitoes.

The subjects were told to make their arms rigid and and to have them insensible to pain, and then physicians pricked them with needles. The subjects evidenced no sign of pain. The physician in putting the needle into the flesh brought no blood. This is said to be a characteristic of the hypnotic state.

Doctors Report

Dr. A. Warren Stearns, psychiatrist of the Massachusetts State Prison and head of the Nervous and Mental Departments of Tufts College, and Dr. C. A. Bonner, Superintendent of the Boston Psychopathic Hospital, examined the subjects during the test.

They found in relation to Hall that "it was apparent he was making supreme efforts to get into a hypnotic state; that his attitude was dramatic and to a certain extent, he overdid the suggestions." The doctors could not say with assurance that Hall was under deep hypnotic influence.

As to Marshall, the doctors declared that his manner and responses were, on the whole, more genuine than those of the other subject. Marshall claimed that he was under complete amnesia during the whole seance, but at the close of the sitting he failed to carry out the suggestion that came from the loudspeaker.

The doctors' statement, summed up, follows:

"It has been a most interesting experience for us. We regret that the speed with which the suggestions were made, the consciousness that the message by Prof. Fitzgibbons once gone could not be recalled, gave us a rather unsatisfactory opportunity to determine the genuineness of the demonstration with a finality which might have been expected."

The familiarity gained by the professional observers has led to a suggestion that the experiment be repeated, so that a conclusive finding may be made.

(Other photo on front cover)

YE GODS! How I'm Frightened! Is Usual Emotion at First Broadcast

By Theophile Spencer

"MICROFRIGHT" is that inexplicable fear that strikes almost every performer or speaker when he makes his or her first appearance before the microphone. Loss of presence of mind and gain of motion in the knees are common. Different from stage fright, yet the cause of it is the same—the audience.

In the case of stage fright the performer is overcome by the fact that he is about to appear before an audience critical of his every move and word—an audience that is sitting in front of him and from whom he can not escape except by running off the stage. In the case of "microfright" the speaker is in a room that is empty except for the microphone; he has no visible audience.

But that lack of audience awes him. Weird thoughts and pictures come into his mind; and they play havoc with his message to his listeners. It is not until he can overcome his fear that the speaker regains control of his voice and thoughts and is in a position to give a clear and intelligible performance.

"Microfright" rarely continues to be a source of annoyance after a performer has addressed the microphone half a dozen times. The novelty of the situation which at first demands great effort to overcome, diminishes gradually and he suddenly finds he is no longer self-conscious.

Friendly Mail Helps

A great factor in overpowering the monster, "microfright," is the mail that is sent to the artist by radio fans. After the performer has read the letters and telegrams he begins to believe that the audiences are not hostile to him—that people are really hearing him and want



A PICTORIAL representation of how persons seem to be affected upon their initial appearance before the microphone, when they do not possess absolutely complete control over their imaginative powers.

him to do well. The microphone loses its terrifying qualities and the studio its bareness.

"Microfright" is just another struggle wherein the "mind over matter" situation

arises. Imagination and strength of will are the two great elements. The artist must learn to harness his imagination and make it serve its purpose. Too great a use of it and he is terrified; too small a use of it and he is terrified. He must have the strength of will to limit the flight of his imagination so that it will create for him a mental picture that will not be in the least disturbing. Visualizing a hostile and ogre-like audience must result in mental disruption. But mental distortion will find no place for rest in a mind strong enough to build for the broadcaster a picture of smiling, pleasant faces.

Some Bring Audiences

It is the practice of some performers, in combatting "microfright," to bring with them to the studio one or two or even several acquaintances to create an amiable and visible audience. In fact many actors and actresses and opera singers have devised for themselves individual means of overcoming "microfright," means that are sometimes very amusing.

A means for overcoming "microfright" that has been tried and found wanting is that of having the message written before the appearance at the studio and then to read it into the microphone. It has not done away with the fear of the microphone but has caused extra terror and has resulted too often in very dull entertainment besides. It is exceedingly difficult to avoid getting monotonous in speech or, what is worse, absolutely flat, when one is excited and tries to read aloud to a large audience. The quality of spontaneity that is one of the most important requisites of those who would broadcast talks is lacking and its value lost when the speaker elects to read.

'Phone Is Established Havana to London

Radio telephone communication was established recently between Havana and London, via Key West and the lines of the American Telephone and Telegraph Company to New York and thence by radio to London. Dr. Martinez Ortiz, Secretary of State for Foreign Affairs of Cuba, sent the following greeting to G. T. Locker-Lampson, Parliamentary Under-Secretary of State for Foreign Affairs of Great Britain:

"On the occasion of the inauguration of radio telephonic communication between Great Britain and the Republic of Cuba, the President of the Republic and the Government of Cuba express their highest regards to his Gracious Majesty, King George V. At the same time the Government of Cuba takes this opportunity to express to you the wishes of the Cuban people for the greatest prosperity and welfare of the British people and for the maintenance of the cordial relations which at all times have existed between Great Britain and Cuba."

Mr. Locker-Lampson replied reciprocating these sentiments on behalf of the British Empire. Thomas J. Morris, British Minister to Cuba, also sent a greeting to Dr. William Patterson, Cuban Minister in London.

The distance covered in the conversations, including the total radio and land lines, was from Havana to London via New York and Wroughton, 5,250 miles, and from London to Havana via Rugby, Noulton and New York, 5,380 miles.

Gigli to Be Heard In Operatic Arias

On Sunday night, April 3, on the Kent program, Beniamino Gigli, tenor of the Metropolitan Opera Company, will sing through WEAF and its chain of stations. He will be accompanied by the Atwater Kent orchestra, Louis Edlin conducting. Vito Carnevali will be at the piano. The program by Signor Gigli is as follows: "O Paradiso" from "L'Africaine"; "De la fleur" from "Carmen"; "Rimpianto"; "O, Marie. O, Marie," "Notturmo d'amore," "Giunto sul passo" from "Mefistofele" and "La donna e mobile" from "Rigoletto".

Fading to Be Tested On 43-Meter Wave

The experimental station 2XAL, of the Westinghouse Electric and Manufacturing Co., at Newark, N. J., will conduct special code tests on a wavelength of 43 meters, using a crystal controlled transmitter, from April 18 through April 30, inclusive, from 8 P. M. to 9 P. M. Eastern Standard Time, to ascertain audibility, fading and keying characteristics throughout the world.

The keying from 8 to 8:30 P. M. will consist of ABC's 2XAL sent automatically, while the other half hour will consist of tests with amateurs.

This event has been awaited for, with great interest by amateurs throughout the world, who are not only anxious to use these tests to test the DX ability of their sets, but to check up as well as gauge their wavelengths.

Finley Replaced Beck on Beethoven Hour

James M. Beck, the former Solicitor General of the United States who was announced to deliver a tribute in honor of Beethoven in the first "Beethoven Hour" being broadcast through WEAF and other stations of the Red Network of the National Broadcasting Company through the sponsorship of the Columbia Phonograph Company, on Saturday evening, March 19, at 9:00 o'clock, Eastern Standard Time was unable to appear at that date.

The address was delivered by Dr. John H. Finley, noted educator and a member of the Advisory Body which has completed arrangements for the nationwide Beethoven Centennial. Dr. Finley was former president of the City College of New York and the New York State University. He is now an editor of the New York "Times."

Fourth KFI Concert

Los Angeles
The fourth of the series of concerts by the Los Angeles Philharmonic Orchestra is to be broadcast by KFI of this city, Saturday night, April 9, at 9 P. M. Walter Henry Rothwell ranks high among orchestra conductors and has built up the Philharmonic until it is now one of the best known organizations of its kind in America. Radio presentations of this nature are steadily gaining in popularity.

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.

PLEASE GIVE me the circuit diagram of a six-tube receiver using three .00025 mfd. variable condensers; an untuned radio frequency transformer (200 to 575 meters); three-three inch metal dials; three .01 mfd. fixed condensers; two audio frequency transformers having a ratio of three to one; a two-ohm rheostat, and a pilot light. The constants of the coils would also be appreciated.—Maxwell Down, Kansas City, Mo.

Fig. 530 shows the circuit diagram of a receiver containing such parts you possess. The first stage of radio frequency amplification is untuned, and therefore the untuned RFT is used here. The three variable condensers are used in the next two tuned RF stages and detector stage, C1, C2 and C3. The three tuned radio frequency transformers contain ten turn primaries L1, L3 and L5, and sixty-five turn secondaries, L2, L4 and L6, each primary and secondary being wound on a three inch diameter tubing with No. 22 double cotton covered wire. Allow a one-quarter inch space between each of the windings. C5, C6 and C7 are the .01 mfd. fixed condensers which are used for bypassing radio frequency energy. C4 is a .00025 mfd. fixed condenser while the grid leak R1 is of the two megohm type. The grid returns of the radio frequency transformers, including the one in the detector circuit and of the first audio transformer are brought to the minus post of a four and one-half volt C battery. AFT1 and AFT2 are the audio frequency transformers. A variable resistance R2 (2,000 ohms maximum) is used to control the B voltage fed into the plates of the radio frequency and first audio frequency amplifier tubes. The plate of the detector tube is connected to a separate post on the B batteries, the voltage being about forty-five volts. The B voltage fed into the plate of the last audio tube should be one hundred and thirty five volts. The same source is used for the plates of the RF and first AF tube tubes. L is the pilot light. S is a filament switch. R3 is the 2 ohm rheostat, used, as you will note, to control the filaments of all the tubes. A nine volt C bias is applied to the plate of the last tube. The -01A tubes are used throughout the receiver. The single circuit closed jack or binding posts may be used on the AF output. You will note that the grid leak is not connected across the condenser. Instead it is connected to the plus A post. This is due to the actual grid returns of all the radio frequency transformer being made common and connected to the C minus post. The complete receiver may be built in a seven by twenty-four inch cabinet. Evenly space the variable condensers, placing the coils directly in back of them; the first one vertical; the second one horizontal, circumference facing the vertical coil, and

the last one with its circumference parallel to the panel. For handsomeness, a subpanel mounting may be used for the sockets and audio transformers. The 2000 ohm resistance may also be mounted here. A bracket should be used to hold the panel to the subpanel. Note that the minus A is grounded. Only the three metal dials, the rheostat knob, the jack, the pilot light and the switch should appear on the front panel; the rheostat being placed in the right hand corner, the pilot light exactly in the center right above the middle dial, the filament switch directly underneath this middle dial, in the same line as the switch and the jack at the left hand corner. * * *

IN THE July 31 issue of RADIO WORLD, there appeared a circuit diagram, on page 13 in the Radio University columns, a circuit diagram of a five-tube radio-dyne. (1)—Could the -01A tubes be used throughout with satisfaction? (2)—What should the resistance of R1 be? (3)—Of R2 and R3? (4)—Are C4 and C5 the neutralizing condensers? (5)—I have a pair, with capacities marked .00004 mfd. maximum. Are these all right?—Samuel Winthrop, Boston, Mass.

(1)—Yes. (2)—Ten ohms. (3)—R2 should have a resistance of twenty ohms, while R3 has a resistance of ten ohms also. (4)—Yes. (5)—Yes. * * *

I WOULD like to have the following information on a DC charger for a 100 ampere-hour battery, charging at a rate of 3.5 amperes. (1)—What lamps should be employed? (2)—About how much does it cost to completely charge a battery of this capacity?—William Bowles, Atlantic City, N. J.

(1)—Place two 200 watt lamps in parallel. (2)—About 75c. * * *

I HAVE constructed a five-tube receiver using an untuned radio frequency stage, two stages of tuned radio frequency amplification, a crystal detector (using a tuned radio frequency transformer) and two stages of transformer audio frequency coupling. The circuit is identical to that shown in the Radio University columns of the Oct. 2 issue of RADIO WORLD. The results with this set, as far as volume on locals, are very satisfactory. However, I cannot get much DX with it. Could I increase the range of this receiver by cutting out the untuned RF stage, and adding regeneration to the second step of tuned radio frequency amplification? (2)—The secondary of the TRFT in this second stage as well as the other stages, consists of forty-five turns, wound on a three inch diameter tubing using No. 22 double cotton covered wire. How many turns on a one and three-quarter inch diameter tubing using No. 30 en-

ameled single silk-covered wire, should be wound for the tickler? (3)—The filament of the RF tubes if connected, as per diagram now, are controlled by a ten-ohm rheostat. When I add the regeneration, will it necessitate the addition of a separate rheostat for each filament? If so, what ohmage rheostat should be used?—Alexander Wallace, Larchmont, N. Y.

(1)—Yes. (2)—Thirty-seven. (3)—Use a twenty ohm rheostat for each filament. * * *

I HAVE a three tube set, wherein a regenerative radio frequency amplifier, a crystal detector and two stages of transformer audio frequency amplification are used. (1)—At the present time, the three filaments are controlled by a single rheostat, having a resistance of fifteen ohms. I note that the RF tube filament requires frequent adjustment for best results. Would I get better results, if I inserted a twenty-five ohm rheostat, which I have, in the RF filament circuit, and used the fifteen ohm rheostat to control the audio filament only? The -01A tubes are used.—Ken Helers, Atlanta, Ga.

The results will be improved greatly with the insertion of the twenty-five ohm rheostat in the RF filament circuit. It is all right to use the fifteen ohm rheostat in the audio filament circuit. * * *

RECENTLY IN an issue of some popular monthly radio magazine, I saw a diagram of a three-tube reflex receiver, wherein the first and second tube were hooked up as audio and radio frequency amplifiers, while the detector was non-regenerative. Each of the filaments were controlled by a twenty ohm rheostat. A double circuit jack at the first and second AF-RF output, as well as a single circuit jack at the final output, were also included. Three to one ratio AFT were specified. Also a 400 ohm potentiometer in the grid return circuit of the first RF-AF tube was included. I built this set, using standard tuned RF transformers and variable condensers, and although the results are satisfactory, much body capacity is experienced. I tried grounding the rotary plates of the variable condensers, but that did not help. Body capacity was noted when the potentiometer knob was touched. I therefore removed this device, but still am bothered with this nuisance. As soon as I place my hands near the panel, the signal fades or increases in intensity, according to the setting of the dials. Hard-rubber dials are used. What could I do to get rid of this nuisance?—Charles Mitchell, Nyack, N. Y.

Be sure that the G and P posts of the sockets are not facing the panel, with the wires running from these posts parallel to the panel. See if the G connections on the coils are not close to the panel. Look at the grid leak, and see if that is close to the panel. It is suggested that you take both double circuit jacks out of the sets. Procure some metal shielding and place it on back of the panel, cutting out all portions, where the metal of the instruments mounted thereon, will touch. Then ground this shield. Keep the antenna

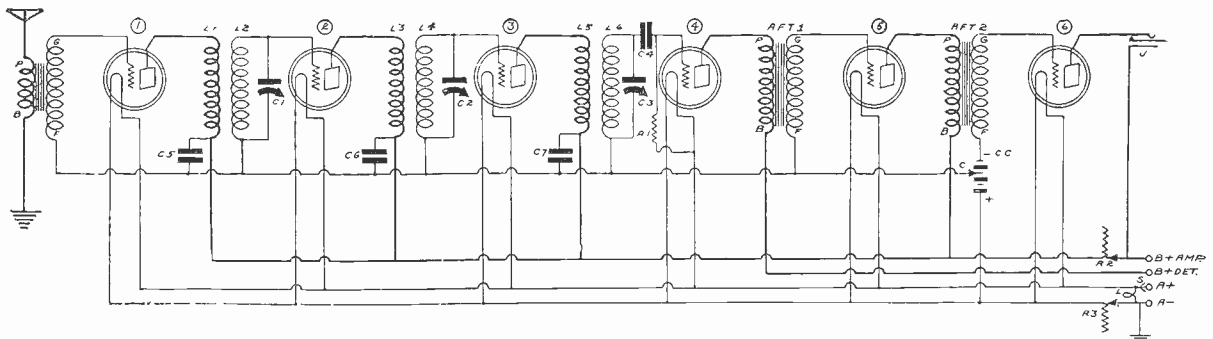


FIG. 530
The circuit diagram of the six-tube receiver requested by Maxwell Down.

wire away from the front of the panel, also.

CAN I successfully construct a five-tube neutrodyne receiver, using the standard two stages of tuned radio frequency amplification, a non-regenerative detector and two stages of transformer audio frequency amplification scheme, using however, a three gang condenser so that I may have single control? (2)—Could a single rheostat be used to control the filaments of all the radio frequency and detector tubes?—Barron Wyles, Cleveland, O.

(1 and 2)—This cannot be done, with any kind of real satisfaction, by the amateur constructor.

IN THE Nov. 13 issue of RADIO WORLD there appeared in the Radio University columns a panel layout scheme. I have a six-tube receiver which uses a stage of untuned radio frequency amplification, two stages of tuned radio frequency amplification and a non-regenerative detector, coupled by a tuned RF transformer, followed by three stages of double impedance audio frequency coupling. The filaments of the second stage of tuned RF amplification, and the detector are controlled by twenty-five ohm rheostats. A filament switch is inserted in the plus A post. A single circuit jack is connected in the last audio output. Could this panel layout be used?—Elmer Triest, Indianapolis, Ind.

Yes, this panel layout can be used. Place the coils, right in back of the condensers, at angles. The untuned RFT and the audio transformers may be placed either in back of these coils, which will necessitate the use of an extremely wide baseboard or underneath a subpanel.

I HAVE two twenty-three plate variable condensers; one, three to one ratio AFT; one, five to one ratio AFT; one, six to one ratio AFT; one Federal RFT (200 to 600 meters); three -01A tubes, and three sockets. I would like to build the three tube reflex diagrammatically shown on page 10 of the Feb. 26 issue of RADIO WORLD. (1)—How should L1 and L2 be made. (2)—What is the value of C2? (3)—Would one Bradleystat control the last two tubes? (4)—How much B battery voltage should be used?—Otto H. Branic, Washington, D. C.

(1)—L1, if you are not going to use the taps, consists of fifteen turns. If you are going to use the taps, it consists of twenty turns, tapped every second turn, five taps being in the antenna circuit and five in the ground. L2 consists of forty-five turns. Both the primary and secondary are wound on a tubing which is three inches in diameter, using No. 22 double cotton covered wire. C1 is a .0005 mfd. variable condenser. C3 is a .0005 mfd. variable condenser, also. (2)—C2 is a .001 mfd. fixed condenser. (3)—Yes, provided the model you have, will carry one-half amperes and has a maximum resistance of no less than ten ohms. (4)—B plus 2 is equal to forty-five volts. B plus 1 equals ninety volts. C minus equals four and one-half volts. Use the five to one ratio AFT in the reflex stage, the three to one in the first AF stage, and the six to one in the last stage.

IN THE Jan. 8 issue of RADIO WORLD, there appeared a circuit diagram of a "Choice Super-Heterodyne". Please let me know how many turns should be wound, to constitute L5 and L6?—F. L. Jennings, Philadelphia, Pa.

L5 should consist of ten turns. L6 should consist of forty-four turns. Be sure you use a .0005 mfd. variable condenser across the secondary winding. Use No. 22 double cotton covered wire.

I HAVE built the four-tube receiver described in the Jan. 15 issue of RADIO WORLD, Radio University columns, and am well satisfied. However, the volume

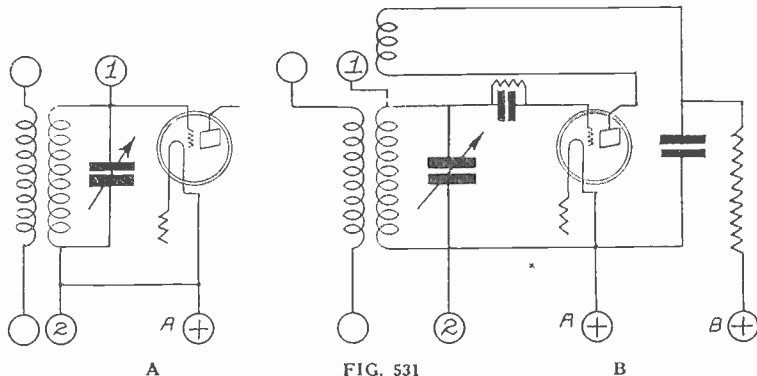


FIG. 531 The circuit diagrams illustrating how to connect up loops, requested by Harry Merle.

is not very great. This, I know is due to the poor transformers I am using in the audio stage I would therefore like to supplant these two stages with three stages of double impedance audio frequency coupling. Will this be all right? (2)—Can I use -01A tubes throughout in these stages, with automatic filament controls?—Henry Meyron, Cincinnati, O.

(1)—Yes. (2)—Yes.

I HAVE a four-tube Diamond of the Air receiver, using four volt-99 type tubes. Two stages of transformer coupled audio frequency amplification are employed. I would like to add a stage of resistance coupled audio frequency amplification. (1)—Is it O. K. to insert a .1 megohm resistor in the plate circuit of the present last tube; a .25 mfd. fixed condenser as a blocking condenser and a 1 megohm resistor in the grid circuit of the new tube? (2)—I intend using a 120 tube here. Is that O. K.? (3)—I am, at the present time, using a C battery for the other two -99 tubes. Should I use a separate C battery for this new tube? (4)—If so, using one hundred thirty five volts B, how much C should then be used?—Louis K. Barr, Houston, Tex.

(1)—Yes. (2)—Yes. (3)—Yes. (4)—Twenty two and one-half volts.

WILL YOU please answer the following queries in the Radio University columns? (1)—Where should the loop be connected to, in a tuned RF receiver? (2)—Also in a receiver using a three-circuit tuner, regenerative detector and three stages of resistance coupled resistance coupled audio amplification? (3)—I live about fifteen miles from the nearest broadcasting station and that station uses only two hundred watts. Would it be all right to use a primary winding which has fifteen turns? How long should the antenna be? (4)—Would I get the complete

band of stations, if I used radio frequency transformers, which had fifty-nine turn secondaries wound on the three inch diameter tubings, shunted by .00035 mfd. variable condensers? (5)—Should a thirty eight turn tickler, wound on a one and three quarter-inch diameter tubing using No. 26 single silk covered wire allow the tube to oscillate freely over the entire band, using the radio frequency transformer with the secondary winding stated above? A -01A tube is to be used with forty-five volts on the plate—Harry Merle, Albany, N. Y.

(1)—In Fig. 531, A, this is illustrated. Connect at 1 and 2. The transformer windings are, of course, disconnected from the variable condensers. (2)—Fig. 531, B, illustrates this point. Connect loop at points 1 and 2. The windings are, of course, also disconnected here. There is no fundamental difference between the connecting of the loop in both circuits, you will note. (3)—Yes. Use one that is approximately one hundred and twenty-five feet in total length. (4)—Yes. (5)—Yes.

THE CRYSTAL receiver described in the Radio University columns of the March 5 issue of RADIO WORLD, was constructed by me and I am very much satisfied with it. The volume with this set of course, is not very great. I have two, audio frequency transformers, with a three-to-one ratio. They test up O. K., with the battery and phones method. Could they therefore be used to hook on to this set? (2) Will the -01A type tubes give good results? (3)—Could I use two 1A Amperites for filament control? (4)—Could I use 90 volts? (5)—What size C battery should be used?—Fred C. Elrew, Lexington, Ky.

(1)—Yes. (2)—Yes. (3)—Yes. (4)—Yes. Four and one volts. (5)—Yes.

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Good Back Numbers of RADIO WORLD

The following illustrated articles have appeared in recent issues of RADIO WORLD: 1926:

- June 19—Selectivity's Amazing Coll. by J. E. Anderson. The Light 5-Tube Portable Set, by Herman Bernard.
- July 3—Set with a 1-Turn Primary, by Herman Bernard. Part 2 of the Victoreen Portable, by H. Bernard. Trouble Shooting Article for the Light 5-Tube Portable.
- July 10—A Rub In Single Control, by Herman Bernard. A DX Double Regenerator, by Capt. P. V. O'Rourke. A 2-Tube Dry Cell Receiver, by Samuel Schmalz.
- July 31—What's Best in an AF Amplifier, by Herman Bernard. A 8-Tube Reversed Feedback Set, by K. B. Humphrey.
- Aug. 14—The Improved Browning-Drake, by Herman Bernard (Part 1). Storage Batteries, by John A. White.
- Aug. 21—A New Stabilized Circuit, by E. H. Loftin and S. Y. White (Part 1). The Browning-Drake by Herman Bernard (Part 2).
- Aug. 28—The Constant Coupling, by E. H. Loftin and S. Y. White (Part 2). The Browning-Drake, by Herman Bernard (Part 3).
- Sept. 4—The Four Rectifier Types, by K. B. Humphrey. A Simple Battery Charger, by J. E. Anderson.
- Sept. 11—The Beacon (3-tubes), by James H. Carroll. The 1927 Model Victoreen, by Herman Bernard.
- Sept. 18—The 1927 Victoreen, by Arthur H. Lynch. Eliminator in a Cash Box, by Paul R. Fernald.
- Sept. 25—The Lynch Lamp Socket Amplifier, by Arthur H. Lynch. Wiring up the Victoreen, by Herman Bernard.
- Oct. 2—The Victoreen (Continued), by Herman Bernard. New Equamatic System, by Capt. P. V. O'Rourke.
- Oct. 9—A Practical "A" Eliminator, by Arthur H. Lynch. Building the Equamatic, by Capt. P. V. O'Rourke.
- Oct. 16—The Bernard, by Herman Bernard. How to Box an "A" Supply, by Herbert E. Hayden.
- Oct. 23—The 5-tube P. C. Samson, by Capt. P. V. O'Rourke. Getting DX on the Bernard, by Lewis Winner.
- Oct. 30—The Singletrol Receiver, by Herbert E. Hayden. How to Get Rid of Squalls, by Herman Bernard.
- Nov. 6—Reduction of Interference, by A. N. Goldsmith. Variations of Impedances, by J. E. Anderson.
- Nov. 13—The 4-tube Hi-Power Set, by Herbert E. Hayden. A Study of Eliminators, by Herman Bernard.
- Nov. 20—Vital Points About Tubes, by Capt. P. V. O'Rourke. The 4-tube Diamond of the air, by Herman Bernard.
- Nov. 27—The Antennalless Receiver, by Dr. Louis B. Blan (Part 1). Short Waves Yield Secrets, by M. L. Prescott.
- Dec. 4—The Regenerative 5-Tube Set, by Capt. P. V. O'Rourke. The 3-tube Lincoln Super, by Sidney Stack. The Antennalless Receiver, by Dr. Louis B. Blan (Part 2). Winner's DC Eliminator, by Lewis Winner.
- Dec. 11—The Universal Victoreen, by Ralph G. Hurd. Some Common Fallacies, by J. E. Anderson.
- Dec. 18—Selectivity on One Tube, by Edgar Spear. Eliminating Interference, by J. E. Anderson. The Victoreen Universal, by Ralph G. Hurd (Concluding Part).
- Dec. 25—A New Coupling Device, by J. E. Anderson. Functions of Eliminators, by Herman Bernard.
- Jan. 1, 1927—The 2 Tube DeLux Receiver, by Arthur H. Lynch. The Twin-Choke Amplifier, by Kenneth Harkness.
- Jan. 8—Tuning Out Powerful Locals, by J. E. Anderson. A Choice Superheterodyne, by Brunsten Brann. The 2-Tube De-Lux Receiver, by Arthur H. Lynch (Part 2).
- Jan. 15—The DeLux Receiver, by Arthur H. Lynch (Part 3). The Stipule Meter Test Circuit, by Herbert E. Hayden. The Superheterodyne Modulator Analyzed, by J. E. Anderson.
- Jan. 22—The Atlantic Radiophone feat, by Lewis Rand. An Insight Into Resistors, by J. E. Anderson. The Circuit for Great Power, by Sidney Stack.
- Jan. 29—The Harkness KH-27 Receiver (Part 1), by Kenneth Harkness. Use of Blasting Resistors, by J. E. Anderson.
- Feb. 5—5-Tube, 1 Dial Set, by Capt. P. V. O'Rourke. The Harkness KH-27 (Part 2), by Kenneth Harkness. What Produces Tone Quality, by J. E. Anderson.
- Feb. 12—Phone Talk Put On Speaker, by Herbert E. Hayden. All Batteries Eliminated, by Herman Bernard. The Harkness KH-27 Receiver, by Kenneth Harkness (Part 3) conclusion.

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THE RADIO TRADE

Patent Licenses Offered By R. C. A. to Competitors

New Policy, Inaugurated by Signing Grant to Zenith,
Heralded As Great Step to Stabilize Industry
At Its Weakest Point

The Radio Corporation of America recently entered into an agreement with the Zenith Radio Corporation of Chicago, one of the largest independent radio manufacturers, under which the Chicago concern is licensed to use patents held by the Radio Corporation and also by the Westinghouse Electric and Manufacturing Company and the General Electric Company.

By the agreement, which both sides referred to as the first real step toward stabilizing the radio manufacturing industry, the Chicago firm had to pay a large amount covering past manufacturing.

David Sarnoff, vice-president and general manager of the Radio Corporation of America, declared that similar agreements with other independents would be made, and that licenses would be issued in all probability.

Less Hostility Now

This statement indicates that the Radio Corporation of America is abandoning its policy of withholding licenses and fighting independents on patent grounds. Its more friendly attitude was first disclosed when it invited competitors to broadcast over the WJZ chain. Some accepted the offer, at a price, paid to the National Broadcasting Company.

It was said by members of the Zenith Corporation that there was no radio receiving set in the country which does not infringe upon at least one of the more than 100 patents of the Radio Corpora-

tion. The R. C. A. alone has invested \$12,500,000 in patents, which do not include the patents held by the Westinghouse Company and the General Electric Company.

Statistics recently compiled indicate that \$218,000,000 worth of radio receiving sets, at wholesale prices, were sold from late in 1922 to December 31, 1926. Sales for 1927 are estimated at \$96,000,000 by the McGraw-Hill Publishing Company. According to these figures the Radio Corporation of America's new licensing policy will involve huge amounts in royalties, for their contracts with the independents call for a 7½ per cent. royalty.

Those Who Signed

The agreement between the Zenith Radio Corporation and the Radio Corporation was signed by Mr. Sarnoff; Gerald Swope, president of the General Electric Company; Walter Teary, vice-president of the Westinghouse Company, and Commander T. F. McDonald, president of the Zenith Radio Corporation. Commander McDonald issued this statement:

"We have carefully studied the patent situation and on advice of our attorneys have decided that the basic patents of the radio industry are held by the Radio Corporation of America and its associated companies. Among its pioneer patents in radio are the inventions of Alexander-son, Armstrong, Langmuir, Hull, Rice, White, Chubb, Lowenstein, Mathes and many others.

Two Great Strides

"It is my belief that the recent appointment by President Coolidge of the Radio Commission, as provided by the radio law enacted by the last Congress, and the licensing by the Radio Corporation of America of an independent manufacturer, constitute the two most important developments in the radio industry which have occurred since the inception of radio broadcasting.

"Manufacturers licensed under the R. C. A. patents will now be able to expand their facilities with greater confidence in the security of their investments and the future of the industry, all of which will enable them to render greater service to the public. The radio has entered its first real state of stability."

WHEN BATTERIES ARE LOW

If your set squeals when the tubes are heated at rated voltage, and again when just under that voltage, look to your batteries. The A or B are run down, or both.



UX POWER TUBES installed in any set without rewiring by NA-ALD Adapters and Connectorials. For full information write Alden Manufacturing Co., Dept. S-20, Springfield, Mass.

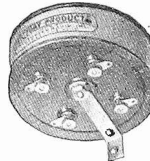
HOW TO BUILD THAT CIRCUIT

The following circuits have been explained and illustrated in back issues of Radio World:

- The National Power Amplifier, Dec. 25, Jan. 8, 15, 22, 1927. 4 copies 60c.
 - The Bernard, Oct. 16, 23, 1926. 2 copies 30c.
 - The Antennalless Receiver, Nov. 27, Dec. 4, 1926. 2 copies, 30c.
 - The Regenerative Equamatic, Dec. 4, 1926. 15c per copy.
 - The Equamatic, Oct. 2, 9, 16, 23, 1926. 4 copies, 60c.
 - The Lincoln Super-Heterodyne, Dec. 4, 1926. 15c per copy.
 - The 3-Tube Karas, Dec. 11 and 18, 1926. 2 copies, 30c.
 - The Lynch Amplifier, Jan. 1, 8, 15 and 22, 1926. 4 copies, 60c.
- Or send \$6.00 for yearly subscription and get as a premium any one set of circuit copies noted above. No other premium with this offer.

RADIO WORLD

145 WEST 45th STREET, N. Y. C.



**VICTOREEN
Super Coils**

Send for Folder

Geo. W. Walker Co.
6528 Carnegie Ave.
Dept. B Cleveland, O.

"Socket Power" Adopted As A Standard Term

Three standards affecting radio were adopted by the Radio Division of the National Electrical Manufacturers Association.

The first of these deals with the frequency band of broadcast receiving sets, and was adopted by this group of radio manufacturers as being desirable for manufactured types of sets. The statement deliberately excludes the construction of shortwave receivers, it being the opinion of the members that regeneration from such receivers worked against the best interests of the group of listeners as a whole. To-day all of the popular stations broadcast within the frequency band designated in this standard, short wave transmission being used only for amateur, experimental work and inter-stations linkage.

The standard reads: "The frequency range of standard broadcast receivers shall be the broadcast frequency band from 550 kilocycles (545.1 meters) to 1500 kilocycles (199.9 meters).

Manufacturers of radio receiving sets also favor this standard, because a greater frequency range in a broadcast type of receiving set complicates the selecting of stations, and decreases the ability of the set to receive with strength and clarity.

The second standard makes a new contribution to radio's vocabulary, coining the term "Socket-Power," which unit is described as "any device suitable for supplying A, B and C battery voltages to a radio receiving set from the house lighting supply circuit by the throw of a switch." The standard also states that the letters A, B and C may be prefixed to indicate the class of service supplied by the unit. It is recommended that the word "Socket-Power" be used to replace various negative terms now in use, such as B battery eliminator, etc. The term "Socket-Powered Receiver" is proposed as a fitting term to designate what is sometimes called a "Batteryless Receiver" an "Electrified Receiver," etc.

The third standard is for the purpose of improving radio service by service men, repair men and others, and advocates the use of a standard size service manual sheet 8½ inches x 11 inches, with three hole punching, the holes being 4 1/4 inches apart. Many service men carry instructions, diagrams and information from the various set and accessory manufacturers and where these are not of a uniform or standard size and easily kept in order, the service man is handicapped, and the device less likely to be correctly serviced, the committee found.

World "A" Power Unit--\$12.75

Automatically provides even, unvarying "A" current from your light socket. Absolutely noiseless. Assures full tone quality from your set and wider D. X. range. Famous WORLD quality—at less than half the cost of any similar equipment. Shipped complete, subject to inspection on receipt of price, or C.O.D. if you wish. 25¢ advance for sets of 4 tubes or less, \$12.75. 5% discount if cash in full is sent with order. Send order today. World Battery Co., 1219 So. Washab Ave., Dept. 82, Chicago, Ill.

BETTER RADIO RECEPTION

Tells you how to quickly locate on your dials any station your set will reach, eliminating squeals and howls of "hit or miss" and "remember" tuning. "Spring, 1927," Issue Now Ready gives complete station information cross-indexed three ways, and "Radio Doctor," *Postpaid 25c.*

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313 Central Bldg., Ft. Wayne, Ind.

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The only automatic self adjusting filament control, supplying at all times just the current your tubes require. Insures 100% tube performance. Safeguards against damage. Eliminates hand rheostats! Simplifies wiring. Insist on Amperite. Re-use substitutes claimed just as good. Price \$1.10 complete.

Radial Co., 50 Franklin St., New York City

Write Dept. RW7 for FREE Hook-Ups

AMPERITE
The "SELF-ADJUSTING" Rheostat

Literature Wanted

THE names of readers of RADIO WORLD who desire literature on parts and sets from radio manufacturers, 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

- David J. Caldwell, Box 124, Tyron, N. C.
- R. L. Case, 416 W. Flemming Ave., Ft. Wayne, Ind.
- Walter N. Mann, 747 Lexington Ave., Indianapolis, Ind.
- F. H. Bohn, Box 542, Klamath Falls, Ore.
- Stanley Grant, 3223 Glenwood Road, Brooklyn, N. Y.
- Chandler Smith, 1480 Larkin St., San Francisco, Calif.
- Sanes Anderson, 2424 East 22nd St., Minneapolis, Minn.
- D. H. Martin, Station D, Danville, Ill.
- H. S. Duford, 47 Salina St., Providence, R. I.
- J. A. Curley, care Pittsburgh Coal Co., Library, Pa.
- William Petersen, Cedar Bluffs, Neb.
- H. F. Holbrook, 305 West State, Charon, Pa.
- Brokers Service Co., 144 Pearl St., N. Y. City, N. Y.
- J. A. Brewer, 300 Liberty Central Trust Building, St. Louis, Mo.
- Winfield Winchester, Dale, N. Y.
- John G. Campbell, East 2420 Sanson Ave., Spokane, Wash.
- H. B. Brown, 3332 Abbey St., Oakland, Calif.

Tilson Variable Leak

Tilson & Tilson, 154 Nassau Street, New York City, have placed on the market a new and highly efficient variable grid leak, the Tilson Variable Grid Leak. This is a well-made instrument of clever design, durably built. It is of the plunger type, is variable from .25 to 20 megohms, and is constant in value over the entire range. There should be a good field for a precision leak of this type and this concern is desirous of getting in touch with jobbers and dealers in all parts of the country. Full information will be given to those interested upon application to the above concern and deliveries can be made immediately. Among other lines in stock, Tilson & Tilson have for immediate delivery, Kroblak, the wire wound resistances, in all stock sizes, also for the Thordarson R-210 and 171; H. F. L. "Nine-in-Line" kits and parts, the beautiful Celeron drilled and engraved panels for this circuit and the Duro loop that works most efficiently with it.—J. H. C.

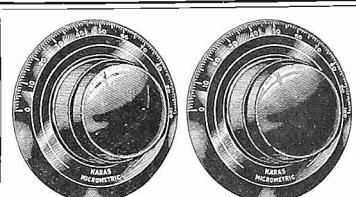
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Engineers and Manufacturers
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Six tubes - One Control FRESHMAN MASTERPIECE

AT AUTHORIZED FRESHMAN DEALERS ONLY

How to build RADIO WORLD'S Four-Tube Universal Receiver fully described by Herman Bernard in the March 12 and 19 issues of RADIO WORLD. Send 30 cents and get these two numbers, RADIO WORLD, 145 W. 45th St., N. Y. City.



2 Karas Micrometric Vernier Dials specified for the Universal

You must use Karas Micrometric Vernier Dials if you want to have your Radio World Universal 4-Tube Receiver give best results. (Read the story about this great receiver in this issue of Radio World.) Editor Bernard, in last week's issue, stated: "It is important to use Karas Dials in this receiver because any dial that permits hand contact with even the ordinarily grounded side of a coil will not do at all. The whole dial front must be insulated so that no metal can touch you."

Dials having exposed metal parts will introduce body capacity." Karas Micrometrics do not. Not only can "no metal touch you" when you tune your Universal 4-Tube with Karas Micrometric Vernier Dials, but you also will discover a marvelous precision of operation that gives a closeness of tuning of 1/1000th of an inch, due to the 63 to 1 vernier ratio of Karas Micrometrics. You can easily bring in stations that you never heard before. Micrometrics tune with a velvety, liquid-like smoothness that no other dial can even imitate. Micrometrics have large, handy knobs, are made throughout of Bakelite and have gold inlay markings. They operate with an entire absence of backlash, no matter how hard you turn. Your dealer can supply you with 2 Karas Micrometrics for your Universal, price \$3.50 each. If he is out of stock and you are in a hurry, you may order them direct from us by filling out and mailing the coupon. SEND NO MONEY. Just hand the postman the price of the dials upon delivery, plus a few cents postage. Remember, you must use Micrometrics in the Universal, so order them today, and build the smoothest tuning set you ever owned.

KARAS ELECTRIC CO.

1143 Association Building Chicago

Karas Electric Co.,
1143 Association Bldg., Chicago.

Send me 2 Karas Micrometric Vernier Dials, price \$3.50 each, for which I agree to pay the postman \$7 upon delivery, plus postage. It is understood that if I am not satisfied with them after 10 days' trial you will refund my money.

Name

Address

City

(If cash accompanies order we will prepay postage.)

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"Built Better"

AEROVOX Products are used by more than 200 manufacturers of Radio Receivers and "I" Eliminators.

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60-72 Washington St., Brooklyn, N.Y.

AT YOUR SERVICE

This department is conducted by Robert L. Eichberg, director of the extension Division of the Federated Radio Trade School, 4464 Cass Ave., Detroit, Mich. All questions regarding the construction, repair, selling, merchandising and advertising of radio apparatus should be sent direct to Mr. Eichberg at that address, where they will be promptly answered. The answers to questions of general interest will be printed here. All others will be answered by a personal letter from Mr. Eichberg. By a special arrangement RADIO WORLD is able to offer this service free to all readers.

By Robert L. Eichberg

It is astonishing to see the many persons who are interested in radio who have failed to study anything about it. The service men who go to radio schools often have anecdotes to relate that give one an insight into the capability of some of the radio enthusiasts. For example, there is one dealer who is laughing yet about an "expert" who bought a set from him.

This customer, whom we will call Mr. Unterdunk, came into the store to listen to the tone of a set, and was enchanted. He bought a set with all accessories. The dealer told him the price and told him he could have it installed for \$10 additional. That did not make a hit with Mr. Unterdunk at all. He asked if he couldn't buy a complete aerial outfit cheaper, and finally did purchase one at considerable less money. It was a good aerial outfit, too. It even contained stranded and varnished antenna wire. Mr. Unterdunk took his set and acces-

sories, not forgetting the antenna outfit, and drove home. The next day he was back at the dealer's store.

"Something is wrong with the set," cried Mr. Unterdunk. "It is so selective that I cannot tune it, and all the volume must have leaked out. It was nice and loud here in the store, but when I got it home oh, it was terrible."

The dealer thought for a moment. "How did you connect your lead-in to your antenna?" he said.

"Oh, I twisted them together tightly and taped the joint," was the reply.

"Er-r-r, did you remember to remove the insulation?"

And then a light struck Mr. Unterdunk. "Insulation!" he said, "What do you mean insulation. That wire wasn't insulated, was it?"

There was the man who wrote in saying that he had just designed a new circuit and then gave an elaborate description of it. He asked us to draw him a picture wiring diagram of this as he was not able to follow a schematic—a question like that from a man capable of designing a circuit!

Very frequently we get inquiries from men who ask us if a coil containing a certain number of turns of a given size of wire will cover the broadcast wavenlengths when used in conjunction with a .00035 mfd. or a .0005 mfd. variable condenser, but who fail to state the diameter of the coils.

I will close by giving a classic—the story of the man who wrote in carefully describing a set which he had built and then ending up:

"Now what I want to know is, will this set enable me to hear the United States Marine Band whenever I want to?"

I am sorry to say that the answer to him was: "Dear Sir: That will depend to a large extent on whether or not the United States Marine Band is broadcasting."

I AM coming to you as one of the readers of RADIO WORLD, regarding the five-tube Diamond of the Air.

I have always been able to get wonderful volume and tone on all locals, but when I go outside at all, the conditions must be exceptionally good. Now I have tried different tubes, added turns on both primaries and also took off turns, reversed the leads on the secondary of the tuner and the tickler, also placed a .001 fixed condenser from plate of detector tube and negative A. Tried same on positive A. Grounded the rotor plates of first variable condenser and varied the voltages.

I am using UX201-A's in the R. F. and first and second audio. A UX200-A is used as a detector and a UX112 in the last stage audio.

I have a storage A and 135 volts of B. My batteries are always in the best of condition as I am in the battery business. I also have tried different aerial lengths. I used a standard Diamond Kit to build this set.—Earl Smith.

The conditions you report sound suspiciously as though you have a poor ground connection, or else a high resistance joint in the wiring of your set.

Check over all the wiring and see that you have no joints in which the rosin or rosin core solder has been allowed to remain between the buss and in the part to which it is supposed to be attached. Also, you should be using a cold water pipe for a ground and should have the pipe scraped clean before the ground clamp is attached.

As a last resort, see that your lightning arrestor is not partially short circuited.

I WOULD appreciate very much if you would kindly advise me in regard to the following:

I am greatly interested in the construction of a receiver that would pick up stations in Spain, France, Germany and England, even if such receiver would not pick up stations in the United States, as I have other sets that get almost any place in the U. S., Mexico and Cuba.

I wish the constants of such a receiver for their regular broadcast band, (not short wave). If there is any charge for making diagrams and instructions, kindly notify me as to the amount in order to remit to you.

Would like to make my own coils, solenoid, if possible.—Alfonso Fabric Arce.

I would be deceiving you were I to tell you that any set could consistently bring in foreign stations. Sets that receive Europe every day are working on the higher waves. The nearest you can come to it is to build one of the standard circuits and get such of the stations as come within the broadcast range, of which they are many. The Experimenters Information Service of New York and Norden Hauck of Philadelphia, have such sets and can quote you prices on the necessary parts.

I AM using a five-tube neutrodyne receiver with the Naald Truphonic amplifier, using

All Popular Kits in Stock

POWERTONE WAVE TRAP
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BRUNO BOOK OF HOOKUPS... \$0.25

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RADION and HARD RUBBER
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Send for Price List

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NEW YORK HARD RUBBER TURNING CO.
212 Centre Street New York

WHAT CIRCUIT DO YOU WANT?

DUE TO THE GREAT DEMANDS FROM OUR READERS FOR VARIOUS BACK NUMBERS OF RADIO WORLD, OUR STOCK OF THESE HAS BEEN RUNNING LOW RECENTLY. OUR EDITORIAL STAFF IS AT PRESENT GATHERING DATA AS TO WHICH CIRCUITS THERE IS MOST DEMAND FOR AND THESE WILL BE RE-PUBLISHED IN COMING ISSUES OF RADIO WORLD. THERE ARE MANY RECENT EXPERIMENTERS WHO WOULD LIKE TO PROBE THE POSSIBILITIES OF THE OLDER CIRCUITS, BUT WHO CANNOT OBTAIN THE NECESSARY INFORMATION. LET US HEAR FROM OUR READERS AS TO WHICH CIRCUITS THEY WOULD LIKE TO SEE PUBLISHED AGAIN. IN WRITING US PLEASE MENTION ONLY THE CIRCUITS WHICH HAVE APPEARED IN RADIO WORLD.

TO INSURE YOUR GETTING ALL OF THIS INFORMATION, SEND IN YOUR SUBSCRIPTION NOW FOR ONE YEAR AT \$6.00. THIS WILL ENTITLE YOU AS A PREMIUM TO MEMBERSHIP IN THE RADIO UNIVERSITY THROUGH WHICH YOU WILL GET ALL YOUR RADIO QUESTIONS ANSWERED FREE DURING THE PERIOD COVERED BY SUBSCRIPTION. OR IF YOU PREFER ANOTHER RADIO PUBLICATION, AS A PREMIUM, TURN TO ANOTHER PAGE IN THIS ISSUE WHERE YOU CAN CONSULT OUR PREMIUM SUBSCRIPTION OFFER AND MAKE YOUR CHOICE OF THE OTHER PUBLICATION. IN SUBSCRIBING FOR ONE YEAR YOU ARE ENTITLED TO ANY SINGLE ONE OF THESE PREMIUMS. SUBSCRIPTION DEPARTMENT, RADIO WORLD, 145 W. 45TH ST., N. Y. C.

Radio Mailing Lists

27428—Radio Dealers, Retail, Per M..... \$7.00
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2857—Radio Jobbers, Per List..... 22.00
1847—Radio Jobbers rated \$5,000 and
up, Per List..... 15.00
1080—Radio Mfrs. Complete Sets, Per
List..... 10.00
and any other Radio List you want. Ask for detailed price lists all guaranteed 95% correct.

Trade Circular Co., Inc.

166 W. Adams Street Chicago

J. E. Anderson's

Vacuum Tube Voltmeter
Price Completely Assembled \$5.00

M. LERNER

145 West 45th Street, N. Y. City

a UX112 power tube in last stage and a CX300-A detector tube in the set. I use a 9 volt C battery with the amplifier and no C battery with the set. I am using Majestic B supply. About 100 feet of aerial are used. I have recently purchased the Walbert Penetrola but when this is added it causes regeneration or whistles. I have tried adjusting the screw of the variable condenser used in the Penetrola and also 2 XL neutralizing condensers used in set. I am using a R. C. A. 100 drum speaker. If rheostats are turned low, the set does not oscillate or regenerate, but volume is cut to almost nothing. Is there any way to remedy this?—W. D. Coon.

You have probably succeeded in putting your neutralizing condensers all out of balance. To neutralize the set, tune in a local station as loud as possible, then take out the first RF tube and block one of its filament prongs with paper or spaghetti. Put this tube back again in the first socket of the set and adjust the neutralizing condenser of that stage until the signal is faintest, leaving the tuning condensers intact. Then replace the tube with the paper removed. The signal should come in loudly.

This same procedure should be followed in each of the radio frequency sockets and your trouble should be eliminated.

* * *

FROM THE point of selectivity and truthful reproduction, which is the better set: multiple stages of radio frequency with improved audio amplification such as the KH Twinchoke, or the Super-Heterodyne, such as the Victoreen, using the same improved method of audio amplification?

(2)—For reasons of a more general nature, other than the initial cost of these receivers and their upkeep, which of the two is the better for best practical results?

(3)—Regarding speakers, which is recommended for best results, truthful reproduction, 3-foot cone types, other smaller cone types or those types employing units such as the Baldwin Concert, using a horn as a medium for sound?—E. E. Bowen.

(1)—As to selectivity, the Super-Heterodyne is to be preferred. For fidelity of reproduction, I prefer a tuned radio frequency set.

(2)—If you are intending to build a set for yourself, I believe that you will have less trouble constructing a tuned radio frequency set. A Super-Heterodyne will give greater selectivity. Either should be sufficiently loud for all practical purposes and either is sufficiently easy to tune, though the tuned radio frequency will probably be slightly simpler.

(3)—Baldwin concert unit with a 6-foot horn, made of some non-vibrating composition will give fine results, so will a better grade 3-foot cone speaker. A small Western Electric cone is also to be recommended highly. All I can advise you to do is to listen to each and then suit your own personal taste.

* * *

I AM taking this liberty in writing you as advertised by RADIO WORLD in regard to my five-tube Diamond of the Air. I have on hand a UX171 which is used in last stage of the audio and would like to know if there

is any other changes in the circuit outside of changing the Amperite.

Should there be a separate C battery in this stage? I have tried out a 22 1-2-volt C battery and it didn't seem to work right. I am using 135 volts on amplifier, 67 1-2 on radio frequency and 45 on detector. All 201-A tubes are good. I get a great deal of distortion. I am using a Western Electric Cone speaker.

(2)—Would you advise me to put the new low frequency transformers in the first stage of audio? I have a Thordarson transformer, 3-1 ratio in there now, but it doesn't seem to pass the low frequencies.—J. J. Burns.

(1)—For use with your 171 tube, you should have 27 volts of C battery with 135 volts of B battery.

(2)—If your Thordarson 3-1 transformers do not pass the low frequencies, you might try out one of the larger transformers, now being made by the same company.

* * *

I READ with interest your data in RADIO WORLD. I am interested in your article about burned out loud speakers. Do you use the winding of the AFT that has the most turns or the one with the less?

I desire to use a Western Electric Cone speaker with a five-tube Diamond of the Air with 135 volts B on the amplifier. Would this be a good combination?—H. L. Fuller.

In making the impedance output, you may use either the primary or the secondary of the transformer. The secondary is the one with the most turns on it and will probably give you better results. It is less likely to be burned out because its resistance is higher.

The combination you mention should work out fine, but you had best use the output impedance to couple the speaker to the set.

* * *

I WISH to take advantage of the kindness of RADIO WORLD to its readers by getting some information which I feel sure of from you.

I am thinking of building a receiver of the following type and wish to have your opinion concerning it, as to distance, volume, and selectivity, especially distance. The receiver contains:

A tuned antenna coupler (when an antenna is used) using a Bruno 99 antenna coupler. This is followed by two untuned radio frequency transformers. The detector

is tuned and regenerative, using a Bruno three circuit (type 99) tuner. The detector is followed by three stages of low-radio audio frequency transformers. In other words, one-stage of tuned radio frequency, two stages of untuned radio frequency, a tuned regenerative detector, followed by three stages of audio frequency amplification. A type -200A detector tube is to be used.—John F. Allison, Jr.

If you are able to control oscillation in this set, it should be very efficient. I would suggest that you connect the grid leads of the three radio frequency stages, or at least the two untuned ones, to the center tap on the potentiometer, the two outside terminals of which are connected across the "A" leads.

You had best put a jack after the second stage of your audio frequency amplification as three stages of transformer coupling are liable to cause an audio howl.

THINK THIS OVER

ONLY a man with a stiff neck or an incurable case of pessimism can fail to see something good and encouraging in the recent passing of radio legislation at Washington. Anybody can suggest something different, but let's be thankful that the lawmakers gave us the best their vision and understanding could devise.

H. F. L. Transformer Kits

FOR THE "NINE-IN-LINE"

Distributed by

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LANCH METALLIZED FIXED RESISTOR

THE 5-TUBE DIAMOND

Fully described by Herman Bernard in a booklet, with diagrams, including blueprint, and sent on receipt of 50 cents. The Diamond is automatically adaptable to phonograph pickup. RADIO WORLD, 145 West 45th St., N. Y. City.

THE UNIVERSAL Standards of Radio

In building a radio receiver remember that its performance depends primarily upon two things; an efficient circuit, and the use of good parts.

Wherever you find a popular circuit you will invariably find General Radio parts.

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Ask your dealer or write for Catalog RW-1926

General Radio Co., Cambridge, Mass

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PARTS and ACCESSORIES



Type 285 Audio Transformer Price \$5.50



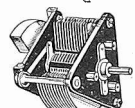
Type 368 Micro-Condenser Price \$1.25



Type 410 Rheostat Price \$1.25



Type 277-D Coupling Coil Price \$1.50



Type 247-F .0005MF. Condenser Price \$4.00



Type 349 UX-Tube Socket Price 50c.

The "WEB" Wave Trap Will Eliminate Your INTERFERENCE !!!

Positive Elimination of Interference. Increases Distance and Volume. Reduces Static.

Price \$2.00

At all good dealers or direct by mail on receipt of price under Money Back Guarantee.

Manufactured by **Walter E. Bathgate Co.**

Inc.

65 West Broadway, N. Y. Dealers and Jobbers Write



How to Calibrate Resistors for Meter

(Concluded from page 5)

in the limits of the calibration may be obtained. In most cases only a few points need be observed, because the curves are regular, but these points must be observed as accurately as possible, or the curve will not be regular. This calibration is useful in connection with coupling resistors in resistance coupled circuits.

To calibrate an improvised high resistance voltmeter (such as described) a high voltage battery and another voltmeter are required. The standard voltmeter and the improvised are connected across the battery at the same time and the two readings should be taken while they are so connected. The standard voltmeter gives the correct voltage and this is proportional to the reading on milliammeter of the improvised meter. The two meters are compared at various values of the battery used. For example, if the resistance in series with the milliammeter is 100,000 ohms the two meters should be compared directly on a voltage range between zero and 100 volts. If the resistor is 250,000 ohms the voltage range should be from zero to 250 volts and so on.

When the two meters have been compared at various voltages a curve should be plotted, voltage in one direction and current in the other. From this plot the voltage between any two points across which the improvised meter is connected can be obtained when the reading on the milliammeter is known. The curve which shows the relationship between the two

readings will be very nearly a straight line.

The Small Deviation

The small deviation which will be noticed, and which makes calibration necessary, is due to the change in the resistance as the current increases.

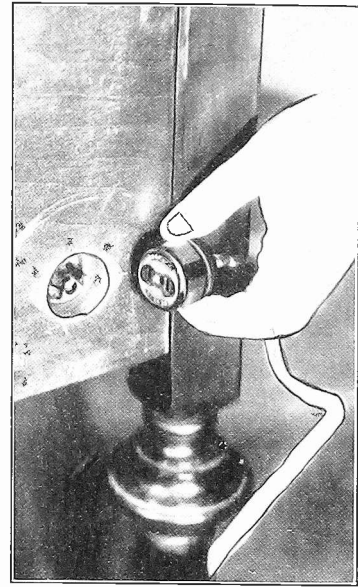
Objection has been raised against the use of an improvised voltmeter of this kind on the ground of inaccuracy. It is claimed that the resistance unit is not reliable. This objection is valid when the meter is not calibrated against a standard meter, because the fact that a resistor is rated at a certain value is no guaranty that it will have that value. The objection raised against this meter on the ground of temperature variation is met by the calibration. As was stated above, however, the meter should be used when the room temperature is approximately the same as it was at the time of the calibration. This condition imposes no difficulty on the operator, because if he can work in comfort in the laboratory the temperature will be right.

Songs Few Years Old Help Make Her Popular

Los Angeles.

Singing some songs of a few years back, such as "Second-Hand Rose" and the "Trail of the Lonesome Pine," a newcomer to KNX, Anita Primrose became popular in a hurry. She has had several return appearances since that time.

A GOOD PLUG PLAN



(Hayden)

IF YOU USE the house line to supply energy for your radio set a male plug may be conveniently mounted in the back of the table or console. The female plug is connected directly to the line. When making the plug connection your fingers cannot possibly touch the prongs.

Prevent the Reception of One or Two Stations

BY USING A

Powertone Wave Trap

(STATION SEPARATOR)

Price \$2.00

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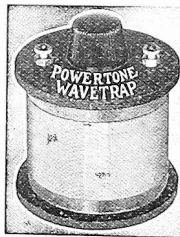
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New Hi-OHM Volume Control



An improved Volume Control built to Carter specifications. Carter parts are the choice of discriminating engineers in all the really popular circuits.

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Amazing new low-priced "Perfect" "B" Battery Eliminator. Power up to 90 volts. Works perfectly on any set. Direct or alternating current. Send only \$5.00. Postpaid. Money back if not delighted after 10 DAYS TRIAL. Order today. PERFECT ELIMINATOR CO., Dept. T-30 National Theatre Bldg., Cin'ti, O.



BLUEPRINTS

for

Radio World's 4-Tube Universal Receiver

Front Panel and Wiring of the Set **\$1.00**

Exactly as specified by Herman Bernard

RADIO WORLD

145 W. 45th St. N. Y. City

COMPLETE DATA on "How to Build a DC A and B Eliminator," were given in the Dec. 4 issue of RADIO WORLD, by Lewis Winner. Lucid photos and diagrams accompanied this excellent article. Either send 15c for this copy, or begin your subscription with this issue. RADIO WORLD, 145 West 45th St., N. Y. City, N. Y.

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How to Build THE DIAMOND

5-Tube Model

[Newsdealers or radio dealers order the booklets with blueprints included, in quantity, direct from American News Co. or branches.]

Herman Bernard, designer of this wonder circuit, has written an illustrated booklet on "How to Build RADIO WORLD'S Improved Diamond of the Air." Send 50c and get this booklet, including a full-sized wiring blueprint.

Outstanding Features of Set: (1) Fans, charmed by tone quality, sensitivity and selectivity, report speaker reception of far-distant stations with great volume. (2) A 2-tube earphone set, a 5-tube speaker set, and a separate 3-stage audio-amplifier for immediate use with any tuner, are combined in one. (3) No rheostats are used. (4) The set is in expensive to construct and maintain. (5) The set works from outdoor aerial or loop; hence no aerial problems present themselves, in city or country.

Send \$6 for year's subscription and get booklet, blueprint.

RADIO WORLD

145 West 45th St., New York City

FOR ONLY 15 CENTS get full directions how to build the Bernard. Radio World, 145 W. 45 St., N. Y. C.

Short Waves in Tropics Aid Pumping of Oil

One Plant Must Know What the Others Are Doing, So Transmitters Are Tested—Stations 45 Miles Apart

Pittsburgh. Radio has invaded the heart of the tropical jungle; its waves soon will be threading the leafy aisles of the Magdalena River valley in Colombia, to maintain communication between pumping stations along a 400-mile oil pipeline.

Two American engineers are engaged now in measuring the penetrating effect of a 500-watt radio-telephone transmitter at Puerto Mosquitos, 200 miles inland along the Magdalena. They are L. C. Hollands and H. V. Johnson, of Pittsburgh, engineers for the Westinghouse Electric and Manufacturing Company. The transmitter under test was built by Westinghouse. Nine pumping stations are situated at 45-mile intervals between the rich oil fields in the interior of Colombia and Barranquilla, a port on the Caribbean Sea.

Information Important

It is important that each station be kept informed of the pumping activities of its neighbors, because closing the valve at one station without informing the next pumper would be certain to result in a burst pipe with consequent expensive delay. The telephone line, however, stretched at random as it is through the dense equatorial foliage, is exposed to the fury of the jungle storms, and with uprooted

trees continually falling across the line, communication along the line has been much interrupted. The oil company's officials decided there was too much time and money lost through these interruptions. They, then called in radio engineers to see if a continuous system of inter-communication could be installed, which would eliminate the uncertainty of straggling telephone lines.

The engineers knew the job could be done, but on account of jungle static, they could not tell beforehand just how much power was needed to penetrate the heavy tangle of damp trees and vegetation which covers the Magdalena Valley. It was necessary to estimate the power requirement; then install the set, and experiment with it.

Waves Used

That is what Hollands and Johnson were doing on the night of January 23, when the three United States amateurs picked up their signals. And that is what they are still working on, with Hollands manipulating the transmitter while Johnson checks reception at the next station down the river with a shortwave receiver. The set is nominally 100 metre wavelength, but the amateurs checked it between 87 and 88 metres the night of

January 23. They were N. E. Brewer, of Abilene, Kansas; Walter E. Leppe, of Concord, North Carolina, and William E. Nester, of Pottstown, Pennsylvania.

The apparatus was shipped early in November, and the engineers sailed November 18. They reached Cartagena, which is about 150 miles south of Barranquilla, on November 29. They went by rail to Calamar, on the Magdalena, and proceeded up river to Puerto Mosquitos by motor launch. The boat trip required one week. A letter received by D. G. Little, of the Westinghouse radio engineering department, East Pittsburgh, confirmed their arrival, announcing they had started to set up the apparatus. The letter was sent on south to Bogota, the capital of Colombia, whence it was taken by air mail to Cartagena. It was posted in Puerto Mosquitos December 29, and reached Mr. Little with the letters from the amateurs.

Trial Installations

The power plant for the set is driven by a gasoline motor.

The trial installation at Puerto Mosquitos represents the half-way mark on the 400-mile pipeline. There are nine pumping stations between the oil fields and Barranquilla. If the half-kilowatt equipment will negotiate two of the 45-mile spans, only five radio transmitters will be installed; if the heavy jungle static proves too troublesome, a transmitter will be required at each pumping station.

When the engineers arrived in Puerto Mosquitos they set up their shortwave receiver and tuned in KDKA, their home station. This pleased the Andian employes so much that the shortwave reception soon became a nightly feature, and, the engineers wrote, the company contemplated purchasing receivers for the community houses as well as equipment for the stations.

Greatest Issue of the Year

RADIO WORLD'S

Fifth Anniversary Number

Dated April 2nd.

Editorial Features

"An AC Power Plant," by Lewis Winner. How to build a B eliminator, with one stage of double impedance audio, this tube heated of double impedance audio, the filament of this tube being heated by alternating current.

"Facts Every Radio Experimenter Should Know," by J. E. Anderson. You can derive a great deal more fun building sets and testing them when you are equipped with the information contained in this article.

"A Two-Stage Resistance Coupled Audio Amplifier—and Plenty of Volume," by Herman Bernard.

"A Fine Portable Set," by Jasper Henry.

Advertiser's Note

Radio World's Anniversary Number is advertised to hundreds of thousands in other publications, is given special newsstand display, and therefore has an extra circulation of many thousands.

Advertising rates remain the same: 1 page, \$300; 1/2 page, \$150; 1/4 page, \$75; inch, \$10.

Last advertising forms close March 23d, noon. For special position wire reservation collect.

Radio World, 145 West 45th Street, New York

Telephones: Bryart 0558-0559

Push-Pull Used By Ham In 'Wiz' Short-Waver

In a talk given at Columbia University, New York City, before a well-attended meeting of The Radio Club of America, C. R. Runyon, Jr., gave a detailed description of his short-wave radio station, located at 544 North Broadway, Yonkers, N. Y.

Seven transmitting tubes are employed, as follows: one 7.5 watt tube as a crystal controlled amplifier; two more of the same type in the first intermediate amplifier; still greater amplification through the medium of two 50-watt tubes in a second intermediate stage of push-pull amplification; and a final stage of amplification employing two 250-watt tubes in a push-pull amplifier circuit.

The output of this powerful amateur short-wave transmitter is radiated from an antenna system which is suspended from the top of a 112-foot mast which is erected in the rear of Mr. Runyon's home. A counterpoise is employed to increase the efficiency of this station.

It is interesting to note that push-pull amplification is used throughout this transmitter with the exception of the first stage—the crystal amplifier stage. Each stage of push-pull amplification is carefully neutralized to prevent parasitic oscillations and to effect maximum amplification.

A novel feature of this station is its flexibility as regards sharpness of the transmitted wave.

If the operator wishes to broaden out his signals, he can actually accomplish that effect through the medium of a chopper which allows direct current to pass through the primary winding of a

modulation transformer at an audio frequency rate (the rate that the chopper contacts are made and broken).

The secondary winding of this modulation transformer is connected in series with a radio-frequency choke coil and a bias battery, across the terminals of the crystal oscillator. The terminals of the crystal are also connected to the grid and filament terminals of the 7.5 watt crystal amplifier tube.

Every time that there is a direct-current chopper impulse sent through the primary winding of the modulation transformer, there is a voltage "kick" across the secondary winding of this transformer, this "kick" being transferred to the terminals of the crystal oscillator, and subsequently to the grid of the first amplifier tube. The effect of each of these "kicks" is to change the frequency, right at the source, hence the frequency of the transmitted signals. By this novel method of modulation, the frequency of the transmitted signals is changed through a band 500 to 1,000 cycles wide, at an audio-frequency rate.

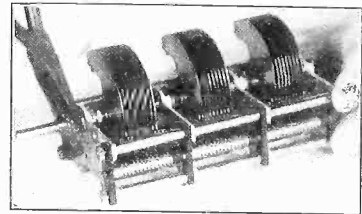
Keying is effected in the plate circuit of the first intermediate amplifier, and, due to the fact that keying is effected so far back of the transmitting system there is little difficulty from key clicks. The operator monitors his outgoing signals by means of a receiver which is tuned to some wavelength in the broadcast band, a harmonic of the receiver beating with the fundamental from the transmitter, to give an audible beat note which can be heard in the earphones and gives a good indication of just what is getting out.

SHINE, PLEASE!



(Hayden)
RUBBING a Bakelite panel with wood alcohol, until thoroughly dry, removes oil, fingermarks and other blemishes, and gives the panel a fine shine.

TIGHTEN UP!



(Hayden)
TIGHTEN the shaft carefully on a gang condenser, for if rotor plates of any section shift just a little the whole tuning arrangement is upset.

Brokenshire Signs As WPG Announcer

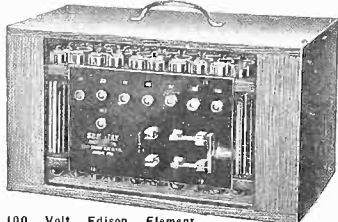
Norman Brokenshire, renowned in the radio realm, recently signed a year's contract to appear as an announcer at WPG, the Municipal Radio station, of Atlantic City, N. J.

"Uncle Norman," as this consummate artist-vocalist-announcer-composer is affectionately known endeared himself to varied audiences as one of the star announcers of WJZ. Regarded as a friend, entertainer and inspiration through his natural and cultivated gifts for alternate radio fun and seriousness, he enters upon his new role as master of ceremonies.

His services as guest announcer during the annual Atlantic City 1926 Beauty Pageant and his frequent microphone appearances with prominent concert companies at recent resort conventions, have to the audience of WPG justified the adage "To know him is to like him."

Mr. Brokenshire's popularity has enthusiastically increased since his WPG debut, bringing to millions of radio fans, the combined pleasure of their favorite station and announcer.

Dependable "B" Battery Power



100 Volt Edison Element, Non-Destructive, Rechargeable "B" Battery, with charger. Shipped dry with solution \$12.00. 140 Volt wit charger \$17.00. SEND NO MONEY. PAY EXPRESSMAN. Write for our Free illustrated 32-page Booklet.

SEE JAY BATTERY COMPANY
913 Brook Avenue New York City

ANY SET DESCRIBED IN RADIO WORLD

BUILT TO YOUR ORDER. WRITE
M. LERNER

1498 Remsen Ave. Brooklyn, N. Y.

THE NEW UNIVERSAL

How to build RADIO WORLD'S Four-Tube Universal Receiver fully described by Herman Bernard in the March 12 and 19 issues of RADIO WORLD. Send 30 cents and get these two numbers.

RADIO WORLD.

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

SPECIAL PREMIUM SUBSCRIPTION OFFER

For NEW RADIO WORLD Subscribers Ordering NOW

Radio World has made arrangements

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

- RADIO NEWS or
- POPULAR RADIO or
- SCIENCE AND INVENTION or
- BOYS' LIFE or
- RADIO DEALER or
- RADIO (San Francisco) or
- RADIO AGE.

This is the way to get two publications

- for the price of one:
- Send \$6.00 today for RADIO WORLD
- for one year (regular price
- for 52 numbers)
- and select any one of the other nine publications for twelve months.
- Add \$1.00 a year extra for Canadian or Foreign Postage.
- Present RADIO WORLD subscribers can take advantage of this offer by
- extending subscriptions one year
- if they send renewals NOW!

RADIO WORLD'S SPECIAL TWO-FOR-PRICE-OF-ONE SUBSCRIPTION BLANK

RADIO WORLD, 145 West 45th Street, New York City.

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

April 21, 1927

Name
Street Address
City and State.....

What a World We Live In! Hoover Speech Canned Far Away

While Secretary Hoover was delivering a speech at New Haven, Connecticut, which was broadcast, a radio listener in Cape Town, South Africa, more than 8,000 miles distant, was making a phonograph record of it.

Secretary Hoover's address, broadcast by several stations, including WGY, was picked up by the Cape Town listener, a chemist named Oxenham, on the 32.9 meter wave of 2XAF an experimental station of the General Electric Company. A message from Oxenham through his

private station was picked up by W. E. Jackson, a Schenectady amateur operating station 2AHM. The message read, in part: "Speech by Hoover heard perfectly during your transmission. Message was taken on phonograph from my loud speaker."

The message also said that the Cape Town agent of the phonograph company was mailing one or two records to station WGY "so you can hear your own transmission."

What next?

Alden Has Two New Power Tube Adapters

The Alden Manufacturing Company, 52 Willow St., Springfield, Mass., are now placing two special socket devices on the market. One is for the insertion of a power tube in storage battery sets, without rewiring the set. The other is also for the insertion of a power tube in storage battery sets, without rewiring, but with a special output transformer to prevent the speaker windings from becoming demagnetized or burned out, due to the high plate voltages. Both models can be used with the V or X sockets. One is known as the No. 171 power tube Connectorald, and consists of a plug, which fits into the last socket in the set; a socket which will hold the power tube, and connecting cable for the extra B and C batteries. The other device is known as the No. 172 Protectorald, and also has a plug which fits into the last socket; with a socket for the power tube, as well as an output transformer which prevents speaker burn-outs. The socket and output unit are mounted on a polished mahogany base-board.

Naylor Sterling Five

Due to lack of space, the name of the set shown in the photograph on the bottom of pages 16-17 in RADIO WORLD, March 19 issue, was omitted. This set is the Naylor Sterling Five, the latest development of Lieut. Sterling G. Sears, well-known for his list of radio achievements. The picture also shows a Polymet Claroplug and a Poly plug connecting the Jaynox Tone Bridge to the Acme K3 Cone Speaker. The plugs are products of the Polymet Mfg. Co.

KROBLAK

WIRE WOUND RESISTANCES

Endorsed by
RAYTHEON
Silver-Marshall
THORDARSON
STERLING CO.
Bremer-Tully
MAYOLIAN
AMERICAN
ELECTRIC CO.
WEBSTER
DONGAN

STOCK SIZES	
10 Watt Capacity	
500 Ohms List \$1.00	
750 " " " "	
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M-210 Kit for Thordarson R-210, \$4.50
M-171 Kit for Thordarson R-171, \$2.00
For 20 Watt Type Add 50c to Above Prices
Write for Ohmage List
Exclusive Sales Distributors
TILSON & TILSON
154 Nassau Street, N. Y. C. Beekman 1975

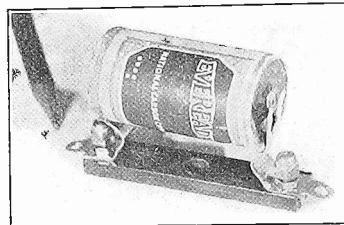
47 Stations Approved As 500 Cast Ballots

A questionnaire is being circulated among listeners by the United States Radio Society, Paul A. Greene, managing director, Temple Bar Bldg., Cincinnati, O. Questionnaires may be obtained from him.

Among the stations accorded prominent ranking with regard to public service in the first 500 questionnaires to be compiled are:

WJZ, WEAJ, KDKA, WGN, WEBH, WPG, WWJ, WBAL, WSB, WSM, KOA, KGO, KFI, KPO, WTAM, WAU, WSAI, WLW, WHT, WJR, WCX, WOC, WOW, WJAX, WMBF, WCCO, WLJB, WJJD, KMOX, WDAF, WQJ, WMC, KYW, WCBP, WLAC, WHO, WLS, WGR, WNAC, KGW, WFAB, WHAS, WBZ, WBBM, WCAE, WTIC, WBAP, and others.

One listener suggests that if elimination is necessary, then eliminate all stations that recently pirated Canadian wavelengths; all other pirates; all stations which came on the air after Government control broke down; a number of stations in Chicago and New York, with those of other cities.



A GRID leak mounting may be successfully employed to mount a 1½-volt battery for use as a C bias on the new high mu tubes.

RF Amplifier Tube Developed by CeCo

The C. E. Manufacturing Co., of Providence, R. I., have just added another amplifier to their well-known line of CeCo tubes. The new tube is known as the type K and is primarily intended as a radio frequency amplifier. It will serve well also as a detector and as a first stage audio frequency amplifier.

The tubes tested in RADIO WORLD's laboratory were found to be uniform in their characteristics and suitable for the purposes for which they are recommended. Tested at a plate voltage of 82.5 volts, filament voltage of 5 volts and grid voltage of zero, the amplification constant was found to be 13, the plate resistance 12,140 ohms and the mutual conductance 1,070 micromhos.

As a radio frequency amplifier the new tube showed up very well, being considerably more effective than other tubes of similar filament requirements. As a detector the tube worked satisfactorily and it also gave a good account of itself in a resistance coupled audio frequency circuit.

Make any Good Receiver BETTER

CeCo TUBES

C. E. MFG. CO.
Providence
R. I.



FREE!! Radio Catalog Will Save You Money

OUR NEW FREE



Before you build or buy a radio be sure to consult our new 100 page catalog — sent to you free. All the latest kits, accessories, and parts—a million dollar radio stock to choose from.

Save Money

We handle only brand new apparatus — standard makes that are fully guaranteed.

QUANTITY sale of QUALITY parts explains our new low prices. Compare with others and see why thousands of fans look to us as radio headquarters.

Write for your copy of this new catalog today.

Chicago Salvage Stock Store
Dept. RW, 509 S. State St., Chicago, U. S. A.

GET DISTANCE

AMAZING INVENTION FOR ANY RADIO

Why confine your radio programs to a few local stations when the exquisite concerts, dance music and lectures of hundreds of big cities are ready for you? Connect this DISTANCE GETTER to your radio, tune according to instructions and presto—instantly the distant programs roll in!

Satisfaction Guaranteed

Your money instantly refunded if you are not satisfied. The article on proper tuning, furnished FREE with each Distinet Getter, alone is worth the price. Galloway of Chicago writes: "Results beyond all expectations. Cuts thru locals like a knife."

MAIL COUPON TODAY!

HAZLETON LABORATORIES
4554 Malden St., Dept. RW, Chicago, Ill.

Send me Distinet Getter, postpaid. Enclosed find \$1.00 (M. O. stamps or check).
Send C. O. D. plus small postage added.

Name _____
Address _____
City _____ State _____

COMPLETED DETAILS on what ohmage resistances may be used with B eliminators to also obtain C bias, was given by Frank Logan in the March 12 issue of RADIO WORLD. Either send 15c for this issue or begin your subscription with this issue. RADIO WORLD, 145 West 45th St., N. Y. City.

WATCH EXPIRATION OF YOUR SUBSCRIPTION!

Subscribers will note that the end of their subscriptions is indicated on the labels on wrappers. If your wrapper shows a date earlier than the current issue, please send payment for renewal. Changes in expiration dates on wrappers appear two weeks in advance. RADIO WORLD, 145 West 45th St., New York City. (Phones: Bryant 0558-0559.)

A Wholesome Reversal

THE newspaper publishers the country over having resolved that it is inimical to the best interest of newspapers to publish programs that disclosed names of manufacturers and their products, constituting in general the best features that are on the air, several of the New York newspapers have displayed the courage to override this resolution by doing the very thing that they voted against.

At the publishers' convention a few months ago there was much ado concerning the solicitation by stations of sponsored programs with the argument that not only did the clients obtain the time on the air and build up good will that way, but also got their names printed in the newspapers' program departments. The capitalization of the newspaper publicity by a few such solicitors led the publishers to adopt the resolution calling for the censorship of programs to the extent of omitting all mention of the name of the advertiser or his product, but not to the extent of excluding the names of noted performers who might be on the program.

As was to be expected, the newspapers soon were deluged with letters of protest. It was hard for readers to understand why they should be denied a service which they keenly desired. To them the Eveready Hour was the Eveready

hour and the Balkite Hour was the Balkite hour and they scarcely found much that was informative when the facts that they were seeking were withheld under the general term "music." In fact, as the readers looked over these programs they came upon an irritating succession of non-informative details like dance orchestra, symphony orchestra, songs, talk.

Pretty soon some of the newspapers must have realized that the thing they have to sell is the product that they print and that they had better publish therein the good things that their readers want to read. While it is true that the sponsored program has met with opposition from many sources since the very beginning, it is also true that it has been the salvation of radio and has presented the only solution so far to the economical problem of who is to pay for broadcasting. Generally speaking, the sponsored programs are the best ones that are on the air and without them there is no chance of hearing John McCormack, Lucretia Bori, Beniamino Gigli, Emilio De Gorgoza and hosts of others whose gifted voices thrill millions of radio listeners. If some of the critics know of an easier yet practical way of obtaining such talent it would be well for them to advise the waiting world of the particulars.

The opposition has been lived down in every case because the kickers had only a complaint and no remedy. None of the gloomy predictions came true, except to the minor extent that a relatively small number of stations permits direct advertising. Secretary Hoover, prior to the judicial decisions that he had no power

over radio, had enjoined the stations not to resort to this method, and no doubt the newly appointed Radio Commission will deal with this problem in due time.

Meanwhile sponsored programs are growing in worth and strength; it is well that newspapers throughout the country should acknowledge this and make their programs mean something, rather than devote valuable space to such uninformative matter as censored programs. Radio listeners throughout the United States know the artists who appear on sponsored programs with an intimacy that must not be trifled with, even though a few indiscreet solicitors try to drum up business for a station in violating a rule that all substantial stations obey and that is, not to use as a wedge the fact that newspapers publish in the programs the name of a manufacturer and his product.

It is true that the newspapers had a grievance, since in theory the advertising done through the sponsored program was competitive with newspaper advertising and it hurt them to think that their own publications were used against themselves. On the other hand, there is a larger aspect of the question and that concerns the public's desire. Also, it is true that manufacturers who sponsor programs are being educated to the policy of advertising these programs on the radio pages, and even advertising their products, besides. The line of 6-point type in the regular program columns of the newspaper is gratefully accepted, but still regarded as inadequate publicity.

The first newspaper in New York City to break away from the resolution of the publishers was the "Evening Telegram," and at the same time it greatly enlarged its program service, devoting many more columns a week to this department. The "Sun" followed suit in omitting censorship, and so did the "Times" and the "Evening World."

No doubt spurred on by the examples of such influential newspapers, other newspapers throughout the United States will see fit to obey the rule of reason.

The new program insertions have met with great favor with the fans.

RADIO WORLD'S QUICK-ACTION CLASSIFIED ADS

10 CENTS A WORD
10 WORDS MINIMUM
CASH WITH ORDER

HOME SET BUILDERS: Join the Radio Builders Service Bureau, and save from 25 to 30% on the list price of all Radio parts and accessories. One dollar per year entitles you to special privileges. Write for details. Radio Builders Service Bureau, 6543 Woodlawn Avenue, Chicago, Ill.

"RADIOGEN" AKALINE STORAGE B.1.95 "Ion" Trickle Charger, 1.95. Acien B. Eliminators, \$7.85 and \$9.85 each. Agents wanted. Electro-Chemical Co., Indianapolis, Ind.

COMPLETE LIST OF BROADCASTING STATIONS appeared in RADIO WORLD dated March 5. 15c per copy, or start sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

TILSON

Variable
Grid-Leak
Helps Your Detector Tube Get Far-away
Stations

Attached in a second
75 cents at your dealer or direct
Jobbers and Dealers write for Discouints
TILSON & TILSON, 154 Nassau Street
New York, N. Y. Phone Beekman 1575

BLUE PRINTS

For the Fenway Receiver

How to Build the Famous Fenway Receiver.

2 Complete sets of Blue Prints
for the Four and Nine Tube
Models **\$3.00**
RADIO WORLD, 145 West 45th St., N. Y. City.

Battery Charger \$2.00

Charges any type radio A or B battery. Uses ordinary house current. Cannot injure battery. Does work of \$8.00 to \$18.00 chargers. No extras to buy. Anyone can operate. Directions enclosed. Send only \$2.00 plus 10c for postage. **MONEY BACK** if not delighted after 10 DAYS TRIAL. Rush order today. R. B. SPECIALTY CO., Dept. H-24 318 E. 3rd St., Cincinnati, O.



By ARTHUR H. LYNCH

A Series of Five Important Articles on HOW TO USE THE DE LUXE SYSTEM

This series tells how to build the 2-tube De Luxe Receiver (without audio) and how to adopt this or any other set so as to obtain the necessary power from the AC electric lamp socket.

Mr. Lynch is one of America's leading radio authors and designers. He has done the best job of his life in this comprehensively illustrated series, a digest of which follows:

Dec. 25 Issue—Theoretical and historical discussion of the De Luxe Receiver and the audio channel and B eliminator. **Jan. 1**—The 2-tube set fully described and illustrated, including wiring and choice of tubes. **Jan. 8**—The National Lynch Power Amplifier and B Supply (3-stage AF and B and C eliminator, adaptable to any receiver). Many illustrations include picture diagram of wired connections to photographed parts. **Jan. 15 and 22**—De Luxe reception from lamp socket with latest devices, including trickle chargers and A battery, relay, trickle charger and Abox filter, with picture diagrams of wiring, from antenna to the Acme speaker.

Send 15c for any one copy, or 60c for all five.
Send \$6 for one year's subscription (52 numbers) and get the five copies FREE!

RADIO WORLD 145 WEST 45th ST. NEW YORK



Court Commercial Photo, Hempstead, L. I.
ARTHUR H. LYNCH, auto speed demon and radio enterpriser extraordinary, about to take a 60-mile-an-hour jog in his car.

BST 5

Tested, Approved and Received Certificate of Merit from Radio News and Radio World

\$40.00

Gets 115 Stations With B. S. T.-5

Have been using one of your B. S. T.-5 sets about three months and I certainly am pleased with the results. I am using a 90 ft. aerial, B eliminator, storage battery and a cone speaker and have logged 115 stations from WOK, 217.3, to KSD, 545.1, all on loud speaker loud enough to be heard all over my house with a clear tone. My neighbors say they have heard it several times in their house with all windows closed and enjoyed it.

W. R. WESTCOTT, 128 Biddle St., Kane, Pa.

B. S. T. Has the "Punch"

I am more than pleased with your B. S. T., for it sure has the punch to go get the stations. At present it is going "strong"—taking care of two speakers. A Western Electric in my home and one in my mother's home next door and both have real volume.

JOHN H. BARTON,

277 Delaware St., New Brunswick, N. J.

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

THOMAS HARTLE,

155 Perry St., Paterson, N. J.

DIRECT FROM FACTORY TO YOU SAVES HALF AND IS GUARANTEED

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

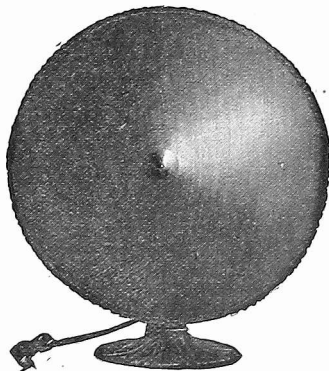


IMMEDIATE DELIVERY

New model cabinet Du Pont Duco finish; base 21" long by 8" wide, height 9 1/2", top 21" by 6". Five-ply walnut veneer

B. S. T. CONE SPEAKER

Guaranteed to give Satisfaction in Tone, Volume and Appearance Adjustable to Volume Desired



18 inches in diameter edged in Gold Braid, Art Metal Base can be placed on highly polished surface without danger of scratching.

Immediate Delivery

\$7.50

Shipped Direct from Factory

Satisfaction Guaranteed or Money Back

GUARANTY RADIO GOODS CO. 145 West 45th St., New York

WHICH Shall It Be?



Panel or Baseboard Mounting?

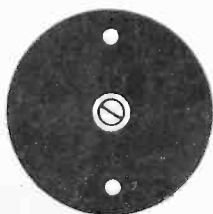
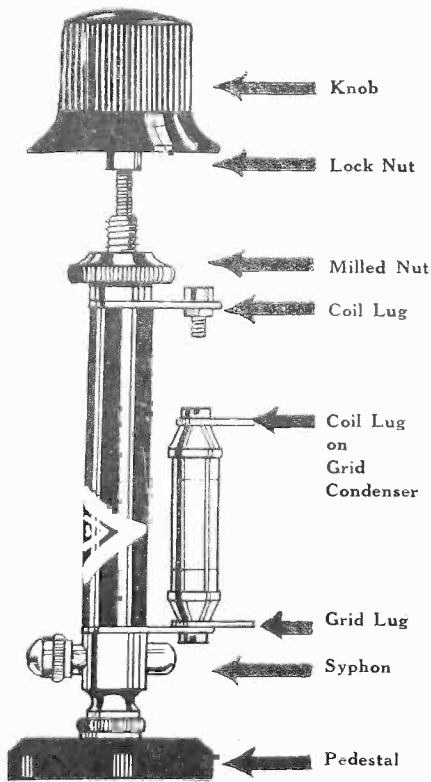
Best sensitivity is obtained from a detector tube when a variable grid leak is used, because the leak may be adjusted to give the correct biasing effect and afford adjustment of leakage from grid.

If the leak is to be used in a regenerative receiver it may be mounted on the baseboard, adjusted once, for greatest volume on a distant station, and left thus. In non-regenerative receivers, for utmost distance reception, mount the leak on the front panel, so it may be conveniently adjusted from time to time.

The new De Luxe Model Bretwood Variable Grid Leak may be mounted on baseboard, by passing two screws through the pedestal. Proper screws are supplied with each leak. The Bretwood may be panel-mounted by drilling a 1/4-inch hole, removing the knob and milled nut, passing the shaft through the back to the front panel, tightening the milled nut against the panel and then the knob against the hex. lock nut.

Note: Proper connections are: Coil lugs joined by soldered wire and connected to outside end of secondary, grid lug to grid post of detector tube.

The De Luxe Model Bretwood Variable Grid Leak is specified by Herman Bernard for Radio World's four-tube Universal receiver.



Bottom View of Pedestal

North American Bretwood Co., 145 West 45th St., N. Y. City.

Gentlemen: Enclosed find \$1.75. Send me at once one De Luxe Model Bretwood Variable Grid Leak on 5-day money-back guarantee. (Or \$2.25 for leak with grid condenser attached.)

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