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**AERIALS FOR USE ON TRIPS**



OP inside the cover of the set makes a good aerial. Turn the set to get directional effects. See articles on Page 3 and following pages about aerials for use on trips.

**The Newest Up-to-the-Minute Radio Set—It has Never Been on a Dealer's Shelf—Most Selective. A Wonderful DX Getter. Sold on a Guarantee of Satisfaction or Money Back.**

**Volume Control—Perfect Calibration—Rang 180-550**

# BST-6

**B-for Beauty  
S-for Selectivity  
T-for Tone purity  
6-its 6 tubes for distance**



**The BST-6. 2 Feet 4 Inches Long. 9 Inches Inside Depth. 8¾ Inches High.**

**T**HIS marvelous six-tube tuned radio frequency receiver is Self-Equalized and built of low-loss materials throughout. Its clear, rich tone of astonishing volume is a revelation. The circuit consists of two stages of tuned radio frequency, tube detector and three stages of balanced audio amplification. Air cooled rheostats and universal sockets are used.

Modified straight line frequency variable condensers are employed, insuring separation of the low wave length stations. **PERFECT CALIBRATION—STATIONS ONCE TUNED IN CAN ALWAYS BE LOGGED AT THE SAME DIAL POINT.**

The BST-6 works best with a 75 to 100 foot aerial, 6 volt "A" storage battery, two 45 volt "B" batteries, 4½ volt "C" battery, six 201-A tubes and any good loudspeaker.

### Specifications

- Bakelite Panel, Walnut Finish—
- With Etch-O-Gravure and Gold Decorations—
- Bakelite Sub-Base—
- Kurz-Kasch Bakelite-Walnut Pointers; Gold-filled, to Match—
- Kurz-Kasch Bakelite Gold-filled Rheostat Knobs—
- Lubree Straight Line Frequency Condensers—
- Special Coils; Double Silk Solenoids—
- Shore Audio Transformers—
- Caswell-Runyan Two-tone Walnut-Finished Cabinet.

### LOG OF BST-6

**Taken on a Fifteen-Foot Aerial in One-Half Hour by Al. Kraus, 996 Aldus Street, New York City.**

WSBC .....	10	WGY .....	50
WBBR .....	16	WMAK .....	51
WEBH .....	49	WMSG .....	11
WHT .....	55	WOC .....	85
WCCO .....	61	WFAA .....	78
WSB .....	66		

### SELECTIVITY

I live within four blocks of WLWL, and since the opening of this station have had great difficulty in choking them off my old set. Even after employing a wave trap I could still hear WLWL around the entire dial and was told by several friends that living so near this powerful station it would be impossible to entirely cut them out with anything less than a super-het. It was a very agreeable surprise, therefore, when I installed my new BST-6, to find that while WLWL came in on 25 I could tune in WRNY on 21 and entirely cut out WLWL. **This is certainly real selectivity.**—F. S. Clark, 350 West 55th Street, New York City.

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*Satisfaction or Money Back*

Each receiver is tested and retested, boxed and inspected before leaving factory, and guaranteed to reach you direct in perfect condition. Workmanship throughout guaranteed the best. Assembled by experts.

### Immediate Delivery

**Direct from factory to you  
No dealers' or middlemen's profits**

**\$40.00**

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**RADIO WORLD Guarantees the Responsibility of This Advertiser**

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# Aerials in Ground or Water



A TREE may be used as an aerial mast, and the usual insulation and other precautions taken for an L-type antenna.

By Lewis Winner

Associate, Institute of Radio Engineers

ALTHOUGH communication by the use of underground antennas has found its only extensive use in connection with the submarine, tests have found it to be of a wonderful value to the camper, hiker, motorboatist or canoeist. Such scientists as Kiebitz have found that signals can be effectively received on an antenna underneath the ground or water whether the wire be short or long. More satisfaction is obtained from a ground antenna when the soil is wet. Better yet is an antenna placed in clear or even salt water. The wire, as will be noted in the photographs, should be of the heavily insulated type. The waves penetrate the ground to a certain extent, this depending upon the wavelength and character of the ground. This applies also to the underwater antenna.

The directional qualities of the subsurface antenna are equal to the best loop obtainable, the strongest waves being received when the wire is extended in the direction of the station. Therefore, by simply shifting the position of the canoe you may often tune out an undesired station. It also serves as a protective device during electrical storms.

The noises received on the overhead type, during a storm, prevent good reception. Also the underground or underwater antenna has a greater ratio of signal strength to strays than has the overhead antenna.

The length of the wire used in the underground system is dependent upon the wavelength of the signals from the transmitting station. For short waves a short wire will be necessary. With a given size of wire, the thicker the insulation, the longer the most effective wave-

length. With a given thickness of insulation, the larger the wire, the shorter the most effective wavelength. If one desires to bury a wire in the ground or water for a long time, then the wire should be insulated with at least  $\frac{3}{8}$  or  $\frac{1}{4}$ " of soft live rubber. Although such construction is expensive, the results obtained are worth the trouble. Lead-in wire may be used for such an aerial.

A wire about 75 feet long, used in connection with a standard receiver, will give reception of from 170 to 550 meters. No. 14 hard drawn or stranded copper wire, with a good coat of rubber insulation should be used. If using the earth, then bury the wire about 15". The deeper, the better, to a certain extent. In most cases, 24" should be the maximum depth. This earth should be fairly wet, which will result in louder, more stable signals.

When using an underwater antenna, the strength of the signals fall off rapidly as the wire is placed deeper into the water. In fresh water, however, the wire may be placed as far down as 50 feet with very little decrease in the strength of the signals.

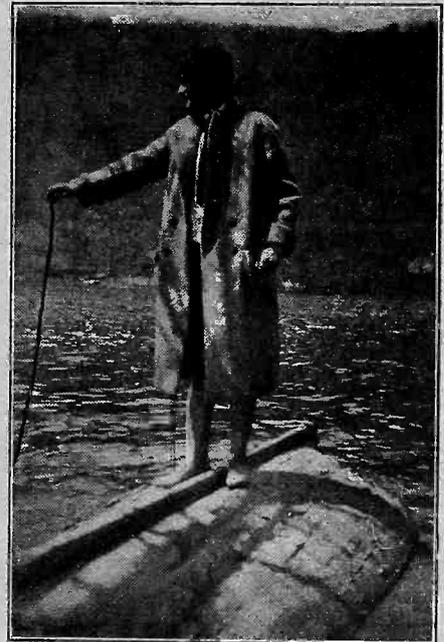
When using the ground or the water antenna, the receiver must have at least a stage of radio frequency amplification or a sensitive detector, as in most portable receivers.

Besides the ground and the underwater wire as antennas, the tree may be employed as such. This was demonstrated about a year ago by General George Squire. A nail may be driven into the uppermost trunk of the tree, or as high as it is possible to do so and the wire attached thereto. According to leading authorities on this system, the actual receiving of the waves is mostly effected by the wire coming from the tree to the receiver, e. g., lead-in. The uppermost portion of the tree serves to increase the capacity of the antenna. It also serves to intercept to a certain extent the electromagnetic waves which induce currents in the electrically conducting juices of the tree, as well as in the lead-in wire.

Generally, it can be said that any system of electrical conductors, so arranged that they are above or underneath the ground, but insulated, is capable of absorbing energy from a transmitted wave, and when used in conjunction with a



THE FIRST step in installing an underground antenna. It is laid upon the ground. The earth is then dug up and the wire buried.



TESTING the strength of the signals by raising or lowering the wire in the water. When an underground or underwater antenna is used, a regular ground connection should be made as usual, if it is possible to make any. When afloat use bare wire dropped in the water a few feet.

receiver employing a sensitive detector, may detect the presence of these waves.

If a loop antenna is at hand, it may be put to good use. That is, it may be used in conjunction with the ground or underwater antenna, which will be of considerable assistance in the elimination of interference. A unidirectional antenna system is obtained and signals often are louder.

Summarizing, if the simple antenna is to be used, it should be properly insulated wire and deeply buried. If the underwater antenna is used, a heavily insulated wire should be used and if in clear water should be fairly deep, but if in salt water should be very near the top. If the tree is used, it should be very high and fairly distant from the set. The underground and the underwater antennas are about equal in performance.

When using the overhead antenna end the tree as a mast, as shown in the upper left-hand photograph, a 75-foot wire, with a lead-in, being suitable to height of tree should be used. It might be found that when employing this system the longer wavelengths cannot be received, this being due to the set being so designed as to operate on a 100 foot antenna with a longer lead-in such as is installed on most housetops. This, however, can be easily cured by placing a 4 or 5-turn coil wound on a 3" diameter tubing with No. 22 double cotton covered wire, in series with the antenna or rather lead-in. When doing this, be sure that neither the lead-in nor the antenna touches the moist ground. This will cause the fundamental wavelength to be increased.

# In Defense of the Loop

By Roscoe J. Ross

THERE are two great types of antennas—the outdoor aerial and the loop. The more popular by far is the outdoor antenna. It costs less and it picks up more energy. For many, those considerations settle the question. But much may be said in favor of the loop. Certainly it is more convenient and versatile.

In a sense all outdoor aeriels are home-constructed, since the erection constitutes the construction. This may include the erection of two towers between which the wire is strung, properly insulated. If one goes in for towers of any size an outdoor antenna will cost more than a loop. Often the slipshod erection of an antenna between chimney pots on a roof gives one an energy collecting source that has little advantage over a good loop.

## Making Up the Difference

As a loop collects less energy than an outdoor antenna, to equalize performance addition of radio frequency amplification may be necessary. That is the chief economic point. It is obvious, therefore, that some sets will not give satisfactory results from a loop, e.g., the 1-tube regenerative receiver. Yet little need be added to make loop operation effective. A stage of tuned radio frequency amplification ahead of a regenerative detector will do it. If properly designed, a set using two stages of tuned RF ahead of a non-regenerative detector tube is sensitive enough to permit of loop operation. Hence it is not true that an elaborate set is necessary before one may obtain good results on a loop.

The Super-Heterodyne is essentially a loop set. While an optional outdoor antenna connection is a good plan, no Super Heterodyne should be built unless provision for loop connection is included. The outdoor antenna energy may be supplied to the loop in auxiliary fashion, by inductive coupling of an antenna coil to the loop, or some switching arrangement may be used, whereby the loop is cut out (instead of being left in) and the secondary of an RF transformer is cut in. The primary, in this system, is connected to aerial and ground.

## Loop Jack Usually Omitted

The efficiency of a 5-tube set is impugned if loop operation is not electrically possible. Usually no mechanical provision for loop connection is included, and this manufacturing omission is one reason why the loop is less popular than it would be. Assuming the truth of the oft-repeated statement that eagerness for receiving distant stations is at a low ebb, there is all the less reason for ignoring the loop.

Any set efficient enough to be put

in the loop class will duplicate, more or less, on a loop the stations receivable on an outdoor antenna, with the proviso that where weak signals are concerned the volume, with loop reception, may be noticeably less. In any case, weak signals are not brought in with comfortable, clear volume on any receiver or any aerial. The miscellaneous noises along the route between station and receiver have to be amplified beyond the satisfaction stage, hence the quality declines as the volume ascends. An available extra stage of audio may be made more serviceable than extra RF amplification, under such circumstances, granting that the signal does actuate the detector, for the amplification of static is less.

## Complexion of Outdoor Antenna

The outdoor antenna and ground are the plates of a condenser. The wire has resistance, of course, and a little inductance, but primarily the system is one of capacity pickup. A loop is an inductance, having resistance and some small capacity. In an outdoor antenna the capacity is lumped, the inductance distributed. In a loop the inductance is lumped, the capacity is distributed. Hence we may compare inductance with capacity to distinguish loop from outdoor antenna.

The capacity system addresses itself to the electro-static component of the broadcast wave. The inductive system relies on the electro-magnetic component. As between the two, the magnetic seems to make for better quality than does the static component. On strong signals the loop may be louder than the outdoor antenna on the same set. The fact that a capacity antenna picks up more energy than a coil antenna is no denial of the fact that it often picks up too much, e.g., in the Super-Heterodyne. Many receivers of a lesser degree of sensitivity than the Super-Heterodyne use some form of audio frequency amplification that is rather strictly limited as to the voltage the grids will endure without loading up. Resistance coupling is an example. Its quality is superb, until the grids are loaded, when it is wretched. This may be controlled by providing a greater leakage path (i.e., using a grid leak of lower resistance in each AF tube). As the resistance goes down, so does the volume, though the volume remains comfortable. Suitable negative bias helps, but it does not wholly overcome the difficulty.

It must be logical, therefore, to use a loop in instances where an outdoor antenna contributes too much energy. In other words, an outdoor antenna will do more than a loop, but often too much more. Diminished risk of loading the grids therefore augments the quality argument in favor of a loop.

## Loop Pretty in Home

A well-made loop is a very sightly orna-

ment. A home-made loop is no more expensive than an outdoor aerial installation, but is not suggested, because the loop, unless very skillfully made, is not likely to be a thing of beauty.

The loop should be rotatable rather than fixed permanently inside the cabinet, for only by turning the loop does one gain the advantage of directional effect.

The loop renders the set and equipment transportable. If the set, speaker, batteries, etc. are on a tea cart, or in a console, as is common, the set may be wheeled from one room to another, on the porch, or into the garden for a festival under the grape vine canopy. Manual ease accompanies the loop at every step, from installation to all stages and conditions of operation.

## Covering the Band

On the point of wavelength scope—not distance range—the loop is much more likely to tune in the entire band with a small capacity variable condenser (say even .00025 mfd.) than if an outdoor antenna were used. In fact it may be accepted as generally true that .00025 mfd. will not tune in the whole band (200 to 550 meters) where an outdoor antenna is employed. A .00035 mfd. condenser just "makes it," with a slight margin. Yet with a loop, due to the absence of strong antenna capacity effect, there is no difficulty.

This is merely another point relative to a loop's versatility. Many sets do not tune down low enough because a relatively sharply tuned input is loaded with antenna capacity that makes the minimum capacity of that tuned circuit several times the minimum capacity of the condenser alone. Subsequent tuned circuits in the set, free from the antenna capacity load, may go down low enough, but the signal wave is irreparably damped in the first stage. This may be overcome by substituting a small indoor aerial for the outdoor one. But the indoor aerial causes volume to drop more than most persons care to endure (unless the receiver is supersensitive). Hence a short indoor aerial, in pickup, is rather in the loop class than in the outdoor antenna group, and if one thinks of selecting an indoor antenna, why not a coil antenna? The loop turns even a colder shoulder to static than does the indoor capacity antenna, indeed a moving shoulder, so that the elimination or reduction of interference is easier.

## Give the Loop a Trial

Loops are like other things in life—liked by some, disliked by others. Each person surely should select what he or she prefers, or have a switching system, to cater to changing moods. At least the loop should not be condemned without trial.

# How New Super-Thin Diaphragm Works

WASHINGTON—The new process for the manufacture of super-thin metal diaphragms, developed by Doctor Carl Mueller of the Physikalisch-Technische Reichsanstalt in Berlin, enables manufacture in thicknesses down to 1/100,000 millimeter.

The practical application of super-thin diaphragms is stated to be of considerable importance in radio communication. It is stated that the largest field of practical application will be found for microphones, telephones, loud speakers, gramophones, etc.

The microphone consists of two parallel metal membranes. Between these two membranes and from 1 to 5 millimeters distance from each, is stretched a very fine silk tissue which is plated with gold, silver or platinum. A 200-volt electric current supplied by a storage battery is passed through the silk-metal tissue. The tissue is connected with an amplifying tube. The sound waves induce the silk-metal tissue between the two metal membranes to swing back and forth, and this swinging motion produces a low fre-

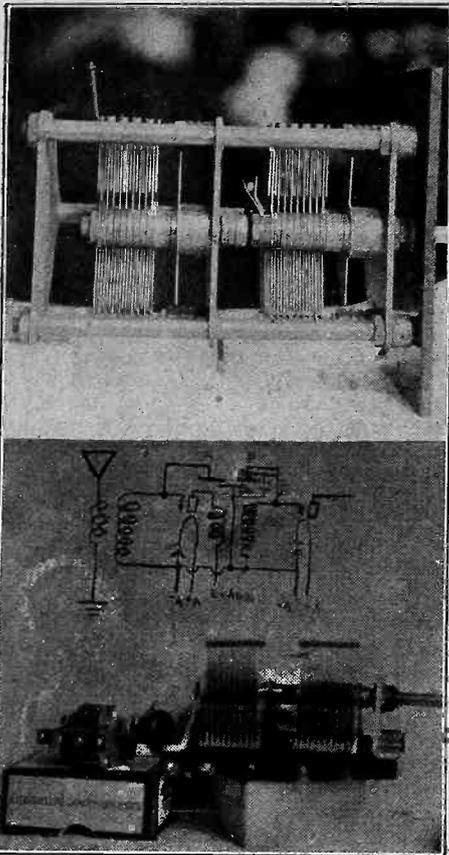
quency current which is amplified by the amplifying tube with which the microphone is connected. The tone strength after first AF tube is equal to that from a carbon microphone.

## BOON TO SHUT-INS

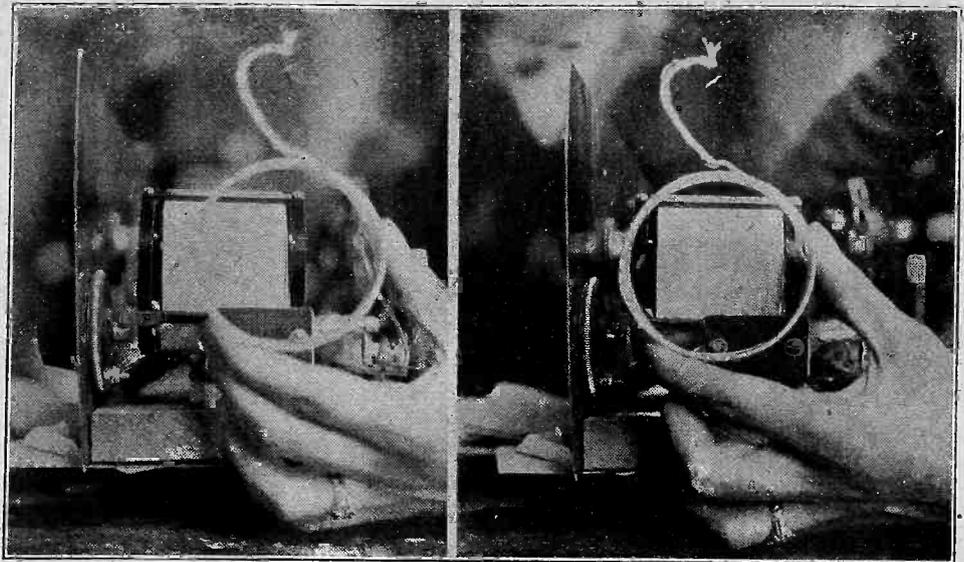
The Washington, D. C., radio hospital fund is a charitable undertaking to install sets in hospitals, institutions, and homes of shut-ins.

### Double Condenser Tests

### Straight Center Line Prevents Coupling



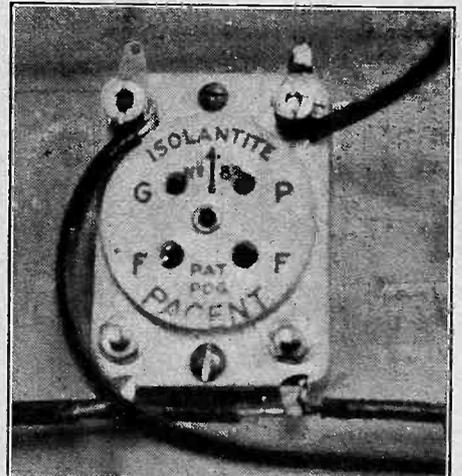
THE PLATES of a double condenser must not be warped, otherwise given dial settings will not always represent equal capacity in both sections. Poor volume and little DX results. The plates should be equi-distant throughout the entire rotation (top photo). A midget condenser may be used for compensating a double condenser, but it constitutes another control, though a minor one, requiring variation only for DX. The double condenser has two stators (A and B) and one rotor (C). The midget is hooked up as shown at DE.



WHEN zero coupling is desired, as between radio-frequency transformers in two stages, it is not enough that the coils be at right angles, but the center through the length of one should pass through the central width of the other, on an imaginary line. An interesting confirmation of this may be made by disconnecting aerial and ground from your set and connecting them to the terminals of an external coil of few turns, like the one pictured, or of smaller diameter. Though you hold the new aerial coil at right angles to the secondary, signals will be heard if the relative position is as shown at left. Put the centers on a straight line (as at right) and no signals will be heard, due to absence of coupling. The zero point is lost if the small coil is moved so much as 1/16".

### Conservator of Electrons

### Neutralizing UX Tube



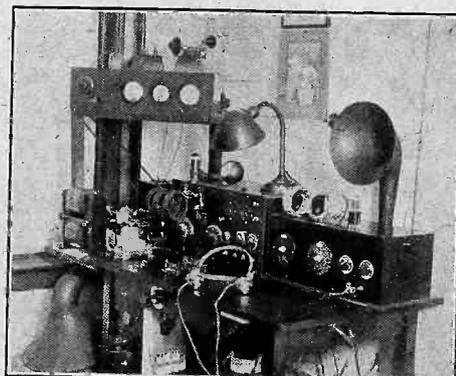
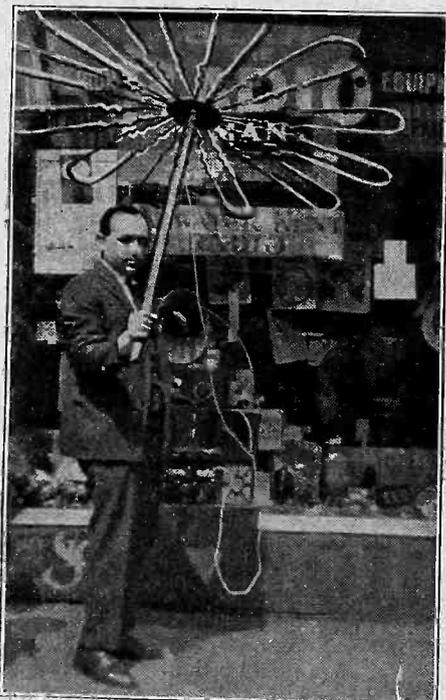
A MOULDED bakelite covering, permanently built into the tube, the base being a part of the mould, is being experimented with by one manufacturer. The theory is that the casing conserves the tube's heat and thus facilitates the electronic flow. The tube is shown in an X socket.

YOU cannot put a piece of paper under a filament prong of a UX socket to keep the tube "cold" when in the socket for neutralizing condenser adjustment. Therefore insert tube in socket and disconnect one of the filament leads to the socket post. The posts are lower left and right.

### Proud of His Aerial

### Hears 24 Countries

### Ready for Alaska



MICHAEL BLAN, known to the radio public as "Blan the Radio Man," of 145 East Forty-second Street, New York City, is shown demonstrating the latest type of antenna.

THE TRANSMITTING and receiving apparatus used by Station 2AMJ, owned and operated by Frank Lester, 4305 Broadway, N. Y. City, to communicate with stations in more than 24 countries, throughout the world.

(Underwood & Underwood)  
GUNNER C. G. ALEXANDER and Chief Radio J. T. Kiepler with the receiving and transmitting apparatus which will be employed on the aerial survey of 40,000 square miles of the south-eastern portion of Alaska. Three years will be spent by the Navy in covering this vast area.

# Aerial Coupling Methods

**Compromise Between Sensitivity and Selectivity May Be Reached at the Original Input—Tuned Impedance Affords Greatest Volume But Requires Larger Capacity Tuning Condenser Than Other Systems.**

*By Herman Bernard*

Associate, Institute of Radio Engineers

MUCH depends on the aerial input of a receiver. A great deal may be lost by using a poor method of introduction of the radio frequency currents that strike the antenna. It is not possible to achieve perfection, but one may obtain the most possible under the circumstances. The question therefore is: What is the compromise you desire to make? It is like an exchange of advantages. You can not keep all the virtues of all systems in any one system.

The most popular method is to have a tuned radio frequency transformer, consisting of a primary coil with few turns, in inductive relationship to a secondary of about four times as many turns. The coupling is fixed (Fig. 1). This enables one to log the condenser dial setting with ease. Generally speaking, nothing will cause the dial settings to change for given wavelengths. This advantage is highly rated nowadays, and fans are willing to sacrifice much for its enjoyment.

## Response Not Uniform

Naturally the amplification, or degree of response, is not the same on all wavelengths, so far as the aerial alone is concerned, because the signals will be stronger nearer the wavelength fundamentally established for the aerial by the antenna capacity, antenna distributed inductance, the lumped inductance of the untuned primary, and the reaction of the secondary upon the primary. The system is responsive to all wavelengths, however, even down to the short waves (those far below the broadcast band), as is proven by the fact that the same aerial and same untuned primary are useful in conjunction with short-wave receivers, although of course the secondary would have fewer turns and the tuning condenser would be of smaller capacity.

The general favor which the Fig. 1 method has met and its high average efficiency establish it as one of the really worth-while input hookups. Besides, it calls for a coil of the same as that used for interstage coupling, and this simplifies matters by affording interchangeability.

The tuning condenser may be .00035 mfd. or higher, but usually does not go higher than .0005 mfd. maximum, since that is a perfectly safe capacity to insure tuning in the entire broadcast spectrum. The number of turns on the secondary is decreased as a condenser of higher maximum capacity is used and also the primary turns usually are regulated by the 1-to-4 ratio.

## Example of Effect

For example: Suppose the tuning condenser is .00035 mfd. maximum capacity.

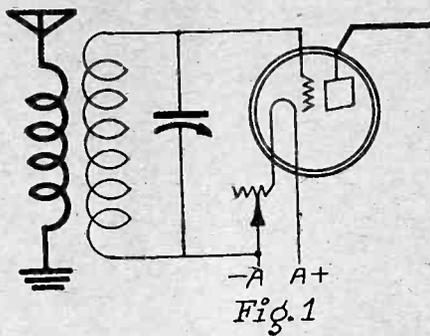


Fig. 1

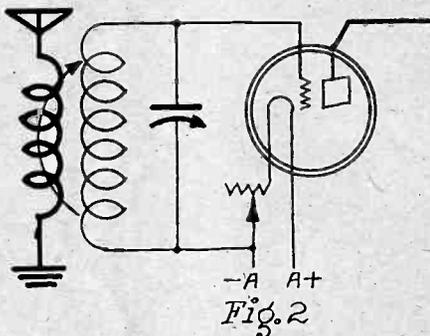


Fig. 2

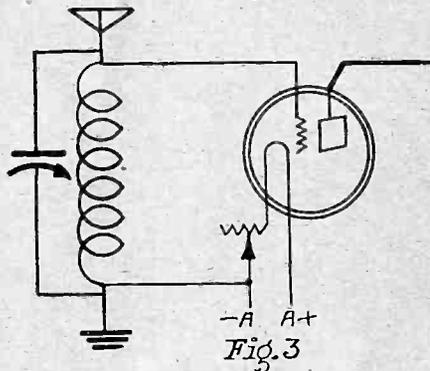


Fig. 3

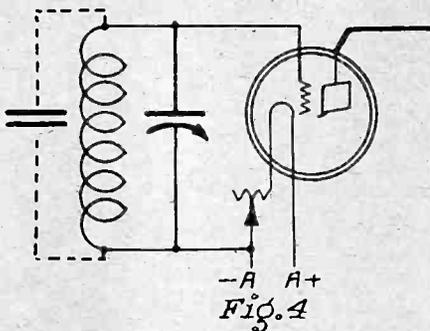


Fig. 4

Then a radio frequency transformer, wound on a 3½" diameter tubular form, may consist of 15 turns for the primary and 60 turns for the secondary, with ¼" separation between the two windings, which are side by side. If a .0005 mfd. condenser is used, the secondary turns would be 50 and the primary would have 12 turns. The diameter is the same, as is the kind of wire used (say, No. 24 double cotton covered).

The rule is to be modified by working conditions. For instance, if greater selectivity is needed, either the space between respective windings is increased beyond the conventional ¼", or the number of turns on the primary is cut down.

## The Variable Primary

A better system, from the viewpoint of efficiency, is shown in Fig. 2, where the primary is rotatable, thus enabling one to vary the degree of coupling so that highest sensitivity is attained. Likewise the variable primary affords opportunity to regulate the selectivity. Where greater

selectivity is needed it may have to be obtained at the expense of volume, but the drop may not be enough to cause any concern.

Instead of the primary being variable the secondary may be so, to the same effect, but this method is hardly ever used.

Against the variable primary method one must register the fact that the dial settings of the condenser shaft will not be the same for the same wavelengths, if the primary is shifted. Tight coupling causes the apparent inductance of the secondary to increase, hence to compensate for this the capacity setting of the condenser must be decreased. This interferes with logging, unless the variable primary is dialled, just like a tuning control.

## The Adjustable Primary

A compromise between the two is to have the primary adjustable. The variation is made until the optimum point for general utility is reached, and then the primary is left in that position. It is a fixed primary in every practical sense, the adjustment being a consideration only at the time of installation. The adjustment is accommodated to the aerial conditions encountered. A greater or fewer number of turns on a regulation fixed primary would accomplish the same object, only the adjustable primary method is quicker and more convenient.

A tremendous increase in volume, accompanied by a decrease in selectivity, is encountered when the tuned impedance method of aerial input is used. Note that the aerial goes direct to the grid and that the end of the coil goes direct to ground and minus A. Whenever the aerial goes direct to grid, without series condensers anywhere in the antenna-ground system, the volume is great.

## The Selectivity Question

Unfortunately, many receivers, while functioning satisfactorily under any of the systems previously discussed, are not selective enough in subsequent stages to allow the reception of so much energy. Fig. 3, the tuned impedance input, is broad in tuning, indeed the condenser requires no dial, actually, since a knob serves the purpose very well, and may be adjudged a volume control. For instance, at a point about 500 miles away, KDKA, East Pittsburgh, is tuned in regularly on a receiver using the Fig. 3 method, yet the signals will not disappear until the dial is turned 9 degrees either way.

A small dial probably would be preferred by most persons, say a 2" diameter, unless a pointer knob is used, and there are panel engravings to designate relative settings.

The variable condenser in the tuned impedance method must be larger than the usual types. For instance, .0005 mfd. is the most popular capacity of the day, but this will not tune in the broadcast band with this hookup. A condenser of .00075 mfd. capacity is likely to do it, but .001 mfd. is safer.

## Antenna Capacity Effect

The reason for the necessity of a larger capacity condenser is shown in Fig. 4. The antenna and ground system constitute a physically large and electrically moderate condenser, of which the antenna is one plate and the ground the other. The dotted lines are used to supplant the usual aerial-ground diagrammatic representations. Therefore it is obvious that the capacity we are referring to is connected in parallel to the tuning condenser. Parallel capacities equal the sum of the

# The Control of Set Results

## Solution of Over-Oscillation Trouble Suggested, So That Strong Input Is Obtained, to Counteract Reduced Amplification Due to "Skinny Primaries" — Autotransformer Advantages Outlined.

respective capacities. Hence if the antenna-ground capacity has .00025 mfd., as is not unusual, this is added to the minimum capacity of the tuning condenser. Assuming the minimum capacity of the condenser to be .00005 mfd., and the maximum .0005 mfd., the ratio is 1-to-10, which is safely more than necessary to enable one to tune in the band. But if .00025 mfd. is added, then the figures are .0003 and .00075, a ratio of 1-to-2½, which is not nearly enough.

In an attempt to overcome this a series condenser often is used in the aerial circuit (Fig. 5), since the effective capacity is reduced by using a series condenser of a capacity less than that of the antenna system. The reduction may result in tuning in the whole band, although this seldom happens, but there is bound to be a severe drop in volume that puts the signal strength about on the same basis as that derived from the hookup shown in Fig. 1. Indeed, the antenna is converted into simply a pick-up system, wherein the series condenser may be considered as a capacity coupled primary. The shifting of the fixed condenser to the ground lead (Fig. 6), gives about the same results all around as does the antenna series condenser.

### Needs Large Tuning Condenser

Therefore one must conclude that the best practice, if one desires the greater volume and sensitivity, is to use a large capacity tuning condenser and not attempt to utilize series makeshifts. If one has not such a large condenser, a smaller one will do just as well, if one is willing to resort to taps. Indeed, one tap will do, about one-third from the filament end of the coil. This interferes a little with the fullest logging convenience, since the switch point and the condenser must be read together.

Note the manner in which the tap switch is included. It is in the ground part of the coil, that is, at low radio frequency potential, and both the movable switch arm and the end of the coil are connected to ground and minus A. Hence any unused part of the coil is short-circuited, and dead end losses are considerably reduced. One need not worry much about these when one considers the terrifically augmented input.

As the selectivity of the tuned impedance method is low, it is necessary that tuned RF follow the input.

The regulation 5-tube set may be accommodated to this system, there being a second stage of tuned RF and a tuned detector input, in other words three tuned circuits. As the volume originally introduced into the receiver is very large, due to the high effective voltage obtained by the input method, the primaries of the interstage couplers may be reduced far below the number of turns supportable

by other methods of aerial input. The fewer the turns on these primaries the lesser the tendency toward over-oscillation and the lesser the amplification at high wavelengths, therefore here is an opportunity to make a receiver that needs no external methods of balancing, but which justifies the use of "skinny primaries." These not only reduce the over-oscillation tendency on the lower waves but also add to the selectivity. A non-selective input, therefore, gets the added advantage of high selectivity derived from succeeding stages and the strong input justifies the lowered amplification on the higher waves.

A point worthy of notice in regard to

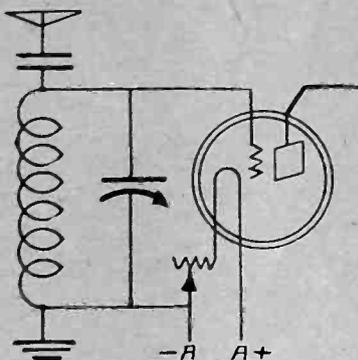


Fig. 5

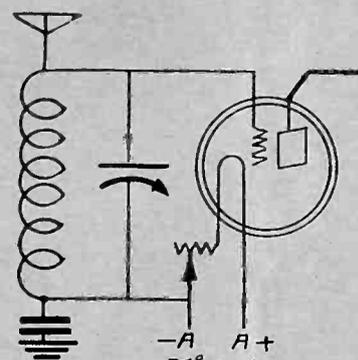


Fig. 6

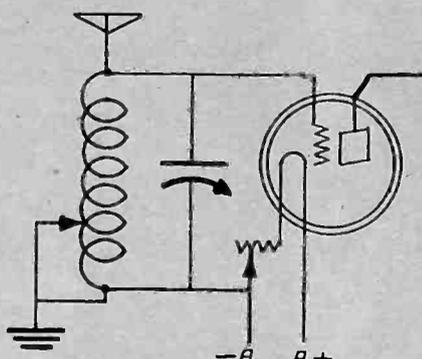


Fig. 7

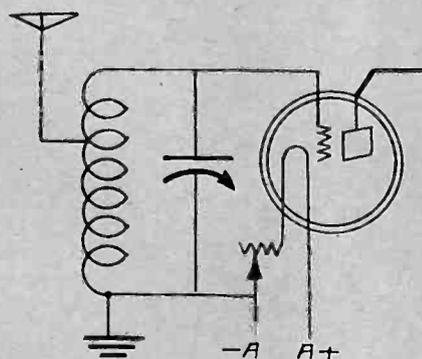


Fig. 8

tuned impedance is that its broadness makes possible the tuning in on succeeding stages of wavelengths below those which the variable condenser would handle at the original input. In other words, despite the inability of the condenser to tune down low enough, the signals flow through, due to their drowning effect. Hence, if you calibrate the condenser in the tuned impedance stage, the chart would show you that it does not tune down to 209 meters, because the condenser is not of proper effective capacity range. But strong stations would come in nevertheless, due to the low resistance of the input circuit to other frequencies.

The impedance coil is not susceptible to general definition as to turns and diameter, because the winding depends on the antenna-ground capacity, as well as on the capacity of the tuning condenser. As a point of guidance, however, it may be said that with a particular aerial, using a .001 mfd. variable condenser, 37 turns of No. 24 DCC wire, on a 3½" diameter tubing, did the trick.

### Auto-Transformer Coupling

The auto-transformer method of coupling (Fig. 8) is a cross between the impedance type and the inductive radio-frequency transformer method. Indeed, the aerial may be introduced at a point low enough on the winding to make the results about the same as with the Fig. 1 method. In fact, if that were done it would be the same as if the negative filament were grounded in Fig. 1 (excepting only that current flow is reversed). Therefore any desiring to use the Fig. 8 method, which will develop loud signals indeed, although not so loud as in Fig. 3, may experiment with the location of the tap. The nearer to ground the aerial is introduced, the less effective is the antenna capacity upon the tuning condenser, hence this method will support use of as low as .00035 mfd. variable condenser. A mid-tap location requires .00075 mfd., at least, for the tuning instrument, while if the aerial is connected about one-third the way up (counting from the ground), .0005 mfd. will work nicely.

It will be seen from the foregoing that the tuned impedance method is actually a way of tuning the aerial, and a tuned aerial makes for best sensitivity and loudest signals, especially when the connection from aerial goes direct to grid. Fig. 5 is an instance of tuning heaped upon detuning, so to speak, and is consequently less effective.

Fig. 7 is an out-and-out tuned aerial system, indeed only Figs. 3 and 7 are such, the rest being examples of untuned antennas, the variations being in the manner and degree of coupling.

Those who have not made experiments along these lines will find a little work on these problems pays a big reward. Your set may be more selective than need be, and you can change your antenna input so that the result is like that obtained from an extra stage of audio frequency amplification. Or you may be about to build a receiver and are wondering how much tuned RF you should use. If you want a very selective receiver, with three stages of tuned RF and a tuned detector input, you may develop one, using an condenser tuned impedance coil in the antenna circuit, perhaps utilizing a multiple condenser for the next two stages to keep the controls down to three.

At least you should see what form of coupling is best suited to your location, for factory-made coils can not take into account the varying conditions met in different locations.

# Economized Filaments

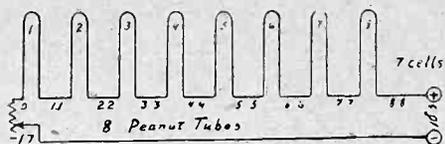


FIG. 1

By J. E. Anderson  
Consulting Engineer

**T**HERE are three fundamental ways of connecting the filaments of a multi-tube set across the source of filament current—in parallel, in series, and in series parallel. Also, combinations may be worked out. The method used depends on the voltage of the A battery, on the filament terminal voltage of the various tubes, and on the filament current requirements of the tubes. Not all the methods are equally economical under all conditions.

Some seem to think that plus current and minus current exist side by side and travel in a conductor in the same fashion that traffic travels in both directions on a street. There is only one current, and it travels from high potential to low potential, just as there is only one current of water in a river, which travels from high altitude to low altitude. And some think that plus and minus are something absolute. These terms are purely relative, indicating direction. We may call any point within a battery, or any point within a circuit, zero potential. Then from this point we may measure negative voltages in one direction and positive voltage in the other.

## The Relativity of It

Suppose we call the negative terminal of the battery zero, then the other terminal is at a higher potential, or positive. It may be 45 volts positive, for instance. But we may also call the positive terminal zero if we wish. Then the negative becomes minus 45, because it is lower in the potential scale. Plus and minus are merely convenient, though misleading, terms to designate which of two terminals, or two points in a circuit, is at the lower potential or voltage. It is necessary to mark them in some manner because we cannot tell by looking at them which is higher and which is lower.

A battery in one sense may be compared with an elevator in a tall building which carries passengers in only one direction. It produces a sudden change in the altitude, or potential, of those riding in it. Suppose all the passengers preferred to, or were obliged to, walk down the stairway. This then would represent the external circuit connected to a battery. We do not have to mark the top of the elevator shaft plus or positive, because we can see that it is higher than the first floor. And we do not have to mark the basement minus or negative, because we can see that it is lower than the first floor. But we can call any point on the elevator shaft zero. If we call the main floor zero, then everything above it would be positive, that is, higher, and everything below it, or in the basement, would be negative.

## Different Zero for Different Tubes

In a radio circuit it is customary to regard the negative end of the filament as at zero potential, or as being on the ground floor. But that refers only to that particular tube. Each tube may have a different zero, just as in a stairway each flight has a different zero. In a stairway the low end or zero end of one flight coincides with the high end of the flight next below. That is, the plus end of one is

on the same level as the minus end of the other. If filaments are connected in series, the minus end of one will be at the same potential as the plus end of the one next below it. The zero of the entire series may be taken anywhere. A convenient point is the negative end of the lowest filament. If there is a rheostat below this, as is customary, the low end of this is a minus potential. It is in the basement. Of course the battery goes all the way down, just as the elevator does.

One often speaks of ground potential, and this is frequently taken as zero. The zero point in our circuit may or may not be the same as ground potential. It is not unless we ground the zero point. Often the zero point on the filament as defined above is at a potential higher than ground potential, for it is very often desirable to ground some point of lower potential than that of the minus end of the filament. We may ground the positive end of the A battery, but it is more customary to ground the negative.

## The Analysis of Fig. 1

Now let us proceed to Fig. 1. This represents the filament circuit of an 8-tube Super-Heterodyne employing peanut tubes throughout, and is the arrangement used by the Western Electric Co. These tiny tubes require a filament voltage of 1.1 and a current of .25 ampere. Since their filament voltage is very low they are especially suitable for the series connection. Eight of them may be so connected and operated satisfactorily on a bank of seven No. 6 dry cells connected in series. The nominal voltage of this battery when fresh is 10.5 volts, and since the eight tubes require only 8.8 volts, there is an excess of 1.7 volts. This excess is taken up in the single filament control rheostat. As the cells run down this excess of course decreases, and when the voltage of each cell is about 1.26 there is no excess. The battery must then be replaced by a new one, or an additional cell of 1.5 volts may be added in series with the seven old cells to boost the voltage. Since the current required is .25 ampere the drain on the No. 6 dry cells is quite heavy, though not excessive. However, it would be better to use two sets of seven cells in parallel so that the current in each cell would only be one-eighth ampere. This would be much more economical. If the set is a portable one the question of weight is important, and then it is best not to use more than seven cells.

The filament circuit connected as in Fig. 1 is quite efficient. The only energy lost is that dissipated in the rheostat. The average voltage drop in this resistance during discharge of the battery is .85 volt. Since the current is .25 ampere the power loss is .212 watt. The useful voltage drop in the filaments is 8.8 and the power used in the filaments is 2.2 watts. Hence the efficiency is 91.25 per cent.

## A Variety of Bias Available

Another advantage of connecting these tubes in series is the ease with which almost any grid bias may be obtained. The negative end of the filament of the first tube is taken as zero in Fig. 1. The negative end of the eighth tube is then at plus 7.7 volts. Now suppose we wish to give the grid of the eighth tube a negative bias. If we connect the grid return of that tube to the point 6.6 between 6 and 7, the grid bias will be 1.1 volts, since 6.6 is that much lower than 7.7 volts. Connecting the grid return to the point 5.5 between 5 and 7 gives a bias of 2.2. Thus the last tube may be given any bias in multiples of 1.1 up to 7.7 volts. This bias remains fairly constant provided the filament current is kept constant. In addition to the 7.7 volts

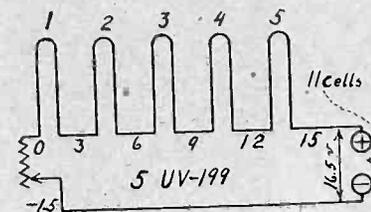


FIG. 2

bias there is the voltage drop in the rheostat, or 1.7 volts. If the grid return lead from tube 8 is connected to the negative terminal of the battery, the total grid bias will be 9.1 volts. The 1.7 volt part of this, however, is variable, depending on the state of the battery. For this reason it is best not to use this for bias at all, except for the first and second tubes.

## The Correct Bias

The tubes located lower in the potential scale may also be given a grid bias by properly connecting the grid return lead. No. 7 can have any bias from zero to 6.6 volts, No. 6 any bias from zero to 5.5 volts, and so on down the scale. The first tube can only have zero bias unless advantage be taken of the drop in the rheostat. The steps by which the bias may be varied are smaller than if dry cells were used to obtain it, and this is a decided advantage. If the tubes are connected so that No. 1 is the first radio frequency tube and the others in the order of increasing signal strength concluding with No. 8 for a power amplifier, then the grid bias obtainable for any tube is just about correct for the plate voltage that should be used.

The effect of the series connection on the plate voltage will bear comment. Suppose that we use a 45 volt plate battery and that we connect the negative of the B battery to the positive of the A battery. The last tube will then have an effective plate voltage of 46.1 volts, since the voltage drop in the last filament is added to the battery voltage.

Tube No. 7 will have an effective voltage of 47.2 volts, because the voltage drop in two filaments is added to the voltage of the battery. The tubes lower in the scale will have correspondingly higher plate voltages. The first tube will have an effective plate voltage of 53.8 volts. That is not as it should be for the tubes which require the highest plate voltage get the lowest.

## The Plate Voltage Analyzed

Let us try connecting the negative of the B battery to the negative end of the first filament, that is, to the point of zero potential. The first tube then gets an effective plate voltage of 45. The second tube only gets 43.9 volts, the third 42.8, and so on. The last tube gets 37.3 volts. This case is worse than the first, since not only is the order wrong but the voltages are less than the voltage of the B battery. Suppose we reverse the order of the tubes so that No. 1 is the last audio amplifier and No. 8 is the first tube in the circuit. Then if we connect the negative of the B battery to the positive of the A battery, the first tube in the circuit will get 46.1 volts on the plate and the last tube will get 53.8 volts. That is better. Instead of reversing the order of the tubes the A battery terminals could have been reversed and the rheostat moved to the new negative branch. That would have accomplished the same object. Of course, making this change does not alter the grid bias potentials that can be obtained.

## Use of Other Tubes

Other tubes besides the peanuts may be

# Drain Cut Astonishingly

connected in series in the manner shown in Fig. 1. Thus in Fig. 2 is shown a circuit comprising a series of five 199 tubes. These five require a total filament voltage of 15 which is nominally given by 10 dry cells connected in series. An extra cell is required to take care of the voltage drop of each cell as the battery runs down, the excess of 1.5 volts being taken up in the rheostat. When the voltage of each of the eleven cells has been reduced to 1.36 it will be necessary to add still another cell. The twelve cells are good until the voltage of each is 1.25 volts, when a thirteenth cell may be added. This should be the maximum number of cells, because if the voltage were boosted any further by adding new cells, the old cells would not contribute anything but would dissipate part of the energy of the good cells. The efficiency of the filament circuit when eleven cells are used is on the average 91 per cent.

Grid bias potentials may be obtained in this series in the same manner as in Fig. 1. In this case, however, the bias can only be varied by three volts at a time, since the voltage drop in each cell is 3 volts. Tube No. 5 can be given a grid bias of 12 volts exclusive of the voltage drop in the rheostat, which should not be used for the sake of definiteness of bias. What was said under Fig. 1 in connection with plate voltages holds equally well here.

### Use of 5-Volt Tubes

The first tube may be given a plate potential of 15 volts by merely connecting the plate return lead to the positive terminal of the A battery. If tube No. 1 is made the last tube in the receiver and if a 45-volt plate battery is used and is connected with its negative terminal to the positive end of the filament of No. 6, the total plate voltage on No. 1 will be 60 volts. Tube No. 6 will only have 48 volts under the same conditions, while the other tubes will have intermediate values.

Even 5 volt tubes may be connected in series, but the only place where this might be done to any advantage is where a 32-volt storage battery is available, such as are used for farm lighting systems. Fig. 3 shows how a maximum of six tubes may be connected in series across such a storage battery. A smaller number of tubes of course, may be used, provided a suitably large rheostat be employed to cut down the excess voltage. Grid bias potentials in steps of 5 volts may be obtained in the same manner as explained under Fig. 1. All but the first tube may be given a bias of at least five volts.

The effect on the plate voltage in this case is much greater than in the preceding two cases. Thus tube No. 1 may be given a plate potential of 30 volts by merely connecting its plate return lead to the positive terminal of the storage battery. Tube No. 6 will only get 5 volts under the same conditions, and the intermediate tubes will get intermediate voltages in steps of five volts. Since it is desirable to have the highest voltage on the last tube in the receiver, tube No. 1 should be made that tube, as already explained.

### Care Is Necessary

In farm lighting systems the positive

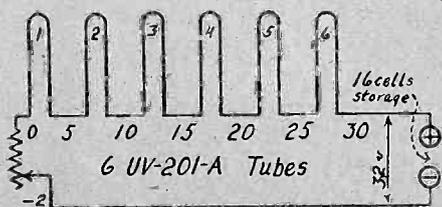


FIG. 3

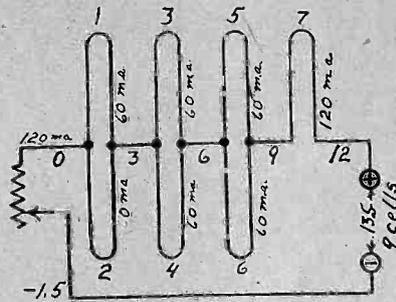


FIG. 4

side of the battery is usually grounded. Hence if a radio set is connected to it in the manner discussed above, the positive terminal of tube No. 6 will be grounded. Care must be exercised to see that no other point of the set is grounded simultaneously.

In Fig. 4 is shown a method of operating 199 and 120 tubes in series parallel on a six volt battery. Each of these tubes requires a filament voltage of 3. Therefore two of these tubes may be connected in series across a six volt storage or dry cell battery, and there will be no energy waste in a rheostat. That is, the filament circuit will be 100 per cent. efficient. A rheostat is merely inserted in this filament

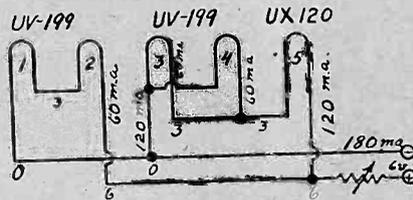


FIG. 5

circuit for controlling the current, that is, in case less than normal current is required. Of course, as soon as the rheostat is cut in the circuit is no longer 100 per cent. efficient, from a battery viewpoint.

When the voltage of each of four dry cells in this circuit is reduced to less than 1.5, and that is very quickly, the voltage must be boosted by the addition of another cell in series. These five cells are good until the voltage of each is reduced to 1.2. The average efficiency of the five cell circuit is 89 per cent. A small storage battery of three cells may well be used in place of the dry cells, even for portable use.

### 6 Tubes Draw Only 24 Amp.

The circuit in Fig. 4 which consists of six tubes, two of which are 120 and the rest 199, draws only 240 milliamperes at the filament. This is well within the allowable current drain of No. 6 dry cells, and hence four to five of these cells may be used for portable sets. For home use double the number should be employed in series parallel.

Negative bias voltages of 3 may be obtained for three of the tubes in Fig. 4, the three even numbered tubes. These tubes are on the high side of the line and therefore if the grid return leads of these tubes be connected to the negative end of the

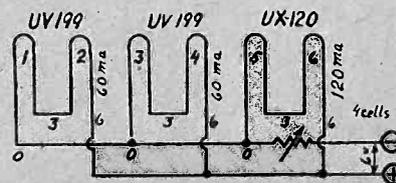


FIG. 6

filament of the odd numbered tubes, the grid bias on the even tubes will be three volts. The odd numbered tubes can only have a zero or positive bias unless an external grid battery be used.

A similar 5-tube circuit is shown in Fig. 5. In this circuit only one 120 tube is used, while the rest are all 199. The first two tubes are connected in series across the six volt battery as in the previous circuit. The next two 199 tubes are connected in parallel, and this parallel combination is then connected in series with the filament of the 120 tube. The latter tube requires 120 milliamperes but only 3 volts. The 199 tube requires the same voltage but only half as much current as the 120 tube. Hence two of the 199 tubes connected in parallel will require the same current as the single 120 tube. The voltage across the three tubes thus connected is 6. Hence, they may be connected across the 6-volt battery.

### Another Economical Move

When the voltage of the battery is exactly six, normal current flows in all the tubes, 120 milliamperes in the 120 and 60 milliamperes in each of the 199 tubes. Thus the total drain is 180 milliamperes, a value so low that a single series of four No. 6 dry cells will supply the filament energy for a considerable period. When the voltage of each cell has fallen too low to give satisfactory results a booster cell may be added. When no rheostat is used in this circuit it is 100 per cent. efficient as regards the filament circuit, and it is the most efficient method of connection. The rheostat should only be used when the booster cell is fresh, or when the battery voltage is over 6.

A similar circuit is shown in Fig. 6. This consists of three pairs of parallel connected 199 tubes, each pair connected in series with an adjoining pair, and the last pair in series with the filament of a single 120 tube. The last tube draws 120 milliamperes and each pair of 199's draws twice 60 milliamperes, or 120, so that the total current in the filament circuit is just 120 milliamperes, since series connection adds the voltage but not the amperage. The total voltage drop across the seven tubes is four times three, or 12 volts. This will be given normally by 9 dry cells with 1.5 volts to spare.

### Grid and Plate Voltages

Grid voltages may be obtained in this circuit as in any of the series-connected circuits given previously, and the variation exclusive of the drop in the rheostat is from zero to 9 volts. The plate voltages are also affected in the same manner as in the previous circuits. Of course a circuit may be built in this manner with a fewer number of tubes than seven. For instance, one pair of 199's may be dropped. The required voltage would then be three less, and the required number of cells would be seven instead of nine.

The filament circuit shown in Fig. 6 has been especially designed for use with an A. B. and C. eliminator. Instead of taking the filament current from a battery it is supposed to be taken from the

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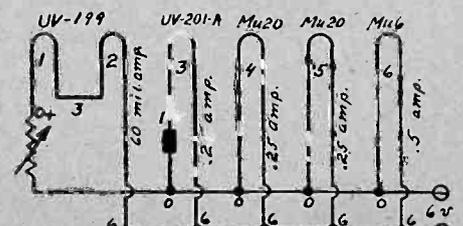
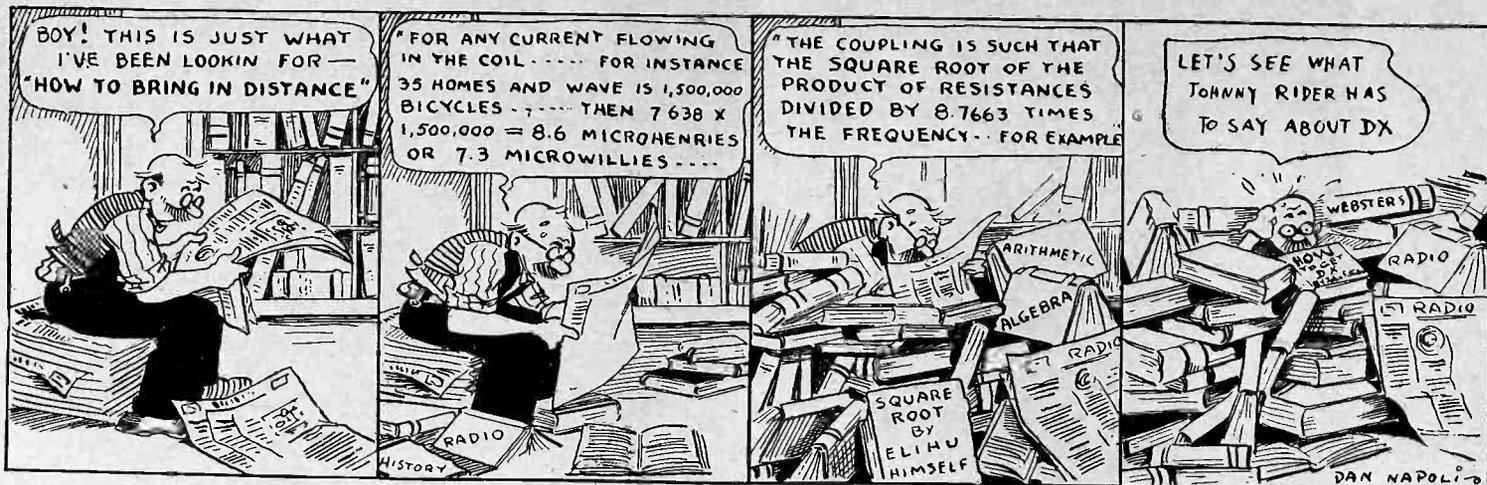


FIG. 7

# The Road to DX Signals



By John F. Rider

Member, Institute of Radio Engineers

NO one can assure another of DX reception and no one can guarantee DX reception. But there are methods whereby one can strive for DX reception, whereby one can increase the possibilities of obtaining reception of stations located at distant points.

The subject of "distance getting" is more complex than one is wont to imagine after one glance or a short period of consideration, and fully to comprehend the subject, it is essential that we be truthful with ourselves. There are two paramount factors to be considered and they are in sequence of importance, location and sensitivity of the receiver. That location is by far the more important is being demonstrated daily, for there are innumerable super-sensitive receivers that are not accomplishing the results obtained with smaller and less sensitive receivers situated in localities more favorable for general reception. This situation however must be fully realized and understood. The fact that the super-sensitive receiver does not record the stations received with the weaker receiver in another location does not signify that the super-sensitive set is inferior or does not possess its rated degree of sensitivity. The reason for its failure is that the distant station does not penetrate with sufficient intensity in the locality wherein this super-receiver is located. If the signal wave does not strike

## Why a Quiet Audio Channel Helps Tremendously in Making Distance-Getting Easier — Good Location a Prime Requisite—How C Batteries and Other Biasing Methods Help—Skill in Tuning an Absolute Requirement.

the receiver aerial, the signal cannot be received even if a thousand stages of amplification were used. One should always remember that a receiver does not reach out for distance. And increase in sensitivity means just what the phrase denotes. The receiver is more sensitive to weaker signals, but this increase in sensitivity does not guarantee reception of the distant station, for perhaps the signal wave of a desired distant station is deflected before reaching the receiver. The weaker signal will be made audible providing the signal wave, as weak as it may be, is impinged upon the receiver aerial.

Were we to take the super-sensitive receiver and operate it in the location of the less sensitive receiver the superiority of

the former would manifest itself immediately by the reception of signals which, while strong enough to actuate the detector tube of the super-sensitive receiver, would be far too weak to actuate the detector tube of the less sensitive receiver. This can best be explained by quoting certain values. Let us assume that the average hard detector tube requires about .02 of a volt incoming high frequency voltage so that the least audible signal be heard in a pair of phones connected in the plate circuit of the detector tube, without any radio frequency amplification or regeneration.

### How It Works Out

A signal with a voltage value of .01 therefore would not produce an audible sound in the phones. Now if we place this detector tube in a certain location with respect to the transmitting station, so that the incoming signal voltage is .025 volts, an audible signal is heard. Suppose in a different location we have a receiver with a voltage of 10 obtained by the use of a stage of tuned radio frequency amplification preceding the detector tube. This means that a signal voltage of .0025 volts applied to the first tube will produce an audible signal in the phones, since the amplification power of the stage of tuned radio frequency amplification will boost this voltage so that the voltage applied to the detector tube grid will be of the required value, namely .025 volt. However, if this more sensitive receiver is so located that the incoming signal voltage as ap-

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output of a B battery eliminator and smoothing out filter. A practical filter and rectifier may be constructed which will deliver 120 milliamperes of steady current. This may then be used to heat the filaments of the tubes if they are connected as shown in Fig. 6.

The voltage drop of 12 across the seven filaments will be taken from the voltage intended for the plate voltage, but the rectifier may be so built as to deliver 12 volts more than will be required for the plate supply. Then the voltage drop in the filaments may be made effective on the plates on some of the tubes as has already been explained.

### Constant Drop in Rheostat

The grid bias voltage may also be obtained in this filter-rectifier supplied circuit in the same manner as has been done in the previous circuits. No. 7 tube can get a maximum of 9 volts bias, exclusive of the drop in the rheostat. The first tube in the series can only get zero, so the bias for this tube must be obtained from the drop in the filament.

Now in this case the drop in the rheostat will be fairly constant, so that it may

well be used for grid bias purposes. In fact the only object of the resistance is to obtain a bias for the tubes lowest in the series. It need never be touched after the first adjustment has been made, because the current may be regulated in the primary of the input transformer to the rectifier.

One advantage of taking the grid bias in this manner is that any residual fluctuation in the voltage supply is balanced out, provided the grid bias is accurately adjusted to match the plate voltage. The receiver which receives its plate and grid potential in this manner is therefore quieter in operation than one in which only the plate potential is taken from the rectifier-filter and the grid potential from a battery.

### A Good Tube Plan

In Fig. 7 is shown an economical and sensible way of connecting up a circuit. Small tubes are used where the voltages are small, a large tube is used for a detector, voltage amplifier tubes where they should be used, and a power amplifier where it should be used. 199 tubes are good radio frequency amplifiers and they can handle all the voltage that is likely to

be met in the R F end of the receiver.

The filaments of these tubes are connected in series across the six volt storage battery because each requires three volts or slightly less. A rheostat is connected in series with these two filaments for volume control. A 201 A is a pretty good detector and it can handle all the voltage that is likely to be met at this place in the circuit. This tube requires .25 ampere at 5 volts, or less.

Ordinarily it is not necessary to vary the current once it has been adjusted. Hence a fixed resistance may be employed, one in which the voltage drop is one to one and one-half volts. Any good audio frequency amplifier employs some form of direct coupling requiring high mu tubes. Mu20 are satisfactory. These tubes draw .25 ampere at 6 volts. Hence they are connected directly across the line. For power amplification in the last stage only a power tube should be employed. Mu6 is one of these power tubes which may be used. It also requires .5 ampere at six volts, so it is connected directly across the line. A master rheostat may be used for all these tubes to maintain the filament terminal voltage at six volts. The total current in this circuit is 1.31 ampere.

# Value of a Variable Leak

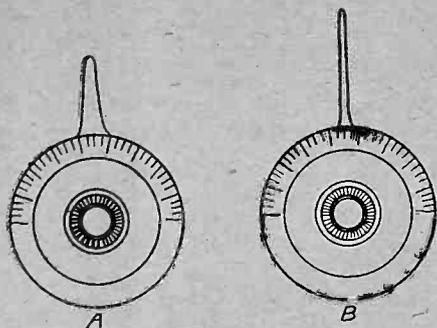


FIG. 1

Graphical representation of the resonance curve (A) on a dial of a multi-dial set and of a curve on a single-control set (B). The sum of the selectivity quality of the circuits must be handled at one stroke at B.

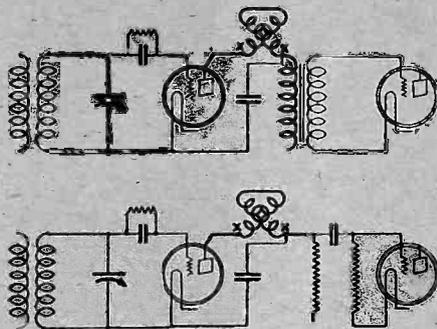


FIG. 3

How a variometer is connected in series with the plate of the detector tube. The top diagram shows transformer coupled audio, the bottom sketch resistance-coupled.

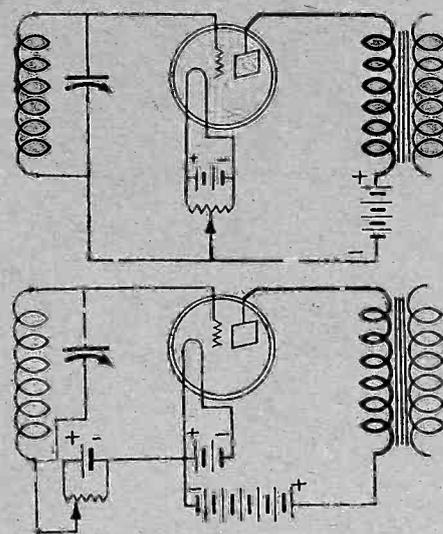


FIG. 4

and you have made a great stride toward DX reception.

In directions of how to obtain distant reception much has been said about inductances, condensers, aerial and ground systems. To discourse further upon that topic is necessary here. To advise the replacement of a variable condenser or a number of variable condensers, whose high frequency resistance is .1 of an ohm at 400 meters, with a set of condensers whose resistance is .085 of an ohm, would be somewhat out of reason.

True, the chances of obtaining distant reception are increased with increase in the electrical efficiency of the parts used in the receiver. If a fan is willing to chance improvement and wishes to change condensers or coils, all well and good. If he is not, for it necessitates much trouble in rewiring, he is not to be blamed. There are sufficient reasons for the lack of DX, other than slightly inferior condensers and coils.

Incorrect operation of the tubes is one. All amplifying tubes should be operated with a negative bias. All grid current must be eliminated. This is equally applicable to the radio-frequency side and the audio-frequency.

No doubt many fans have utilized potentiometer control and have noted how the output signal is reduced as the positive bias is applied to the grids of the radio-frequency amplifying tubes. This is due to a reduction in the amplification power of the radio-frequency tubes. And conversely, the amplification is increased as the lever is swung towards the negative side, applying a negative bias. It is therefore logical that an incorrect grid return connection which results in practically zero bias or slightly positive bias, is causing reduced amplification. The less the radio-frequency amplification, the less the chance for DX, since the received signal is weak enough, as it is, without reducing the receiver amplification.

The more sensitive the receiver the greater the DX; and the more stages of RF amplification added, the greater the sensitivity. That much stands to reason. A receiver utilizing three stages of tuned radio-frequency amplification and detector will be more responsive to distant and weak signals than a receiver consisting of one stage of tuned radio frequency. Suggestions to incorporate new units are not taken very favorably, and we will leave that to the last and continue to consider factors which do not involve additional financial expenditures.

Outstanding among these is tuning. It  
(Continued on page 26)

plied to the first radio frequency tube is only .0015 volts, due to absorption of some of the signal's intensity by objects intervening between the transmitter and the receiver, the amplification power of this R.F. stage would be insufficient to produce the required signal voltage on the detector grid and no signal would be heard.

Relative to the methods of improving the chances of obtaining distant reception, let us start with receivers in operation; receivers which are housed in cabinets and with which one is reluctant to tamper to replace coils and condensers with equipment of lower losses. In fact, let us forget for a moment all losses in radio frequency circuits, inclusive of the aerial and ground systems, and devote our attention to the audio frequency amplification, not with the purpose of boosting the amplification by adding power tubes, C batteries and B batteries, but by striving for quiet and noiseless amplification. This does not mean a reduction in the amplification, but it does mean that the amplifier must be correctly operated. Excessive plate current flow through the primaries of audio frequency transformers will invariably result in the development of a leakage, which will be audible in the phones as continual crackles.

### Where C Battery Helps

The same is true of excessive current flow in chokes in impedance coupled units. The use of the current C battery will not reduce the amplification but it will preclude the possibility of overloading the winding and causing the leak. This is occasioned by the reduction in the plate current drain due to the negative bias upon the grid. Care must be exercised to see that the coupling resistances in resistance coupled amplification stay put, and do not deteriorate under the applied voltage. This action occurs frequently with carbon strip coupling resistance, when the applied voltage is carried above 150. It may occur in mediocre units with plate potentials as low as 90 volts.

Another source of noise in audio amplifiers is non-uniform electronic emission from the filament. Each variance will cause a change in plate current, which when amplified by a succeeding stage will be made audible in the output circuit through phones or the loud speaker. Hence it is imperative that filament potentials remain constant. The same of course is true of the B battery voltage.

### The B Battery

While it is understood that the voltage gradually decreases, the decrease should be gradual and not radically fluctuating due to the chemical action taking place within the cells. This means that the life of the battery is limited, if noiseless am-

plification is desired, to a terminal voltage of approximately 19 for each 22½-volt block. Under normal conditions 17 volts is taken as a standard, but at that value the battery may be what is termed "noisy." With correct operation of the tubes, and correct choice of the C batteries, satisfactory operating life will be obtained from the B batteries before the 19-volt level is reached.

Bypass condensers must be employed to bypass high frequency currents around all units which would tend to obstruct the flow of these currents. This means that bypass condensers must be placed across all resistance through which are otherwise forced to flow any high frequency currents. All batteries should be shunted with bypass condensers.

Care should be exercised to see that high plate voltages do not leak across defective insulation in sockets, jacks, plugs and condensers. If they do, there will be heard continual crackles in the loud speaker, too frequently interpreted as "static."

Another item is the overloading of the tubes, by excessive plate voltages with insufficient negative grid bias. In the quest for greater DX via greater audio amplification, the path of least resistance is chosen by the fan, and he adds plate voltage. While it does increase the overall amplification, it possibly injures the tube and associated equipment. If the plate voltage is excessive, leakage may develop across the "mesh" in the tube. The tube will be noisy and finally break down entirely by arcing across. This occurs most frequently in the last stage.

### Avoids Drowning Out Signals

All of the above are detrimental to the reception of distant signals for they contribute to noisy audio amplification, and very often the inherent noise in the amplifier is sufficient to drown out a weak signal which would be audible with a quiet amplifier. The most prolific source of noise in an audio amplifier is the first stage of audio, due to the succeeding stages of audio amplification. Obtain audio amplification consistent with freedom from noise

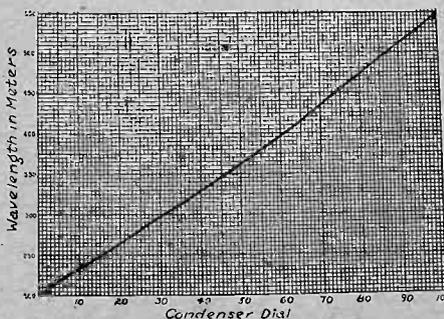
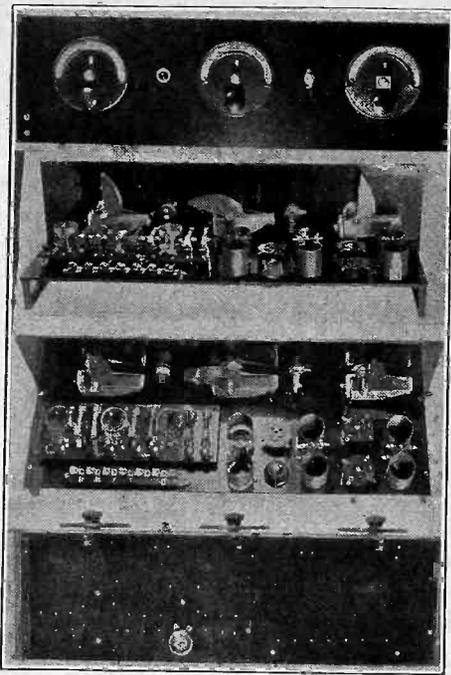


FIG. 2

# Radio University

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FIGS. 341, 342, 343 and 344 (Top to Bottom)

I HAVE two .0005 mfd. variable condensers, a RFT and a three circuit tuner, with 10 turn primaries and 45 turn secondaries wound on a 3/4" diameter tubing, with No. 22DCC wire, tickler consists of 36 turns of No. 26 SCC wire, and a low ratio audio frequency transformer. I would like to have a picture diagram of a 5-tube receiver, employing a non-regenerative tuned RF stage, a regenerative detector employing the 3-circuit tuner, a stage of transformer coupled AF amplification and two stages of resistance coupled AF amplification. The output of the last stage should be so arranged that no direct current can enter the magnet windings of the speaker. I would

like to control the filaments of the RF and the detector tubes with rheostats, while the filaments of the three audio tubes are controlled by a 3/4 ampere ballast resistor. I will want to use a loop and an antenna, etc., so an arrangement for switching is also desired. I have a 1-tube regenerative set, on which I will want to use the amplifier used in the above receiver. If this could be arranged, I would greatly appreciate it. Please give the constants of the resistors, condensers, etc.—Harvey Blanders, Atlantic City, N. J.

Fig. 345 shows the picture diagram of such a receiver. R1 and R2 are the 6 ohm rheostats controlling the filaments of the detector and the RF tubes. C4 is a bypass condenser, having a capacity of .001 mfd. J1 is the loop jack. J2 is a double circuit jack connected on the detector output, so that signals can be heard from only the RF and detector tubes. S1 is the switch arrangement whereby you can use another receiver with the same AF amplifier used for this set. R8 is the 3/4 ampere ballast resistor. C5, C6 and C7 are 25 mfd. fixed condensers. R3, R4, R5 and R7 are .1 megohm resistors. R6 is a .5 megohm resistor. C2 is a .00025 mfd. grid condenser. R0 is a variable grid leak, which will increase the sensitivity of the detector tube.

\*\*\*

I HAVE three Bodine Twin-Eight RF transformers; three .00035 mfd. variable condensers; three Amsco Universal sockets; a three stage resistance coupled audio frequency amplifier; a switch; three 4" Amsco dials; one Bruno Light Switch; one clip terminal strip; a rheostat, 6 ohm type; a zero to 200,000 ohm non-inductive resistance a 7x24" panel and a 6x23x1/4" baseboard. I also have the circuit diagram, where these parts are used, but do not know how to place the parts. The circuit is a standard type, wherein two stages of tuned radio frequency amplification, a non-regenerative

detector and three stages of resistance coupled audio frequency amplification are employed. The rheostat is used to light the filaments of all the tubes. The high resistance is connected so that it varies the voltage of the plate supply to the first and second tubes. The plate of the first tube is connected to one terminal of a .5 mfd. fixed condenser. The other terminal of this condenser is connected to the F minus post on the same socket. This applies to the plate filament connection of the detector tube also. All the F minus posts are connected to a terminal of a .5 mfd. fixed condenser, with the other terminal of the condenser going to the B plus 90 volt post. This seems to act as a bypass condenser. A panel, as well as a baseboard layout of the parts, etc., would be very much appreciated.—Sidney Rhamstein, Port Jervis, N. J.

The photographs shown in Figs. 341, 342, 343 and 344 give clear views as how to lay these parts out. Fig. 341 shows the panel layout. The pilot light is placed between the variable condensers, which shunt the secondaries of the second and third RFT. The switch is placed between the first and second condensers. No rheostats are placed on the panel. Fig. 342 shows the back view, while Fig. 343 shows the top view. Note that the coils are mounted parallel to each other. Due to the characteristic winding of this coil, it is possible to do this, e.g., enclose fields. The rheostat is mounted between the second and third RFT toward the rear. Fig. 344 shows the bottom of the baseboard view. Note the resistance wire of the rheostat. The high resistance rheostat is mounted near the resistance coupled AF amplifier and is hidden from view. Both these controls are not critical.

\*\*\*

I HAVE two forms, both of which I wish to use in the Anderson Baby Super-Heterodyne described in the July 18, 1925, issue of RADIO WORLD. However, they haven't the same dimensions as those specified in the article. The 2" bakelite cylindrical disks are the end supports, these being 3/4". Between the two disks is a cylinder 3/4" in height and 1 3/8" in diameter. This means that I have a 1 3/8" diameter to wind with the coils on, instead of a 2" diameter, as per article. How many turns should I place on these

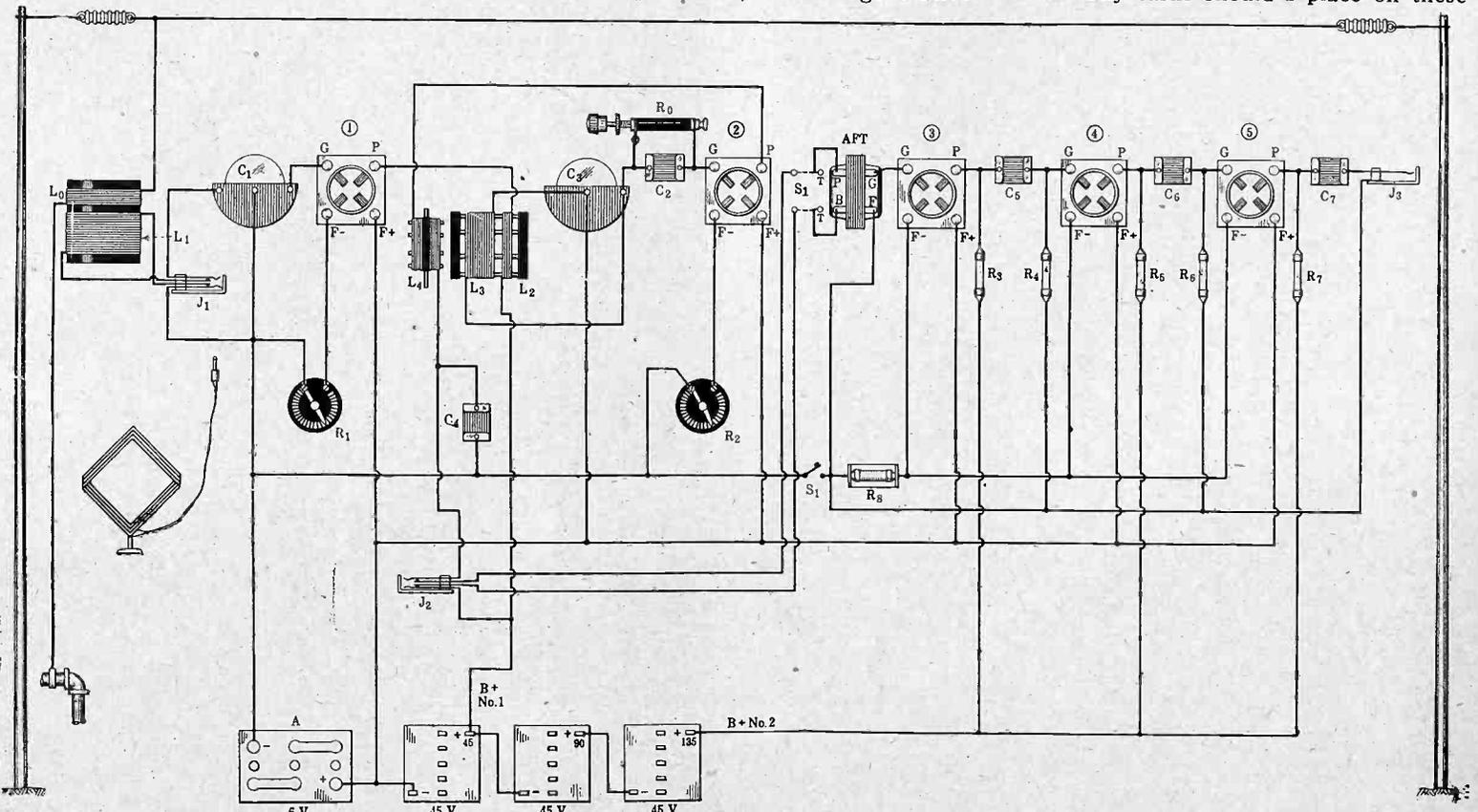


FIG. 345. The picture diagram of the receiver requested by Mr. Harvey Blanders.

forms to make up the intermediate frequency transformers, using No. 30 DCC wire? (2)—Can two .0005 mfd. variable condensers be used instead of the double condenser? (3)—I now have a Super in which the filter is placed after the first detector. Is it possible that the results may be superior if the filter is placed after the intermediate transformers or before the second detector?—Joseph Hamata, Raymond, Nebr.

(1)—The primaries consist of 160 turns. The secondaries consist of 730 turns. The two windings are in the same direction. They are separated by two layers of heavy wrapping paper. The primary is wound right next to the core or tubing. (2)—Yes. (3)—Yes.

\* \* \*

**KINDLY INFORM** me as to the number of turns to place on a tubing 2 3/4" in diameter to constitute the primary and the secondary windings of a radio frequency transformer, the secondary to be shunted by a .0003 mfd. variable condenser. (2)—I would also like to have a diagram of 6-tube receiver, employing two stages of tuned RF, a non-regenerative detector and three stages of resistance coupled audio frequency amplification.—A. E. Henderson, 3026 North 48th Ave., Omaha, Neb.

(1)—The primary consists of 10 turns. The secondary consists of 65 turns. Use No. 22 double cotton covered wire. (2)—Fig. 346 shows the electrical diagram of a set along the lines as you described. The audio portion is different. However, by following this description, you may obtain the wiring directions of the resistance AF stages. The wiring description of the RF and detector portion of the set can be obtained from the answer to Joyce Lucke's query. The plate post of the detector or third tube is brought to one terminal of a .1 megohm fixed resistor, and to one terminal of a .001 mfd. fixed condenser, C5. The other terminal of the resistance is brought to the B plus 67 1/2-volt post. The P post of this same socket also is brought to the one terminal of a .25 mfd. fixed condenser. The other terminal of this condenser is brought to one terminal of a .1 megohm resistor and to the grid post on the fourth socket. The other terminal of this resistance is brought to the A minus post on the strip. The plate post on the fourth socket is brought to one terminal of a .1 megohm fixed resistor and to one terminal of a .25 mfd. fixed condenser. The other terminal of this resistor is brought to the B plus 135-volt post. The other terminal of the .25 mfd. fixed condenser is brought to the grid post on the fifth socket and to one terminal of a .5 megohm fixed resistor. The other terminal of the fixed resistor is brought to the A minus post on the strip. The plate post on this fifth socket is brought to a terminal of a .1 megohm fixed resistor and a terminal of another .25 mfd. fixed condenser. The other terminal of this fixed resistor goes to the B plus 135-volt post. The other terminal of the fixed condenser goes to the grid post on the last socket and to a terminal of a .25 megohm fixed resistor. The other terminal of this resistor is brought to the minus post of a 6-volt C battery. The plate post of this socket is brought to the top terminal of a single circuit jack. The bottom terminal of this jack is brought to the B plus 135-volt post. Now all the F plus, as well as the F minus posts are connected together. The common negative terminal is brought to a terminal of a 3/4-ampere ballast resistor. The other terminal of this ballast resistor is brought to the A minus post on the strip. The plus terminals are brought to one terminal of the switch S2. The other terminal of this switch is brought to the A plus, B minus post on the strip.

\* \* \*

I WOULD like to have a circuit dia-

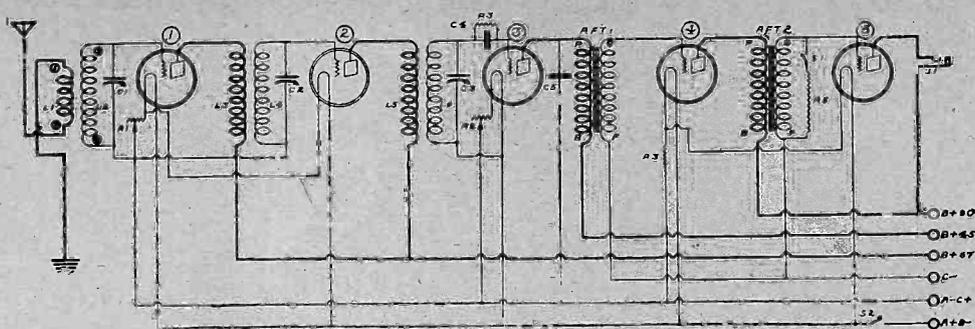


FIG. 346  
The electrical diagram of the receiver requested by Mr. Joyce Lucke.

gram of a 5-tube receiver employing two stages of tuned radio frequency amplification, a non-regenerative detector and two stages of transformer coupled audio frequency amplification. The filaments of the RF tubes should be controlled by a single rheostat, the filament of the detector tube should be controlled by a rheostat, while the filaments of the audio tubes should be controlled by a ballast resistor. Some provision should be made for the control of volume on the second stage of audio. Complete data on the coils (basket weave type), condensers, resistances, wiring and operation are desired also.—Joyce Lucke, Tindall, Idaho.

Fig. 346 shows the electrical diagram of this receiver. The primaries, L1, L3 and L5 consist of 10 turns. The secondaries, L2, L4 and L6, consists of 65 turns wound on a form 2 3/4" in diameter. Fifteen dowel sticks are employed. These are 1/4" in diameter. The under two and over two method of winding is employed. No. 22 double cotton covered wire is used. C1, C2 and C3 are .0003 mfd. variable condensers. If you wish to use .0005 mfd. variable condensers, then the secondaries should consist of 55 turns. R1 is a 10 ohm rheostat. R2 is a 15 ohm rheostat. R3 is a 1/2 ampere ballast resistor. R5 is a high resistance rheostat (0 to 5 megohms). C4 is a .00025 mfd. fixed condenser. R3 is a 2 megohm grid leak. C5 is a .001 mfd. fixed condenser. AFT1 and AFT2 are both low ratio type audio frequency transformers. S1 is a single throw, single pole, or simple filament switch. S2 is a filament control switch. J1 is a single circuit jack. The radio frequency transformers may be placed on the end plates of the condensers or on angle irons mounted directly on the baseboard. When mounted, the second RFT should be mounted erect, with the windings of the other two RFT bending away from each other, (V shape formation). The primary windings may be wound in the regular fashion, e. g., 1/4 or 1/8" separation between the primary and the secondary windings, or 27 turns of the secondary are first wound, then 10 turns of the primary winding and 10 turns of the secondary winding are wound. This is followed by the remaining 28 turns of the secondary winding. A 7x24" panel can be used. The rheostat can be placed in between the condensers. The switches can be placed at the extreme bottom portions of the panel. The single circuit jack can be placed underneath the dial on the shaft of the second variable condenser. Now as to the wiring. The beginning of the primary winding, indicated by 1, in L1, is brought to the ground post. The end of this winding, indicated by 2, is brought to the antenna post. The beginning of the secondary winding, indicated by 3 in L2, is brought to the grid post on socket 1 and to the stationary plates of the variable condenser, C1. The end of this winding, 4, is brought to the rotary plates of C1 and to the arm of R1, which incidentally also goes to the A minus C plus post on the strip. The beginning of the primary winding, L3, is brought to the plate post on the first socket. The end of this winding is brought to the B plus

67 1/2 volt post. The beginning of the secondary winding, L4, is brought to the rotary plates of C2 and to the arm of R1. The end of this winding is brought to the stationary plates of C2 and to the grid post on socket 2. The beginning of the primary winding, L5, is brought to the plate post on socket 2. The end of this winding is brought to the B plus 67 1/2 volt post. The beginning of the secondary winding, L6, is brought to the rotary plates of C3 and to the F plus post on the third socket. The end of this winding is brought to the stationary plates of C3 and to a terminal of the leak-condenser combination, C4, R3. The other terminal of this combination is brought to the grid post on the third socket. The plate post on this socket is brought to the P post on AFT1 and to one terminal of C5. The other terminal of this condenser is brought to the A minus C plus post. The B post on this AFT is brought to the B plus 45 volt post. The G post on this AFT is brought to the grid post on the fourth socket. The F post is brought to the C minus post. The P post on AFT2 is brought to the plate post of the fourth socket. The B post is brought to the B plus 90 volt post. The G post on AFT 2 is brought to the G post on the last socket and to one terminal of the switch, S1. The other terminal of this switch is brought to one terminal of the variable resistance, R5, although not shown in that fashion in the diagram. The other terminal of this resistance is brought to the F terminal on AFT2, which also is brought to the C minus terminal. The plate post on this last socket is brought to the top terminal of the single circuit jack, J1, while the bottom terminal is brought to the B plus 90 volt post. Now as to the wiring of the filament circuits. The F minus posts of the RF tubes are connected together. They then are brought to one terminal of the rheostat, R1, holding the resistance wire. All the F plus posts are connected together and then to a terminal of the filament switch, S2. The other terminal of the switch is brought to the A plus, B minus terminal. The resistance terminal of R2, is brought to the F minus post of the third socket, holding the detector tube, while the arm of this rheostat is brought to the A minus, C plus terminal. The two F minus posts of the audio sockets are brought to one terminal of R3, while the other terminal is brought to the A minus, C plus terminal post. All -01A type tubes should be employed. If it is found that the RF tubes oscillate beyond control, decrease the amount of turns in the primaries, L3 and L5, e. g., take 3 turns off, or you can place a high resistance rheostat (2000 ohms) in series with the grid returns of the RF tubes, e. g., the arm of the rheostat to the grid returns of the RF tubes and the resistance terminal to the A minus terminal. Of course, when doing this, be sure to disconnect the grid return of these tubes from the rheostat, R1. The fixed condenser, C5, should not impair the signal strength. If it does, the condenser is leaky, etc. Be sure that the rotors of the variable condensers are connected to the filament sides. Otherwise, you will

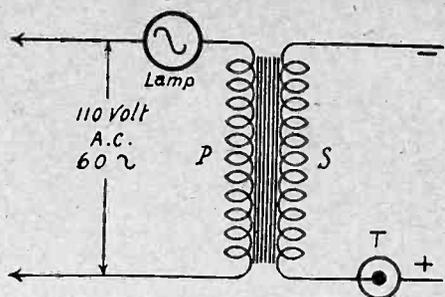


FIG. 347  
The electrical wiring diagram of the S-tube B battery charger.

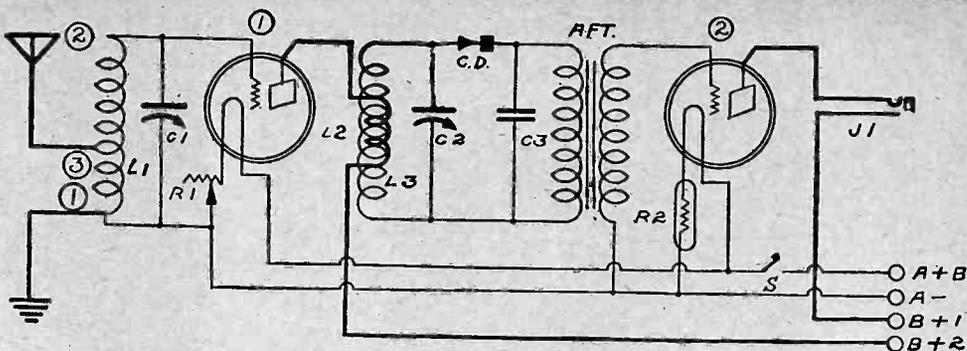


FIG. 349  
The electrical diagram of the quality set.

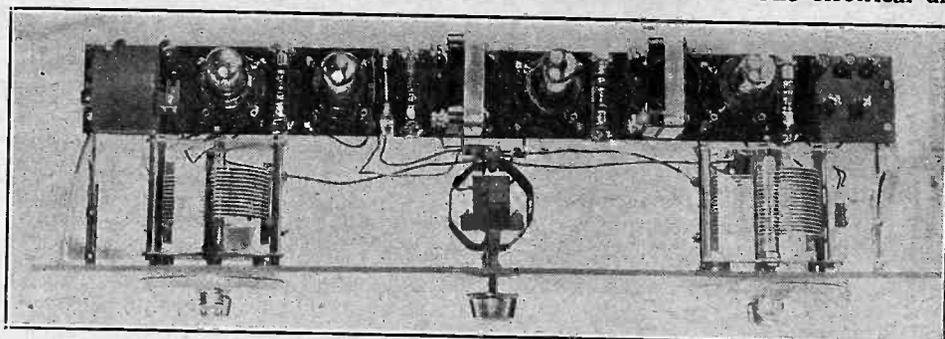


FIG. 348  
The photographic layout of the set asked for by Roland Starck.

be troubled by body capacity. Also be sure that the low and the high potential sides of the coils are kept together. With the coils specified and the condensers having their proper minimum as well as maximum capacity, there ought to be no trouble in covering the entire wavelength of from 200 to 550 meters, using a 100 foot antenna, including the lead-in, and a 20 foot lead from the set to the ground.

I HAVE an S-tube and a step-up transformer. The secondary of this transformer delivers 550 volts passing 1/2 ampere, operating from the 110 volt, 60 cycle line. I would like to use this transformer and tube to construct a B battery charger. The diagram of such an instrument is therefore requested. I would also like to know how to increase or decrease the charging rate. I have six 22½ volt storage batteries, which I may wish to charge at once, or individually.—Thomas Fredericks, Mt. Zion, Ill.

Fig. 347 shows the wiring diagram of such a charger. The charging current is regulated by the lamp, which is connected in series with the primary side of the line. A resistance, which is equal to that of the lamp, may be used instead of the lamp. The lamp should be of the carbon or the tungsten type. The rate of charging as, you probably know, is stated on the cover of the battery by the manufacturer. The following table shows how, with different

sizes of lamps, the charging rate may be increased or decreased:

Rating of Lamp in Watts	Charging Rate
100.....	.046 amperes
150.....	.068 amperes
200.....	.089 amperes
250.....	.095 amperes

Incidentally, when you insert this lamp, the voltage of the charging source is greater also. For obtaining an intermediate number of watts place the lamps in parallel to those already in the circuit.

I HAVE two .0005 mfd. variable condensers, which I would like to use in a 4-tube receiver, employing a tuned stage of radio frequency amplification, a regenerative detector with the inductive method of coupling the grid and plate and two stages of transformer coupled audio frequency amplification. The filaments of each of these tubes should be controlled by a ballast resistor. I have octagon forms, more commonly known as pickle bottle forms, which I wish to use for winding coils. One of these is 3 1/4" in diameter, while the other 2 3/4" in diameter. However, I have no directions as to the winding of coils on this form which is solid and resembles a solenoid tubing, except that it has eight sides. The method of winding on these forms as well as the number of turns, etc., wiring direc-

tions and a picture layout of the parts would be very much appreciated. I am going to use —99 type tubes.—Roland Starck, West Sterling, Mass.

The primaries, which will be known as L1 and L3, consists of 10 turns. The secondaries, which will be known as L2 and L4, consists of 45 turns. The tickler, which will be known as L5, consists of 36 turns. Now as to the method of winding. Pieces of adhesive or plain tape twice as long as the tubing is placed on each one of the eight sides, before the wire is put on. If the winding is 4", then the tape should be 8". If the tape is 8" long, then it should be so placed that a 4" portion lies upon a side, with a 2" portion overlapping on each side of the form. Thus, when the 2" portions are doubled up, they will form another 4" portion, falling over the entire length of the coil. The tape is so placed that the sticky side is face up. The windings are then put on the form. The dangling portions of the tape on either side of the form are then lapped over the winding. When doing this, it will be noted, that the sticky side will fall here. The winding is then slid off the form without squashing the coil. It might be difficult to get this winding off, if wound too tight. Therefore underneath each piece of tape, place some paper. This will give a smoother surface. It will also give some space between the coil and the form. Thus if the paper is pulled out, it will become easier to pull the winding off. No space need be left between the primary and secondary windings. No. 24 single cotton covered wire should be used for winding the primary and the secondary windings, while No. 26 single silk covered wire should be used for winding the tickler. These secondaries are wound, so that your .0005 mfd. variable condenser may shunt and cover the entire wavelength band. Strips of hard rubber, 1/8 or 1/4 in. in width are placed on front and back of two of the sides and bolted together. Holes should be drilled preliminary to this on one part of strips and binding posts inserted. The beginnings and ends of the coils are then brought to these posts. The coil where-in the tickler is to be mounted should have one of its pair of strips (where posts are absent) 1/4 in. longer, so that a hole can be drilled and the tickler shaft inserted. The strips of hard rubber should be also placed on the tickler winding and the beginning and end of the winding, thereto. In the exact center of these strips, holes should be drilled. This is for the passing through of the shaft. The end of this shaft is either bolted down, with the aid of a screw soldered in the hollow center of the shaft, or soldered down, the solder acting as a nut and preventing the shaft from slipping through. The ballast resistors, which control the filaments of the tubes, will be known as R1, R2, R3 and R4. These are all 1/4 ampere type. The variable condensers will be known as C1 and C2. The grid condenser, .00025 mfd. type, will be known as C3. The grid leak, which is variable and of the plunger type, will be known as R5. The audio frequency transformer will be known as AFT1 and AFT 2, respectively. The jack on the output will be known as J1. This is of the

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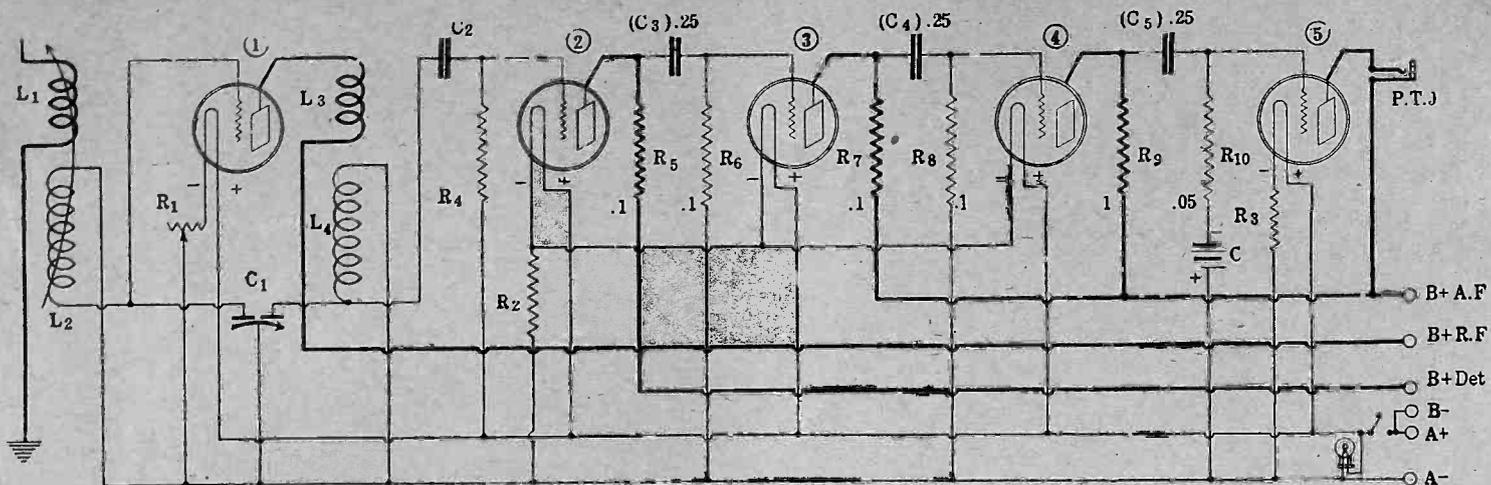
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**THE SCHEMATIC** diagram of a 5-tube quality receiver. The secondaries of the RFT are tuned by a double condenser, C1. Each section of this condenser has a capacity of .0005 mfd. The primary in the first RFT is variable. In this manner we are able to tune the antenna, which gives us a greater DX range than otherwise. The filament of the first tube is controlled by a single rheostat. The detector and first two audio tubes are however, controlled by a 3/4 ampere ballast resistor. The filament of the last tube is controlled by a single ballast resistor. This facilitates use of a power tube.

single circuit type. A switch will be known as S. The tubes are called thus: RF-1; Det-2; AF-3 and 4. Now as to the wiring. As was stated time and time again in these columns, when following these directions always follow the circuit out with a pencil and paper, marking all the coils and condensers. Then wire the set from the diagram. Confusion results otherwise. The beginning of the primary of the antenna RFT, L1, is brought to the antenna binding post, while the end of this same coil is brought to the ground post. The beginning of the secondary of this RFT, L2, is brought to a binding post terminal, which should be marked 1. Another binding post, placed directly adjacent and marked 2, should be connected to the rotary plates of C1 and to the A minus post. The end of this winding is brought to a binding post, marked 3. Another post also adjacent and marked 4, is connected to the stationary plates of C1 and to the grid post of the first tube. The beginning of the primary winding, L3, is brought to the plate terminal on the first tube socket, while the end of this winding is brought to a B plus 67½ volt post. The beginning of the secondary winding, L4, is brought to the rotary plates of C2 and to the F plus post on socket 2. The end of this winding is brought to the stationary plates of C2 and to one terminal of the grid leak, condenser combination, C3 and R5. The other terminal of this combination is brought to the grid post of the second socket. The beginning of the tickler winding, L5, is brought to the plate post on this same socket, while the end of this winding goes to the P post on AFT1. The B plus post on this AFT is brought to the B plus 45 volt post. The G post on this AFT is brought to the grid post on the third socket. The F minus post of this AFT is brought to the A minus post. The P post on AFT 2, is brought to the plate post on socket 4, while the B post is brought to the B plus 90 volt post. The grid post of this AFT is brought to the grid post on the last socket, while the F minus post is brought to the F minus post on the socket. The plate terminal of this socket is brought to the top terminal of the single circuit jack, J1, while the bottom terminal is brought to the B plus 90 volt post. This is the same post, the B plus post on AFT2 was connected to. All the F plus posts are connected together. This common lead is connected to one terminal of a switch, while the other terminal of the switch is connected to the A plus, B minus post. One terminal of each of the ballast resistors, R1, R2, R3 and R4, is connected to the F minus post of each socket. The other terminals of these resistors are connected to the A minus post. It will be remembered that when connecting up the secondary of the RFT, no direct

connections from the coil to the condenser were made. This is due to the fact that provision is made for a loop, which may be used successfully. When the antenna and the ground are to be used, strips of bus bar are connected across the binding posts adjacent to each other, viz., 1 and 2; 3 and 4. When the loop is to be used, the terminals from the loop are brought to posts marked 2 and 4, e.g., those connecting with the stator and rotor of C1. The strip is of course, taken off, thereby disconnecting the primary and the secondary windings, as well as the antenna and the ground from the loop circuit. By allowing them to be in the circuit, the efficiency of the loop is nil, except that it acts as an inductance, to bring in higher wavelength stations, etc. This method of connecting a loop or an antenna-ground is much more efficient than the jack method. In the latter case, the plug or the prongs of the jack seldom make proper contact. At times, when the plug is inserted, the secondary winding becomes shorted, due to the plug touching those terminals of the jack which are connected thereto. The terminals of the jack, sometimes, do not break contact, when the plug is inserted. This again, causes the shorting of this winding. Of course, when this happens no signals can be heard resulting in the condemnation of the set with a loop. Although the AF transformers used here had the familiar P, B, G, F, markings, you or someone else, desiring to construct this same receiver, may have those with such markings as P1P2; S1S2. In this case, P1 is the P post; P2 is the B post; S1 is the G post; and S2 is the F post. Fig. 348, shows the layout of the parts used in this set, photographically. The variable condensers are mounted on both sides of the tuner. A 7x24 in. panel is used. The sub-panel idea is used for mounting the sockets, transformers, ballast resistors, and RFT, etc. The RF coil may be seen at the extreme left on this sub-panel, with the following arranged in order: RF tube, R1, detector tube, R5 and R2, AFT1, first AF tube, R3, AFT2, last AF tube, R4 and the battery binding posts on the side. The antenna and the loop posts are behind the RFT. Brackets hold the sub-panel to the panel proper. The filament switch is placed directly underneath the tickler knob. The jack is placed a little to the right of the second variable condenser, at the bottom of the panel. There should be no difficulty attached to the operating of this receiver upon completion. The tubes are first inserted. The antenna and the ground or the loop are then connected. The A battery is then connected and the switch pulled. Upon the lighting of the filaments, the tubes should be taken out of the sockets. An old tube having a good filament, should

be inserted in any one of the sockets, and the B batteries connected. This same tube should be placed in each of the sockets. If she lights O. K. in each of the sockets, etc., then the good tubes can be inserted with safety. A tube having a good filament, but no other value is of great use, as in the case just mentioned, the lives of any number of tubes being saved, if wrong B connections, etc., have been made. The phone plug should now be inserted. A sort of whispering power sound will indicate that the "set has life." That is, it is in proper working condition. Thereupon the condenser dials are turned both in step. The tickler knob is brought around to about 50. When the station is tuned in and the signals are too loud or distorted, or the set is erratic or squealy this knob is turned, so the dial numbers read less or so that the magnetic relationship between the secondary winding and the coil nears minimum. The loop used with this set, should consist of 14 turns of No. 18 bare copper or double cotton covered wire, wound on a two foot frame. The antenna should be approximately 100 feet in length, including the lead-in, using No. 14 enameled or stranded wire as the conductor.

\* \* \*

**I WISH** to build a receiver, for use on local stations, to be received with headphones, but with absolute quality of reproduction. Please give the electrical diagram of such a set, stating the constants of the parts and any special operating advice which may be necessary. I would like to use spider weave coils, as they take up very little room. Please tell also, how to make the forms, etc.—Jack Granville, Newburgh, N. J.

Fig. 349, shows the electrical diagram of this set. The antenna coil, L1, consists of 50 turns, tapped at the 8th turn. The primary of the RFT, consists of 8 turns, while the secondary, L3, consists of 42 turns. The form can be made from a piece of cardboard or hard rubber, 5 in. in circumference. Dots are made at every 15/16 in. point on this circumference. A 2 in. center hub is made. Dots are made at every 2/5 in. point on this circumference, lines are then drawn from the 15/16 in. portion down to the 2/5 in. portion. The pieces between the lines are then cut out. You will then have 5 triangle shaped projections. Two forms are required, one for the antenna coil and the other for the RFT. The beginning of the antenna coil is started near the hub, etc. When winding the RFT, the primary winding is placed in between the secondary winding. That is, this latter winding is divided into two 21 turn windings, with the 8 turn primary between. The secondary winding is not wound with the primary winding, though. (Concluded on page 28)

# Educators Debate Extent The Radio May Help Them

Dr. Joseph M. Sheehan, Associate Superintendent of Schools, New York City, in charge of public lectures under the Board of Education, told of a plan to create community receiving stations in the central schools in the city, where people may gather to hear lectures by radio and other forms of educational entertainment.

The project, said Dr. Sheehan, was still in the "state of consultation" by the Board of Education and may be definitely taken up for consideration and action in the fall.

Dr. Sheehan made known the plan while speaking on the future of the public lecture system, in which he said the Board of Education was deeply interested and for which it had the profoundest admiration.

"No institution is saved from the ravages of time," he continued, "nor can it fail to keep abreast of the march of events and invention. Why may you not ally your powers with the radio and send your message to hundreds of thousands instead of to hundreds?"

This method he said would make greater use of the radio for educational purposes, and spoke of the people who could not afford receiving sets who would benefit by these community receiving stations.

It would mean a more active program, with inspirational messages perhaps for mothers during the morning hours, and musical selections.

To devise some means to advance the public lecture system, preliminary nego-

tiations, he went on, have already been entered into with the city authorities, in connection with placing the radio at the disposal of the system.

Dr. Ernest L. Crandall, Director of Lectures, said it was the opinion of many that radio was bound to supplant their work, and told of broadcasting 200 lectures over WNYC station in the last year.

"While the radio may stimulate interest and arouse curiosity," he said, "when it comes to the art of teaching, it can do mighty little."

It was equally deficient in preaching, he said, and spoke of the "arm-chair Christians" who listened in on sermons at their homes instead of attending public worship, adding that it was generally conceded that no souls had been saved by that process. "You can't get enthusiasm over the radio," he added.

Dr. Crandall predicted that the radio wave was bound to recede, and that there were certain things in spoken words that could not be replaced by radio. The public forum constituted the best and most valuable part of the public lecture system, he went on, and this could never be replaced by radio.

"Man is gregarious, and the gregarious habit will bring people to sit at the feet of some teacher as they did long ago in the hills of Judea," he continued. His message to the 300 members of the association assembled at the luncheon was not to become disheartened in their work, and "to keep alive the flame of the spirit that is within you."

## Coolidge Will Be Heard With Crown Prince

A ceremony which cannot be seen except by a limited number of persons in the nation can be enjoyed by thousands Saturday afternoon, May 29, beginning at 3:30 p. m., when WEAF and WCAP will broadcast the proceedings of the official ceremonies in connection with the unveiling of the statue of Leif Ericsson in Washington, D. C.

WEAF's audience will again have the opportunity of hearing President Coolidge make an address. There will also be an address by the Crown Prince of Sweden, which will be in the nature of an official response to the recognition by Americans of the explorations of the hardy Norseman who is generally supposed to have visited this country before the voyage of Columbus. It is possible that a few brief remarks will be made by the Crown Princess of Sweden. A brief address will also be delivered by Congressman Carl R. Chindblom of Illinois.

### LOVE ALL

"Secretary Hubbard, of the Bureau of Standards, may be right," George Rothwell Brown observes, "in saying that the transmission of letters by radio is at hand, but we fear he doesn't know much about billet doux."

### SUCH IS FAME

Poor old Gilbert and Sullivan—how their fame has been dimmed! After the WEAF Light Opera Company had presented "Pirates of Penzance" before "mike" an epistle arrived at WEAF with favorable comment for "the fine opera by Ginsberg and Solomon."

## Death Penalty Fixed For Radio Burglar

Judge Frank F. Adel in the Queens County Court, New York, sentenced Paul E. Hilton, the "radio burglar," convicted of murder in the first degree for killing Patrolman Arthur Kenny, to die in the electric chair during the week of June 20.

"You have been a menace to society for several months," Judge Adel declared. "It is a fortunate thing that you did not kill more people. I am not in sympathy with your desire to be relieved of your responsibility."

Hilton was taken to Sing Sing immediately after sentence by Deputy Sheriffs William Desmond and William Stuart.

William F. Lyons, counsel for Hilton, moved that the verdict of guilty be set aside and for a new trial. Both motions were denied.

### THE OBJECT OF TUNED RF

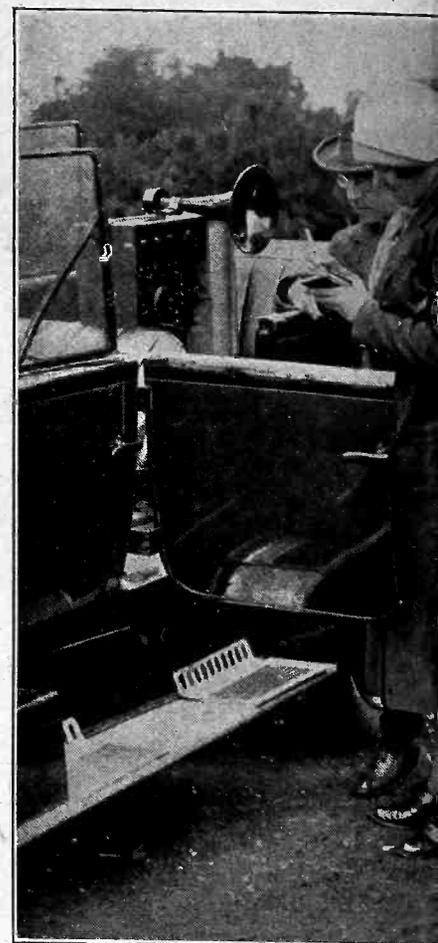
By amplifying the signal at radio-frequencies sensitivity is obtained. The amplifier should be of the tuned type. This is selective, keeping out signals of a different frequency than the desired one. The amount of amplification in this unit should be sufficient, when adjusted to maximum, to build up the signals even only a bit stronger than the background level, to a point where the detector gives normal headphone output.

### THE ADULT CORRECTIVE

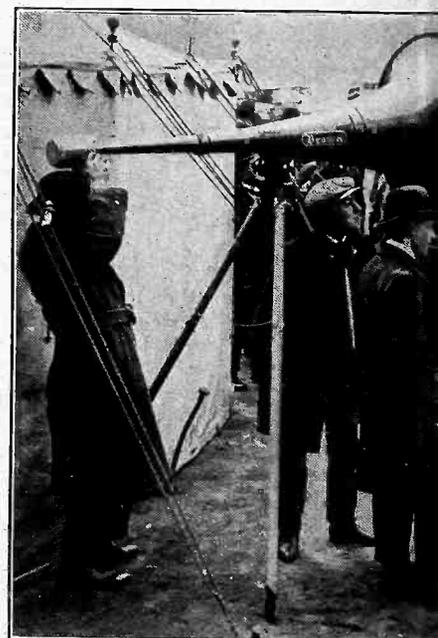
The Boy (tuning radio)—I wonder who's at the mike.

Grandmother—Don't say Mike, dear—it's Michael.—"Life."

## How Strike News



**DURING ENGLAND'S** recent economic paper presses were stopped, a portable motor car to receive strike news from a relayed to



**BRITISH GOVERNMENT** authorities the general strike to assembled crowd several stages of radio-frequency amplifier. The audio-frequency power amplifier. The instruction, made to v

## WGN French Class

Almost 1,000 pupils are enrolled in the radio French class of Prof. Henri Crozard, who broadcasts the French lesson each Thursday afternoon from WGN. The professor, who is an experienced teacher, never ceases marveling at the extent his radio class has developed. Hundreds of students seeking special information

as Heard in Britain



war, in which all of the leading news-  
as shown above was carried around in  
the broadcasting stations. The news was  
e countryside.



erated the receiver for giving news of  
A super-sensitive receiver, employing  
ation, was used in conjunction with an  
nit of the speaker is of a special con-  
and a terrific volume.

s Nearly 1,000 Pupils

When the idea of broadcasting French lessons was first proposed, the WGN officials were frankly skeptical. They said that it could not be done. The professor was given an opportunity to demonstrate. Hundreds of queries come to him every week and the results have surprised even himself.

# Air Piracy Is Growing, Says Chicago Supervisor

CHICAGO.

E. A. Deane, district supervisor of radio, Department of Commerce, announced that air piracy is continuing in several sections of the Ninth Radio District. Recommendations for issuances of the new broadcasting licenses are being withheld pending final action by the Senate in radio legislation.

The Chicago Federation of Labor, which is completing a new station on the municipal pier, faces the prospect of being denied a license on the same basis that other applicants have been refused recommendation for six months, Mr.

Deane said, due to the congestion of the air in the Chicago district.

Station WJAZ, which defied Secretary of Commerce Hoover's allocation of wavelengths and defeated the old wireless communication law, continues to violate the regulations, Mr. Deane said, adding that he has received reports of similar infractions in various sections of his district and the whole country. The pending legislation, he explained, would provide for the issuance and revocation of licenses on the basis of necessity and public service. It is reported that fans are showing great interest in air piracy.

## First Radio Parish Begins Its Career

A non-sectarian radio parish, believed to be the first one, has been established by the Rev. Howard O. Hough at Portland, Me. The station is WCSH.

The Rev. Mr. Hough has been broadcasting a weekly service since November and because of the responses received has resigned as pastor of the Advent Christian Church to assume the pastorate of the Radio Parish.

Business men and others interested have pledged financial support. A violinist, a pianist and a mixed quartet assisted at the first service.

## Six Stations Put on Frequency Honor List

WASHINGTON.

According to measurements by the Bureau of Standards, the following stations have been found sufficiently constant in their frequencies to be used in the calibration of sets and wavemeters:

WJR, Detroit, Mich.; WEAJ, New York; WCAP, Washington; WRC, Washington; WSB, Atlanta, Ga., and WGY, Schenectady.

## May in Radio History

1827, May 19.—Savary found that a steel needle could be magnetized by the discharge from a Leyden jar.

1872, May 6.—Highton made various experiments across the River Thames with Morse's method.

1879, May 22.—Hughes discovered the phenomena on which depend the action of coherer. The coherer was later used practically by Marconi.

1889, May 10.—Thompson suggested that electric waves were particularly suited for the transmission of signals through fogs and material objects.

1894, May 28.—Rathenau experimented with a conductive system of wireless telegraphy and signaled through three miles of water.

1915, May 12.—In Battery Park, New York City, the mayor unveiled the monument in memory of wireless operators who had lost their lives at the post of duty.

1916, May 20.—The determination of the difference in longitude between Paris and Washington with the aid of radio which had been in progress since October, 1913, was completed.

1925.—During May the radio compass (direction finder) came into use on board vessels.

## Odd Sources of Trouble

It seems that almost anything is capable of causing radio interference, as is shown by the following additional trouble makers recently unearthed by a Federal radio supervisor in Oregon:

A sign on a street corner peanut roaster in an Oregon city caused trouble fifteen blocks away.

A small but active motor with a dirty commutator and improperly fitted brush.

Twelve defective flour bleachers equipped with electrical arcs in an Oregon flour mill.

Faulty insulators and other power line equipment on a high voltage transmission line carrying 66,000 volts were found to be causing considerable interference to radio fans in western central Oregon.

In its desire to cooperate with the fans of that section the power company has appropriated money with which to purchase an auto equipped with a trouble-finding set, and has appointed a radio expert to patrol its lines to locate and eliminate trouble as it occurs.

## INTERESTING FACTS

Amateurs are responding to the War Department's request for aid in strengthening the country-wide radio net.

Radio, Va., is the home of NAA at Arlington.

The fire departments of Amsterdam and Vienna are apparently the first to equip their apparatus with radio.

Prices Neck, R. I., radio compass station now transmits bearings to vessels using alternating continuous waves.

By means of radio a New York man located his daughter, last seen when but a year old. She is now grown and married.

Another radio show appears on the horizon with the announcement that the Boston Exposition will be held during the week of September 27.

## THE FIRST BROADCASTING

From the Columbia Phonograph laboratories in 38th Street, New York, Dr. Lee DeForest placed on the air what will be known as the first regular broadcast program. It consisted chiefly of records and was picked up in the ball-room of the Hotel Astor, where a number of celebrities had gathered to grace the occasion.

A dinner table was set, and at each cover there was a pair of regulation telephone receivers with head-bands. The program came in strong and clear. The following morning the daily press heralded the feat far and wide.—"Radio News."

# Board Plan Un-American, Coolidge Warns Congress

WASHINGTON.

Four major developments served to impair the chances for the enactment of radio legislation before the end of the present session of Congress:

**1** The announcement that President Coolidge is not in favor of the creation of an independent commission for the regulation of radio.

**2** The decision of the Senate Interstate Commerce Committee, of which Senator Watson, of Indiana, is chairman, to fight hard for the Dill bill which would establish an independent commission to regulate radio.

**3** The announcement of House leaders that they would stick by the White bill, which has the approval of President Coolidge, Secretary Hoover, and the industry generally.

**4** The insistence of Secretary Hoover that radio legislation is imperative in view of the Chicago decision which denies the right of the Department of Commerce to assign wavelengths to stations.

## Coolidge Fears Bureaucracy

President Coolidge let it be known that he believed independent commissions which are not under executive control tend to create bureaucracy. For this reason, the Chief Executive is more favorable toward the White radio bill which leaves the details of administering the radio law in the Department of Commerce.

The White House view is that an independent commission, responsible to no government authority, and with the entire control of radio regulation, might create a situation distasteful to the American people.

In addition, the White bill is more economical in that it requires less money to put into operation, which is a feature that appeals to the President.

In spite of the announcement of the President, Republican and Democratic members of the Senate Interstate Commerce committee voted solidly to report out the independent commission bill.

## Commission Plan Goes Forward

Unless revamping is done, the bill reported will provide for an independent commission with five commissioners, each with a term of seven years and with a salary of \$12,000 per annum. This commission would take over the present radio personnel of the Department of Commerce. The commission would have general blanket authority to handle almost any radio problem that arose.

Congressman White does not believe that this is the time for an independent radio commission. He believes his bill provides adequate safeguards against "one-man" control of radio.

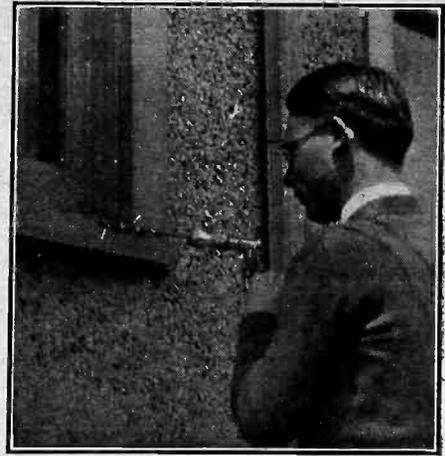
Under the White bill, a semi-judicial commission is provided which would have the power to review any decision of the Department of Commerce. This commission, which would be appointed by the President with the consent and approval of the Senate, would have final authority to uphold or revoke any decision of the Secretary of Commerce in connection with radio regulation.

## Hoover's Statement

Mr. Hoover indicated his resentment of statements which have been current

alleging his anxiety to retain control of radio regulation. The Secretary pointed out that the White bill, which has his indorsement, would completely deprive the Department of Commerce of authority finally to pass upon any regulatory matter.

"The White bill," said he, "leaves to us only the details of administering the radio law. I think this is an administrative function and should rest in some existing Government Department. Whether it is the Department of Commerce, or any other Government department, is immaterial to me."



**DRILL** a hole for a leadin insulator tube so that the hole slants upward from the outside. When it rains the water will not drop into the house.

# Senators Fear Danger If One Man Rules Radio

WASHINGTON.

"The probable influence of radio on the social, political and economic life of the American people, and the new and complex problems its administration presents, demand that Congress establish an entirely independent body to take charge of the regulation of radio communications in all its form."

This is the outstanding statement of the committee report on the Dill radio bill which has been favorably reported to the Senate for passage. It is expected that the bill will be taken up for consideration in the Senate within a short time and passed with few changes. It is believed that no attempt will be made to change several features which are considered objectionable until the bill reaches conference between the House and Senate.

## Too Much Power For One Man

Outlining the great possibilities of the use of radio as a means of distributing information or propaganda, and the power which would be held by the regulatory authorities of radio, the committee report on the Dill bill says:

"The exercise of this power is fraught with such great possibilities that it should not be entrusted to any one man nor to any administrative department of the Government. This regulatory power should be as free from political influence or arbitrary control as possible. A commission which would meet only occasionally would gain only a cursory and incomplete knowledge of radio problems. It would necessarily be largely dependent on the administrative authority, namely, the Secretary of Commerce, for expert knowledge it would require.

## Defense of the Extra Expense

"Your committee recognizes there are many important objections to the establishment of additional commissions under the Federal Government, but the relation of radio communication to the Government makes it absolutely necessary that some bureau, board, or commission under the Government shall administer the law regarding radio.

"If the channels of radio transmission were unlimited in number the importance of the regulatory body would be greatly lessened, but these channels are limited and restricted in number and the decision as to who shall be permitted to use them and on what terms and for what periods of time, together with the other questions connected with the situation, re-

quires the exercise of a high order of discretion and the most careful application of the principles of equitable treatment to all the classes and interests affected. For these and other reasons your committee decided that all power to regulate radio communication should be centered in one independent body, a radio commission, granting it full and complete authority over the entire subject of radio.

"It therefore amended H. R. 9971 (the White bill) by striking out all reference to the Department of Commerce as provided in that bill and enlarging the powers of the commission already provided for therein. In order to secure the service of men of big ability and to make the commission of equal dignity with other bodies of that kind, the bill provides for a commission of five members, at a salary of \$12,000 per year, to be appointed by the President, by and with the advice and consent of the Senate, for terms of five years, and subject to removal only for neglect of duty or malfeasance in office.

"Such a body will soon become an expert authority on radio communication. Its members will study every phase of the subject, and as a governmental body will be able to assist and encourage the development of the art of radio communication. The tremendous growth of radio during the past five years and the probable development of the art in the transmission of pictures and electric power within the comparatively near future, make it highly desirable that the Government have such a body to administer this law."

A bulletin of the National Association of Broadcasters says:

"Just what will happen to the Dill bill is entirely a matter of speculation. Senator Dill made an effort to gain unanimous consent for consideration of the bill, but was unsuccessful. It is understood that Senator Curtis has promised to help bring the matter up at an early date. There is little doubt but what many forces are at work behind the scenes in this important piece of legislation. The administration is against the establishment of another commission; yet the Senate Committee felt by writing the bill so that it could be reported out unannounced, it would pass the Senate easily despite the administration's wishes. It is believed that considerable discussion will come forth on the floor as soon as the bill is considered, resulting in several changes, and perhaps no action until late in the session, if at all.

# Stations Are Plentiful For DX Tests World Over

Fans who boast of logs showing reception of 200 American stations are hitting around .350 in the Broadcasting League—and that average would give any balltossler a star rating in the National or American League.

Batting even .200 in the International Radio League (counting all the stations of the world) would be fair enough, because there are no less than 922 broadcasters, sending at all hours, due to the difference in time, and until daylight reception at 10,000 mile range becomes possible foreign results will be a negligible factor in American radio.

There are 356 transmitting stations outside of the United States, of which about 100 are in Canada. Others are scattered in remote regions, as far as the chance of hearing them is concerned.

It is expected that by 1927 there will be 1,000 stations in operation. In addition, many foreign stations will go on much higher power. Russia and Japan are leaders in the establishment of new broadcasters.

## Some Strange Names

Greetings from practically every station in the world will be displayed at The Radio Show in Grand Central Palace, New York City, September 10-17, the first world collection of such cards.

Some of the new stations are to be located in places that are new names to most persons, particularly those which the Soviet Republic is to operate.

Canada is very active in radio, most of its stations sending programs regularly. There are 13 stations in Toronto, 11 in Calgary, 9 in Vancouver, 8 in Montreal, and 5 in Winnipeg.

The lowest number is accredited to the far away Canary Islands, Iceland, Peru and Venezuela. They have one each. OAX, in Lima, became quite well known during the 1926 international tests.

Great Britain has 21 stations, one the high power Daventry station. Nine of the stations are on what is popularly rated as substantial power, the others being comparatively low-power relay stations.

## Now 20 Stations in Germany

Today Germany possesses 20 stations, but in a very short while will have in Berlin one of the world's highest-powered stations.

France has 19, Spain has 23, but soon will possess others.

Several very high powered stations are included in the Russian broadcasting program, and there will be 30 in all by December 31.

Sweden has 14 and a new one is being added. Norway has 2 and more to follow. The list gives Czecho-Slovakia 9, Holland 5, Finland 4, Jugo-Slavia 4, South Africa 4, Chile 2, Uruguay 2, and extensive China only 2, but 4 soon to start activities.

India, with all its millions of people, like China, is backward in broadcasting, having only 3 stations, but 2 others will be ready in a few months.

Australia has 8 stations and Ceylon, far smaller in extent, has 10. Japan boasts 3 but will have 30 shortly. American experts are in Japan now installing many fine stations.

## Cuba Does Well

Cuba has 36 stations, of which 18 are in Havana, including the well-known PWX. The others use very little power.

Mexico has 16; 7 in Mexico City, Brazil has 9. The Argentine Republic possesses

## Carlin a Daddy



(Foto Topics)

**PHILLIPPS CARLIN, one of WEAF's popular announcing sextet, with a new member of his family, Virginia Claire Carlin.**

12 stations, of which all but one are in Buenos Aires.

Italy is building a number of new stations, supplementing those in Rome and Milan, and Switzerland has 7 prominent stations, one in Berne with 6 kilowatts.

Austria has 2 with 3 under construction. Denmark has 3 with 2 relay stations. Belgium has 5.

## Frequency Signals May be Discontinued

Since other means of disseminating the Government standards of radio signals of definitely announced frequencies have become increasingly available, the Bureau of Standards is considering the termination of these transmissions. This is in part due to the increasing use of Piezo oscillators and the wide availability of reliable standards testing service from a number of laboratories that do commercial testing of frequency meters. None of these means were at hand when the standard frequency transmissions were inaugurated three years ago.

The frequency schedules extending through June, will be carried on as published. The Bureau of Standards is now announcing the possible termination of the service after that date in order that persons who depend upon the service in any special way may inform the bureau of any objection to its termination.

The bureau will be especially glad to hear from persons in the western part of the United States who have been utilizing the signals from Stanford University, since the listing of standard frequency stations on the west coast has not yet been begun. Any letters on this subject should be addressed to Bureau of Standards, Department of Commerce, Washington, D. C.

## GENERAL SIGNALS ASSIGNED

The following general call signals have been assigned by the Government:

NOB, for any or all warships; NQQ, for all naval coast stations; WKW, for merchant vessels, and WTM, for commercial coast stations.

## Thomas Again Loses Chance to Broadcast

Norman Thomas, former Socialist candidate for governor and mayor, has no luck in his attempts to speak over the radio.

At the time set for his speech the voice of Donald Flamm, an official of station WMCA atop the Hotel McAlpin, from which Mr. Thomas's remarks were to have been broadcast, announced over the air instead that because of the "controversial nature" of Mr. Thomas's proposed speech, it had been deemed "only fair" to postpone it. Arrangements may be made for another speaker to present the opposite view.

When Mr. Thomas was seen at his home he said that it was the third time within a month he had been refused permission to express his views over the radio.

Mr. Flamm, who is described officially as critic of station WMCA, when questioned about the refusal, declared that the proposed speech of Mr. Thomas had been found to be "too radical."

Mr. Thomas, he said, wanted to "slam" WEAF, and WMCA had to depend upon WEAF.

## Organist Needs 4 Hours To Prepare for Recital

Four hours of preparation a day is required of Arsene F. Siegel, organist of the Uptown Theatre, Chicago, in order to put on his radio "request" concert which lasts just forty-five minutes.

From 1:15 to 2 p.m. daily, except Saturdays and Sundays, Siegel plays an organ program made up of numbers requested by his theatre and radio audiences. The program is broadcast direct from the theatre by the Edgewater Beach Hotel-Chicago Herald and Examiner station, WEBH, with the announcer Carl F. Strodel, on the stage in full view of the audience.

The reading of requests, which average 150 a day, selection of the program, acknowledgment of mail, rehearsal of selections and preparation of notes take much time.

## WGY On Daylight Time

WGY, the powerful General Electric broadcasting station, located in Schenectady, N. Y., is also operating on Daylight Saving Time (Eastern). This policy is adopted because Schenectady and New York City, in which most of WGY's program originate, are both on this time. Those living in sections where D.S.T. does not prevail, will find the WGY programs one hour earlier than heretofore.

## CALL SIGNAL CHANGES

The call signals of station KFVW, San Diego, Calif., have been changed to KFSD; KOP, Portland, Ore., to KOIN; WCBQ, Nashville, Tenn., to WBAW; WGKY, Minneapolis, Minn., to WDWY; WHAV, Wilmington, Del., to WDEL, and WWGL, Richmond Hill, N. Y., to WMSG.

The location of WMSG was changed from Richmond Hill to New York City and the owner of the station is Madison Square Garden Broadcasting Corporation.

## WATCHING THEIR STEP

Middle Western stations which have recently been equipped with Piezo crystal oscillators to keep them on their assigned frequency and to perfect transmission are:

WEBQ, Harrisburg, Ill.; WENR, Chicago, Ill.; WGN, Chicago, Ill.; WIBO, Chicago, Ill.; WLIB, Elgin, Ill.; and WOC, Davenport, Iowa.

## A THOUGHT FOR THE WEEK

**R**ADIO is showing universal expansion in its usefulness to the world at large. It now takes in the entire gamut from amusing the baby in the cradle and the bedridden shut-in to serving great scientific purposes, such as airship trips to the North Pole.

# RADIO WORLD

REG. U.S. PAT. OFF.



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

TELEPHONE BRYANT 0558, 0559  
PUBLISHED EVERY WEDNESDAY  
(Dated Saturday of same week)  
FROM PUBLICATION OFFICE  
HENNESSY RADIO PUBLICATION CORPORATION  
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FRED S. CLARK, Secretary and Manager  
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EDITOR, Roland Burke Hennessy  
MANAGING EDITOR, Herman Bernard  
TECHNICAL EDITOR, Lewis Winner  
CONTRIBUTING EDITORS, John F. Rider, J. E. Anderson

## SUBSCRIPTION RATES

Fifteen cents a copy. \$6.00 a year. \$3.00 for six months. \$1.50 for three months. Add \$1.00 a year extra for foreign postage. Canada, 50 cents.  
Receipt by new subscribers of the first copy of RADIO WORLD mailed to them after sending in their order is automatic acknowledgment of their subscription order. Changes of address should be received at this office two weeks before date of publication. Always give old address; also state whether subscription is new or a renewal.

## ADVERTISING RATES

General Advertising	
1 Page, 7 1/2" x 11"	462 lines ..... \$300.00
1/2 Page, 7 1/2" x 5 1/2"	231 lines ..... 150.00
1/2 Page, 8 1/2" D. C.	231 lines ..... 150.00
1/4 Page, 4 1/2" D. C.	115 lines ..... 75.00
1 Column, 2 1/4" x 11"	154 lines ..... 100.00
1 Inch	..... 10.00
Per Agate Line	..... .75
Time Discount	
52 consecutive issues	..... 20%
26 times consecutively or E. C. W. one year	..... 15%
4 consecutive issues	..... 10%

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

## CLASSIFIED ADVERTISEMENTS

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

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

MAY 29, 1926

## The Pay Problem

**T**HE question of who shall pay for broadcasting is solving itself. The wheel of fortune whirls in favor of the larger stations. The chain idea is growing. The safeguard against reduction of quality is injecting itself automatically. Regularity of rendition is taking care of itself. All signs point to healthy roads, with no detours. The advertising program is the pivot of everything.

Broadcasting started because some one sensed its possibilities, its advantages, indeed its necessity. There was little time to think of programs five years ago. To get started was the problem. Everything else was incidental.

The success of KDKA attracted others to the field. They sprang up fast. It would be unkind to draw the parallel regarding weeds. Some stations indeed were flowers of rare delight. But in the maelstrom of broadcasting that followed

there was much that was flimsy and trashy. Many of the weaker stations were compelled to resign the duties they had rushed themselves into, while others struggled along exasperatingly, and still others climbed to thrilling heights of performance.

WEAF started broadcasting advertising programs. These were presentations financed by companies seeking the goodwill of the radio public. The advertisers paid the talent and also paid for the privilege of broadcasting. WEAF tried to find excuses for retaining unto itself the privilege of selling time on the air, but failed. Now the practice is widely indulged in, sometimes with effrontery, even occasionally with pernicious direct advertising introduced. It is the proud cry of the stations, however, that only indirect advertising is permitted. No mention of goods, time of sale and price in one breath. Indeed, the rule is that price is never mentioned, although a couple of stations in New Jersey, for instance, ignore this admonition of the Department of Commerce.

When WEAF started broadcasting advertising presentations there was a loud and seemingly general cry of fear. Other stations, then excluded from this source of revenue, joined the cry. It included the charge of monopoly of the air. Then some of the stations whose voices were loudest suddenly subsided in this tirade, because they were permitted to share the privilege.

Today, on the whole, advertising programs are the best of all. The Atwater Kent Radio Hour is an example. So is the Eveready Hour, one of the most delightful weekly events in broadcasting. The newly created Reading Hour is another source of joy. The Victor Talking Machine Co. must not be ignored where praise is to be given for excellent programs in the advertising class.

Looking at the subject negatively, the collapse of the criticism made against advertising programs, the silence that now reigns amid ranks that formerly were so noisy, and which silence is shared the country over by non-participants in the earlier outcry, must be taken as an expression of general approval.

The radio audience takes no offense at the fact that the announcer simply tells them that that particular "hour" is broadcast by the National Carbon Co., makers of Eveready radio and flashlight batteries. Mention of Atwater Kent, maker of radio receivers and speakers, is not taken as an unwarranted intrusion of the privacy of one's home. Indeed, one gladly accepts the mention of the trade names, for the excellent program concerns the listener most, and he is utterly willing to be made familiar with the nature of the business of the company that foots the bill. The Happiness Boys, the Gold Dust Twins and all the others who have met with high favor are welcomed into one's home, indeed missed when they take a vacation.

Once it seemed to be a problem to determine who was to pay for broadcasting. Naturally the stations could not bring before their microphones, at their own expense, such artists as John McCormack, Lucrezia Bori, Frances Alda, Albert Spaulding, Claudia Muzio, Reinold Werrenrath, Maria Jeritza and the rest of the stars of the music world whom it has been the great joy of radio audience to hear. It was left to the great enterprises that have some substantial and material reason for paying these artists, these concerns, without philanthropic motive, it must be admitted, have done more for radio than any group (even philanthropists) within the radio industry itself.

Now many stations also pay artists. Also there are what are known as studio artists, who have steady jobs as such and who stand ready to fill gaps in programs.

Often announcers with piano-playing or singing ability are in this group, too. A step farther and all artists who appear before the microphone will be paid. This will put broadcasting on a sounder basis, for no industrial branch could long survive on gratuitous work.

There must be some incentive besides publicity, otherwise the rule of the wretched will prevail. While many of undoubted talent have volunteered their services, and even endured an audition, in most cases free talent has not represented that high degree of quality which radio should command.

As the advertising feature is working out now, stations are not showing any financial profit. It is not necessary that they should. Gradually the income will amount to such a figure that it will defray the cost of operation and amortization. The real profit will be rated in good will that the station commands for the products or objects of the station owner, be it a radio company, a telephone company, a church or a hardware store.

## The Appetite for Distance

**W**HETHER the desire for receiving distant stations is abating considerably is a question that only a canvass could settle to the satisfaction of all. The general assumption is that owners of receivers are very keen for DX—the abbreviated designation for distance—when these persons are new to radio, but that in about a year they get over this and settle down to the reception of local stations. As against this is the undoubted proof that there are many radioists who fish for distance quite assiduously, although this is their fifth year in radio. Also dealers know that prospective purchasers, including radio veterans, frequently inquire about the DX capabilities of receivers they have in mind.

It is probably true that for a long while to come there will be enough division of desire on the score of DX to make distance-getting sets attractive to large numbers of persons. Certainly complaints of "no DX" do not come from fans who have no interest in distance reception, and such complaints are heard on every side.

Is it well to attempt to educate the public that it should not strive for DX? It is a hard and probably thankless task to try to convince persons to refrain from striving for the things they want.

Where DX is desired it has a charm hard to define. Although the quality of the reception can not be compared to that obtained from local stations, yet DX is an appeal to the pride of possession and accomplishment. To receive many distant stations is a tribute not only to the distance capabilities of the receiver but to the tuning skill of the fan. Log sheets that run as long as roller towels repose in thousands of homes, and as long as these logs are kept and proudly exhibited, who can say that DX has become meaningless? To catch only the call letters, so as to distinguish them, though the music is blemished beyond redemption, is a source of exultation to many, and it does not seem sound to initiate propaganda for the sole object of convincing persons that they should not like what they enjoy intensely.

Let DX have its appeal so long as any natural impulse creates or sustains that appeal. And if the appetite for distance shall die, let fond roses be placed upon the resting place of the thing that gave radio its outstanding lure in the early days of broadcasting and helped to carry it along in the trying days that followed.

## WHBH BECOMES WCMA

WASHINGTON.

The call signal of WHBH, Culver, Military Academy, Culver, Indiana, has been changed to WCMA.

# Music Fees Are Debated By Buck and Harkness

Arguing the question of how much the broadcaster shall pay the composer for the privilege of using copyrighted musical numbers, Gene Buck, president of the American Society of Composers, and W. E. Harkness, of the newly formed Broadcasting Company of America, express themselves in the May issue of "Singing."

"Those for whom I speak," Mr. Buck declares, "as well as myself, feel a certain bitterness of spirit when we consider how these great corporations—whose aggregate capitalization amounts to some \$2,000,000,000—twist the freedom of the air for their private ends into a fallacious argument for making the radio-users and lovers throughout the United States believe that men who ask no more than their constitutional rights, the protection of their own property, are trying to rob the American public, instead of enriching it, taking from it instead of giving to it. The freedom of the air, as interpreted by the great electric trusts, would justify the use of the phrase 'the freedom of floor' on the part of the huge baking trust combine recently ordered dissolved by the Government."

## Must Have Music

"Broadcasting is a business, a tremendously profitable one. The great corporations controlling it sell the public of the United States, on conservative estimate, receiving apparatus—without which the public cannot enjoy the music broadcast—to the tune of more than \$500,000,000 a year. Broadcasting could not exist without music and the words to which music is written. This music and these words are the bulk of the actual goods the radio delivers, but the men who wrote them asked a decent, reasonable fee for the exploitation of these creations of their own minds from radio companies which draw vast profit from their use. And at once the cry was raised that we were extortioners."

"I feel that any man, farmer, mechanic, inventor, salesman, writer, painter or other is entitled to get all he can out of the gifts God has given him, whether those gifts be manual or mental."

## Sliding Scale Prices

"The representative broadcasters have recently attempted to arrive at an understanding with the Composers Society as to the amounts to be paid for license fees for stations of different powers, but without success," Mr. Harkness argues. "The fees paid have varied to a wide degree for stations of the same power and, further, the fees per year during the past three years have been increased at abnormal rates—as an illustration \$500 the first year, \$2,500 the second year, and \$25,000 the third year, with no assurance that they have reached a limit. What the future demands may be, no one can predict, nor will the Society state."

"There has been much misunderstanding as to the relation of the broadcaster to the radio industry as a whole, and attempts have been made to show that the broadcasters are benefited directly by the sales of radio receiving equipment. This is not true. There are comparatively few broadcasters who have any direct or indirect connection with the manufacture of radio equipment. Thirty-six stations out of a total of 536 are operated by radio manufacturers."

## Broadcasting Doesn't Pay Yet

"The gross radio business of the United States for the year 1925 is esti-

mated at \$450,000,000. This includes the total business done by manufacturers, jobbers, and dealers in complete sets and parts. Less than one per cent. of this amount is devoted to the support of broadcasting. This sum is but a small part of the annual cost of operating the total number of stations throughout the country, most of which are supported by the owners or those using their facilities in an endeavor to create good will toward those who supply the programs."

"Broadcasting in the United States is not on a paying basis. What the ultimate means of supporting it will be has not yet been determined, and this will be further deferred if the music situation remains unsettled and subject to such major fluctuations as have occurred in the past. What the broadcasters desire is some assurance of stability in their raw material—music. For that stability they stand ready to pay generously, but upon some definitely organized price list or price plan."

## Brooklyn Radio Show Set For Oct. 30 to Nov. 6

Brooklyn is to stage its Third Annual Radio Exposition, October 30 to November 6, in the 23d Regiment Armory.

The decision to hold the Radio Exposition this year was made following requests by several leading radio manufacturers and others for a show, so that they may get in closer touch with the radio owner and builder, and in view of the fact that there is estimated to be more than 350,000 radio sets in operation in Brooklyn and the rest of Long Island.

The Exposition this year will cover over 60,000 square feet of floor space. A broadcasting booth will be erected in the center of the Exposition hall which will provide entertainment for both afternoons and evenings.

The exposition will be under the personal management of Stephen T. Rogers, Room 513, Albee Bldg., Brooklyn, N. Y.

## New Thomas Loop

The new Thomas collapsible box type loop is now ready for distribution. This loop should prove popular among fans, meeting all their needs for economy of space, efficiency and beauty. It requires only a 6" space for a turning radius, thus allowing its use in confined spaces. It also has the advantage of being quickly dismantled and set up. It has good pick-up and inductance and is scientifically stagger wound, insuring proper spacing. It is handsomely finished in dark walnut. It has three taps and thus can be used on regenerative Super - Heterodynes. Three 36" leads are furnished and it is fully guaranteed by the makers. Full information on this loop can be had from the W. I. Thomas Co., 215 North Desplaines Street, Chicago, Ill. Mention RADIO WORLD.

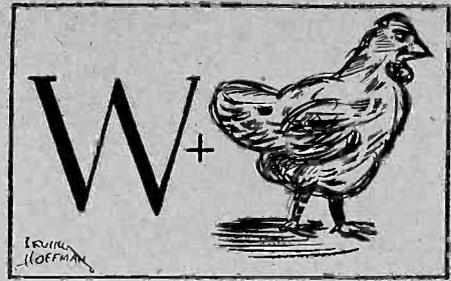
## NEW CORPORATIONS

May Radio Broadcast Corp., Newark, N. J., \$100,000 preferred and 2,500 shares common, no par value; D. W. May, Harry Green, Samuel Green, Newark. (Atty., Green & Green, Newark, N. J.).

Howards Radio House, Inc., Paterson, N. J., \$50,000; Lillian Kanter, Barney Hughes, Walter Bligh, Lillian Tracey, Paterson, N. J. (Atty., Samuel Raff, Paterson, N. J.).

Radio Printing Co., N. Y. City, \$10,000; J. H. R. Littman, S. Backlar, H. Barshay. (Atty., J. Nemerson, 261 Broadway, N. Y. City).

## The Rebus



WHAT station does this represent?

## Used Set Exchanges Propheesied by Boyd

ATLANTIC CITY, N. J.

The establishment of used radio set exchange marts likely will come in every city in the United States before long, said Carl Boyd, newly elected first vice-president of the Radio Manufacturers' Association.

"Just as the handling of used automobiles is an important part of the automobile business, so the sale of used radio sets will become an important part of radio sales," he said.

"More than 7,000,000 radio sets have been sold in the United States since radio became a business and approximately 5,000,000 of them are in condition that makes them useful today."

"These sets are being retired by their present owners as they are replaced by receiving sets of modern cabinet design, and more modern circuits. The retired sets are still in good condition and will find a ready market among beginners in radio as the used set markets develop."

## New Amsco Resistor Handles 1 Watt Safely

The definite trend toward the improvement of resistors for use in resistive coupled amplifiers has developed the Metaloid resistor, a new product manufactured by Amsco Products, Inc.

This resistor, which has been designed with the rather special requirements of resistive coupled amplification in mind, will dissipate over one watt of energy continuously without appreciable variation in its electrical characteristics. The Metaloid is made entirely of glass and metal, the resistive material being deposited on an interior glass tube. Absolute permanence and noiselessness are guaranteed by the manufacturer as well as accuracy to within five per cent. on either side of the rated resistance.

While the Metaloid may be clipped into the conventional mountings, its diameter is greater than that of the "leak" type unit, permitting sufficient conducting area to permit 100% power overload without other than practically negligible temporary variations in resistance values.

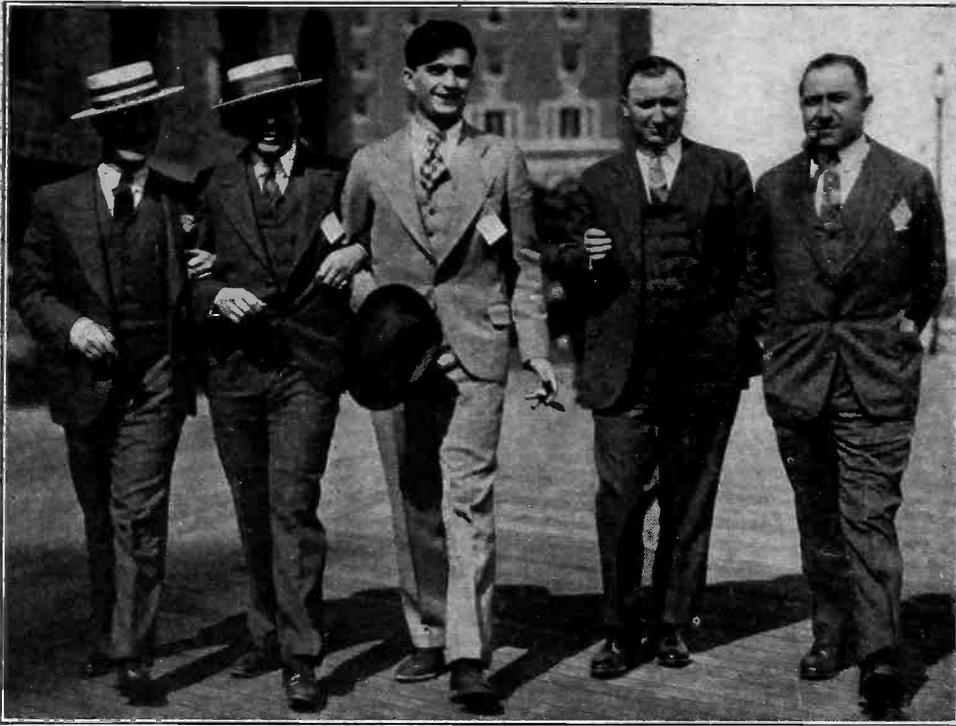
This new resistor can be supplied in any desired resistances, from the comparatively low values employed in B battery eliminator circuits to the leak values measured in megohms.

## Business Opportunities Radio and Electrical

Rates 10c per word; Minimum, \$1.00; Cash with order

WELL-KNOWN FURNITURE INSTALLMENT HOUSE DESIRES TO LEASE OUT ITS RADIO DEPARTMENT; PERMANENT WINDOW DISPLAY AND AMPLE FLOOR SPACE; ONLY EXPERIENCED RETAIL RADIO MAN WILL BE CONSIDERED; NO BEGINNERS; RESPONSIBLE PARTY WITH PERSONAL CREDIT RATING; CASH GUARANTEE WILL BE ESSENTIAL; VICTOR AGENCY INCLUDED. BOX 292, 228 WEST 42D, N. Y. C.

## Radio Promenaders Grace the Boardwalk



FOLLOWING a session of the Radio Manufacturers' Association at Atlantic City recently, these five men of the trade promenaded the boardwalk. Left to right, A. Irving Witz, of the Gray Sales Co., Philadelphia; Richard Barnett; Sidney E. Finkelstein, sales manager of the Bruno Radio Corporation; Louis Lager, president and general manager of the B. C. L. Radio Service Co., and Joseph Barnett. The Barnett Brothers hail from the Keystone Radio Co., Philadelphia. Evidently Mr. Lager was stuck for the cigars.

## THE RADIO 'TRADE

# Radio Now the Delight of Fastidious Musicians

By James H. Carroll

A short time ago it was almost impossible to interest a real music lover in radio. Orchestra leaders, pianists, singers, and other music lovers turned deaf ears to the blares of the rattling horn roaring away outside of inferior radio stores. A great many were at fault for this condition, chiefly, we regret to say, the average fan who demanded quantity and not quality—in other words, the demand was for lots of "volume." Give them that and all else was overlooked. It was this condition that must have prompted the English cynic's definition of broadcasting as the art of transmitting the worst possible music to the greatest possible distance.

Fortunately, with the great advance of radio, the conditions are reversed, real tone quality has been achieved by many improvements, and music lovers turn to radio not only as a recreation but also as a means of enjoying music and advancing their own musical education. Radio is a boon to education, for when one can listen to the great masters of song and instrument it is the best mode of improving one's individual technique.

### Advances In Many Fields

Now, let us consider the various means of actual reproduction. Tubes, transformers and audio hook-ups have all been improved to a great degree and many have done their share in this direction. In the speaker field great advances have

also been made. We have progressed from the horn to the cabinet type and from the cabinet to the cone. There are many types of cones and many schools of cone experts. A great divergence of opinion exists between the advocates of the bound edge cone, those who hold out for the free edge cone, the paper diaphragm, the pleated diaphragm and so on ad infinitum.

Let us first consider the horn and compare the advantages of the cone over the horn. Let us remember, however, that we must have a faithful amplifier circuit, for we can only take out of the output end of the circuit what quality we put into it; no more. No speaker, however good it may be, will iron out all faults of distortion or poor amplification. In fact, the better it is the more strongly it will bring out the faults.

The horn functions as an air resonator in this way: the volume of air inside the horn resonates in very much the same way as a tuned aerial resonates electrically but, to carry out the analogy, the speaker very often suffers from the defect that its wavelength is too short, or in other words it will not bring out clearly the bass notes, losing many, because in order to take care of these satisfactorily the speaker should be at least six feet long. For the same reason many of the higher frequencies are also lost and only an apparent all-scale reproduction is accomplished.

To prove this, listen how many instruments in an orchestra you can pick out.



Acme Double Free-edge Cone, Type K2

In a symphony, listen to pick out the deep brasses, the cellos, the piano and the drums. On the other hand, even the most indifferent cone will reproduce a greater part of the musical scale with extreme fidelity. On a good cone speaker, and particularly on the free edge type, the low tones are adequately released, while the high ones are produced in the proper frequency, thus striking the right balance, and the organ notes become rich and booming instead of flutelike and thin; realism is achieved and the room may be filled with music without any musician present protesting that it is "too loud." This cry is the unconscious protest of the person with a true musical ear when distortion is heard. Extraneous noises and static seem to be somewhat dampened out also, for the accomplished realism helps to offset the disturbing factors. The victory of improved reproduction is therefore thoroughly accomplished.

Pioneers in radio since its inception, the Acme Apparatus Company, whose motto from the beginning has been, "Amplification without Distortion," set its engineers to work on the acoustic problem many years ago.

### The Final Idea

Years of experimenting and the destruction of hundreds of models which fell short of the ideals sought, brought forth the Acme Double Free-edge Cone, the latest development along these lines. One set of experts worked exclusively on the problem of magnets, another group on diaphragm materials and still others on the factors of shape and form. Many forms of magnet were tried, only to be discarded. The single cone was developed to a high degree only to be thrown out upon the inception of the idea of the double cone. This was brought out in many forms and finally perfected in its present style which was the final answer to difficulties in the way of perfect tone reproduction.

The Acme reproducer in its present form was developed primarily for high quality reproduction of sound, but as it was necessary to have it very sensitive, to bring the volume up to a level which sounded natural without overloading, a large amount of development was required to make the reproducer sensitive with no sacrifice of quality.

### Demands Were Exacting

To do this, it was found necessary to design the reproducing device with a large effective sound radiating area and at the same time to enable this large area to be vibrated without the use of mechanical reproduction of the motion such as by the levers usually used with cone speakers.

This result was accomplished by using two free cones, each mounted on its own armature, the armatures being so disposed as to form a single air gap which is in the center of the winding. The armatures are carried on flexible, permeable members mounted on the opposite poles of a permanent magnet. By this arrangement, the variation in the length of the air gap is twice the amplitude of each armature giving in effect a 2:1

mechanical reduction. The use of two free cones gives a very large effective radiating area for the over-all dimensions of the device. The design is such that the length of the air gap can be accurately adjusted to a small valve, thereby insuring the fullest degree of sensitivity and since the dynamic balance is inherently perfect it has been found literally impossible to overload the reproducer. It has given splendid reproduction, without trace of distortion from the output of two 5-watt tubes operating push-pull with 400 volts on the plate.

The speaker is designed to operate with a direct current component in the winding of 4 to 5 milliamps. It will, however, operate well with no direct current or with as much as 20 milliamps. These operating values, therefore take care of any system of amplification; the better it is the greater the volume and the more perfect the tone quality.

**Constants of Speaker**

The ohmic resistance of the winding is around 400. The inductance runs from about 2 henries at low frequency to 1 1/2 at high, and the AC resistance will run from 4,000 to 8,000 ohms, depending on the frequency and the motional impedance. The total impedance at 1,000 cycles is therefore about 15,000 ohms.

The two free edge cones are of special Japanese parchment, impervious to atmospheric changes, practically puncture proof and mounted in such a manner as to allow for all changes of tone. These pass all vibratory tests, responding in a perfect degree to the sand test. The means of adjustment allows for matching all forms of plate impedance and an unlimited number of tube combinations.

We have been asked to illustrate for the beginner in plain language the difference in sound reproduction. This is hard to do, even with diagrams and pictures. However, let us imagine that the musical notes of the orchestra came from the horn or speaker in the form of smoke rings. Let us take for example, as a standard of comparison, a 6-foot smoke ring as the perfect, rounded fully timbered musical note. From the horn this might issue as a 4-foot ring, hazy and indistinct and not quite a perfect circle.

**Maintaining the Rings**

As the others follow in fast or slow tempo, they will be observed to vary greatly from the circular shape. Occasionally one will dance forth perfect in every way, size, shape and thickness. But the others will rush into and through it, some will stagger drunkenly, others will flatten out or stretch into straight lines; some shooting straight up to the ceiling, others to corners of the room. A weird impressionistic nightmare, if it could be made visible. Now then, if this would be the effect of visibility, imagine the effect in sound.

Now, take the single conventional cone and turn the sound waves into smoke rings. We see the rings coming forth in nearly perfect standard 6-foot rings, fairly good in thickness and vigor but perhaps dwindling as they travel across the room till some become only about a couple of inches in diameter, maintaining a fairly good balance and distance apart, but, nevertheless failing to fill our room in orderly array and in every corner. A big difference is claimed for the free-edge cone. Here the rings trip sprightly, in orderly ranks, every one six feet in diameter, perfectly rounded, each taking its appointed place, like a well-drilled army under the command of a good general.

**A BUILT-IN SPEAKER SET**, by Herbert E. Hayden, appeared in RADIO WORLD dated May 22. 15c per copy, or start sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

**COMING EVENTS**

**JUNE 1 to DEC. 1**—Sesqui-Centennial, Industrial Arts Bldg., Philadelphia, Pa., with concurrent radio exposition.

**SEPT. 10 to 17**—National Radio Exposition, Grand Central Palace, New York City. American Radio Exposition Co., 1560 Broadway, New York City.

**SEPT. 13 to 18**—Third Radio World's Fair, Madison Square Garden, New York City. G. Clayton Irwin, manager, Times Bldg., N. Y. City.

**OCT. 11 to 17**—Fifth Annual Chicago Radio Show, Coliseum, Chicago, Ill. G. Clayton Irwin, manager, Times Bldg., N. Y. City.

**OCT. 25 to 30**—Second Annual Indianapolis Radio Exposition of the Central States, State Fair Grounds, Indianapolis, Indiana. Management of Indianapolis Radio Exposition Corp., 1407 Merchants Bank Bldg.

**OCT. 30 to NOV. 6**—Cleveland Radio Industries Exposition, Public Auditorium, Cleveland, O. G. B. Bodenhoff, manager, 511 Guarantee Title Bldg., Cleveland, O.

**Rouse in New Post With Research Concern**

R. Louis Rouse has been appointed general manager and chief engineer of the United Research Laboratories of Cincinnati, specialists in radio and electrical research and designing. Mr. Rouse is a graduate of Pennsylvania University and The Radio Institute of America. He has been actively interested in this line of work for the twelve years and has a number of inventions to his credit.

Mr. Rouse designed and built the WHBR station and was manager and announcer for over a year. He was the first person successfully to use grid modulation in a broadcasting station. He holds the design for an improvement known as master grid modulation.

**Pittsburgh Show**

Pittsburgh will have a big radio show beginning Saturday, September 25 and ending Saturday, October 2.

Although Pittsburgh is the home of pioneer broadcasting station, KDKA, and one of the pioneer cities in the radio industry, it has never had a real radio show. H. R. Eleyet, care Pittsburgh Press, is secretary of the Pittsburgh Radio Show Company.

**Eric Palmer Appointed Exploiter of Radio Show**

Harold Bolster, managing director for the Radio Exhibition Corporation of The Radio Show (Grand Central Palace, New York, Sept. 10 to 17), announces the appointment of Eric H. Palmer to be in charge of exploitation. The corporation's office is at 1560 Broadway, New York.

Mr. Palmer is well-known in radio by his frequent writings on popular radio subjects and by his arrangement of special features of nationwide importance. He conducted the radio exploration tour of the United States during May and June, 1925, emphasizing the improvement in summer reception and radio's service as an all-year-round entertainment. During the 1926 international tests Mr. Palmer acted as official American observer in Europe, returning with the first message of the League of Nations on the importance of radio as a factor for universal peace and as an instrument in battling

**Literature Wanted**

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

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

I desire to receive radio literature

Name .....

City or town .....

State .....

Are you a dealer? .....

If not, who is your dealer?

His Name .....

His Address .....

- E. S. Broadfoot, 774 West 7th Ave., West Homestead, Pa.
- Geo. W. Gribbling, 912 East 8th St., North, Portland, Ore.
- Walter Radio Service, R. 4, Iola, Kan. (Dealers).
- Charles T. Kirk Radio Service, 3441 Island Ave., Toledo, O. (Dealer).
- Leonard Poll, 1301 Alpine Ave., N. W., Grand Rapids, Mich.
- Hyam Yamins, 367 Whipple St., Fall River, Mass.
- W. H. McCumsey, Ft. Wayne, Ind.
- C. E. McKeever, Bradford, Ill.
- Jack Evaden, 705 South Washington, Iola, Kan.
- Arthur C. Lasey, Newcomerstown, O. (Dealer).
- J. Tenenty, 596 Ave. A, Bayonne, N. J.
- E. E. Kane, 1013 S. W. Court St., Miami, Fla. (Dealer).
- H. M. Aldrich, 115 Congress St., Portland, Me. (Dealer).
- L. Armstrong, 6315 Marsden St., Philadelphia, Pa.
- C. Wale, 322 Fourteenth St., Buffalo, N. Y. (Dealer).
- F. J. O'Brien, Box 2086, Philadelphia, Pa.

**LOS ANGELES SHOW**

The exposition committee of the Radio Trades' Association of Southern California, under whose guidance the successful 1925 radio show was held, announce September 5 to 11, inclusive, as the dates for the 1926 radio show, which will again be held in the Ambassador Auditorium. The managing director is at Los Angeles.

**FARMERS RESPONSIVE**

County Agent B. G. Southwick of Hartford County, Conn., Farm Bureau, reports that the farm radio talks from WTIC have resulted in more comment and inquiries than any other thing he has ever tried.

disease, ignorance and bigotry. Last year, while engaged in a similar capacity with the Radio World's Fair, he inaugurated the Radio Diana contest in which the fair listeners of the United States and Canada competed for the title of Miss Radio—which idea strikingly illustrated women's intense interest in radio.

Mr. Palmer, who was at one time publicity commissioner for the United States abroad, promises some international features for The Radio Show.

He resigned from the Radio World's Fair a few days ago to take up his duties with the manufacturers' own exposition.

Prior to his advent in radio, Mr. Palmer was a star political reporter and the incumbent of important executive posts in the city, state and Federal Government. During the war he was intelligence chief for the United States in the Nordic countries.

# DX Crystal Sets Reality In Britain, Editor Reports

"American radio is absolutely different from English wireless."

That is the conclusion of Bernard E. Jones, editor of two English publications dealing with amateur wireless and broadcasting.

Mr. Jones has returned to England after a five weeks tour of principal American broadcasting centers.

"In America, radio is individualistic," is the opinion of Mr. Jones. "In England, the Government controls it. All over America we find broadcasting stations erected and conducted by private enterprise, providing attractive programs of which there seems to be no end.

### Lauds American Sets

"With the right kind of receivers, operated by those who understand them, there seems to be little or no interference in America, despite the very large number of stations.

"The powerful set, with its two, three or four radio-frequency tubes to bring in the long-distance stations, can bring the American listener a fresh station every minute if he so wishes, and the listener can continue his radio explorations for hours without repeating the fare or straying far outside his national boundaries.

"In Great Britain, the sole right to send or receive a radio communication is vested in the Postmaster General, and in issuing a license for either purpose, he inserts whatever conditions he deems advisable. He has issued 1,750,000 licenses to receive but only one license to broadcast—and that one is to the British Broadcasting Company (we call it the B. B. C.). Nobody else in Britain may put a program on the air, and publicity and advertisement as Americans understand them can have no place in the British programs.

### Has Twenty Stations

"Great Britain has about twenty broadcasting stations, all built, equipped and maintained by the B. B. C. which, originally, a committee of the radio trade, is now developing into a public utility body. It started with a tiny capital. Then how does it get money to found and maintain twenty stations? From the Post Office. And the Post Office gets it directly from the public.

"Every listener must buy at the local Post Office a ten shilling license (\$2.50) and this must be renewed every year. It is easy to evade taking out the license, but public opinion is against the mean

man who does so, and there is now a penalty for the offense. Of the \$2.50 paid for the license, part is kept for expense of collection, and the balance, about \$1.80, is passed to the B. B. C. which has an annual income of at least \$2,500,000 with which to erect and equip new stations, improve existing ones and maintain a series of almost wholly professional programs, often costly. With only twenty stations, there are yet considerable differences between the wavelengths, London (2L0) being 364, and its nearest neighbors, Bournemouth, 386, and Birmingham, 479. There is scarcely any interstation interference.

### Surprised at Daventry

"Great Britain possesses in the B. B. C. Station Daventry (5XX), in the Midlands, what is probably the highest-powered purely broadcasting station in the world. It operates at 1,600 meters, and I am surprised that it is not better heard in America. The reason for the poor reception of British broadcasting in the U. S. A. is not yet apparent.

"A large proportion—perhaps 65%—of the British public listens on crystal sets, a type of receiver which appears to be

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WORLD BATTERY COMPANY 1219 So. Wabash Ave., Dept. 82 Chicago, Ill. Makers of the Famous World Radio "A" Storage Battery Prices: 6-volt, 100 Amp. \$11.25; 120 Amp. \$13.25; 140 Amp. \$14.00. All equipped with Solid Rubber Case.

World STORAGE BATTERIES Set your Radio Dials at 210 meters for the new 1000 watt World Storage Battery Station, W.S.B.C., Chicago. Watch for announcements. WKA WEA WGN WJS KHJ KGO KFA WJY KOE

smiled upon in America as belonging to history. I have myself listened on a crystal set to Daventry in a rock-bound bay on the coast of Cornwall, a distance of about 230 miles. The B. B. C. has set itself out to provide crystal reception for the bulk of the population. Of course, more and more people use tube sets, and in my opinion, the proportion of home-built tube sets is larger than in America. Our tube set (we call it the valve set) is not yours. The conditions that produced it are different. The need for combined critical selectivity and long-distance reception is felt to a less degree and has not existed long enough to influence the design of the everyday set. We do not in general use six or eight tubes. Three or four are more usual, and there are thousands of 2-tube reflex or feed-back sets that can at a distance of 80 to 100 miles from Daventry give good loud-speaker reception. With three or four tubes (a straight circuit one radio-frequency, detector and one or two audio-frequency) I can listen to any British station on the loudspeaker.

### The Rule About News

"All the B. B. C. stations are linked

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up at certain hours each day for the simultaneous broadcasting of the Greenwich time signal and of the day's news. This news is supplied in the form of a summary from an Association of the Press, and the Postmaster General's license, under which the B. B. C. operates, forbids the broadcasting of news obtained in any other manner. Technically, for example, if there was a slight earthquake under the B. B. C. studio, the fact would not be available for the broadcast until the Press had collected the news and passed it to the B. B. C.—rather a humorous situation."

Mr. Jones told Eric H. Palmer of the Freed-Eisemann Radio Corp.:

"The British listener has a big neighbor—the European continent—every country in which maintains a broadcasting service. Such famous stations as Rome (425 metres); Radio Toulouse (443); Berlin Vox Haus (505); Hilversum (1,050); Königswusterhausen (1,300); Radio Paris (1,750), and Eiffel Tower (2,650), are all easily heard on a 3-or-4-tube set. The 80 or 90 more important Continental stations provide remarkable variety."

### Hooks 'Em and Explains



(Foto Topics)

**WILLIAM DICK**, veteran champion angler, hooking a trout in the trout pool at a department store exhibit in New York, and telling the radio audience of his experiences and sensations. This pool was installed as a part of a spring camp exposition.

### RADIO CABINETS

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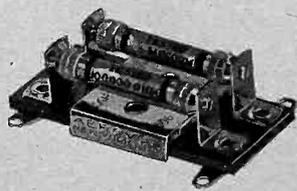
7x12	7 x 18	7 x 26	<b>\$2.25</b>
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### Better Announcers

**A**NNOUNCING is difficult work. It requires education, poise, versatility, vocal attraction and personality. The announcer bears as important a relationship to a station as does the sales manager to his company. It is assumed excellent sales managers are excellently paid. It is known that excellent announcers are none too excellently paid. Also, not enough is offered to make announcing attract the best talent and brains that would be available for the purpose.

To-day announcing has not risen to an art, but is rather on a hit-or-miss basis.

Some day announcing will rise to the position its importance justifies. Ability to read, write and speak the English language, and murder all other tongues, especially foreign titles of music, no longer will be the prime requirements for an announcer's job. Indeed, schools will spring up. "Be An Announcer! Make \$10,000 a Year!" the advertisements will read. At upper right will be a picture of the owner of the school, emphasizing his advice by bringing the fist of one hand hard upon the palm of the other. At lower left will be a testimonial from a plumber's helper stating that, due to having taken the course, he increased his income from \$30 a week to \$125 a week. "The work is pleasant, the pay is big."

It is pleasant indeed, if one is sufficiently wrapped up in it to make it pleasant. Such enthusiasm is necessary in any line of work, but none too much of it is found in announcing as it is done to-day. While an announcer's voice may be cheery, for gloom would cost the man his job, the reading of titles becomes a dull ritual, and the filling of a short gap with nothing but conversation becomes a silly performance that tires any audience very quickly. A man alert enough to talk entertainingly for a few minutes, although the exigency was never dreamed of, is not likely to have risen suddenly from plumbing to announcing. A college education, fluency in foreign languages, a knowledge of music, both technical and historical, a pleasing voice, excellent enunciation and constant alertness, with the gift of a romantic touch, are advantages worth considering. Not all are requisites, but there is enough in the list to disclose that the typical announcer of to-day will not measure up to the demands that broadcasting will develop in the early future. Indeed, the need for improvement is here now, but the process of producing it is retarded.



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### THE VICTOREEN

How to build this 8-tube Super-Heterodyne described in February 20, 27, March 6 and 13 issues of RADIO WORLD. Send 60c for all four copies. Send \$6 for year's subscription and get these four copies FREE!

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### RADIO WORLD'S Fifth Annual Vacation Number June 12th

COMPLETE LIST OF BROADCASTING STATIONS appeared in RADIO WORLD dated May 1. Sent on receipt of 15c, or start sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

# Why Variable Leak Improves DX Results

(Continued from page 11)

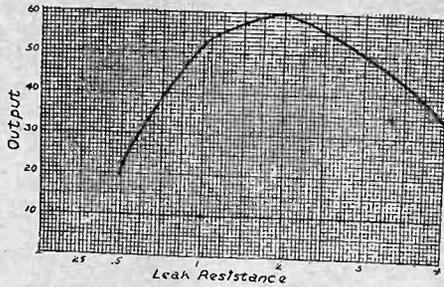
is an art in itself and cannot be acquired by the beginner in a week or a month. And the first requisite of tuning for distant stations is the use of head phones instead of the loud speaker, as the response medium. This is so, irrespective of the sensitivity of the loud speaker. It should be realized that response is greatest when the unit is adjacent to the ear, and while the final signal after being tuned in correctly will be audible on the loud speaker, the fan tuning with the loud speaker as the response device invariably passes over many stations.

The next item in tuning is that of slow manipulation of the dial, especially when more than one circuit is tuned from one point. The cumulative effect upon the final resonance curve when three or four tuning condensers are controlled from one point is such that the base of the curve is only a fraction of the width of the resonance curve for one of the individual circuits. Expressed in figures and diagrammatically as shown in Fig. 1, the resonance curve for a station may cover six divisions on a theoretical dial for one of the individual circuits (A), but only one and a half divisions on the major dial controlling all the circuits (B). The necessity for slow tuning is very evident. With a single dial control receiver, tuned hurriedly, many stations are passed over.

The same rule of care applies to two and three control receivers.

In addition to careful, slow tuning, keep a log of stations received. The dial settings will prove beneficial in the hunt for additional DX, as any desired station will be reduced to a certain area upon the dials, and the curve will disclose the location. An example of a graph of logged stations is given in Fig. 2, representing wavelengths plotted against dial settings. It is not unnecessary to plot a curve, and good use can be made of an enumerated list, if the stations are arranged in sequence, starting with the lowest wavelength and progressing to the highest.

Now for the choice of receivers which will afford DX reception. By the judicious selection of certain units and their incorporation in an existing receiver without entailing the construction of a completely new receiver, it is possible to increase DX reception. The first is the use of regeneration in the detector circuit of a tuned radio-frequency receiver, especially with receivers of the neutralized type. The regenerating unit is a variometer connected as shown in Fig. 3. The selection of the variometer is due to its adaptability to all receivers, since it



HOW correct leak setting improves the power output.

can be located external to the cabinet, preferably on top. The connections to it from the receiver proper need not be permanent, and therefore may consist of two flexible leads.

The variometer is connected into the plate circuit between the plate and whatever coupling device is used for coupling the detector to the succeeding stage of audio. This position is designated as X in the circuits shown in Fig. 3. The variometer need not be in inductive relation with any portion of the receiver preceding the detector tube. But care should be exercised to see that the variometer is correctly located. If it is connected on the wrong side of the coupling transformer primary or the coupling resistance, the usual bypass condenser used in the plate circuit of the detector tube will ruin the effectiveness of the variometer.

Another item is the use of a variable bias on the grid of the detector tube. This consideration in the majority of cases is entirely overlooked. This means the use of a fixed leak with a variable bias or a variable leak with a fixed bias. Other methods are illustrated in Fig. 4. Varying the bias on the detector tube will greatly increase sensitivity. The systems A and B in Fig. 4 are preferable if any doubt is entertained as to the efficiency of the

(Concluded on page 27)

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**KILOCYCLE-METER CHART**, appeared in RADIO WORLD dated May 1. Sent on receipt of 15c, or start sub. with that number, RADIO WORLD, 145 W. 45th St., N. Y. C.

**CHANGES OF ADDRESS**

should be sent to Subscription Department at least two weeks in advance of publication in order to insure early and proper attention. RADIO WORLD'S subscription list is so large that it is necessary that changes be sent in as requested. Address, Subscription Department, RADIO WORLD, 145 W. 45th St., New York.

## Good Back Numbers of RADIO WORLD

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

- 1925:
- Aug. 26—A Set a Baby Can Build, by Herbert E. Hayden. A Fine Meter Switch-board, by Lewis Winner.
- Sept. 12—The 1926 Model Diamond of the Air, (Part 1), by Herman Bernard. A 25-to-110 Meter Receiver, by Sidney E. Finkelstein.
- Sept. 19—Diamond of the Air (Part 2), by Herman Bernard. A Tube B Battery Eliminator, by Louis Winner.
- Oct. 14—A Phonograph Cabinet Set, by Lewis Winner. The Thoroughbred, by Herbert Hayden (Part 3).
- Oct. 21—The 4-Tube Pathfinder, by S. E. Finkelstein. How to Make a Simple Loop, by Herbert E. Hayden.
- Nov. 7—A 3-Tube Dry-Cell Circuit, by Capt. P. V. O'Rourke. One of the Best Crystal Sets, by Herbert E. Hayden. 1-Tube DX Set, Herman Bernard.
- Nov. 20—The Zero Potential Loop, by Frank Freer. The 1-Tube Headset Receiver, by J. E. Anderson. A Discussion of AF Amplification, by Wm. Fortington.
- Dec. 5—A Toroid RF Set, Using Crystal, by Lewis Winner. The Diamond of the Air (In Test and Diagram), by Herman Bernard.
- Dec. 12—A Self-Contained Receiver, by H. E. Hayden (Part 1). B Battery Eliminator, by Lewis Winner (Holiday Gifts No.).
- Dec. 26—The Regenerative Wave Trap, by John F. Rider. The 5-Tube Tuned RF Set, by Capt. P. V. O'Rourke.
- 1926:
- Jan. 2—The 3-C Set for Simplicity, by Capt. P. V. O'Rourke.
- Jan. 9—The 4-Tube DX Symphony Set, by A. Irving Witta. A Skillfully Made 1-Dial Set, by Herman Bernard.
- Jan. 16—Anderson's 5-Tube Quality Receiver, The Raytheon B. Eliminator, by Lewis Winner.
- Jan. 23—The 4-Tube Diamond of the Air, by Herman Bernard. B Batteries Last Six Months, by S. E. Finkelstein.
- Jan. 30—An Individual AF Amplifier, by H. E. Hayden. The Antennastrol, by Herbert Hayden (Part 2). Trapping Out Super-Power in New Jersey, by Capt. P. V. O'Rourke.
- Feb. 6—The Fenway (4 or 9 tubes), by Leo Fenway (Part 1). The Great 1-Tube DX Set, by Herman Bernard.
- Feb. 13—Anderson's 5-Tube Economical Receiver, Trouble Shooting for Norices, by M. B. Stock. The Fenway, by Leo Fenway (Part 2).
- Feb. 20—The 5-Tube Victoreen, by Herbert E. Hayden. The Fenway, by Leo Fenway (Part 3). Quality Stressed in 3-Tube Set, by Brainerd Foots.
- Feb. 27—The 4-tube DX Dandy, by Herbert E. Hayden. Umbrella Aerial for DX, by Hugo Gernsback. Part 2 of The Victoreen.
- Mar. 6—The 1 tube Set, by Capt. O'Rourke. The Chemistry of Batteries, by A. R. Reid. The Victoreen Set (Part 3), by Herbert E. Hayden.
- Mar. 13—The Non-Regenerative Browning-Drake Set, by M. B. Sleeper. The Tectron Eliminator (Part 1), by Lewis Winner. Curing Victoreen Trouble, by Herbert E. Hayden.
- Mar. 20—The Super-Heterodyne, by J. E. Anderson. A 2-Tube Speaker Set, by Percy Warren. The Browning-Drake Set (Part 2), by M. B. Sleeper. A 2-tube Eliminator, by Lewis Winner.
- Mar. 27—An Economical 4-Tube Set, by Edgar T. Collins. A Practical B Battery, by Capt. P. V. O'Rourke. Tectron Trouble Shooting, by Lewis Winner.
- April 3—The Bernard Portable, by Herman Bernard (Part 1). How to Get Dx, by Capt. P. O'Rourke. A Compact B Supply, by Lewis Winner.
- April 10—The Bernard Portable, by Herman Bernard (Part 2). Two Eliminators for DC, by Lewis Winner. A Super From An Old Set, by C. King.
- April 17—The New 1-Dial Powertone, by Capt. P. V. O'Rourke. The Bernard Portable (Part 3), by Herman Bernard. The Action of Transformers, by Lewis Winner.
- April 24—All Waves on One Set, by Capt. P. O'Rourke. Bernard's Portable (Conclusion). Control of Feedback, by Barney Feete.
- May 1—New Multiple Tube, by Herman Bernard. The Aero All-Wave Set, by Capt. O'Rourke. Kilocycle-Meter Chart. Official List of Stations. An Analysis of Detection, by J. E. Anderson.
- May 8—A Study of Detection, by J. E. Anderson, Part 2. To Wind a Loop on a Card-board Frame. How to Reflex Resistance AF, by Theo. Kerr.
- May 15—Super-Heterodyne Results Brought Up to Maximum, by Herman Bernard. The Truth About Coil Fields, by J. E. Anderson.
- May 22—A Built-in Speaker Set, by Herbert E. Hayden. The Powertone in Operation, by Capt. P. V. O'Rourke. Confessions of a Super Bug, by James H. Carrol.

Any copy, 15c. Any 7 copies, \$1.00. All these 31 copies for \$4.50, or start subscription with any issue. RADIO WORLD, 145 W. 45th St., N. Y. C.

# Put Power Tube in First And Last Fenway Sockets

For radio with a certainty of satisfaction the Fenway combination 4 and 9-tube receiver is in a class by itself, says Leo Fenway. "Fenway—for DX" has come to mean more than merely a catch phrase, as thousands of satisfied builders realize. Since its first appearance in RADIO WORLD on February 6, fans have voiced their approval of the circuit, and back numbers of this magazine, containing the entire Fenway data, are in great demand. Fenway blueprints have been sent to all corners of the world.

Mr. Fenway has now come forward and told us that a power tube, of the -X112 variety, should be placed in the first radio frequency stage—that is, the first socket in the first can. No change in the circuit is necessary to do this. The tube is placed in the socket—that's all. The -X112 tube in the first socket is responsible for coast to coast reception on the Fenway almost any time of the year.

(Concluded from page 26)

variable grid leak on hand. A glance at the curves shown in Fig. 5 will bring to light the effect of the variable grid leak and bias upon the signal intensity output obtainable with the detector tube. It is very evident that one value of bias is conducive to maximum signal output. In addition the regeneration obtainable with the tube and the position of the regeneration control are governed to a great extent by the value of the grid leak. If the leak is excessively high in ohmic value, regeneration is critical and very unstable. If the grid leak value is too small, regeneration necessary to produce a certain condition will be difficult to obtain. And since the signal intensity is a prime factor in determining the correct value of

RADIO WORLD readers who have already constructed the Fenway are urged to use a power tube in the first and last sockets as the results will more than discount the extra filament consumption.

The fellow who is experiencing some difficulty with excessive oscillation on the first tube can eliminate all his trouble by placing another Royalty resistance, type B, on his Fenway. This should be in series with the rotor of the special coupler and the B battery 90 volts. Do you understand this? One side of the Royalty will go to the front end of the coupler (where the shaft comes through to the panel, the other side of the Royalty goes to the plus 90. Naturally, the other side of the coupler still connects to the plate of the first tube. By increasing or decreasing the resistance, regeneration on the first tube is controllable from 35 meters to 600 meters.

This is quite an advantage.

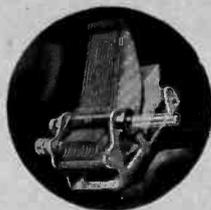
the leak, it stands to reason that for greatest sensitivity a variable leak or bias is necessary.

Another pertinent item pertaining to leaks is that of the position of the leak. The two possible methods of connecting a grid leak are familiar. Consider A the condenser shunt method and B the grid-filament method. I conducted a series of tests which showed that the method A was superior to that in B over the entire range of grid leak values, and especially when receiving powerful signals and low values of grid leak were employed. The effect of a low value of grid leak directly across the grid and filament, as in B, was increased difficulty of obtaining regeneration in the detector tube. Not that regeneration was impossible, but that it was necessary to advance the regeneration control beyond the point necessary with the A position of the same leak.

Incidentally, the setting of the variable leak will usually vary the tuning of the secondary circuit, and when in the quest of DX stations, accurate resonance in the secondary circuit is imperative. Hence retuning of the secondary circuit when the grid leak is varied may be tried. Another item with respect to retuning of the secondary circuit is that it is necessary when the tickler regeneration system is used.

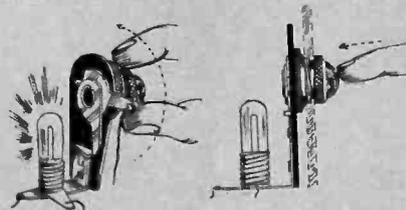
(This concludes a series of these articles on "How to Get DX." The others were written by Capt. Peter V. O'Rourke (April 3 issue) and J. E. Anderson (April 10, 17 and 24 issues).

## A BAKELITE SHAFT CONDENSER!



The new Bruno Straight-line Frequency Condenser has a transparent Bakelite shaft, rendering full insurance against body capacity effects. Single hole panel mount; also base-board or subpanel mounting holes. Strictly low-loss, full rated capacity.

.0005 mfd. \$4.00 .00035 mfd. \$3.75 .00025 mfd. \$3.50



The Bruno Ruby Light Switch is a combination A battery switch and pilot light. When the knob is turned to the right, the bulb lights up, the set is on. When the knob is pressed, the set is turned off. Single hole panel mount. Price, less bulb, 75c

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Complete Parts for the 5-tube 1-dial set described in Radio World, April 17 and May 22. \$22.50

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Accusti-Cone Laboratories  
96 Church St. New York

# RADIO UNIVERSITY

(Concluded from page 15)

The secondary winding is begun near the hub, then at the 21st turn, the lead is brought through a small hole, not broken though. The primary winding is then wound. The left off portion of the secondary winding is then continued. The under one and over one flap method is used in winding. No. 22 double cotton covered wire is used. The beginnings and the ends of the coil can be brought through small punchings, which can be made in the form. Through the center hub a large hole should be drilled. This is for placing angle irons for mounting the coil on the baseboard, one of which should be placed at right angles to the other. C1 and C2 are both .0005 mfd. variable condensers. R1 is a 10 ohm rheostat. R2 is a ¼ ampere ballast resistor. C3 is a .001 mfd. fixed condenser. CD is a fixed crystal detector. J1 is a single circuit jack. AFT 1 is a low ratio AFT. As to special wiring data. The beginning of the antenna coil, L1, 1, is brought to the ground post. The tap, 3, is brought to the antenna post. The end of this winding is brought to the grid post of the socket and the stationary plates of C1. The end of the primary winding, L2, goes to the plate post on the first socket. The beginning of this coil goes to the B plus 67½ volt post, (B plus 2). The beginning of the secondary winding, L3, goes to the rotary plates of C2, while the end of this winding goes to the stationary plates of C2. C3 is experimental. R1 is a very important control. The low potential side of the of crystal is brought to the P post on the transformer, while the high potential side is brought to the end of the secondary winding, L3. No. C battery is required. Both the variable condenser should tune in step. A .001 mfd. fixed condenser across the output may help to increase the volume or prevent any muffling of the voice, etc. A 7x12 in. panel should be used for mounting the condensers, rheostat, crystal detector and

jack. The coils, ballast resistor, sockets and terminal strip should be mounted on a baseboard, 6x11 in.

## COMPARISON OF TUBES

The Sodian was an alkalai-metal tube, with an extra filament resistance in the tube itself, and the new Donle has this feature, too. The 5 volts at the terminals are reduced to 1.1 volts at the filament proper. The tube requires no rheostat, nor even grid leak and condenser, although all may be used thereon. Donle claims the Donle tube is the most sensitive detector in the world and exceeds others in statements on the extra RF amplification obtained.

The R. C. A., through its experimental and manufacturing allies, Westinghouse and General Electric, is working on some new dry-cell tubes that will have —01A characteristics, except that the filament voltage is about 3, instead of 5, thus enabling dry cell operation.

The tube market promises competition of an order not previously experienced. The "gyp" tube manufacturers—irresponsible makers of inferior products—disappeared during the past season.

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**CHAS. W. DOWN**

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New York City

Elmer B. Myers' name is in the tube field with a specialized line of tubes—separate ones for RF, detection and AF—and promises to make things lively, as he is an experienced tube man of a high order. The expiration of the tube patent eased matters up for the independents, including Myers, who, by the way, had been frozen out of the American market on patent grounds, though his tube was made in Canada.

Another phase of the tube situation is the arrival from Germany of David L. Loewe; of the great Loewe-Audion Co., with a tube that is three tubes in one. It consists of a detector and 2-step amplifier, all in one glass envelope, including all wiring and parts, excepting, of course, the tuner. Another multiple tube of his is two steps of resistance coupled RF in one envelope. These tubes he will try to market here, unless he sells the patent rights.

22½ volt  
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Storage  
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**\$2.95**

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**CONSTRUCTION OF RADIO PHONE AND TELEGRAPH RECEIVERS** by M. B. Sleeper, sent on receipt of 75c. The Columbia Print, 145 W. 45th St., N. Y. C.

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**THE GREAT AID OF BY-PASS CONDENSERS,** by John F. Rider, appeared in RADIO WORLD dated May 8. Sent on receipt of 15c, or start sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

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**HERMAN BERNARD,** managing editor of RADIO WORLD, broadcasts every Friday at 7 p. m., from WGBS, Gimbel Bros., N. Y. City—315.6 meters. He discusses "What's Your Radio Problem?" Listen in!

**A BUILT-IN SPEAKER SET,** by Herbert E. Hayden, **POWERTONE IN OPERATION,** by Capt. P. V. O'Rourke, **THE NOVICE'S NOOK,** by James B. Scully, appeared in RADIO WORLD dated May 22. Sent on receipt of 15c, or start sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

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**CONFESSIONS OF A SUPER BUG,** by James H. Carroll, appeared in RADIO WORLD dated May 22. 15c per copy, or start sub. with that number. RADIO WORLD, 145 W. 45th St., N. Y. C.

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NEW YORK CITY

# Proof of Ionized Layer Convinces British Experts

WASHINGTON.

The British National Committee for Radio-Telegraphy at the recent International Radio-Telegraphy meeting at Washington received direct proof of the existence of an ionized layer in the upper atmosphere.

"The results provide direct experimental proof," says the British National Committee, "in that interference phenomena have been shown to exist both by day and by night, while for the nighttime phenomena it has been proved that the interfering rays come down from the upper atmosphere and do not travel in a horizontal plane.

"The differences observed between day and night phenomena are adequately explained by a theory of diurnal variation, itself based on Larmor's theory, according to which the under-boundary of the deviating layer is higher at night than during the day.

"In connection with the electrical processes by means of which rays are deflected by the layer, mention may be made of the extension of the ionic refraction theories of Eccles and Larmor made by Appleton and by Appleton & Barnett in which the effect of the earth's magnetic field on the phase-velocity of wireless waves is taken into account.

"It is shown that if the negative carriers in the atmosphere are electrons as seems most probable, the formulae for the phase-velocity given by Eccles and Larmor require considerable modification, the terms arising from the recognition of the magnetic field being of importance except in the case of ultra short waves.

"It is found that the atmosphere acts to wireless frequencies as a quartz crystal does to optical frequencies in that there is a rotation of the plane of polarization for transmission along the magnetic field and double refraction for transmission at right angles. In the general case it is found that the ray deviated by the upper atmosphere should be of elliptical polarization, so that we have here a possible theoretical basis for the explanation of direction-finding errors originally advanced by Eckersley and Bellini.

"It may be mentioned that the investi-

## Proud of Vagabondage



(Herbert)

**JUNE LEE**, called the "Vagabond of the Air," because of her broadcasting from stations on both coasts and in between, is shown wearing her radio log dress. The dress has on it the call letters of all of the stations from which she has broadcast. Miss Lee is in London for a single appearance at 2LO. She is a gifted singer.

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**D X OWL** **EUREKA JR.**

gations of Smith-Rose have shown that directional errors are obtained with a vertical transmitting antenna so that the atmosphere must be responsible for the production of abnormal polarization of the waves. Further experiments made by Smith-Rose and Barfield on the Adcock system of direction-finding show that lateral deviation of the waves, such as would be produced by a tilted ionized layer, does not exist so that we must regard the influence of the earth's magnetic field on the properties of the layer as largely responsible for the complex polarization.

"A more detailed investigation of the magneto-ionic theory shows that such complex polarization is produced only when the time between two collisions of an electron and gas molecules is long, so that directional errors should be most pronounced at night when the layer is high and in a region of low pressure."

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# RADIO WORLD'S

## Fifth Annual Vacation Number JUNE 12th

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### The Trade's Best Opportunity to Build a Big Sales Demand

RADIO WORLD is now the only illustrated national radio fan weekly. RADIO WORLD is the only publication having 100,000 weekly readers, most of whom are *experimenters* in radio. RADIO WORLD'S readers build sets for the fun of it, the thrill of the successful experiment, and when something new comes along they start all over again with a new set, and they not only build sets but buy sets as well.

"Drops of water wear away the hardest granite." Even a small advertisement in RADIO WORLD brought to our readers' attention week by week, fifty-two times a year, wears away trade resistance and brings a brand or trade-mark to the buyers' attention so persistently it creates real demand. RADIO WORLD gives you a service that no other publication can, because it is a radio *service* publication.

Fiction magazines of general circulation supply the best fiction; newspapers, even small-town papers, give good radio programs, but only RADIO WORLD gives real weekly radio service information—the newest things in radio, the latest and best hookups, the last word in battery service and elimination, etc. In other words, RADIO WORLD is the only national radio weekly, and its 100,000 weekly fan readers who are constant buyers of radio can give you the biggest result for your advertising dollar.

RADIO WORLD is dated each Saturday, is on the news-stands the previous Wednesday, and closes each Wednesday noon, ten days in advance of date of issue. Results are

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RADIO WORLD gives its advertisers every possible editorial co-operation. The set builder as a rule follows as closely as possible the laboratory models of radio tuned circuits in which the manufacturer's article is specified, and in this way it is constantly creating a demand, and new users for radio parts and accessories.

In regard to factory-made sets, we take various leading sets from week to week, giving full and detailed information regarding each particular set, creating not only a demand for the goods but showing the buyer in advance how to get the best possible results from the set, making the buyer a pleased and satisfied customer that will recommend your set to his friends. To get any real joy out of radio, one should know something about radio. RADIO WORLD fifty-two times a year is putting joy into radio reception by giving useful radio information—nothing else—no programs, no fiction—*just all radio*.

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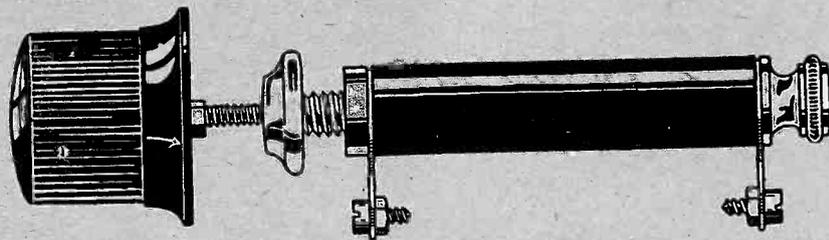
Extra color red FREE on full page advertisements if copy is received by Tuesday morning, June 1st.

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FRED S. CLARK, Advertising Manager

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Guaranteed Precision Range  $\frac{1}{4}$  to 10 Megohms

**Brings in More Distant Stations — Affords  
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Fits Any Set, Panel or Baseboard. Price, \$1.50**

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*“Nothing Better”*

The North American Bretwood Co.

For some time I have seen in the Radio World your advertisement of the Bretwood Grid Leak, as well as some of your testimonials, and I decided to try one of them at the first opportunity which presented itself last night.

I own a 5-tube factory built set. During the last three days I could not get a sound out of it due to what I thought was a terrific spell of static, but which was caused by a defective grid leak. The noise was indeed so terrible that rather than hear such a racket I turned off the set and went to bed.

To-day, as luck would want it, I happened into a store and saw a Bretwood Variable Grid Leak on display. I decided to try it immediately. The results were absolutely gratifying. Other sets in the neighborhood are not getting anything at all, while I have brought in a great number of stations with speaker volume, with a socket aerial. I must say for the benefit of those who have not tried your grid leak that there is nothing better in this line.

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This wonder set can be had in Kit form for those who roll their own. Write for prices on **COMPLETE PARTS**, with **FREE Blue Print**, **Speaker**, **LOOP** or **CARRYING CASE**.

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