May 1, 1924
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RADIO PROGRESS

"Always Abreast of the Times"

IN THIS ISSUE:

YOU WILL UNDERSTAND THIS MAGAZINE---AND WILL LIKE IT

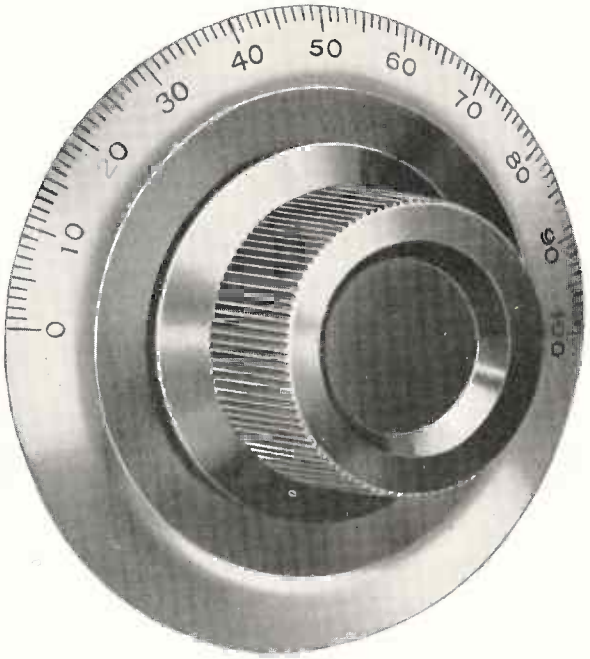
PUBLISHED TWICE A MONTH

42 MAVERICK SQUARE

TRU-FIX RADIO PRODUCTS

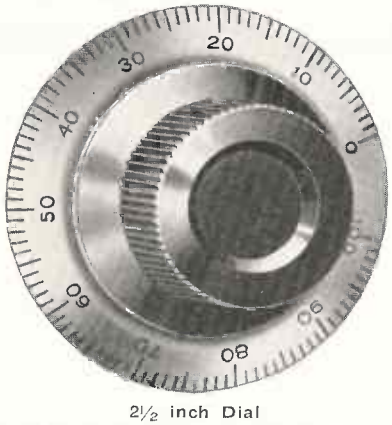
EAST BOSTON, MASS.

THE DIAL "DE LUXE"



4 inch Dial

In designing the TRU-FIX the manufacturer has gone into every detail relative to requirements of Dials used on Radio Instruments, and after many experiments with springs, etc., adopted the last word in Dials—the springless TRU-FIX Dial.



2½ inch Dial

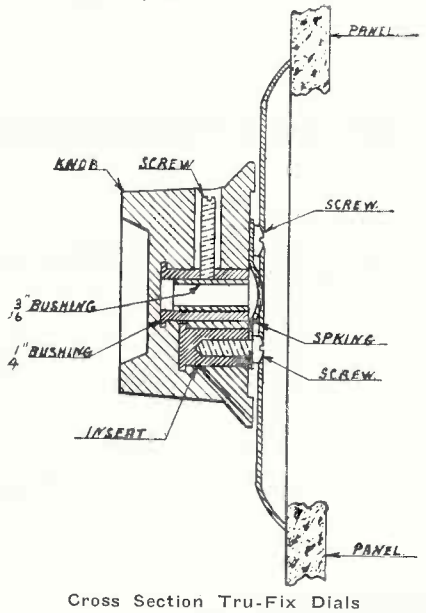
TRU-FIX Dials are made of selected sheet brass .023 of an inch thick. The edge is very thin with a gradual contour to meet the panel and is finished in bright nickel with 100 division scale running from left to right, etched in the surface, inlaid with black enamel, thereby making TRU-FIX DIAL easily read at all times.

The Knob, highly finished, is made of Bakelite 1½ inches high with bevel edge at base and is attached to dial with a flat spring device made into the dial itself.

DISTINCTIVE AND SELECTIVE

The patented spring feature under the knob is one of the superior points of this dial. You are always sure of a true running dial, as it keeps the dial in perfect alignment—always flush with panel, ensures perfect settings as the dial is not disturbed by jars or other causes. This gives you a dial that is different and one that always insures a more selective tuning. **Perfect control on portable sets. Other dials cannot accomplish this feature.**

Replaces the Vernier, as it can be moved forward or backward to within one thousandth of an inch, without **backlash,** and **stays put.**



Cross Section Tru-Fix Dials

WHY TRU-FIX IS A SUPERIOR DIAL

1. **Corrects out-of-alignment** of shaft with panel by spring feature made into the dial.

2. **Corrects looseness of end play** in any units used, such as Variocouplers, Condensers, Rheostats, etc., by slight friction on panel to take up this end play.

3. **Corrects overbalanced units** where there is a loss of friction caused by poor assembly in their manufacture and incorrect balancing of weights and metals.

4. **Corrects loss of tuning adjustments,** such as fading, etc., due to slight jars or vibrations, which allows the condenser or variocoupler to rotate out of position, thereby losing the station being tuned.

5. **Corrects body capacity,** as the metal of the dial acts as a shield when grounded. This can be done by setting a plug flush with panel and allowing the dial to touch it lightly, having the plug grounded.

These Dials, on account of the above listed features, are the only Dials to use on portable sets.

LIST PRICES

	Silver	Gold
100—3 inch Dial	$1.00	$2.00
102—4 inch Dial	1.25	2.50
104—2½ inch Dial	1.00	2.00

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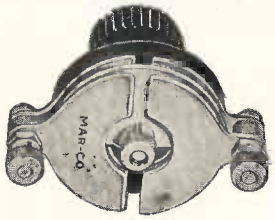
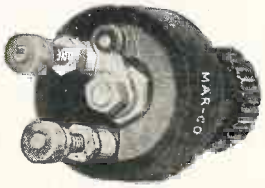
MAR-CO SURE-GRIP JACKS

Nine styles—all with sterling silver contacts
Micarta insulation and heavy springs. $ .60 to $1.25



Balancing Condenser
(left)
$1.25

Variable Grid Leak
(right)
$1.50



A new neutralizing condenser. Bakelite insulation. Nickel-plated working parts. Easy to mount. Easy to adjust.

A new Grid Leak, ranging in smooth easy adjustment from 1/5 to 5 megohms. Bakelite insulation. Entirely enclosed weather-proof construction.

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RADIO PROGRESS

HORACE V. S. TAYLOR, EDITOR

Volume 1 Number 4

Contents for

MAY 1, 1924

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RADIO PROGRESS

"ALWAYS ABREAST OF THE TIMES"

Vol. I, No. 4 MAY 1, 1924 15c. PER COPY, $3 PER YEAR

What Happens When Tuning In

This Tells the Reasons Why You Turn the Dials in Tuning

By HORACE V. S. TAYLOR

PERHAPS you have heard the story of the eminent scientist of an experimental laboratory who remarked at the dinner table that he wished he really could understand the electric light. The sweet young thing at his side exclaimed, "Why, doctor, I am surprised! It is very simple. You merely push that upper button on the wall and it puts the light on. You push the lower one, and it turns it off again." The doctor thanked her.

Perhaps in the same way you know how to tune your set. By plugging in the phones, turning on the "A" battery and spinning the dials you get a noise and more or less music. However, few operators understand just why they turn the dials and what happens behind the panel which causes a station to come in or fade out.

Springs and Weights

As was explained in our last issue, under the title "Taking the Cap Off Capacity," a coil is like a weight, while a condenser is like a spring. When a coil and condenser are connected together, they will conduct electricity back and forth, or oscillate, just the way a weight attached to a spring oscillates. For instance, Figure No. 1 shows a spring which has a length of one inch attached to a weight of one pound. If you pull down on this weight and then let go, it will bob up and down, or oscillate, quite fast. You also see a second spring of the same length with two one-pound weights attached to the bottom. If you set these to bobbing up and down they will go a great deal slower than the first one did.

"Free" Length is Meant

In speaking of the length of these spiral springs here and through the remainder of this article, what is meant is the length over all of the spring, when no weight is attached. When a weight is hooked on the lower end, of course it stretches it out somewhat, and the deflection depends on the stiffness of the spring partly, and also on the amount of the weight pulling on it. If you use the same springs or two springs

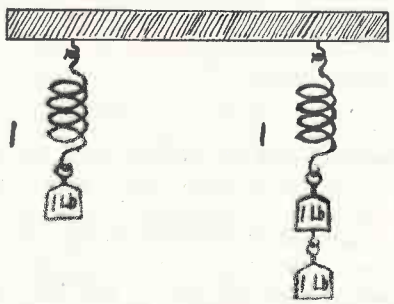

Fig. 1. Light Weight is Lively

wound of the same size of wire and with the same size of turns (which makes them equally stiff), then the amount of the deflection or stretch will be just proportional to the weight hung on it. If Figure No. 1, the spring at the left will be stretched out say one-quarter of an inch, that is, from one inch free length to an inch and a quarter, then the spring at the right, since it has twice the weight, will stretch twice as much, which will give a deflection of one-half an inch. so the overall length of the stretched spring will be an inch and one-half. But remember, in drawing these pictures and talking about the springs, we are going to show and use the free or unstretched length. This is to make it clearer, as it is hard to see a small deflection in the picture.

Getting back to Figure No. 1 again, we see that a single light weight at the left will cause a fast vibration or oscillation, whereas by putting additional weight on we can slow it down. This is a matter of common sense.

Ford or Packard

The same principle holds in the weight of an automobile. Why does a Packard ride easier than a Ford? Well, one good reason is that the Packard is a much heavier car than the Ford; this increased weight slows down the vibration when you go over a bump, so that instead of being shaken up and down it is more like swinging in a hammock. A similar reason explains why a Ford, or, for that matter, any car, rides easier with five passengers than it does with one. The additional weight of five or six hundred pounds slows the vibration down enough so that it does not bound and bump around as it did before. Perhaps you have noticed when riding on a Pullman car that the track is a lot smoother than when you are riding in a light wooden day coach. Of course, the same thing applies—the heavy weight of the Pullman slows down the vibration so that you ride in comfort.

Spring Just as Important

But the weight is not the only thing that governs the timing or period, as it is called, of an oscillating spring and weight. Figure No. 2 shows two combinations using the same weight of one

pound each, but different springs. The free or unstretched length of the left one is one inch, while that on the right is two inches long. Suppose, as before, we set them bobbing up and down. The left-hand one with the short, stiff spring will go just the same speed as shown in Figure No. 1, while the right-hand one will oscillate much slower, or have a much longer period. The word "period" means the number of seconds it takes to bob up and down. This latter point is also a matter of common sense. You will be able to understand the principle without trying out the experiment yourself, although if you will try this test you will be pleased to see the right-hand one go slowly, while the left-hand one goes fast. Again, think of a Ford and a Packard automobile. The former has much shorter springs than the latter, and this is the second reason why a Packard is an easier riding car. (Don't think we have a Packard agency—we do not sell automobiles).

Just Like Shock Absorbers

How can we improve the riding qualities of any car that has rather short, stiff springs and so bounces up and down rapidly? The easiest way is to add supplement springs or shock absorbers and thereby double the spring action. These supplementary springs have just one effect. It is the same as is shown in Figure No. 2. The spring at the right, being long, will cause the weight to vibrate slower than the one on the left. That

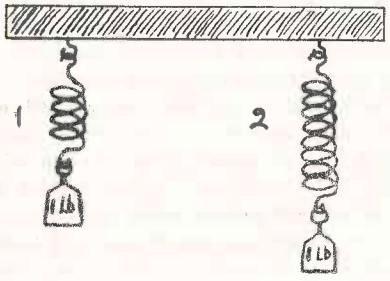

Fig. 2. Long Spring is Lazy

is why a person once having used supplementary springs on his automobile will never think of doing without them again, as it makes the car ride a lot easier.

Good Common Sense

So far it has been evident that everything shown is a matter of common sense. Here, however, is a point which only experiment will prove. Compare Figure No. 1 and Figure No. 2. The left-hand spring and weight is the same in each, and so, of course, vibrates at the same time or period. Now look at the right-hand figure. You will notice that while one has a spring of unit length and two weights, the other has a spring length or two with a weight of one. The remarkable thing is that these two will vibrate at exactly the same speed. Let us introduce the words "tuning factor," which we will define as the condition which causes the spring and weight to vibrate at any special speed. That means, if the tuning factor of two systems is the same, they will bob up and down together. It is because the tuning factor in Figure No. 1 and Figure No. 2 is the same that causes them to keep step.

What is the Tuning Factor?

The tuning factor is found by multiplying the value of the spring by the weight. In Figure No. 1 the spring is one and the weight is two, so the tuning factor is 1×2, which equals 2. In Figure No. 2 the spring is two and the weight is one, so the tuning factor is 2×1, which again equals two, and that is why they oscillate together. Suppose now we look at Figure No. 3. At A we have a spring one inch long with four one-pound weights attached. B is a two-inch spring with two weights, while C is four inches long with a single one-pound weight. The tuning factors are $1 \times 4 = 4$; $2 \times 2 = 4$; $4 \times 1 = 4$, respectively. Since the tuning factor 4 is the same in each of the cases, they will all oscillate at the same speed. It is rather surprising to see how they keep step together, but if you will try this experiment yourself by pulling down all three and then letting them up they will keep exact step up and down, up and down together.

Electrical Circuit is the Same

Exactly the same thing in an electrical circuit is shown in Figure No. 4. At A is shown an electric circuit consisting of a condenser and of one microfarad (abbreviated mfd.) in series with an inductance of four millihenries (abbreviated mh.). B shows a series circuit of a capacity of two microfarads and inductance of two millihenries. C contains 4 mfds. and one mh. Since the tuning factors are $1 \times 4 = 4$, $2 \times 2 = 4$, $4 \times 1 = 4$, they are all alike, and the circuits will oscillate at the same time, or, in other words, the three are all tuned to the same wave length.

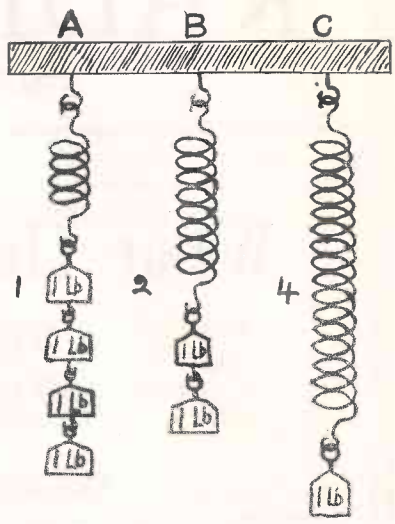

Fig. 3. Playing Same Tune

How does this apply in a radio set? The rule here is just the same as with the springs and the weights. If we wish to tune a radio set to a certain sending station we have to adjust the tuning factor of our set to that of the station. When the two are just alike we will receive that wave length and no other. Referring to Figures Nos. 3 and 4 again, let us assume that B is a sending station. Stations A and C will both pick up B station, because they are both adjusted to the same tuning factor as is B. But perhaps in A we have made a mistake; the weight (coil) instead of being 4 is really 5. Then A will no longer receive B, as it has a tuning factor of $1 \times 5 = 5$, and since the tuning factor is different from the sending station it can not receive it any more. What shall we do in this case? Since the tuning factor is too big, we have got to reduce it, and this means we must cut down either on the condenser or the inductance (spring or weight) until the product is again 4.

Variable Inductance or Capacity

This brings up the question, is it better to use a variable inductance or a variable capacity to tune a radio? We can see from our spring or weights that either will tune equally well. Our sending station is again B. You will notice that A uses a small condenser and then varies his inductance up to 4 to get into tune with B. However, Station C uses a small inductance and a variable condenser, increasing that until it is big

enough to give a product of 4. And yet A and C are both in exact tune with B.

Who Gives Out Tuning Factors?

The Federal Government is responsible for the values of the tuning factor at each station. Secretary of Commerce Hoover is in charge of this matter. When a new broadcasting station wants to go on the air, they have to get a license from the Department of Commerce, and at the same time they are assigned a tuning factor and a signature, consisting of three or four call letters. Both tuning factors and call letters are given out by the Government at random, except for the fact that nearby stations are never assigned the same tuning factor. If they were, it would mean that radios located between the two would not be able to separate them, but would hear both going at once. As an example, suppose in Figure No. 4 that a station in Milwaukee had a set with capacity and inductance like A, while across the river in St. Paul a station was operating with adjustments like B. Here we would have two nearby stations with the same tuning factor, and listeners-in would get scrambled music whenever both stations were going together. To take care of this the Government would assign a tuning factor of 4 to Milwaukee, while St. Paul would be given some other numbers like 3 or 5. As illustrations in this article we are using whole numbers, but it will be realized that fractions like 4½ work out the same way.

Why Various Dials?

Since each dial changes the tuning factor of some part of the set, it may be asked, Why use so many? The reason is that each separate circuit in the radio must be tuned to the tuning factor of the broadcasting station in order to get best results. Different radios have a different number of tuned circuits, depending upon how elaborate the set may be. A third circuit tuner must invariably have at least three controls. First, the aerial must be tuned to the broadcasting tuning factor; then the grid circuit is adjusted until it has the same value, and, lastly, the plate circuit is altered until it, too, is identical with the others. A two-circuit radio will not need adjustment for the third circuit and the single circuit is naturally simplest of all.

Single Circuit Simple

In the single circuit radio, which is the most popular form, there is usually a tap switch, which adjusts the coil in rather coarse steps, and a condenser, which gives fine tune. Since it is the inductance times capacity (coil times condenser) which counts, we can vary either the point switch or the condenser to bring in a station. This explains why different stations can be pulled at different pairs of values. So we may get KDKA on switch point 1 and condenser 70, or switch coil 2 and condenser 35, etc.

In addition, there is usually a dial controlling regeneration or feedback. This control has nothing at all to do with the tuning, but merely adjusts for loudness. The theory of its operation is made plain in "What Happens When You Oscillate," appearing in the April 1 issue of RADIO PROGRESS. Besides this, there is a rheostat for adjusting the brightness of the tube, which has to be changed only as the "A" battery falls off in voltage.

From the above, it will be seen that there is nothing very mysterious about adjusting a radio set to tune to a certain station. Or, if it is called mysterious, then the same mystery appears whenever we adjust a combination of springs and weights to vibrate up and down.

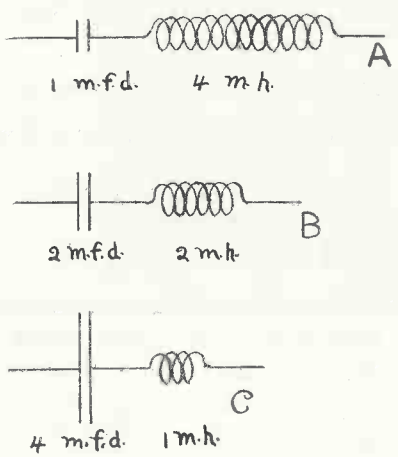

Fig. 4. They Hear Same Station

What, then, are the relative advantages of variable inductance and variable capacity in tuning? Since either will tune equally well, we must decide on other considerations. A variable inductance or variometer costs about twice the price of a variable condenser. Furthermore, it takes up a lot more room in the set. Being heavier, it is not quite so easy to adjust the rotor to the right position, and the change in its value is not proportional to the scale on the dial, as it is on a variable condenser. As partial offset to these disadvantages a variable inductance can sometimes be made slightly sharper in tuning than a variable condenser, but, on the whole, a variable condenser is much more popular.

If you look in the paper you will find that sending stations are not rated as having certain tuning factors, but as having certain wave lengths. A simple mathematical formula connects the two, however, so that if we know the tuning factor (the condenser times the coil) we can immediately find what the wave length must be. and, conversely, knowing the wave length, we can tell what our tuning factor is. When operating the radio set it is not necessary to work out the answer by this mathematical formula. All we do is shift the value of our tuning by adjusting the condenser or coil until we hear the station we are after. But, although we may not be conscious of this mathematical tuning, the electric waves know all about it and when we tune to WCAP at Washington, or WDAP in Chicago, the reason we pick them up is because we have adjusted our coils and condensers so that our tuning factor is the same as that of the sending station.

STATE CHARITIES GET BROADCAST

The New York City Visiting Committee of the State Charities Aid Association is up-to-date. It is providing broadcast concerts for the patients in its charge.

Since July, 1922, a special committee of this association, whose work it is to keep in touch with the 28 city hospitals and almshouses of New York, has been arranging and giving regular municipal concerts in the municipal institutions. During that period 250 concerts have been heard and enjoyed by 90,000 patients. To the hospitals for contagious diseases, where few visitors are willing to go; to the patients in the island hospitals, often far removed from their families, and to the inmates of the city almshouses, lonely and friendless, this music has brought cheer and comfort.

BAKELITE MADE OF ANTI-SEPTICS

Many people are interested to know of what a bakelite panel is made. It is constructed of a large number of thin layers of special tough paper, which are cemented together by bakelite gum. This bakelite gum is a mixture of carbolic acid, such as you use to disinfect a cut, and formaldehyde, which is an antiseptic gas, often used to fumigate a sick room. The two are combined and heated, and the result is the peculiar insulated resin, which is so generally used for radio panels.

SNAPPING ON YOUR TUBE

Many fans are afraid to leave their filament rheostat turned on and then snap the "A" battery on and off with a switch. They fear it will damage the tube. Such apprehension is unnecessary, as no injury results from this practice. It is the same idea as turning off and on your electric lights. Would you ever think of installing a rheostat on the wall and bring the light on gradually up to full brillancy, such as is done in the theatre?

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or
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A Real Portable Set for Your Vacation

How You May Build a Set Small Enough to Go in Your Suit Case

By OLIVER ARNOLD

EVER since the beginning of broadcast radio the idea of portable sets has presented itself at the beginning of each summer season. Inasmuch as most of us leave the city whenever possible, going to anything from a summer home to a rough camp, the question arises as to whether or not we will forget radio for the summer or take it along with us to enliven the pleasant hours we spend away from the heat and bustle of the city.

At distant points in the country good musical entertainment is rarely to be found, and it certainly appears to the writer that the radio at the shore or in the camp is more essential than ever. As previously mentioned, portable sets have periodically made their appearance at the beginning of the vacation period, but heretofore the so-called portable receiving sets have consisted of little more than standard commercial instruments supplied with a handle or other convenient carrying means. There has also been a tendency to cram into small dimensions units that require a larger amount of space to work right.

Radio apparatus needs elbow room. Some makes of apparatus need considerably more than others. By using parts which are quite self-contained this portable set is made really portable without sacrificing efficiency. We also wish to call the reader's attention to the neat way the wiring has been laid out. All the high frequency leads are spaced far enough away from the rest of the apparatus so that no bad capacity effects are found.

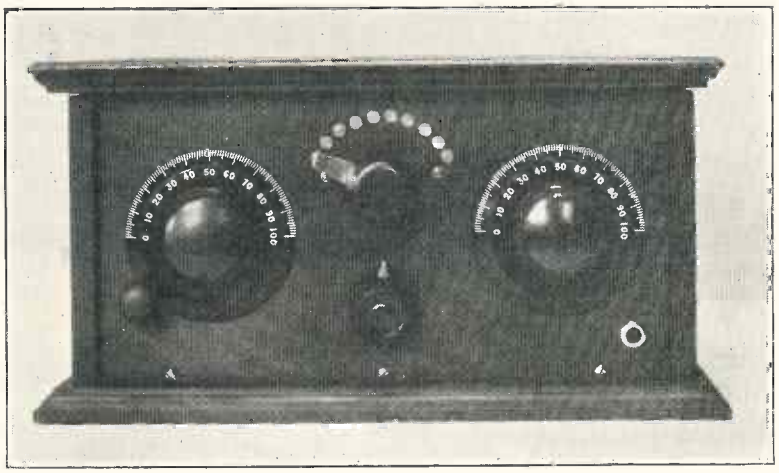
How to Carry It

At this season of the year the all-important problem of the radio enthusiast is how to transport his outfit to the shore or to the mountains or wherever he may be planning to spend his summer vacation. There is no doubt but that outdoor activities from now on will hold the center of the arena, but there is no reason why radio should be abandoned, as there are just as many interesting programs during the summer months; and with a set that is truly portable, radio should be just as much a pleasure in summer as in winter.

A large number of radio fans have recognized the value of this viewpoint and have requested information on a set of this character which could be easily taken along on summer outings, to the fishing shack or the little cottage by the sea. This kind of a set is of such universal interest that a detailed description of one that will meet the requirements of the average person is published so that all may enjoy radio this summer wherever they may be. The set is very simple to construct, is relatively inexpensive, and will give very excellent results either for local or distant reception.

The set as shown is about 6x11x6½ in. over all, and is a 2-tube receiver—one tube being a regenerative detector, the other being a stage of audio frequency amplification. This will be found all the amplification desirable for use when static is at all disturbing, and more consistent reception can be had during the summer if only one stage of audio is used rather than two. The mounting of the set consists of three parts. the panel, the baseboard and the cabinet. Each will be described in turn, so that each stage in the construction will be clear in the mind of the reader.

THE PANEL—Figure No. 1 shows the layout of the panel and the drilling necessary. The easiest way, perhaps, is to lay out on paper the actual dimensions shown on Figure No. 1 and then check carefully. Now paste this full-sized layout on the panel at the four corners, and with a center punch spot the center point of each hole; then drill the holes right through the paper with a small size drill, say, No. 40 or No. 50. The advantage of using this small drill first is that the tendency for the hole to run off to one side is very much less. When a larger drill is run into a bakelite or condensite panel there is the very pronounced tendency for the hole to shift to the side, especially if the drill is run by hand instead of in a drill press. Once the small-sized hole is correctly located, a larger drill will follow it



This Set is Only 11 Inches Long Over All

exactly. The final dimensions of the holes in the panel are given in the drawing. There are only two sizes to be used, the small ones, a No. 27 drill, and the large ones, five-sixteenths. This cuts down the number of drill sizes to complete the set. It is well to be very careful in the drilling, as defective workmanship at this point will make a lot of filing and fitting later on. The nine switch point screw holes in the upper center may be countersunk to a depth sufficient to take the head of the screw; and if this is done carefully the heads will lie just a little above flush with the surface. It will also be found a good stunt to remove the burrs very carefully from all the holes with a knife or other similar sharp instrument.

After drilling, the panel may be grained. This is done by rubbing down with sandpaper in the following manner: Use very fine-grained sandpaper and wrap it around a perfectly flat block of wood. Then rub the length of the panel, exerting a firm, even pressure, and always in the same direction—lengthwise. Keep rubbing until all shiny spots have disappeared. Then wipe panel off with a soft oily cloth, and then dry with a clean cloth. This will give a lasting, handsome finish. The panel is now ready for assembling.

THE BASE-BOARD is approximately 10x 6 in. wide. It might be advisable to have the base-board a shade under 10 in. long, as there will be less work in fitting when the set is put into the cabinet. Quarter-inch ply wood will be found very suitable for a base-board, although other material will be found satisfactory, provided it has been thoroughly dried and is not likely to warp. This, however, is optional with the builder. The panel can be secured to the base-board by screwing directly into the base-board through the panel. If it is desired to use metal brackets, which is perhaps a better job mechanically, the drilling at the bottom of the panel would have to be changed, and this will depend on the nature of the bracket made or purchased. Unless the set is to be removed very often from the cabinet, the first method will be found sufficiently strong for all ordinary purposes.

For mounting the terminal binding posts, two strips of bakelite or hard rubber approximately ½x2 in. with the antenna and ground, and ½x3 in. for the battery terminals should be used. In mounting these to the base-board with screws it will be found necessary to elevate them about ¼ in. from the base-board by putting washers under the screws between the panels and the base-board. This will allow plenty of room to get wires underneath. The next step is to get the apparatus mounted on the panel and then mount the panels and the apparatus to the base-board, following as nearly as possible the location shown in Figure No. 2.

Owing to the small spacing of the various units it is quite important that parts be used which do not react on each other when close together. This is especially true of the variocoupler and variable condenser. It was found that the Coto parts possessed this requirement to an exceptional degree. The other parts, like the inductance switch, rheostat, sockets, etc., do not need to meet such rigid specifications and various styles might be used. In making out a list of the parts, however, it will be noted what kind was used in actually constructing this set, and parts from any other manufacturer could be substituted if of equally good construction. The list follows:

P One panel, 5x10x3/16 in., Bakelite or Condensite.

V One Coto Variocoupler.

C One 23 plate Coto Air Condenser .0005 Mfd.

S Two Sockets to take WD-12 or UV-199 tubes.

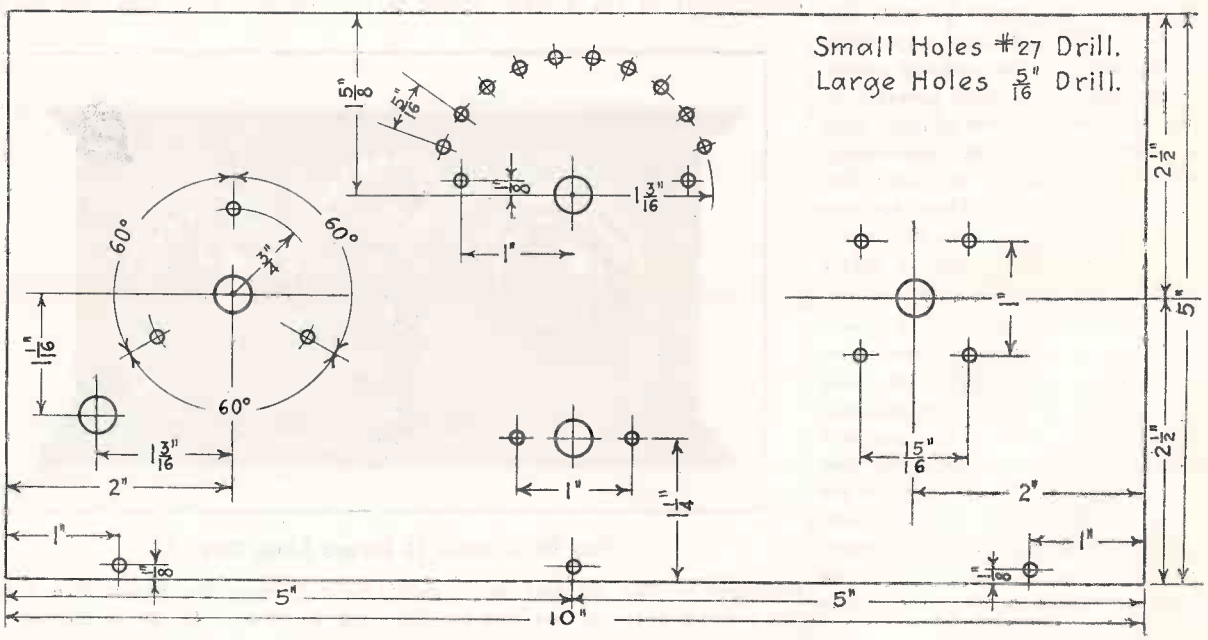


Fig. 1. This Shows How to Locate All Holes in Panel

Two tubes, WD-12 or UV-199.

T One Audio Frequency Transformer (Coto used).

L One Grid Condenser and Leak Mounting (Dubilier Co.).

One Grid Leak, two or four megohms.

One Jack, either two or four circuit will do.

I One Inductance Switch (Fada shown).

Ten contact switch points.

R One Rheostat (General Radio), 6 ohms for WD-12 tubes or 30 ohms for UV-199.

One Base-board, 6x10x¼ in.

the stator binding post on the condenser goes to the switch arm of the inductance switch. The other wiring, we believe, will be perfectly clear and obvious. Solder connections wherever necessary, making sure that your iron is hot and clean, as solder will not flow properly if the iron is dirty or not hot enough. Do not, however, let the iron get hot enough from these binding posts and unscrew the panel from the cabinet to remove.

What Tube to Use

In Figure No. 3 is shown the use of two UV-201-A tubes. While these give very clear reception, they need the use of a storage battery, and so are rather undesirable for portable use. Instead, WD-12 tubes may be substituted with

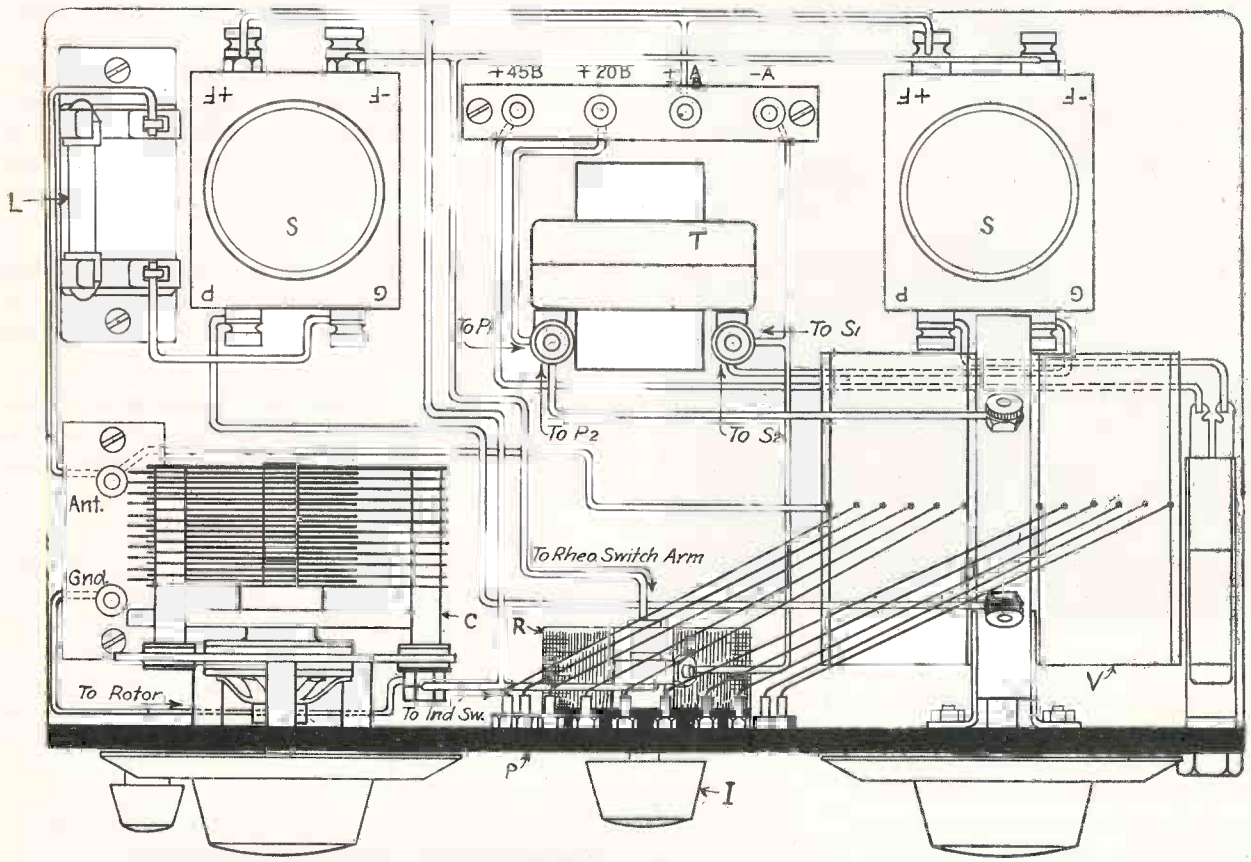


Fig. 2. This Diagram Gives Complete Wiring of Set

WIRING—In wiring up the set it is best to start at the panel and work toward the back. The wires shown in Figure No. 2 with double lines represent either square or round bus bar, whichever suits the eye or mood of the builder. No. 14 is a convenient size. The black narrow lines from the coupler to the inductance switch represent flexible wires covered with spaghetti tubing. These tap leads, however, should be connected to the switch after the other wiring has been put into place, so that it will not be necessary to work under them. The other wiring is fairly clear to follow. Notice that the rotor binding post on the condenser should be connected to the ground and the lead from

to burn. Be very careful to follow the wiring exactly as shown, as it will probably save you some time.

CABINET—It will be found best either to run your antenna and ground leads through bushed holes in the cabinet (suitable electrical bushings can be bought at almost any hardware or electrical store), or binding posts can be placed on the outside, as we have shown on a small bakelite panel, with a hole cut away in the wood immediately behind the panel. From these terminals flexible silk covered leads may be run to the binding posts on the base-board, so that to remove the set it is merely necessary to remove these flexible leads

excellent results. In this case use a "B" battery of 20 to 22 volts on the detector and 45 volts on the amplifier, as shown in Figure No. 2. For the "A" battery a single dry cell is enough, although two connected in parallel will give more than twice the life. But be sure you connect them in parallel; that is, run a wire from the zinc of one battery to the zinc of the other and from there to the "A" minus post. Another wire runs from the center carbon of one battery to the carbon of the other, and then over to the "A" plus terminal. The "B" minus wire and the "A" plus wire are both connected to this same terminal.

Continued on Page 12

Kadel & Herbert

WHEN IS A LAMP NOT A LAMP?

This Radio Set is Unusually Good for Getting "Light" Opera.

What would you think if you had a lamp in your living room and as the evening darkened you reached to switch it on and instead of giving a flood of light you got a flood of sound? It is now possible to have this experience happen. The lamp shown above is unusual in that it can talk and sing as well as give illumination. When it first appeared at the radio show it took all visitors by storm. A complete radio set is installed in the base. This consists of three stages of radio frequency, detector, and two stages of audio frequency. Although it is a six-tube set, it has the merit of being controlled by a single dial.

There is also a loud speaking horn. Can you find it? As a matter of fact you are looking right at it. The base of the lamp itself is constructed like a horn inside and acts as the loud speaker.

Notice the loop aerial at the left. This is all that is used to get in even distant stations. Of course, the reason is that the three stages of radio amplification make an outside aerial unnecessary.

Although the set is so efficient as a radio it does not detract at all from the appearance as a lamp, for when lighted, it offers a beautiful sight, almost as beautiful we might add, as the girl holding it.

A REAL PORTABLE SET

Continued from Page 11

If you prefer, UV-199 tubes may be used instead. There is not much choice, as they are about equally loud and have about the same selectivity. In such a case, use the regular 199 sockets instead of standard sockets; or, better, use standard sockets with a 199 adapter. Such an arrangement gives you a choice of any kind of tube at a later date. The 199 tubes use three dry cells connected in series. Run a wire from the "A" plus and "B" minus terminal to the carbon of one dry cell. Its zinc goes to the carbon on the second cell and its zinc to the carbon of the third cell. The third zinc is connected to the "A" minus terminal. For "B" battery use 45 volts on the 45-volt terminal and run a short piece of wire connecting the 45 "B" to the 20 "B," so putting 45 volts on detector and amplifier.

For ease in handling it might be advisable in making up the cabinet to put a cover on the front to conceal the dials. A suitable strap handle for carrying would be convenient. If another box of about the same size were fitted to take the standard dry cells and "B" battery for the tubes used, the set could be very easily carried from place to place.

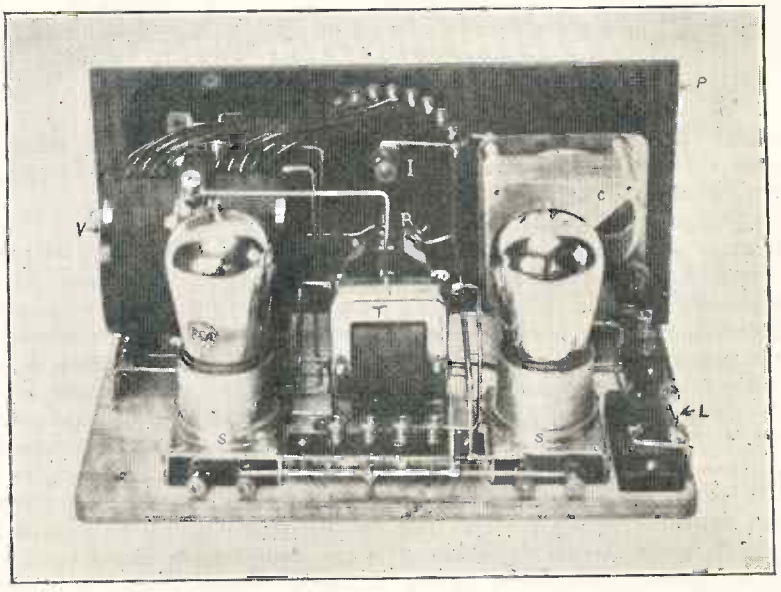


Fig. 3. Rear View of Assembled Set

Doesn't Your Set Sometimes Hum?

If it is a "Humdinger" Perhaps it is the Fault of the Generator

By VANCE

MANY listeners complain of a serious humming sound which comes in over the air especially from certain stations. They often ask just what is the cause of this noise which detracts so much from the enjoyment of the concert. Such disturbances are usually caused by an irregularity in the voltage supplied to the plate and transmitting tubes. You will remember that in the receiving set the plate voltage is supplied by "B" batteries. These have a pressure of from 22½ volts up to 90 volts and the current taken by the plate from the "B" battery is so small (usually two or three thousandths of an ampere) that flash light dry cells are satisfactory. Such a block of dry cells has a life on the ordinary set of two to eight months as a general rule.

Power Tubes Different

When power tubes are used in sending the case is different. Such tubes require a pressure of three or four hundred up to a couple of a thousand volts, and the current taken from the "B" battery may be ten to one hundred times as much as that drained from the "B" battery of an ordinary receiving set. This would naturally make the cost prohibitive if the attempt were made to use the "B" batteries which are ordinarily supplied with receiving sets.

How can the broadcasters meet this problem of a high "B" battery voltage at reasonable cost? There are two systems in general use to-day. One is the use of a high voltage direct current generator and the other is that of using storage batteries. The former method is the one most stations employ as it is the older system and also the equipment required costs considerably less. The principle is simple. A generator is used which is electrically and mechanically the same idea as the generator which charges the battery on your automobile. The chief difference is this. Your automobile generator is designed to furnish a lot of current at say 12 to 15 amperes at a potential of six volts. This voltage is determined by the fact that you are using a six-volt battery. A plate generator corresponding to the "B" battery on the other hand is designed for a very high voltage, perhaps a thousand volts and only a fraction of an ampere. The way this change is made is by putting a great many turns of fine wire on the armature of the generator. The armature you will recall is the part that turns and looks like a toy drum with a lot of wires around the outside. The fact that this armature carries a very large number of wires insures that the pressure developed will be very high because each wire on this drum generates nearly a volt, and so when they are all added we get the necessary high pressure.

What is Commutation?

But now we get to the difficulty. Each group of wires is connected to a bar in the commutator. If you will look at an automobile generator you will notice that at one end of the armature is a collection of copper bars. Each bar is separated from its neighbor by a thin black line, which is in fact a strip of mica. Mica is one of the best electrical insulators there is, and furthermore is not bothered at all by high temperature. That is why it is used in the commutator. As a matter of fact mica is the insulation used in your electric flatiron. Each group of wires then is connected to its individual bar in the commutator. These commutator bars, of course, spin around at a high rate of speed when the machine is running and to collect the current from the armature a piece of carbon, called a brush, bears against the commutator and makes a rubbing contact with it. This is the weakest part of a generator. Unfortunately, it is absolutely necessary since the electricity is generated in a moving part, and yet is to be used in an outside circuit, which is stationary. The commutator might be called an electrical bearing. It plays the same part in the electrical circuit that a ball bearing does on the armature shaft.

Enter the Hum

The unfortunate part in the operation of our generator is this: As the armature spins around, the carbon brush first rests on one bar, then an instant later on a second, then on a third, etc. While it is touching any bar no hum is caused, but just at the instant it jumps over the mica insulation to the next bar a little jerk is given to the electric circuit. Of course, one such jerk would not be serious, but a moment later as the brush jumps to the next mica insulation and touches the next bar another jerk follows and so on. It is this rapid series of electrical jerks which makes the hum. The designers of the generator naturally want to cut this hum down as much as possible, and for this reason they make the mica insulation very thin and use just as many commutator bars as they can crowd into the space so that the jerks will be very small and will come so close together that the ear does not catch them, but with the utmost care the hum is still discernible if you listen for it.

As a further measure for reducing this objectionable noise the current from the generator is run through what is called a filter. This apparatus consists of various coils and condensers arranged in such a way that the coils choke off the hum and the condensers short circuit it and so the tone is very largely eliminated. Without this filter the hum would be very objectionable indeed.

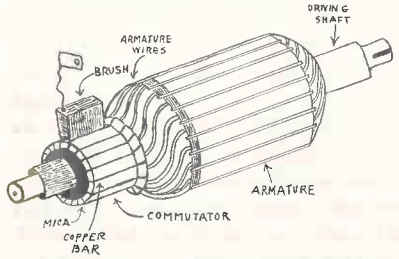
The Commutator Ripple

When listening to your favorite broadcasting station, if you observe that the noise coming through is unusually great, you will know that something has happened either to the generator or the filter and this so-called "commutator ripple," which we have just described, is getting through into the sending ap-

paratus. However, if your broadcasting station makes an objectionable hum all of the time, of course it means that the apparatus used is not powerful enough to reduce the noise to the minimum which you would prefer. Naturally, such powerful devices are very expensive.

A Humless Station

For those stations which desire the very best and can afford to pay for it, a second type of apparatus has come on the market for supplying the necessary high plate voltage, to operate the sending tubes. This consists of a storage battery, consisting of from five hundred to one thousand cells. When you realize that a three-cell battery in your automobile costs around $6.00 to $8.00 a cell, you can readily see that such a battery will run into a lot of money. Naturally,



This Armature Rotates at High Speed

the small size of cells required in this "B" battery will not cost nearly as much as the large size which you use to turn over your automobile starter, but even at that it requires a very large outlay of money to put in such a "B" battery.

Charged at 110 Volts

Such a battery station is operated first by charging up the batteries while the station is off the air, and then in the evening switching them on to the sending tubes. When charging the batteries they are connected in blocks of one or two hundred volts each, as using this lower pressure enables the sending station to use an ordinary 110 or 220-volt generator. Then when the charge is finished, they are reconnected so that the voltages of the various blocks all add together and make the necessary one or two thousand volts. At the time of using the battery for broadcasting, the generator is naturally not running, and so the hum caused by the "commutator ripple" does not exist.

Sixteen Such Stations

At the present time there are sixteen stations using Willard B Batteries, as has just been outlined. The first one was station WTAM at Cleveland, and it proved so successful that the others have followed suit. As the chief objection to this system is the expense of the batteries, it is quite likely that other stations which can afford it will eventually change over to battery operation.

PUTTING THE BAN ON THE BAND

Radio Threatens American Band Concert.

Now that half a million people can listen to the programs broadcast from a single station, what will happen to the village bands? Of what use are the uniformed and spangled players that decorate the small town band-stands when the townspeople can just as well sit at home with the phones clamped on their ears? Will the trend be to keep the family at home instead of on the country green or city park?

No More German Bands

No longer do we see the old German bands that traveled from place to place and enlivened the atmosphere with their cheerful "toots." The old-time fiddlers have vanished into the past, and the wailing of their instruments is recalled only in the memory of our grandfathers. Are the deep-throated, droning park bands headed in the same way? Can it be that the trombone and the cornet will no more inspire listless citizens to drop comic sheets and orange peels on the green?

What a relief such a change would be to the townspeople of Podunk, Ohio, who for years have undergone the mental suffering of being compelled to listen Friday nights while Tom Greene's band got in a couple of hours' practice in the vacant room over the local hardware store. Yet, again, what a tragedy to drift aimlessly about the empty streets on a Saturday night without the familiar martial strain of music.

Surely someone will be quick to declare that something vital and human has gone out of life if radio undertakes to encroach upon the famous institution known as the American band. What excuse, if any, will the farmer have for taking his family to town if he cannot sit back comfortably in his automobile, and when the band has finished playing, reach out and toot his horn for dear life?

The opportunity to meet his neighbors and shake their hand on the strength of a band concert will have been gone, and heaven knows a loud speaker is no excuse to break a bottle of lemonade. The disappearance of the band will be a disappointment to the youngsters, for at no other time except when the band is playing would the Old Man be good-humored enough to buy a toy balloon.

But then we are not sure but radio is just as good!

A TASTER-TESTER

A Meter You Always Carry Round in Your Face

By HARRY A. NICKERSON

This is a description of about the simplest device possible for use by the "trouble shooter" in radio.

Run the ends of two wires connected to the terminals of an ordinary dry cell or flashlight battery to the tongue and notice the peculiar salty taste. If the two wires are provided with spring clips, we have the complete "taster-tester."

Its use is probably self-evident,—in testing wires for continuity, presence or absence of "short-circuits," and even as a rough test for the condition of batteries.

Testing the Shield

As an example, suppose you wish to learn whether any part of a variable condenser is touching the panel shield behind it. Lead a wire from the shield to the tongue; touch the various metal parts of the condenser with one clip at the same time touching the tongue with the other spring clip. If there is experienced the peculiar taste, then the condenser is "shorted" on the shield.

WARNING.—More than three or four volts should not pass through the tongue or injury may result. Under no circumstances use the whole of a 22 volt "B" battery to do your testing. Vacuum tubes should be removed from sockets when there is danger of supplying too great filament voltage to them through using the tester.

Putting the Vacuum Into a Tube

It's Not What's In but What's Left Out That Will Count

LITTLE JOHNNY asked his mother what kind of a vacuum cleaner they used for putting the vacuums in radio tubes. But, unfortunately, the process of making a tube is not as simple as that. The most expensive part of a vacuum tube is not in it at all—it is the air which was once in it, but has been exhausted out of the bulb by a vacuum pump. The manufacture of this most important part of a radio set is quite interesting. Although hundreds of thousands of dry-cell vacuum tubes are now in use by radio enthusiasts, it is safe to say that only a very small percentage of the users know anything at all about their process of manufacture.

These little bulbs, because of their convenience and low operating cost, added tremendously to the interest in broadcasting, and gave to the great general public an opportunity to obtain tube receivers. Before the coming of radiotrons WD-11, WD-12 and UV-199, the most of receiving sets used a crystal detector and so were limited in range to about 20 miles.

Thirteen Steps Needed

Great care is necessary in the manufacture of these tubes, which, despite the fragile character of the material, are sturdy bits of apparatus, well adapted to stand fair handling and give constant service during long periods.

There are thirteen steps or processes of assembly before the tube, starting as raw material, takes its completed shape. There is also a test made after each assembly and still further tests after the tube is completed. These tests are so severe that once a tube has passed through them it is rarely returned because of failure in operation.

The parts used in making a tube look quite innocent, and no one would ever imagine that they would enable President Coolidge to talk to the whole United States at one time. They consist of the following: A circular piece of glass called a blank; a thin glass stem to support the elements; a short tube of glass used to vacuate the air; the filament, which later will furnish the electrons to carry the music; the grid, which controls the operation of the tube, and the plate to receive the current and take it to the telephones.

Spinning a Flare on End of Glass Tube

The first step in the assembly process is spinning a flare on the end of the short glass tube. This tube is then called the flare. Next is the inserting of the five wires in the flare. One carries the grid, two more the two ends of the filament, and two run to the plate. The plate is the heaviest piece and so requires two supports to make it mechanically strong, but of these last only one wire is brought out through the seal to form a connection.

The five wires are inserted in the end of the glass tube opposite the flare and the glass melted to the shape seen in the completed tube, thus holding firmly in place the wires. The glass tube with its wires inserted is now called the press. It looks like a pretty simple process to run these wires through the glass, but it must be remembered that on the outside of this seal is the ordinary air pressure of 15 pounds per square inch. All this pressure is trying to force air through the seal into the inside, where the most perfect vacuum possible is maintained, so a very small amount of leakage through the crack between the wire and the glass will allow a constant procession of little bits of air (or air molecules) to wend their way into the inside. Since this parade will be going 24 hours a day, it will not take long for the vacuum to be destroyed. This shows the need of an absolutely tight joint at this place.

It Took Years to Make Seal

The process of making this joint tight was not discovered in a month or a year. The same problem presented itself in the manufacture of electric light bulbs. Up to 10 years ago platinum wire was used to run through the glass because platinum has the same action under heat that glass has. This is called the coefficient of expansion, and it means that when glass gets warm it swells exactly the same amount as platinum does. If this were not the case, it would naturally follow that when the tube got alternately hot and cold, the crack between the two would open up and let in some air. In the old days platinum was not very expensive, and a small length, say one-eighth of an inch long, was welded to the lead-in wire which carried the electricity to the lamp. This platinum wire was then sealed into the glass. This was very satisfactory until girls began to ask for platinum rings when they announced their engagement. The price of platinum gradually rose until now it is worth about five times its weight in gold.

So a hunt was made to find some other metal or alloy which would have the same coefficient of expansion as glass. This was comparatively simple, as several such alloys were discovered which answered this requirement. But here another difficulty arose. After these lamps had been in service for some time they would mysteriously burn out. On investigating the cause it was found that the vacuum deteriorated, owing to air getting through the seal. This difficulty for a time seemed insurmountable because no one knew how or why the air got in.

Glass Wets Platinum

After a long and exacting research it was found that molten glass wets platinum just the way water does, and when it cools down it leaves no crack. On the other hand, glass was not wetting the substitute alloys any more than glass is wet by mercury. When a glass rod is dipped into mercury and then pulled out, none of the mercury adheres,

and so there is a very minute crack between the two. Once the cause of the trouble was found, a new search was started to find a metal which would expand at the same rate glass does and also be wet by melted glass. Such a cheap substitute for platinum was finally discovered, and so the vacuum in your tube is in no danger of being impaired by leakage through the seal.

Spot Welding the Leads

Getting back to our vacuum tube, the five wires are next cut to their proper lengths so that the plate, grid and filament can be mounted. These units are electrically spot-welded in place by girl operators, each of whom is a highly skilled worker. The filament used in the WD-11 and WD-12 is a metal wire coated with oxides.

Now the glass blank is tubulated, or, in other words, the thin glass tube is placed on its end after a small hole has been melted in the glass blank with a gas flame.

Next the press is sealed to the bottom of the blank. In this process the flare is held tightly to the bottom of the blank and a flame melts the glass sufficiently so that they weld together.

As the long glass stem is placed on the blank for the purpose of exhausting the tube, this process is the next in order. The long glass stem is inserted into a piece of rubber tubing which leads directly to the pumps, which are two in number. An oil pump exhausts most of the air out of the tube, but cannot get out the last dregs, so to speak. A mercury vapor pump is needed for the final vacuum.

Before the pumps are turned on, a covering which serves as an oven is pulled down over them and they are subjected to a high temperature to drive gases from the glass walls and metal parts. A temperature of 400 degrees centigrade equal to 700 degrees Fahrenheit is reached before the baking is finished.

Then the pumps are turned on and the tubes exhausted to a very low pressure—much lower than that given the electric lamp bulb.

A coil of wire surrounds the tube when placed in the exhausting machine, and by means of a high tension spark the vacuum is tested. By observing the color and looks of the spark an experienced operator can get a very good idea of the amount of the vacuum. The ordinary vacuum gauge is no use in such a measurement, as it would read zero on the scale long before the vacuum was low enough for the purpose.

Next, the plate of the tube is heated red hot by a high frequency oscillating current generated from transmitting tubes to remove the gas from the plates and metal supports. The plate oscillations are then turned off and the filament heated to obtain the proper chemical reaction on the filament oxide, and thus increase the possible electron emission. The pumps are turned off and a gas flame run around the bottom of the long glass tube until it melts off and forms the tip of the vacuum tube. This finishes the glass part of the tube.

Taking Its Base

A supporting base to hold the glass has in the meantime been made up in another department. It is now assembled with the glass part and baked on in an automatic machine. This base consists of a brass ring surrounding a piece of insulation. Four brass prongs or tips stick out through the base. These will be used in your set to make contact, one to the grid, one to the plate and two to lead the current in and out of the filament. These prongs are hollow and a lead-in wire from the glass is threaded through each one. These wires are next cut off flush with the end of the prong and soldered in place. That is why you will find a drop of solder on the bottom end of each of the projecting tips.

RADIO THE LEVELLER

The time was when a banker in a silk hat thought himself perhaps a little above some of the more humble occupations. But radio has changed all this. Bank president and burglar, clerk and chief, all listen to the same music and stories on the air. Here is an illustration:

Two prominent men in financial circles were discussing an important question at the intersection of two streets in Brooklyn. A negro, driving a team of horses, was forced to wait at the curb, as the traffic officer allowed vehicles to pass in the other direction.

The negro overheard the conversation between the two men, and after a few moments stepped down and said, "Pahdon me, sah, ahn't you all the gen'lman, Mr. Vice-President Peter Hamilton, o' the Lawyers' Mortgage Company, what broadcasts through WEAF, New York, every Monday evenin'?"

Mr. Hamilton, startled, turned at this greeting and answered, "Yes, I am."

"Well, sah," answered the darky, "Ah want to say Ah have enjoyed youah financial talks on mah crystal set and Ah surah am pleased to meet you all." Just then the traffic officer's whistle blew and the colored financial expert assumed his regular duty as charioteer of his express wagon.

Neutralizing the Neutrodyne

Unless Neutralized Correctly it is No Better Than Others

By KIMBALL HOUTON STARK, Chief Engineer, F. A. D. Andrea, Inc.

EDITOR'S NOTE.—One of the most popular sets at the present time is the Neutrodyne. This usually contains five tubes. As it is unusually sharp tuning, distance stations can be obtained even when powerful local broadcasters are on the air; besides, it is easier to control than a good many hook-ups.

In our last issue appeared the first half of an article giving the list of necessary material and the hook-up for this set. In this concluding part is given the information for neutralizing the circuit and detailed instruction for operation. As the neutralization of leakage capacities is one of the main parts of the neutrodyne, it is well to give particular attention to this important point.

IN Professor Hazeltine's arrangement, however, coupling capacities are made to counteract each other, and each individual tube circuit is balanced against another tube circuit so as to reach a condition where no signals can be heard in the phones because of passing through coupling capacities existing in the circuit.

In the neutrodyne circuit, the electromagnetic coupling between the neutroformers is approximately zero. The effect of this is to make one portion of the circuit capacity balance against another practically equal portion of circuit and tube capacity, so as to eliminate or neutralize the effect of the parasitic feed-back capacities of the entire circuit.

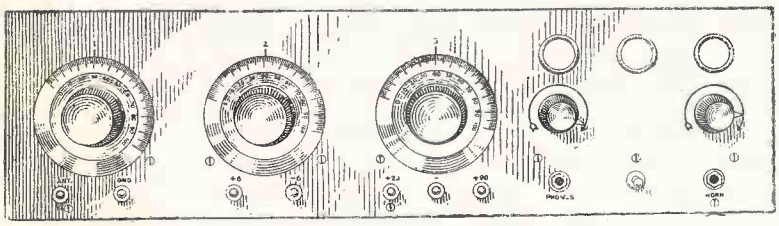


Fig. 4. Neat Appearance of Panel

How to Neutralize the Circuit

In practice, the balancing-out process consists of exciting the coupled receiver circuits with a comparatively strong signal and then adjusting the special neutralizing capacities or Neutrodons, as they are called, to a point where that signal becomes inaudible. The fact that this adjustment of the neutralizing capacities is made toward a minimum or inaudible signal and can accordingly be made very exact, gives us proof that the method of neutralization is a true process of actual circuit capacity neutralization and not a method of preventing or reducing regeneration. This is even more forcibly brought out when it is realized that the adjustment is made *without lighting the filament of the tube you are adjusting.*

The completed receiver as shown in Figure 4 should first be connected up to the "A" and "B" batteries as shown also in the drawing of Figure 5.

Figure 5 shows the battery connections for the four-tube receiver, the connections for the five-tube set, however, being the same.

In addition to the battery connections, a special balancing-out circuit must be hooked up. The balancing-out circuit consists of an inductance and a variable condenser excited by a buzzer and coupled to the input or antenna terminal of the completed receiver. It is usually desirable to place this adjusting circuit 10 or 15 feet away from the actual receiver and lead a single wire over to the antenna binding post. To complete the balancing-out circuit arrangement, a wire is connected from the main terminal of the receiver to the ground such as a water pipe, etc. The wiring and circuit constants of such a circuit are shown in Figure 6.

With the adjusting or balancing-out circuit connected as above and with the "A" and "B" batteries connected as shown in Figure 5, we are ready to start balancing out our receiver. The method is as follows:

1. Turn the knobs of both detector and amplifier rheostats as far to the left as possible.

2. Insert two UV-201-A or C-301-A vacuum tubes in the radio-frequency amplifier tube sockets (the two single-tube sockets at the left end of the receiver looking from the panel front). In the detector-tube socket (the one directly above the phone jack), insert a UV-200 or C-300 detector tube.

3. Pull out the filament switch shown between the two jacks, thus closing the filament circuit, and turn the amplifier rheostat (the one at the extreme left of the panel) so that the pointer points directly at the number three Neutroformer dial. This is about the correct position of the rheostat for the UV-201-A tubes. Turning this rheostat to this position will light the filament of the first two left-hand tubes. Now turn the knob of the detector rheostat about three quarters of the way around or approximately with the pointer at the right and pointing toward the pointer of the amplifier rheostat. It is best to adjust the detector rheostat slightly so that when the phones are plugged into the phone jack, the detector rheostat will be adjusted below a point where a decided sizzling and frying sound is heard in the phones.

4. With the buzzer of the balancing-out circuit running, rotate all three

Neutroformer dials from the front of the panel, about in step with each other, and pick up the buzzer signals with the variable condenser of the adjusting circuit set at approximately 15 or 20 degrees (an approximate wavelength of 225 meters). The buzzer signals should be picked up at about the same setting, glass insulating tubing, the strength of signals heard with the tube in its socket with the filament circuit inoperative can be varied from loud to a minimum or inaudible signal. The desired adjustment point is the one where the signals are very weak or disappear entirely and no sound is heard in the phones. To terminals insulated, after which the neutralization adjustment covered in paragraphs 7 and 9 should be followed out in detail, adjusting the second Neutrodon from the left end of the base board and securing the adjustment at the given inaudible signal point.

The most important point to follow

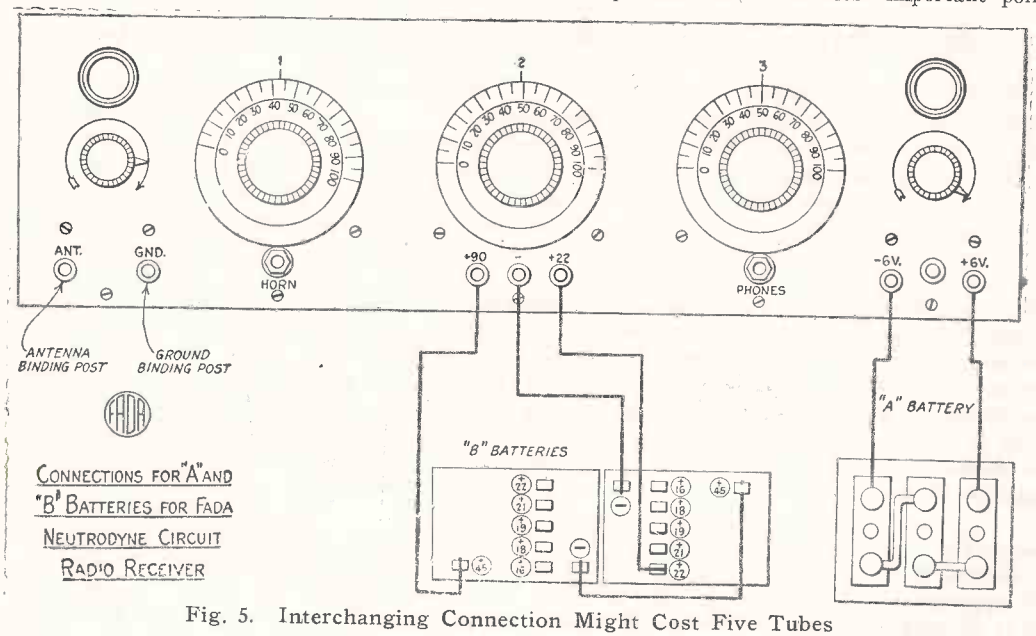


Fig. 5. Interchanging Connection Might Cost Five Tubes

near 15 or 20 degrees on all three of the dials. When buzzer signals are picked up, all three Neutroformer dials should be adjusted very slowly until buzzer signals come in at their maximum. At this point the dials should have approximately the same settings.

5. Remove the tube from the left-hand tube socket.

6. Readjust the three Neutroformer dials again for maximum signals.

7. Take the UV-201-A tube removed from the left-hand socket and place a small piece of paper over either one of its filament contact pins so that the paper will remain in position when the tube is again inserted in its socket.

8. Place the tube with the insulated contact pin back in its socket. This allows the connection of the plate and grid of this tube to the receiver circuit, but as one of the filament contacts is insulated, the filament of the tube will not light. With the tube in its socket and the filament unlit, signals will still undoubtedly be heard, but with considerably less volume than before. It will be found that by adjusting the brass tube of the first or left-hand Neutrodon lengthwise over the prove the minimum signal point, the tube can be lifted out of the socket and immediately signals can come in at their maximum as they did at the end of the adjustment 6 above. Replacing the tube in its socket (with the paper still in place) will cause the signals to disappear or be heard at the minimum signal intensity. The ideal condition for the Neutrodon adjustment is for the signal to disappear entirely when the tube is in its socket (with the paper in place) and at this point the Neutrodon clamp should be tightened down securely. For a more permanent adjustment of the Neutrodon, the clamp, after being tightened down, can be directly soldered to the sliding brass adjustment tube.

9. This covers the neutralizing adjustment for the first radio-frequency amplifying tube (the one on the extreme left.) The same procedure is followed with the second radio-frequency amplifying tube (the second tube from the left looking from the panel front). In this case the first left-hand tube and the detector tube are kept in their sockets and lit, and the second left-hand tube removed and its filament in this balancing-out process is to adjust all three Neutroformer dials for a maximum signal when either the first or second tube is taken out of its socket and before the neutralization and adjustments are made with the insulated filament contact pin of either the first or second tube in its respective socket.

A further test, to determine that the circuit is properly balanced out, is made with the "A" batteries still connected and with the antenna and ground connected to their respective binding posts, all tubes being in the receiver without any of the terminals insulated. One can try to receive broadcast signals by adjusting the receiver dials, etc., similar to method of tuning for balancing out signals described above.

By tuning the receiver one should be able to receive broadcast signals without hearing beat notes, whistling, etc., which are the usual indications of regeneration or oscillation. If under any circumstances, such whistles are encountered, (unless supplied over the air by some squealing neighbor) the entire receiver should be carefully gone over and possibly rewired and readjusted, as will be described in greater detail later

on in this article. If beat notes, etc., are heard, it is proof that the circuit is not functioning according to the neutrodyne principle and most satisfactory results cannot be obtained. The experimenter is cautioned to make sure that his receiver is adjusted properly and that no parasitic disturbances are caused by the improper capacity neutralization in the circuit, otherwise the value of the neutrodyne circuit will not be realized.

Operating the FADA Neutrodyne Five-Tube Set

The necessity of such a neutralizing adjustment is characteristic only of neutrodyne receivers. Due to the radical difference of the circuit, the method of tuning is also quite different from the tuning of the usual regenerative or non-regenerative receiver. Consequently, instructions must be very explicit.

In this article, we shall accordingly study in detail the method of tuning neutrodyne circuit receivers and in addition, some general information will be given on antennas, vacuum tubes and "trouble-shooting."

Tuning the Receiver

The procedure of tuning your neutrodyne receiver, providing antenna, ground, and all battery connections have been properly made, is as follows:

1. Insert the recommended vacuum tubes (see paragraph on the use of different tubes) in their respective sockets and with the power rheostat at its correct position for the type of tubes you are using, and with the vernier rheostat knob turned to the left as far as possible, and with the plug of the loud speaker inserted in the "horn" jack, pull out the knob of the filament switch on the panel front, causing the three amplifier tube filaments to light.

2. Turn the vernier rheostat knob to the right slowly. When the filament current is turned on, the first indication that the receiver is functioning properly will be indicated by a slight noise in the phones. As the rheostat knob is turned farther to the right, this slight sensitivity indication does not increase in volume until a point near the end of the rheostat adjustment is reached. At this point will begin a comparatively loud "hissing" and "frying" noise. For the best signal reception the rheostat should be turned back slightly to a point just before this "hissing" and "frying" starts.

3. With the detector tube at approximately its right operating point, set "Neutroformer" dials 2 and 3 at the same dial setting. Select any particular dial setting, but take for instance the wavelength of station WEAF, 492 meters. Dial settings for this particular station are about 66 or 67. Setting dials 2 and 3 at this point, rotate dial 1 very slowly over its entire range from 0 to 100. If any broadcasting station is operating at the particular time at 492 meters, it should be heard at a maximum when the setting of dial 1 is approximately in the range of 10 or 15 above or below these settings of dials 2 and 3.

4. When signals from any particular broadcasting station are coming in, it is advisable to readjust dials, 1, 2 and 3 slightly and possibly also the vernier rheostat, in order to increase the intensity of the signals.

In tuning, the dials should be moved slowly. It may be found that the tuning adjustment will have to be changed slightly when shifting the phone plug or loud speaker plug from one jack to another.

Dials 2 and 3 should be rotated slowly at the same time, and about in step with each other. Then with dials 2 and 3 on the setting for a particular station, dial 1 is rotated until signals come in with maximum strength and clarity. Sharpness of tuning of neutrodyne receivers when using short indoor antennas is much greater than when using outdoor antennas.

In tuning neutrodyne receivers, the broadcasting stations will not be picked up by hearing "beat notes" and the usual regenerative whistling. As the dials are rotated the programs of different stations will be heard, first softly then with greater intensity and clarity as all adjustments are properly made for that particular station.

The Wavelength Range

The Neutroformer coils specified in these articles are designed to cover a wavelength range of from approximately 200 to 600 meters. The wavelength calibration curve is shown in Figure 7 and has several broadcasting stations' wavelength calibration points indicated.

Using Different Tubes with the Neutrodyne

In the early stages of neutrodyne receiver development, receivers were constructed that allowed the neutralization of a given tube and circuit capacity and which did not operate efficiently when different vacuum tubes having different capacities were used. With the placing on the market of the UV-201-A and the dry-cell tube, this matter of basic design was very carefully studied, and now they, and other tubes, can be used with comparatively good success. It has been found that C-301-A tubes are the best for the radio and audio-frequency amplifier circuits. The C-300 or UV-200 is the best to use as detector tube. The UV-201-A is very good as an amplifier tube and is a close second to the C-301-A. I have been in intimate touch with many users of neutrodyne receivers and a great many of them have had good success with WD-11, WD-12, VT-1, VT-2, 216-A, and UV-199 tubes. When using any of these various types, it is, of course, necessary to make sure that correct filament voltages as well as filament current is supplied to the tubes and in general the chart given in Figure 2 covering "Operating

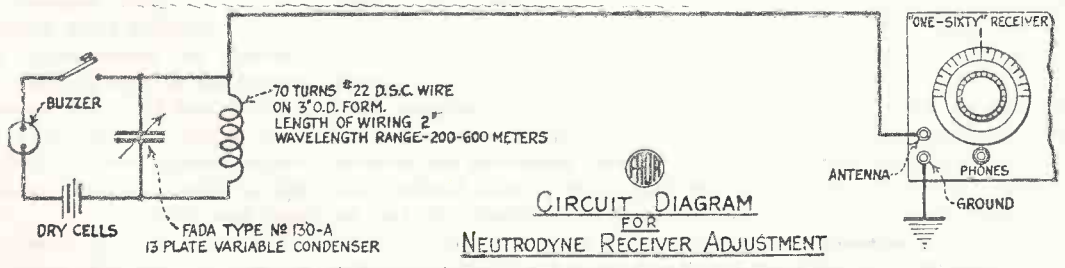


Fig. 6. A Buzzer is Valuable for First Adjustments

Data for Vacuum Tubes" will be found variable. The lettered notations as regards the suitability of the tubes has been described with neutrodyne receivers particularly in mind.

of an outdoor installation. With a five-tube neutrodyne receiver, constructed in accordance with these articles, such an arrangement is feasible and in fact very good results can be obtained if one does

the ground binding post to the receiver connected to the ground wire. The five-tube receiver described is not designed primarily for loop reception and an outdoor antenna is strongly advised.

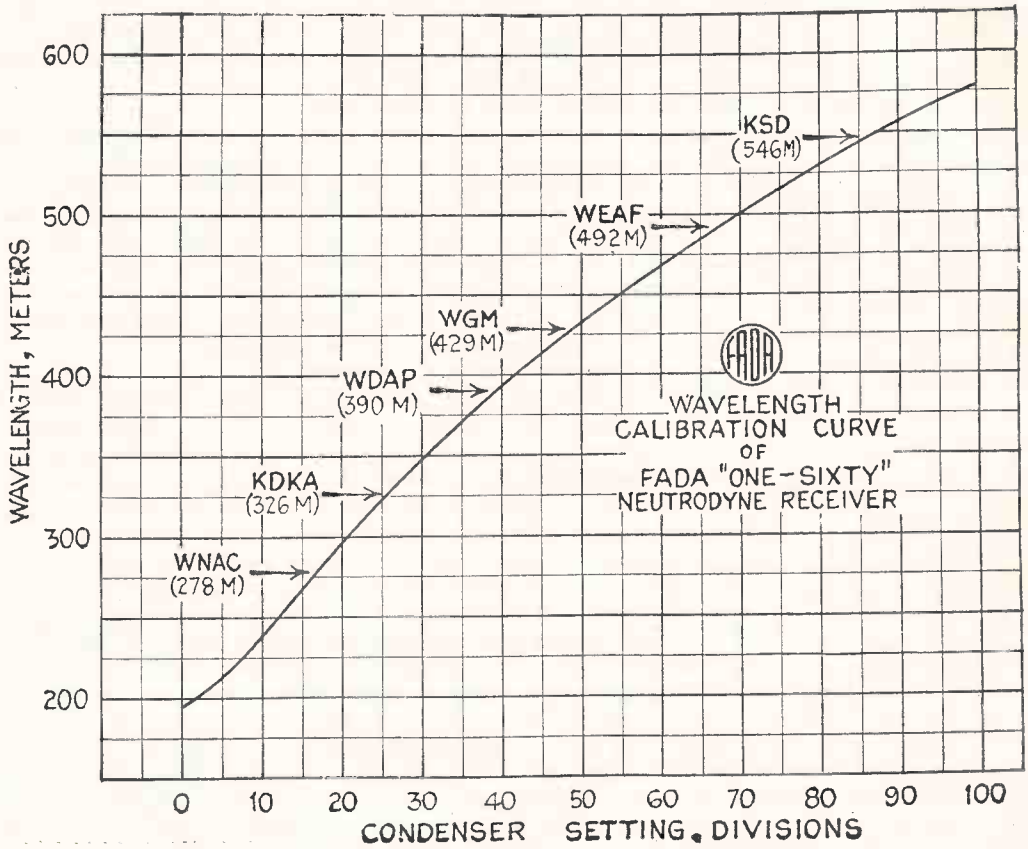


Fig. 7. Chart Gives Dial Settings for Popular Stations

The volume obtained using UV-199's or other dry-cell tubes is generally less than the volume obtained using UV-201-A or C-301-A tubes, and this in general is true when any of the other different types of dry-cell tubes are used. The volume obtained, however, with dry-cell tubes under conditions permits loud speaker operation on distant stations. It is suggested, however, that with UV-199 tubes as radio-frequency amplifiers, C-301-A or UV-201-A tubes be used for the audio-frequency amplification.

The Most Suitable Antenna

An outdoor antenna 60 to 70 feet long and 30 feet to 40 feet high, is possibly the best for use with a neutrodyne receiver. The multiple-wire antenna is generally no better than the single wire type for receiving,

A great many people desire to use an indoor antenna, either through necessity or to eliminate the trouble and expense not insist on getting the distant stations. A stretch of wire 50 or 60 feet long in an apartment will work nicely, but this same length of wire should not be coiled around the wall in a single room and the same results expected.

There is still loop reception to be considered. Many people are using neutrodyne receivers with loop antennas. There are several methods of connecting a loop to the receiver; connecting one terminal of the loop to the antenna binding post; connecting both terminals to the antenna binding post, thus shortening the loop itself; connecting the loop in series with a variable condenser and then connecting the condenser and loop in series with the antenna and ground binding post; and connecting one terminal to the antenna post and the other to the ground post. This is the arrangement most frequently used. In any of these cases it will usually be best to have

"Trouble-Shooting"

There are people who build receivers that have very little technical knowledge, and it is somewhat difficult to describe to them technical processes. Even the simplest thing which the radio amateur or experimenter takes for granted are at first puzzling to the uninitiated and it is not surprising that many people who have constructed neutrodyne circuit receivers have not been able to obtain complete satisfaction at their first efforts.

A detailed list of "trouble-shooting" instructions that will usually aid the home constructor to put the breath of life into his receiver satisfactorily follows:

Check all connections very carefully with the wiring diagram given in Figure 1. After your own check convinces you that your wiring is correct and ab-

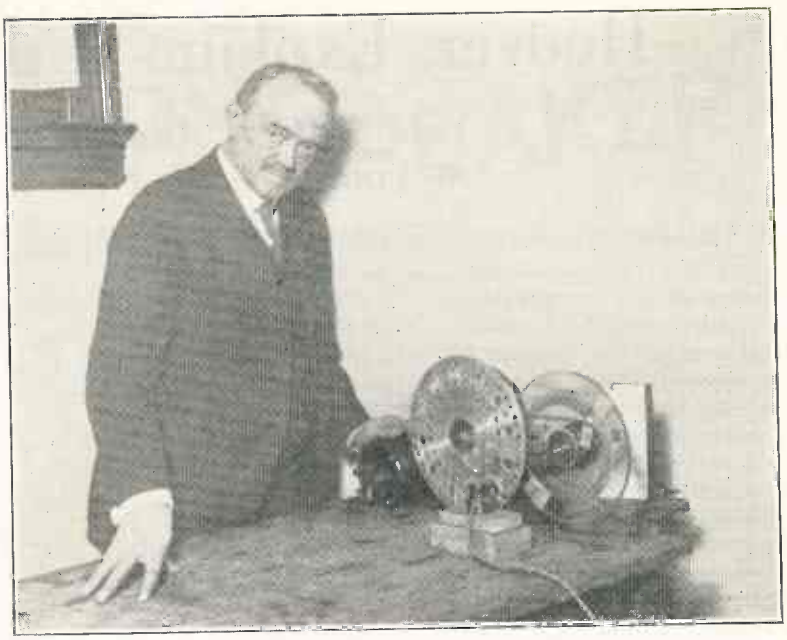
Continued on Page 21

SEEING AROUND A CORNER

Television the Next Aim of Radio

It may soon be possible to see around a corner and through two brick walls. Not with a new kind of telescope, but by the radio apparatus shown at the right. Mr. C. F. Jenkins, of Washington, D. C., has already been able to send photos and printed matter over the air. He uses a large number of lenses in front of a prismatic ring, which is rotated by an electric motor. In this way enough impulses are sent over the air to speed up the transmission of images to a point where it begins to look practical. The trouble with former schemes is that they have been altogether too slow.

It is reported that many women are in favor of this scheme, but that their husbands are not so enthusiastic. However, they have not explained why.



—Kadel & Herbert

NEUTRALIZING THE NEUTRODYNE

Continued from Page 20

solutely identical with the diagram, it is best to have someone else check it over so that the same mistake will not be repeated.

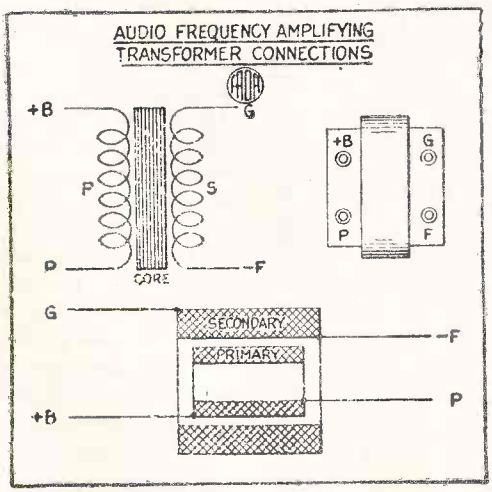


Fig. 8. Shows Transformer Polarity

A point of great importance is that the variable condenser of the Neutroformer unit rotary plated terminal be connected directly to the negative terminal of the vacuum-tube socket of the amplifier tubes. It will be noted in the diagram, however, that this wire from the rotary condenser plate terminal of the third from the right hand Neutroformer connects to the +90-volt terminal of the detector tube.

Audio Transformers: Many times, when howling occurs, reversing the connections to the primaries of either one or both of the audio-frequency transformers will remedy the trouble. The drawing Figure 8 shows the correct arrangement of transformer terminals and also the best plan of connecting the various leads from the transformer winding to the terminals.

Fixed Condensers: In special cases, where trouble with balancing-out is had, it may be advantageous to cut out entirely the fixed condenser (capacity .006 mfd.) which is connected from the detector tube plated terminal to ground of the negative "A" and "B" batteries common lead. Eliminating this condenser and re-balancing carefully will many times secure a very good minimum or inaudible signal balance.

Dirty Contacts: Connections which lead from the elements of the vacuum tube to the direct terminals are soldered to the tube contact pins and these soldering connections oxidize and become dirty very quickly. One should see that the bottoms of these tube contact pins are always bright and clean.

Neutroformer Mounting: The neutrodyne circuit requires that all electromagnetic couplings as well as electrostatic coupling be balanced or neutralized. Accordingly, the mounting of the Neutroformer is of great importance, and the correct angle that they should be mounted at is 54.7° from the horizontal. A slight variation from this angle will cause trouble in balancing out. If the experimenter drills his own panels, great care should be taken to see that this angle is correct.

Be sure that all your connections are O. K. Then if your set is built in accordance with the directions given in these articles, the results will repay you many times over for your work.

Hoover Explains Ether Zones

You Are Not Allowed to Talk to Your Friends Over the Air

IN the turmoil of teapots and the suspecting of secretaries now going on at Washington, it is refreshing to know that at least one Cabinet official has been receiving nothing but praise for his work. Secretary Hoover has handled the very difficult radio situation in a way which seems to be pleasing to everybody. When you realize that at least 20,000 people are all wanting to talk at once, you will see that it is no easy job to satisfy them. It would seem that the Tower of Babel would be completely lost under present-day conditions.

Class A and Class B

The smaller radio broadcasting stations in the United States are called Class A, while the most important ones, which use a large amount of power, are named Class B. The smaller stations do not interfere much with each other, because their waves do not penetrate very far. Whispering in a crowd is not very disturbing, but it is the man who yells who gets the attention. That is why the Government is very careful in assigning wave lengths to Class B stations. If two of them are close together and work on nearly the same wave length, they will raise Bedlam in most of the receiving sets which are within earshot (or should we say air shot?).

In broadcasting from WCAP, Washington, Secretary Hoover discussed the radio situation as follows:

"Up to a few years ago, no one dreamed that the ether had any special importance in law or in government. It was surely inert from the point of view of public interest. Then it was discovered that radio messages are transmitted by an electrical wave through the ether. At once the ether developed some very important public questions, like water rights and land rights. It threatens even to have property values. It has become the vehicle of public services, the possible scene of monopolies; it has boundaries, rights of way, rules of the road, raises questions as to free speech—functions that have hitherto been confined to the land and the water.

"To-day there are literally 20,000 people trying to traverse the ether with all sorts of messages, and inasmuch as there would be utter pandemonium if there were no traffic rules, there has grown up a demand from the users of the ether themselves for Government regulation. This is indeed the only industry I know of which has generally with one acclaim welcomed and prayed for Government control.

"Some day, with a greater development of the art, we may use several thousand different wave lengths; but to-day we must keep them a good ways apart, and we have the use of a very limited number. Therefore, the assignment of wave lengths and preventing duplication and crowding in their use is the first step in regulation of the traffic.

"The use of radio for telephone purposes only became possible with the discovery of the vacuum tube for amplifying the electric currents which are controlled by the voice and which are made to produce sound. But the transmission of sounds in this way has so far been generally and practically used only in the lower wave lengths. Our broadcasting and ordinary receiving sets are to-day limited to the area from 200 meters to about 600 meters. In this range we can so far only safely venture fifteen or twenty wave bands in any one zone. Some of the bands in this range must be reserved for ships and for amateurs, and the use of closely adjacent bands in nearby cities is not feasible, so that we have at present a maximum of about seven that we can safely use for telephone broadcasting in a given vicinity without interference.

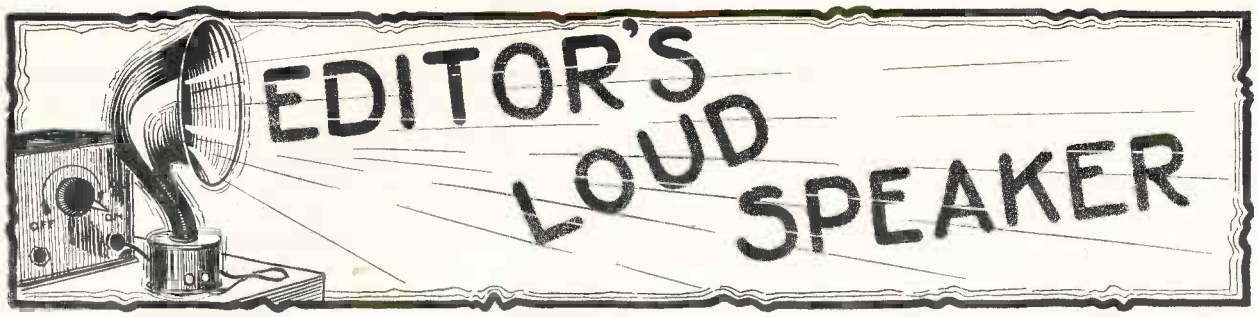
"For telegraphic purposes we can use a great many different wave bands above 600 meters and there is no substantial congestion in that work. Furthermore, we are trying gradually to eliminate the use of telegraph, except for amateurs, in any of the wave lengths which can readily be applied to telephone purposes, always maintaining, of course, provision for communication with ships.

"If we wanted to apply the telephone communications, such as we have in the normal telephone service, only seven people could call up at once in any one neighborhood, and therefore it has no practical application for service in personal communications.

"This brings us to the second step in regulation. We do not allow any personal communications by telephone within this range of wave lengths, but reserve it entirely for broadcasting purposes, where millions of persons can be served instead of a few. If we allow private communication by radio telephone we would have the air filled with invitations to a dinner or comments on Lily's bobbed hair, with a possible exclusion of a speech by the President of the United States.

"We have about 570 broadcasting stations, and in order that each one of them may have some right to start things in the ether, we have to regulate them in two different fashions. First, in making the assignments to Class B broadcasting stations, we have divided the country in five zones and assigned about ten frequencies or wave lengths in Zone 1, ten other wave lengths in Zone 2, and so on. The wave lengths used in adjacent zones are separated further than those used in widely distant zones. And when there are more than two or three stations located close to one another in any given zone, we have to arrange for them to divide the time during the day."

Secretary Hoover has already gone on record as favoring no censorship by the Government as long as the broadcasters behave themselves. Since the broadcasting licenses which the Department of Commerce gives have to be renewed every three months, it is quite plain that he can hold a club over the head of any station which seems to be inclined to take an unreasonable attitude.



LEAVE THE CAT, NOT THE RADIO

WHEN you go on your vacation this summer, if you must economize space by leaving something behind, by all means take a radio set, and if necessary, leave the family cat. There are two good reasons for doing so. In the first place, you will miss the radio keenly, for no doubt you are quite accustomed to listening at least several hours a week, even in your home, where there are plenty of other distractions. And when you get down to the beach, or up in the mountains and run into a dull, drizzling, rainy day, with absolutely nothing to do but watch the raindrops run down the window pane, you will need the cheering voice coming from the loud speaker or phones far more than you ever needed it at home.

The second reason why you must take it along is because every one else will do so. It has become the fashion. As for going without a radio set this year—it just simply *isn't done.* What matters if your wife takes fifteen gowns and seven trunks on the vacation? When her new acquaintances find that she has no radio, they will elevate their eyebrows, and that is all there is to it.

Why the Change This Summer?

There are several reasons why a radio will be much more popular this summer than ever before. The principal one is the improvement in the average set over what it was a year ago. At this time last year many folks were complaining about the very bad static which was interfering with their concerts. But this year nothing has been heard about it as yet. For this we cannot thank the weather man, as the static is in the air just as before, but the better sets and better tubes now in use are not so badly affected. This improvement in radios is also noticeable from the fact that interference from unwanted stations is not nearly as bad as it used to be. Of course, the average set even now will not tune out a powerful local broadcasting station and get one a thousand miles away. But a distinct improvement in this direction is easily noticed.

Don't Need a Loop

Another change which points in the same direction is the portable set. The modern portable set uses only as much material as can be easily carried in half a suit case. As an illustration of this, refer to Page 9 of this issue, where such is described. No storage battery is needed and two blocks of 22½ volt "B" batteries making a total of 45 volts is all that is required to operate phones or loud speaker. Several types of loud speakers have been developed, which can be packed in a suitcase. When it comes to the aerial, there is a divergence of opinion. Most people are now talking about a loop aerial which may perhaps be carried inside the set for portable use, but we feel this is a distinct mistake. In order to receive satisfactorily on a loop it is absolutely necessary that two or preferably three stages of radio amplification be employed. This, with a detector tube, and one or two audio amplifiers makes a large and very expensive set. It also seems far too complicated for use in the summer time where you ought to be able to turn on jazz music for a dance most any time without doing a lot of fussing and tuning. If you are fortunate enough to have a five or six tube set, which will receive on an inside loop, then use it, but do not think you have to invest a couple of hundred dollars in such a radio to make it portable.

Take the Aerial with You

A much better proposition is to take two coils of wire with you. One should be about fifteen feet long and end in a ground clamp. This can be connected to a convenient water pipe for a ground, or lacking that to a three-quarter inch iron pipe driven at least six or eight feet into moist earth. The other roll should be 85 feet long. This must be well insulated flexible wire, and if desirable may be part of the 100-foot roll from which the 15-foot ground has been cut. When you are ready to set up a radio attach one end of this coil to the aerial binding post and then string this wire through the house. If you can get to the second or third story, it is better to do so. You will need no insulators of any kind, as the covering on the wire itself will take care of that. Just loop it over any convenient door or window, hook or nail. But keep it as far away as possible from any electric light wire or gas or water pipes. Another thing that you must be particularly careful of is the distant end of the wire. This should be as high as the highest part of the aerial. That is, don't run most of the wire up into the peak of the attic and then carry the end down to the eaves. It would be better to do it the other way and have the end up in the peak of the attic.

Better Than It Looks

Such an aerial may be put up in a very haphazard method, so that it looks as if it would scare away

the radio waves, but it will operate a great deal better than it looks. Indeed, it will cause considerably less trouble from static than most outdoor aerials which were installed more than six months ago. Up to a comparatively recent date, it was generally advised that outside aerials be made 150 feet long or more including the lead-in. It is only recently that it has been found that an antenna 85 or 100 feet long will work a modern set just as well as one 50 feet longer, with the decided advantage that it will cut down considerably on static and interference. It is further possible that if you will try out the experiment with this 85-foot coil of insulated wire you may find that you get even better results at home than you do from your elaborate outside aerial.

Change in Broadcasting

Still another reason for the new summer popularity of radio is the big improvement in the broadcasting stations. The science of sending out programs has changed much more in the last year than in the preceding years. Mighty few sending stations look the same now as they did in 1923. We cannot receive better music than what is being sent, and when the sending improves 100% it is quite likely that receiving will be better in the same proportion. This phase of the matter has not been so thoroughly realized because it is of a rather complicated technical nature and is not particularly interesting to any one not connected with broadcasting. But it is results that count and the results have been obtained.

So when your friend remarks to you, "Have you put away your radio yet for the summer?" make answer, "No, the fun has just begun."

THE FAN AS A VOTER

Are you a good citizen? Let us hope you are not the type who is good at criticising the officials who run your town but who never goes around at election time to help elect these same officials. Maybe you come with the old story that your one vote will not affect the results very much. But listen to the tale of how a comparatively few radio fans were able to change an important contract in a city of 100,000 inhabitants.

The City of El Paso, which you will recall is located on the Rio Grande in Texas, recently decided that their business district was not lighted up well enough at night to be in keeping with the progressive character of the town. A White Way would be necessary and 400 lamps would be required to give the kind of illumination which the town deserved. So it was determined to call for bids for 400 arc lights to be installed in keeping with the most modern science of street lighting. But here is where the radio fans came in.

Broadcasting All Night

When an arc light gets into action it may run very smoothly. On the other hand, it may mistake itself for a sending station, and if it does, it will broadcast all night. Although it may be said to send out "light" music, still it is not the kind which most listeners wish to hear as it consists of a series of whistles and squeals. Furthermore, when the carbons burn too short, and the automatic apparatus in the lamp causes them to feed together again, a chattering is set up which is not at all like the chatter your neighbor across the back fence gives you. Most radio fans are aware of these facts, and so the host of broadcast listeners in El Paso were quite disturbed. They have a live organization called the El Paso Radio Club, of which Mr. J. T. Burke is President. This Club immediately got after the City Council to see what they could do.

400 Would Wreck Radio

It was pointed out by the Club to the City Fathers that a single chattering arc lamp would kill all the sets within a few blocks, and that 400 arc lamps would wreck the radio for the entire city. And when you get right down to it we can live without light, but we cannot exist without radio. So what was the upshot of the matter? Needless to say the calling for bids on the 400 arc lights was postponed indefinitely until tests could be made on a new style of white way lighting which would not cause any interference with the evening programs. In all probability some one of the new styles of high brilliancy incandescent lamps will be used, as they send out no carrier wave.

As a further evidence that the fan is becoming important as a voter, notice how anxious various political organizations are to get their candidates' speeches broadcast. This is so true that you see the phrase, " Radio will Elect the Next President" quoted a great deal recently.

THE HEAD SET VOGUE

Many of our readers use nothing but the loud speaker for getting their concerts. This is a very good idea when in the city, but there is a pronounced tendency this spring towards the use of head phones for vacation reception.

There are some advantages in changing to the phones. Of course, they are much easier to carry on a trip. You can slip a pair in your pocket, but it is not considered good form to carry a loud speaker in that way. Furthermore, at least one stage of amplification can be cut out if the phones are used, and this minimizes trouble from static. There is one other advantage not generally realized. When you lie by night on a grassy knoll in the moonlight and listen to the faint far away music, you will find the use of a head set keeps the ants and mosquitoes out of your ears.

Lines for Lady Listeners

Edited by Miss Opal A. Mowry

Contributions for This Department Will be Accepted if They Are of Special Interest to Women

POPULAR WITH WOMEN, ALSO WITH MEN

One of the most popular entertainers of the East is Mrs. Howard P. Wood of Station WJAR, Outlet Company, Providence. She is especially liked by the housewives in New England, and if it be true that the way to a man's heart is through his stomach, she must also be popular with a great many men. Every Monday, Wednesday and Friday morning she broadcasts menus to the housewives who may be listening in.

Our photograph shows Mrs. Wood in the act of explaining how to cover a piece of hot mince pie with a layer of coffee ice cream and wrap the whole in a blanket of marshmallow fudge.

A "Directress" at WLAG

She Tells Who Will Pay for Broadcasting

Eleanor Poehler is one of the few women having complete charge of a broadcasting station. At WLAG, Minneapolis, she hires and fires everyone who takes part in the program and is well liked by all. Here she gives an interesting article on broadcasting as she sees it in the future.

THE FUTURE OF BROADCASTING

By ELEANOR POEHLER

What is the future of broadcasting?

How long is broadcasting going to last?

How long can the broadcasting stations get talent without paying for it?

It would require a high-class ouija board operator to answer all these questions correctly, but certain trends are becoming apparent and may now be recognized. They are gradually working themselves out.

In the midst of the ebb and flow of broadcasting stations, the enthusiastic inauguration of new broadcasters and the "signing off" of other stations that were started with just as much enthusiasm, it begins to be quite apparent that the future of broadcasting is the future of the race. The only thing that will kill off broadcasting will be something that renders it obsolete, and thus far there seems to be nothing formulated in the imagination of the scientific world that makes this likely within a thousand years.

One thing, of course, might easily kill broadcasting if it were allowed to do so, and that is broadcasting itself. But so long as the governments of the world continue to exercise proper supervision and broadcasting stations obey the rules, there is no great danger of this. Indications are that the clamor of the smaller voices in the concert of the air will be stilled through the insistence of the listening public, and that a few dozen of the best broadcasters will continue to carry the burden of radio entertainment.

This weeding-out process is inevitable, and will be done by the public and its agency, the government, and it behooves every broadcaster to shape his programs and handle his technical equipment so that he may survive the test.

The question of the payment of talent and that related question of the payment of royalty on publications and compositions used by the broadcasters are working themselves out.

Should Pay, Not be Paid

Sooner or later, perhaps sooner than later, publishers will come to realize that the commercial organizations that can benefit directly from the publicity and advertising incident to broadcasting are the publishers, authors, and composers of the music broadcast.

It seems a little ridiculous for music publishers who hire hundreds of song "pluggers" to sing their songs in order to popularize them to protest when sending stations broadcast them without charge.

The rapid inroads being made by independent publishers and song composers who have never before been able to get any kind of a hearing from the czars of the music world indicates that

it will not be long before every publisher of material that can be broadcast will besiege the radio stations for a chance to put his performers on the program.

My own idea is that the finest musicians will soon be engaged by publishers to present their publications by radio.

Another significant indication in the radio world may be found in the appearance of Wendell Hall as the special broadcast representative of a battery company of which every radio listener knows the name.

Broadcasting Soup

How long will it be before every national manufacturer of consequence will engage the best artists it can find and plead for a place on the program? Why has not the Cream of Wheat Company been represented before this with its colored basso, or the Campbell Soup Company with its child artists billed as the Campbell Kids?

What a broadcaster Sunny Jim would have made! How about the Gold Dust Twins?

The way is open at little expense for the commercial world to entertain the public in a way most profitable to itself and at the same time place its firm names before the public in a manner that cannot possibly offend the listener.

This means that sooner or later every broadcast entertainer will be well paid and at the same time the burden of financing this payment will not be laid on the broadcasting station.

The problem of finance for the broadcaster is a serious one, but it has been solved by WLAG, the Twin City Station, in a manner which may possibly be adopted by other stations throughout the country.

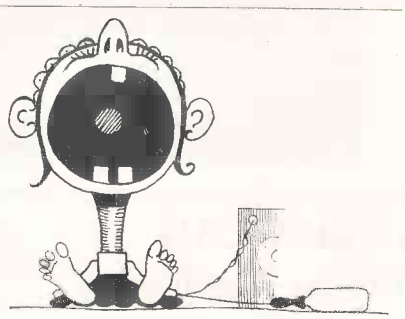
There Are Ten Subscribers

This station has ten subscribers who share its budget. They are the Munsingwear Corporation, the L. S. Donaldson Company, the Northwest Farmstead, the Benzo Gas Motor Fuel Company, the Northwestern National Bank and Minnesota Loan and Trust Company, Brown & Bigelow, Purity Baking Company, the St. Paul Retailers, the St. Paul Jobbers, and the Cutting & Washington Radio Corporation, which owns and operates the station.

Each of these companies might find it difficult to justify an expense of $20,000 or $30,000 for broadcasting, but among them they are easily able to provide a sum sufficient for WLAG. In fact, each company is able to participate in a national advertising plan for a full year for less than the price of one full page in a certain large weekly popular magazine.

Surely some such plan as this will grow out of the present free-for-all scheme, except in the cases of national companies of great size, capable of taking care of the entire expense of a station.

As for the broadcast programs, the trend is toward the greater and greater artists. A check of the mail received by such a station as WLAG easily reveals the preference of the fans for band music when the band is high class, for the best in orchestra music even to the symphony style, for straight concert work, for jazz singing and novelty instrumental music, for brief monologs and anecdotes, and for very short plays.



LOUD SPEAKER
Another Use for the Child in Your Home

DO AS I DO

Tired and worrying housewives,
You may now put your minds all at rest,
Do WJAR cooking;
Their receipts always are best.

The "Never Fail" cake is delightful,
The "Dandy Plum" pudding is, too,
But you'll not know what you've been missing
Till you try out the new beanpot stew.

If you wish by your friends and your neighbors
To be known as a capital cook,
Then serve a receipt for your meat course
From the Radio Housewives' Cook Book.

And after the entree is over,
To give them a lovely surprise,
Serve one of its dainty fig puddings,
Or one of its luscious mince pies.

When the chairs are pushed back from the table,
I'm willing to wager my hat,
You'll hear all the people exclaiming,
"I ne'er ate such nice dinner as that."

So try out your Radio Cook Book,
For delightful and varied menu,
And you'll always serve company dinners
If you use its receipts as I do.

—*Contributed*

—Kadel & Herbert

A REAL RADIO GIRL

Almost every fellow has told at least one girl that she is his "Radio Girl." (Have you? If not, you have overlooked a bet). But here is a picture of a real radio girl. Miss Bertha Holley designed this costume and won first prize at a fancy costume contest in a pageant ball held in New York. You will notice that the gown, which is made entirely of silk, has printed on it replicas of the pages of radio magazines. The flags which show in the picture represent all the nations who are now doing broadcasting. That means that Iceland and Timbuctoo are missing.

There is one serious defect in her costume. What's wrong with this picture, (you will immediately spot it), is the absence of the page from RADIO PROGRESS. But it was not the fault of the designer, as the ball occurred just before our first issue went to press.

American Radio Relay League

WGY Works Catalina by Day — Effect of Light Being Studied

IT is generally known that sunlight has a very bad effect on radio waves. Reception by daylight is only about one-third as good as by night. That is why the results reported below are of special interest.

Amateur radio signals have been transmitted across the continent in daylight. Ernest Hobbs, operator of Station 2ADM in Schenectady, reports that he recently received messages on amateur wave lengths from Station 6XAD, owned by Lawrence Mott of Catalina Island, soon after sunrise.

The two amateurs had been conversing with each other by radio telegraph as they had been accustomed to do a short time before daybreak, and it was not until the times of sunrise at both stations had been checked up that Hobbs realized the full significance of the feat. Of course, the three-hour difference of time was taken into consideration.

Deeds of Darkness

For six months amateurs conveniently situated across the country have endeavored to relay a message from ocean to ocean in daylight. At one time six stations worked on schedule. Always as soon as the sun appeared the signals began to fade. The failure of this relay makes the final success the more remarkable.

Both operators used the regular wave length of their station, 2ADM transmitting on 195 meters and 6XAD on 230 meters. Their ability to converse with one another under daylight conditions was a total surprise to both, as at the time no definite tests were being carried out. It was just a friendly conversation.

An Hour and a Half Late

The original tests, which were prompted and supervised by the technical department of the American Radio Relay League indicate that the real daylight conditions follow about 90 minutes after sunrise—excepting on cloudy days when signals do not fade out completely until sometimes 120 minutes after.

"On ordinary days," says S. Kruse, technical editor of QST, "the very best west coast signals are received about 10 minutes after the sun gets clear of the horizon, although this may be delayed 20 minutes on a cloudy day. After that the signals begin to die down slowly and at the end of the 120 minutes there appears to be full noontime conditions."

Only Teamwork Will Do

To do experimental work of this nature it is necessary that a great many investigators work simultaneously over a large area. That is beyond the scope of corporations like Westinghouse and the General Electric Company, as their laboratories are too compact to cover the field. About the only organization which can conduct such experimental work is the American Radio Relay League. Believing that the radio problems affecting the transmission and reception of signals are a long way from being solved to the entire satisfaction of the radio public, the technical department of the American Radio Relay League is giving an increasing amount of thought to the development of its experimental section. The most bothersome questions have been classified and distributed for detailed investigation.

The fact that the experimental section of the A. R. R. L. consists of highly skilled radio men, variously located over a wide area and having access to the most improved type of laboratory equipment gives rise to the opinion that hitherto little known fields in radio will be explored and much valuable information gained from aggressive application to the subjects outlined.

How the Moon Affects the Tune

The various phenomena connected with radio reception will be studied under a variety of weather conditions by men whose different geographic locations add much to the importance and value of the data gained in this manner. The effect of the moon's phases upon reception signal strength in daylight, dead spots and efficiency of wave lengths below 90 meters will be studied.

The experimenters have been asked to conduct tests with filters, rectifiers, counterpoises, special coils and helices. Included as a part of the current radio work it has been suggested that information be sought as to the desirable material for condenser insulation, best disposition of this material, effect of frequency upon condenser resistance, effect of the material and thickness upon coil resistance and other kindred subjects.

LISTEN TO THE EIFFEL TOWER

If your radio is built so that you can add loading coils to the primary and secondary to increase the wave length, you will perhaps be able to hear "A Smile Will Go a Long Way" sung in French. If you cannot understand French, at least you will believe the long way part. To get Station SFR, the Eiffel Tower, Paris, France, you will have to tune in to 1780 meters. They are broadcasting a special musical program on this wave length between 5 p. m. and 7 p. m., Eastern Standard Time, every day. The first time this station was heard in America on broadcasting (as distinguished between code) was March 29, when it was picked up by Bert Moulton, Chatham, Mass. Moulton is employed at the Radio Corporation of America coastal station at Chatham, Mass., besides operating his own experimental station.

A carefully calibrated receiver employing four tubes was used, and Moulton listened to the French broadcast program for over an hour. He heard instrumental and vocal selections at 6:10 p. m. and held them until 7:15 p. m.

It was the first time a regular concert from France was received in America. Station SFR uses 2000 watts, which is twice as much power as American broadcast stations use, and it is also significant that the wave length used is much higher than the average broadcasting wave length. Static and the fact that little previous notice of the test was given to American listeners was responsible for the small American audience.

D. W. Flint's Station Opens May 11th

Well known Ford Dealer Will Have Model Broadcasting Station

GEORGE SPINK, the Providence composer and theatrical producer, will be the entertainment director of WKAP, the new broadcasting station in Providence, soon to be opened in the Narragansett Boulevard home of Dutee Wilcox Flint. Mr. Spink will write for and arrange all programs sent from this station, and he states that entertainments of a high order, including numerous novelties, will be offered to all who care to listen in. Concerts will be broadcast twice a week, and radio fans are promised that nothing will be put on the air from the new station which has not been tried out by Mr. Spink and approved by Mr. Flint, as Mr. Flint intends to broadcast only worthwnile programs.

One of the entertainment features will be a *"special orchestra,"* now being assembled by Mr. Spink. This orchestra will be composed of the best musicians available, and both classical and popular compositions will be played. Mr. Flint's 2200-pipe organ will be used not only for solo work, but it will also be made the basis of the orchestral music.

Sunday organ recitals featured the programs broadcast when Mr. Flint's former station was in operation, and these were given on a 600-pipe "echo" organ, but it will now be possible to broadcast music from the larger organ; and it is expected that the new equipment which is being installed in the broadcasting station will considerably improve the tonal qualities of the music sent out.

When the new station opens, few cities in the United States will have more first-class broadcasting stations than Providence. These include WEAN, WJAR, WKAP and WSAD. Mr. Flint's new 500-watt station will be one of the most powerful in the East, but it will be operated with the least possible interference with other New England stations. It is hoped to secure a low wave length for this station.

The first programs will be broadcast from the new station, WKAP, during the week of May 11, Mr. Flint announced recently; and the Sunday night program will close by 7:30 o'clock, and Mr. Spink will be the announcer.

The broadcasting apparatus is being installed in two rooms of concrete construction in the basement of the Flint residence in Edgewood. There is only one other station in the country of the type of WKAP. The latest improved speech amplifiers, assuring purity of tone, as well as volume, will be used, and two towers, 100 feet high, will support the aerial.

UNITED STATES BROADCASTING STATIONS ARRANGED ALPHABETICALLY BY CALL LETTERS

Abbreviations: W.L. wave length in meters; K.C., frequencies in kilocycles; W.P., watt power of station.

		W.L.	K.C.	W.P.
KDKA	Westinghouse Elec. & Mfg. Co., East Pittsburgh	326-	920-	1000
KDPM	Westinghouse Elec. & Mfg. Co., Cleveland, O.	270-1110-		250
KDPT	Southern Electrical Co., San Diego, Cal.	244-1230-		100
KDYL	Salt Lake Telegram, Salt Lake City, Utah	360-	833-	100
KDYM	Savoy Theatre, San Diego, Cal.	280-1070-		100
KDYQ	Oregon Institute of Technology, Portland, Ore.	360-	833-	100
KDYX	Star Bulletin, Honolulu, Hawaii	360-	833-	100
KDZB	Frank E. Siefert, Bakersfield, Cal.	240-1250-		100
KDZE	The Rhodes Co., Seattle, Wash.	270-1110-		100
KDZF	Auto. Club of So. Cal., Los Angeles, Cal.	278-1080-		500
KFAD	McArthur Bros. Mercantile Co., Phoenix, Ariz.	360-	833-	100
KFAE	State College of Washington, Pullman, Wash.	330-	910-	500
KFAF	Western Radio Corp., Denver, Col.	360-	833-	500
KFAJ	University of Colorado, Boulder, Col.	360-	833-	100
KFAQ	City of San Jose, San Jose, Cal.	360-	833-	250
KFAR	Studio Lighting Service Co., Hollywood, Cal.	280-1070-		150
KFAU	In. Sch'l Dist. of Boise City, B'ise H. S., Boise, Id.	270-1110-		150
KFBB	F. A. Buttrey & Co., Havre, Mont.	360-	833-	100
KFBK	Kimball-Upson Co., Sacramento, Cal.	283-1060-		100
KFCF	Frank A. Moore, Walla Walla, Wash.	360-	833-	100
KFCM	Richmond Radio Shop, Richmond, Cal.	360-	833-	100
KFCZ	Omaha Central High School, Omaha, Neb.	259-1160-		100
KFDH	University of Arizona, Tucson, Ariz.	360-	833-	150
KFDV	Gilbreth & Stinson, Fayetteville, Ark.	360-	833-	200
KFDX	First Baptist Church, Shreveport, La.	360-	833-	100
KFDY	So. Dakota State College, Brookings, So. Dakota.	360-	833-	100
KFEL	Winner Radio Corp., Denver, Col.	360-	833-	100
KFEQ	J. L. Scroggin, Oak, Neb.	360-	833-	150
KFEV	Felix Thompson Radio Shop, Casper, Wyo.	263-1140-		250
KFEX	Augsburg Seminary, Minneapolis, Minn.	261-1150-		100
KFEZ	Amer. Society of Mech. Engineers, St. Louis, Mo.	360-	833-	250
KFFQ	Markehoffel Motor Co., Colorado Springs, Col.	360-	833-	100
KFFV	Graceland College, Lamoni, Iowa.	360-	833-	100
KFFX	McCray Co., Omaha, Neb.	278-1080-		100
KFFY	Pincus & Murphy, Alexandria, La.	275-1090-		100
KFGC	Louisiana State University, Baton Rouge, La.	254-1180-		100
KFGD	Chickasha Rad. & Elec. Co., Chickasha, Okla.	248-1210-		200
KFGH	Leland Stanford University, Stanford Univ., Cal.	360-	833-	500
KFGJ	Mo. Natl. Guard, 138th Infantry, St. Louis, Mo.	265-1130-		100
KFGX	First Presbyterian Church, Orange, Tex.	250-1200-		500
KFGZ	Emmanuel Missionary Col., Berrien Sprs., Mich.	268-1120-		250
KFHD	Utz Electric Shop, St. Joseph, Mo.	225-1330-		100
KFHF	Central Christian Church, Shreveport, La.	265-1130-		150
KFHJ	Fallon & Co., Santa Barbara, Cal.	360-	833-	100
KFHX	Robert W. Nelson, Hutchinson, Ks.	229-1310-		150
KFI	Earle C. Anthony, Inc., Los Angeles, Cal.	469-	640-	500
KFIF	Benson Polytechnic Institute, Portland, Ore.	360-	833-	100
KFIX	R. C. of Jesus Christ of L.D. Sts., Ind'p'nd'n'e, Mo.	240-1250-		250
KFIZ	Daily C'm'nw'lth & O.A.Heulsm'n, Fond d'L'c,Wis.	273-1100-		100
KFJC	Seattle Post Intelligencer, Seattle, Wash.	270-1110-		100
KFJK	Delano Radio and Electric Co., Bristow, Okla.	234-1280-		100
KFJM	University of N. Dakota, Grand Forks, N. Dak.	280-1070-		100
KFKB	Brinkley-Jones Hospital Association, Milford, Ks.	286-1050-		500
KFKQ	Conway Radio Laboratories, Conway, Ark.	250-1340-		100
KFKX	Westinghouse Elec. & Mfg. Co., Hastings, Neb.	341-	880-	1000
KFLR	University of N. Mexico, Albuquerque, N. M.	254-1180-		100
KFLV	Rev. A. T. Frykman, Rockford, Ill.	229-1310-		100
KFMQ	University of Arkansas, Fayetteville, Ark.	263-1140-		100
KFMS	Freimuth Dept. Store, Duluth, Minn.	275-1090-		100
KFMX	Carleton College, Northfield, Minn.	283-1060-		500
KFMZ	Roswell Broadcasting Club, Roswell, N. M.	250-1200-		100
KFNF	Henry Field Seed Co., Shenandoah, Iowa.	266-1130-		500
KFOA	The Rhodes Co., Seattle, Wash.	454-	660-	500
KFSG	Echo Park Evangelistic Ass'n, Los Angeles, Cal.	234-1280-		500
KGN	Northwestern Radio Mfg. Co., Portland, Ore	360-	833-	100
KGO	General Electric Co., Oakland, Cal.	312-	960-	1000
KGU	Marion A. Mulreny, Honolulu, Hawaii	360-	833-	250
KGW	Portland Morning Oregonian, Portland, Ore.	492-	610-	500
KHJ	Times-Mirror Co., Los Angeles, Cal.	395-	760-	500
KHQ	Louis Wasmer, Seattle, Wash.	360-	833-	100
KJR	Northwest Radio Service Co., Seattle, Wash.	270-1110-		100
KJS	Bible Institute of Los Angeles, Los Angeles, Cal.	360-	833-	750
KLS	Warner Brothers, Oakland, Cal.	360-	833-	250
KLX	Tribune Publishing Co., Oakland, Cal.	508-	590-	500
KLZ	Reynolds Radio Co., Denver, Col.	360-	833-	500
KNT	Grays Harbor Radio Co., Aberdeen, Wash.	263-1140-		250
KNV	Radio Supply Co., Los Angeles, Cal.	254-1180-		100
KNX	Electric Lighting Supply Co., Los Angeles, Cal.	360-	833-	100
KOB	N. M. C. of Agri. & Mech. Arts, State Col., N. M.	360-	833-	500
KOP	Detroit Police Dept., Detroit, Mich.	286-1050-		500
KPO	Hale Bros., San Francisco, Cal.	422-	710-	500
KQV	Doubleday-Hill Electric Co., Pittsburgh, Pa.	280-1070-		500
KSD	Post Dispatch, St. Louis, Mo.	545-	550-	500
KTW	First Presbyterian Church, Seattle, Wash.	360-	833-	750
KUO	Examiner Printing Co., San Francisco, Cal.	360-	833-	150
KUS	City Dye Works & Laundry Co., L. Angeles, Cal.	360-	833-	100
KWG	Portable Wireless Tel. Co., Stockton, Cal.	360-	833-	100
KWH	Los Angeles Examiner, Los Angeles, Cal.	360-	833-	500
KYO	Electric Shop, Honolulu, Hawaii	288-1040-		100
KYW	Westinghouse Elec. & Mfg. Co., Chicago, Ill.	535-	560-	1000
KZM	Preston D. Allen, Oakland, Cal.	360-	833-	100
KZN	The Deseret News, Salt Lake City, Utah	360-	833-	500
WAAB	Valdemar Jensen, New Orleans, La.	268-1120-		100
WAAC	Tulane University, New Orleans, La.	360-	833-	100
WAAF	Chicago Daily, Drovers Journal, Chicago, Ill.	286-1050-		200
WAAM	I. R. Nelson Co., Newark, N. J.	263-1140-		250
WAAW	Omaha Grain Exchange, Omaha, Neb.	360-	833-	500
WAAZ	Hollister-Miller Motor Co., Emporia, Ks.	360-	833-	100
WABA	Lake Forest College, Lake Forest, Ill.	265-1130-		100
WABE	Young Men's Christian Assn., Washington, D. C.	283-1060-		100
WABI	Bangor Ry. & Elec. Co., Bangor, Me.	240-1250-		100
WABL	Conn. Agri. College, Storrs, Conn.	283-1060-		100
WABM	F. E. Doherty Auto. & R'dio E. Co., Saginaw, M.	254-1180-		100
WABN	Ott Radio, Inc., La Crosse, Wis.	244-1230-		250
WABP	Robert F. Weinig, Dover, Ohio.	265-1130-		100
WABT	Holliday-Hall, Washington, Pa.	252-1190-		100
WABU	Victor Talking Machine Co., Camden, N. J.	225-1330-		100
WABX	Henry B. Joy, Mount Clemens, Mich.	270-1110-		150
WBAA	Purdue University, West Lafayette, Ind.	360-	833-	250
WBAD	Sterling Electric Co., Minneapolis, Minn.	360-	833-	100
WBAH	The Dayton Co., Minneapolis, Minn.	416-	720-	500
WBAK	Penn. State Dept. of Police, Harrisburg, Pa.	400-	750-	500
WBAN	Wireless Phone Corp., Paterson, N. J.	244-1230-		100
WBAP	Wortham-Carter Pub. Co., Fort Worth, Tex.	476-	630-	750
WBAV	Erner & Hopkins Co., Columbus, Ohio.	389-	770-	500
WBAW	Marietta College, Marietta, Ohio	246-1220-		250
WBAY	American Tel. & Tel. Co., New York, N. Y.	492-	610-	500
WBBF	Georgia School of Technology, Atlanta, Ga.	270-1110-		500
WBBG	Irving Vermilya, Mattapoisett, Mass.	240-1250-		100
WBBM	Frank Atlass Produce Co., Lincoln, Ill.	255-1330-		200
WBBO	Michigan Limestone & Chem. Co., Rodgers, Mich.	250-1200-		500
WBBQ	Frank Crook, Pawtucket, R. I.	252-1190-		100
WBBR	Peoples' Pulpit Ass'n, Rossville, N. Y.	244-1230-		500
WBL	T. & H. Radio Co., Anthony, Ks.	261-1150-		100
WBR	Penn State Police, Butler, Pa.	286-1050-		250
WBT	Southern Radio Corp., Charlotte, N. C.	360-	833-	500
WBU	City of Chicago, Chicago, Ill.	286-1050-		500
WBZ	Westinghouse Elec. & Mfg. Co., Springfield, Mass.	337-	890-	1000
WCAD	St. Lawrence University, Canton, N. Y.	280-1070-		250
WCAE	Kaufmann & Baer Co., Pittsburgh, Pa.	461-	650-	500
WCAH	Entrekin Electric Co., Columbus, O.	286-1050-		100
WCAJ	Nebraska Wesleyan Univ., Univ. Place, Neb.	360-	833-	500
WCAL	St. Olaf College, Northfield, Minn.	360-	833-	500
WCAM	Villanova College, Villanova, Pa.	360-	833-	150
WCAP	Chesapeake & Potomac Tel. Co., Wash'gt'n, D. C.	469-	640-	500
WCAR	Alamo Radio Elec. Co., San Antonio, Texas.	360-	833-	100
WCAS	W. E. Dunwoody Ind. Inst., Minneapolis, Minn.	246-1220-		100
WCAT	S. Dakota State Sch. of Mines, Rapid City, S. D.	240-1250-		100
WCAU	Durham & Co., Philadelphia, Pa.	286-1050-		250
WCAY	Kesselman-O'Driscoll Co., Milwaukee, Wis.	261-1150-		250
WCBC	Univ. of Michigan, Ann Arbor, Mich.	280-1070-		200
WCBD	Wilbur G. Voliva, Zion, Ill.	345-	870-	500
WCK	Stix, Baer & Fuller Dry Goods Co., St. Louis, Mo.	360-	833-	100
WCM	University of Texas, Austin, Tex.	360-	833-	500
WCX	Detroit Free Press, Detroit, Mich.	517-	580-	500
WDAE	Tampa Daily Times, Tampa, Fla.	360-	833-	250
WDAF	Kansas City Star, Kansas City, Mo.	411-	730-	500
WDAG	J. Laurance Martin, Amarillo, Tex.	263-1140-		100
WDAH	Trinity Methodist Church, El Paso, Texas.	268-1120-		100
WDAK	The Courant, Hartford, Conn.	261-1150-		100
WDAP	Board of Trade, Chicago, Ill.	360-	833-	1000
WDAR	Lit Brothers, Philadelphia, Pa.	395-	760-	500
WDAU	Slocum & Kilburn, New Bedford, Mass.	360-	833-	100
WDAX	First National Bank, Centerville, Iowa.	360-	833-	100
WEAF	American Tel. & Tel. Co., New York, N. Y.	492-	610-	500
WEAH	Wichita Board of Trade, Wichita, Kas.	280-1070-		100
WEAI	Cornell University, Ithaca, N. Y.	286-1050-		500
WEAJ	University of S. Dakota, Vermillion, S. Dak.	283-1060-		200
WEAM	Borough of N. Plainfield, N. Plainfield, N. J.	252-1190-		100
WEAN	Shepard Co., Providence, R. I.	273-1100-		100
WEAO	Ohio State University, Columbus, Ohio.	360-	833-	500
WEAP	Mobile Radio Co., Mobile, Ala.	360-	833-	100
WEAS	Hecht Co., Washington, D. C.	360-	833-	100
WEAU	Davidson Bros. Co., Sioux City, Iowa.	360-	833-	100
WEAY	Iris Theatre, Houston, Texas.	360-	833-	500
WEB	Benwood Co., St. Louis, Mo.	273-1100-		250
WEV	Hurlburt-Still Electric Co., Houston, Texas.	360-	833-	100
WEW	St. Louis University, St. Louis, Mo.	261-1150-		100
WFAA	Dallas News & Dallas Journal, Dallas, Tex.	476-	630-	500
WFAB	Carl F. Woese, Syracuse, N. Y.	234-1280-		100
WFAH	Electric Supply Co., Port Arthur, Tex.	236-1270-		150
WFAN	Hutchinson Elec. Service Co., Hutchinson, Minn.	360-	833-	100
WFAV	Univ. of Nebraska, Dept. of E. Eng., Lincoln, Neb.	275-1090-		500
WFI	Strawbridge & Clothier, Philadelphia, Pa.	395-	760-	500
WGAQ	Glenwood Radio Corp., Shreveport, La.	360-	833-	100
WGAW	Ernest C. Albright, Altoona, Pa.	261-1150-		100
WGAV	Northwestern Radio Co., Madison, Wis.	360-	833-	100
WGAZ	South Bend Tribune, South Bend, Ind.	360-	833-	250
WGI	Am. R'dio & Res'ch Corp., Medf'd Hillside, Mass.	360-	833-	100
WGL	Thomas F. J. Rowlett, Philadelphia, Pa.	360-	833-	250
WGR	Federal Tel. & Tele. Co., Buffalo, N. Y.	319-	940-	750
WGV	Interstate Electric Co., New Orleans, La.	242-1240-		100
WGY	General Electric Co., Schenectady, N. Y.	380-	790-	1000
WHA	University of Wisconsin, Madison, Wis.	360-	833-	500
WHAA	State University of Iowa, Iowa City, Iowa	484-	620-	500
WHAR	Clark W. Thompson, Galveston, Tex.	360-	833-	200
WHAD	Marquette University, Milwaukee, Wis.	280-1070-		100

Continued on Page 32

Rx DR RADIO PRESCRIBES.

NOTE: In this section the Technical Editor will answer questions of general interest on any radio matters. Any of our readers may ask not more than two questions, and if the subjects are of importance to most radio fans they will be answered free of charge in the magazine. If they are of special interest to the questioner alone, or if a personal answer is desired, a charge of fifty cents will be made for each answer. This will entitle the questioner to a personal answer by letter. However, if the question requires considerable experimental or development work, higher rates will be charged, which may be obtained upon application.

Question. In making up a variocoupler how much space should be left between the rotor and the stator, and why?

Answer. The spacing of the stator compared to the rotor is a kind of compromise. There should be as little condenser action between the two parts as possible. It is undesirable condenser action which often times causes the set to oscillate, even when the rotor and stator are turned exactly at right angles. This is supposed to be the zero position and no action should take place. But in many sets which we have tested we find that the rotor must be turned quite a distance beyond right angles in order to cut the action down to zero. This naturally shows the presence of the undesirable capacity action owing to the fact that the two windings act like the two plates of a condenser. By leaving a considerable air space between the two windings, this unwanted result is cut down to a low value. From this point of view it would be desirable to leave as much as one inch space between rotor and stator.

On the other hand, the whole idea of the variocoupler is to couple together two electrical circuits, and the closer the two coils fit each other the better the coupling obtained. From this point of view the rotor should be made as large as possible, so as to fit the stator with only a small air space. Since these two requirements are opposed to each other, it is found best in practice to split the difference and leave about half an inch clearance all the way around between the two coils.

Question. I have a three-tube regenerative set which operates very well, but so far I have not put it into a cabinet. Does it do any harm to leave it exposed to the dust?

Answer. Most parts of the radio set are not affected at all by dust, but it sometimes happens that the condenser will pick up enough dirt so that it becomes partially short circuited. Of course, this is a disadvantage, because it increases the losses considerably and so cuts down the loudness of the programs received. The dirt referred to is not what collects on the plates themselves, for no harm can be done at that point. What is alluded to is a covering of dust on the insulating ends which will partially connect the rotor to the stator, and to that extent allow a leakage current to flow across. The remedy for this condition is to dust off the ends of the condenser occasionally if you see that they are collecting an undue layer of dirt.

Question. Where can I obtain a variable condenser with a capacity of .00023 mfd?

Answer. In all probability this is a typographical error for .00025 mfd. Some diagrams are rather carelessly drawn and special values are assigned to coils or condensers for no reason at all. There are three popular sizes of variable air condensers, the 43 plate, the 23 plate, and the 11 plate instruments. These have average capacities of .001, .0005 and .00025 mfd, respectively. However, since these condensers are made by a great many different manufacturers, and the spacing and size of their plates vary slightly, you can easily see that they will not all have exactly the same capacities. In rating a condenser it is the maximum possible value which is counted. Any capacity from that down nearly to zero can be obtained by turning the dial, so if for any reason you really need a capacity of .00023, all you have to do is to get a standard 23 plate condenser and instead of turning the dial to 100 to give you .00025, just rotate it back to about 92 on the dial and the capacity will drop to .00023. It is to be regretted that more care is not used in making up radio hook-up diagrams to see that standard apparatus is specified rather than unusual values as above.

Question. Which is a better tube, the WD 11 or the WD 12?

Answer. These two tubes are just alike on the inside, as they have to use the same filament, plate and grid. The only difference is that the WD 12 has a large base to fit in a standard size socket, while the WD 11 has a special base and needs a socket to fit. Since the WD 11 is used in larger quantities than the WD 12, we would recommend installing it in your new set if you have not yet bought the sockets. But if it is for replacement in a set already built using standard sockets, by all means use the WD 12, and no change or rewiring of any kind will be needed other than to use one or more dry cells in parallel to light the filament instead of a storage battery.

Question. In the Teledyne set, which you recently described, how many turns should be used on the tickler coil?

Answer. The tickler or regeneration coil should be wound with eight and one-half turns.

Question. Can the same meter be used for testing "A" batteries and "B" batteries?

Answer. It is undesirable to do so because of the different values. A "B" battery volt meter must read at

least as high as the voltage on your plate, which will be 22½, 45 or perhaps 90 depending on the kind of set. Usually the full scale of the meter is a little above these values, that is, it will be a 25, 50 or 100 volt meter. The voltage on the "A" battery, on the other hand, is so much lower that it will not be read accurately on such a scale. This amounts to 6 volts on the storage battery or from 1½ to 4½ volts on the dry cell installation.

For such a range it is better to get a separate low reading meter.

Question. Should the gravity as read by a hydrometer be the same in a radio storage battery as in the one used on an automobile?

Answer. Many radio sets use a storage battery which has been designed for autobile use, and consequently when fully charged the hydrometer reading will be the same, 12.75 to 13.00; but in the batteries designed especially for radio work such strength of acid is not used, and 12.25 to 12.50 indicates a full charge. The reason is that the output will never amount to more than a few amperes, and so the acid strength can be much weaker than in automobile use where 300 or 400 amperes are required to turn over a cold starter.

Question. In shielding a set is it best to run the tin foil the whole length of the panel or not?

Answer. Most diagrams and articles show complete shielding of the panel, but this is a mistake. The only parts which need shielding are those on which the last tuning is done. These will be the variable condenser or variometer and perhaps the rotor of the variocoupler, if it is used to control the amount of regeneration or feedback. Parts like step switches, rheostats, etc., are not used for the final tuning, and so if some body capacity effect is noted in touching them, it does no harm.

The disadvantage of shielding where it is unnecessary is first that it weakens the signals, and second that it broadens the tuning. This is because any leakage of magnetism from any of the coils will induce high frequency alternating currents in the metal of the shield. These currents naturally do not appear in the telephone and so represent a loss of energy.

Question. Why will not a Ford coil supply current to amplifier tube plates?

Answer. The reason is that a Ford coil is alternating current instead of direct. A "B" battery is necessary on the plates as a uniform steady pressure of 22 to 90 volts is needed.

A Ford coil can sometimes be used in sending code where the buzzing caused by the interruptor circuit breaker is not objectionable in listening to the dots and dashes.

Question. How can the ordinary radio be adjusted to receive longer wave lengths?

Answer. The tuning factor must be increased by enlarging either the coil or the condenser. This must be done for each of the several circuits. The easier method is to increase the value of the coil by adding another one in series. A three-circuit tuner will usually require three such coils, one for the primary, one for the grid or secondary, and one for the plate circuit. The single circuit set often needs only one additional coil, that is, connected directly in the aerial. Occasionally, however, such a set will need a few more turns added to the rotor of the variocoupler to assist in getting greater feedback or regeneration.

Question. How strong is static compared to broadcasting?

Answer. Static varies all the way from nothing at all up to the most powerful sounds caused by direct strokes of lightning. In general, it does not interfere very much unless it is at least fifteen or twenty per cent. as loud as the music, whereas, on code reception, it can be nearly as strong as the dots and dashes before it is considered bad. An experienced radio amateur can sometimes get messages through even though the static is three or four times as loud as the signals, as the context helps a great deal in recognizing the various words.

Question. In the new Radiola III and IIIa how do they succeed in using three audio amplifiers?

Answer. As a matter of fact, although there are three amplifier tubes used, it is not three amplifiers. One tube is a detector, the next is the first stage, and the other tubes make up the second stage of a push pull connection. Either one of these last two tubes may be removed from the socket, without cutting off the music. When so removed, the reception will not be quite so loud and some distortion will be introduced, but no more so than on an ordinary two-step amplifier which does not use the push pull connection.

NEAT APPEARANCE OF PANEL

Considerable improvement can be made in the looks of a good many radios, by leaving off the switch points or contacts. These are often necessary in the operation of the set, but they do not have to show on the front of the panel. Instead, it is a better idea to use some one of the newer types of inductance switch. These accomplish the same purpose. They are made of a small circle of fibre, or bakelite, and have ten or fifteen switch points fastened in it. A switch handle usually carries a dial, which shows on which contact the switch arm is resting.

To install such an inductance switch you need to drill only a single hole for the dial shaft to project through. In some styles a couple of mounting screw holes are also drilled, but they are covered by the dial. Such a switch not only makes the set look a lot better, but often gives better results owing to the fact that the contacts are better spaced.

—Kadel & Herbert

SOLO BY ZULU

Isn't it fortunate that the Zulu chieftain shown in our picture broadcasts his war cries and defiance, instead of giving us personal attention? He is Chief Sakabone Sonki from the darkest regions of Zulu land. Perhaps we should state that his family named him Ned Lincoln. He recently gave a talk on the war calls and drum beats of Zulu land from Station WJY in New York. After one look at him we understand why missionaries seldom lived long enough to learn Zulu.

BROADCASTING STATIONS—Continued from Page 29

		W.L.	K.C.	W.P.
WHAG	University of Cincinnati, Ohio	222	1350	200
WHAH	Rafer Supply Co., Joplin, Mo	283	1060	250
WHAM	University of Rochester, Rochester, N. Y	283	1060	100
WHAS	Courier-Journal & Louisville Times, Louisville, Ky.	400	750	500
WHAZ	Rensselaer Polytechnic Institute, Troy, N. Y	380	790	500
WHB	Sweeney School Co., Kansas City, Mo	411	730	500
WHK	Radiovex Co., Cleveland, Ohio	283	1060	100
WHN	George Schubel, New York, N. Y	360	833	100
WIAC	Galveston Tribune, Galveston, Tex	360	833	100
WIAD	Howard R. Miller, Philadelphia, Pa	254	1180	100
WIAJ	Fox River Valley Radio Supply Co., Neenah, Wis.	224	1340	100
WIAK	Journal-Stockman Co., Omaha, Neb	278	1080	200
WIAO	School of Eng. of Milwaukee, Milwaukee, Wis.	360	833	100
WIAR	Paducah Evening Sun, Paducah, Ky	360	833	100
WIAS	Home Electric Co., Burlington, Iowa	360	833	100
WIK	K. & L. Electric Co., McKeesport, Pa	234	1280	100
WIP	Gimbel Brothers, Philadelphia, Pa	508	590	500
WJAB	American Electric Co., Lincoln, Neb	360	833	500
WJAD	Jackson's Radio Eng. Laboratories, Waco, Tex.	360	833	150
WJAG	Norfolk Daily News, Norfolk, Neb	283	1060	250
WJAN	Peoria Star, Peoria, Ill	280	1070	100
WJAQ	Capper Publications, Topeka, Ks	360	833	100
WJAR	The Outlet Co., Providence, R. I	360	833	500
WJAS	Pittsburgh Radio Supply House, Pittsburgh, Pa.	250	1200	500
WJAX	Union Trust Co., Cleveland, Ohio	390	770	500
WJAZ	Chicago Radio Laboratory, Chicago, Ill	448	670	1000
WJH	Wm. P. Boyer Co., Washington, D. C	273	1100	100
WJX	Deforest Radio Tel. & Tel. Co., N. Y., N. Y.	360	833	500
WJY	R. C. A., New York, N. Y	405	740	500
WJZ	Broadcast Central, New York, N. Y	454	660	500
WKAA	H. F. Paar, Cedar Rapids, Iowa	268	1120	100
WKAF	W. S. Radio Supply Co., Wichita Falls, Tex	360	833	100
WKAP	Dutee W. Flint, Cranston, R. I	360	833	250
WKAQ	Radio Corp. of Porto Rico, San Juan, P. R	360	833	500
WKAR	Michigan Agr. College, E. Lansing, Mich	280	1070	500
WKY	WKY Radio Shop, Oklahoma, Okla	360	833	150
WLAG	Cutting & Wash. Radio Corp., Minneapolis, Minn.	416	720	500
WLAH	Samuel Woodworth, Syracuse, N. Y	234	1280	100
WLAJ	Waco Electrical Supply Co., Waco, Tex	360	833	150
WLAK	Vermont Farm Machine Corp., Bellows Falls, Vt.	360	833	500
WLAL	Naylor Electrical Co., Tulsa, Okla	360	833	100
WLAN	Putnam Hardware Co., Houlton, Me	283	1060	250
WLAW	Police Dept. City of N. Y., New York, N. Y.	360	833	500
WLW	Crosley Mfg. Co., Cincinnati, O	309	970	500
WMAB	Radio Supply Co., Oklahoma, Okla	360	833	100
WMAC	Clive B. Meredith, Cazenovia, N. Y	261	1150	200
WMAF	Round Hills Radio Corp., Dartmouth, Mass	360	833	500
WMAH	General Supply Co., Lincoln, Neb	254	1180	100
WMAJ	Drovers Telegram Co., Kansas City, Mo	275	1090	250
WMAK	Norton Laboratories, Lockport, N. Y	360	833	500
WMAP	Utility Battery Service, Easton, Pa	246	1220	150
WMAQ	Chicago Daily News, Chicago, Ill	448	670	500
WMAT	Paramount Radio Corp., Duluth, Minn	266	1130	250
WMAV	Alabama Polytechnic Institute, Auburn, Ala	250	1200	750
WMAY	Kingshighway Presbyterian Church, St. Louis, Mo.	280	1070	100
WMC	"Commercial Appeal," Memphis, Tenn	500	600	500
WMU	Doubleday-Hill Elec. Co., Washington, D. C	261	1150	100
WNAC	Shepard Stores, Boston, Mass	278	1080	100
WNAD	University of Oklahoma, Norman, Okla	360	833	100
WNAN	Syracuse Radio Telephone Co., Syracuse, N. Y.	286	1050	200
WNAP	Wittenberg College, Springfield, Ohio	231	1300	100
WNAS	Tex. Radio Corp. & Austin Statesman, Austin, Tex.	360	833	100
WNAT	Lenning Brothers Co., Philadelphia, Pa	360	833	250
WNAV	People's Tel. & Tel. Co., Knoxville, Tenn	236	1270	500
WNAX	Dakota Radio Apparatus Co., Yankton, S. D	244	1230	100
WOAC	Pagan Organ Co., Lima, Ohio	265	1130	150
WOAG	Apollo Theatre, Belvidere, Ill	273	1100	100
WOAH	Palmetto Radio Corp. Charleston, S. C	360	833	100
WOAI	Southern Equipment Co., San Antonio, Tex	384	780	500
WOAL	William E. Woods, Webster Groves, Mo	229	1310	100
WOAN	Vaughn C'nserv't'ry of Music, Lawrenceb'rg, Tenn.	360	833	200
WOAP	Kalamazoo College, Kalamazoo, Mich	283	1160	100
WOAV	Penn. Nat'l Guard, 2d Bat, 112th Inf., Erie, Pa.	242	1240	100
WOAW	Woodmen of the World, Omaha, Neb	526	570	500
WOAX	Franklyn J. Wolff, Trenton, N. J	240	1250	500
WOC	Palmer Sch. of Chiropractic, Davenport, Iowa	484	620	500
WOI	Iowa State College, Ames, Iowa	360	833	500
WOK	Pine Bluff Co., Pine Bluff, Ark	265	1130	250
WOO	John Wanamaker, Philadelphia, Pa	508	590	500
WOQ	Western Radio Co., Kansas City, Mo	360	833	500
WOR	L. Bamberger & Co., Newark, N. J	405	740	500
WOS	Mo. State Marketing Bureau, Jefferson City, Mo.	441	680	500
WPAB	Pennsylvania State College, State College, Pa	283	1060	500
WPAC	Donaldson Radio Co., Okmulgee, Okla	360	333	200
WPAH	Wisconsin Dept. of Markets, Waupaca, Wis	360	833	500
WPAK	North Dakota Agri. Col., Agri. College, N. D	360	833	250
WPAL	Avery & Loeb Elec. Co., Columbus, Ohio	286	1050	100
WPAM	Auerbach & Geutell, Topeka, Kas	360	833	100
WPAZ	John R. Koch (Dr.), Charleston, W. Va	273	1100	100
WQAA	Horace A. Beale, Jr., Parkesburg, Pa	360	833	500
WQAC	E. B. Gish, Amarillo, Tex	234	1280	100
WQAM	Electrical Equipment Co., Miami, Fla	283	1060	100
WQAN	Scranton Times, Scranton, Pa	280	1070	100
WQAO	Calvary Baptist Church, New York, N. Y	360	833	100
WQAQ	Abilene Daily Reporter, Abilene, Tex	360	833	100
WQAS	Prince-Walter Co., Lowell, Mass	265	1130	100
WQAX	Radio Equipment Co., Peoria, Ill	360	833	100
WRAA	Rice Institute, Houston, Tex	360	833	200
WRAL	No. States Power Co., St. Croix Falls, Wis	248	1210	100
WRAM	Lombard College, Galesburg, Ill	244	1230	250
WRAV	Antioch College, Yellow Springs, Ohio	242	1240	100
WRAX	Flexon's Garage, Gloucester City, N. J	268	1120	100
WRAY	Radio Sales Corp., Scranton, Pa	280	1070	100
WRC	Radio Corp. of America, Washington, D. C	469	640	500
WRK	Doren Bros. Electric Co., Hamilton, Ohio	360	833	200
WRL	Union College, Schenectady, N. Y	360	833	500
WRM	University of Illinois, Urbana, Ill	360	833	500
WRW	Tarrytown Radio Research Lab., Tarrytown, N. Y.	273	1100	150
WSAB	S. E. Mo. State T'chers' Col., Cape Girardeau, Mo.	360	833	100
WSAC	Clemson Agri. Col., Clemson College, S. C	360	833	500
WSAD	J. A. Foster Co., Providence, R. I	261	1150	150
WSAH	A. G. Leonard, Jr., Chicago, Ill	248	1210	500
WSAI	U. S. Playing Card Co., Cincinnati, Ohio	309	970	500
WSAJ	Grove City College, Grove City, Pa	360	833	250
WSAP	Seventh Day Adventist Church, New York, N. Y.	263	1140	250
WSAW	Curtis & McElwee, Canandaigua, N. Y	275	1190	100
WSAY	Irving Austin, Port Chester, N. Y	232	1290	100
WSB	Atlanta Journal, Atlanta, Ga	428	700	500
WSL	J. & M. Electric Co., Utica, N. Y	273	1100	100
WSY	Alabama Power Co., Birmingham, Ala	360	833	500
WTAM	The Willard Storage Battery Co., Cleveland, O.	389	770	1000
WTAN	Orndorff Radio Shop, Mattoon, Ill	240	1250	100
WTAQ	S. H. Van Gorden & Son, Osseo, Wis	225	1330	100
WTAR	Reliance Electric Co., Norfolk, Va	280	1070	100
WTAS	Charles E. Erbstein, Elgin, Ill., near	286	1050	500
WTAT	Edison Electric Illum. Co., Boston, Mass	246	1220	100
WTAY	Pioneer Publishing Co., Oak Park, Ill	283	1330	500
WTG	Kansas State Agri. Col., Manhattan Ks	360	833	500
WWAD	Wright & Wright, Inc., Philadelphia, Pa	360	833	500
WWAE	Alamo Dance Hall, Joliet, Ill	227	1320	500
WWAF	Galvin Radio Supply Co., Camden, N. J	236	1270	100
WWAO	Michigan College of Mines, Houghton, Mich	244	1230	250
WWJ	Detroit News, Detroit, Mich	517	580	500
WWL	Loyola University, New Orleans, La	268	1120	100

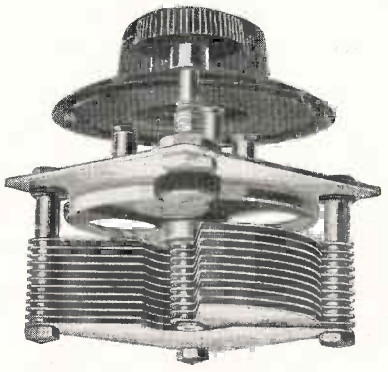
Coto

"Built First to Last"

For Summertime Radio by Roadside Stream or Rolling Surf—

Here are the makings for as fine a little portable set as you will see anywhere this summer. A set you will show with pride and your friends will listen to with real enjoyment. Furthermore, it can be made really portable, just about camera size. If you can't do the work yourself, let your radio friend do it for you.

A Coto Compact Portable Set is Easily built. Two tubes give Loud Speaker Volume on near Stations. Excellent D. X. on Phones



Superior Audio Amplification for the Coto Portable Set

The writer of this advertisement listened last night to Chauve Souris from Boston via WEAN. Two tubes and Table Talker, fine volume and splendid tone. Never heard better reception on any set. That is the kind of radio this 5 to 1 ratio transformer gives every time.

Type 4000 . . . . . **$5.00**

Volume, Sharp Tuning and Lasting Efficiency

The electrical characteristics of this SILVER PLATED Condenser with Vernier are really remarkable. For the .0005 Mfd. Condenser, maximum capacity is .000540, minimum capacity .0000240, power factor .00063. Even if you do not understand the significance of these figures, the tuning of your Coto set will tell you.

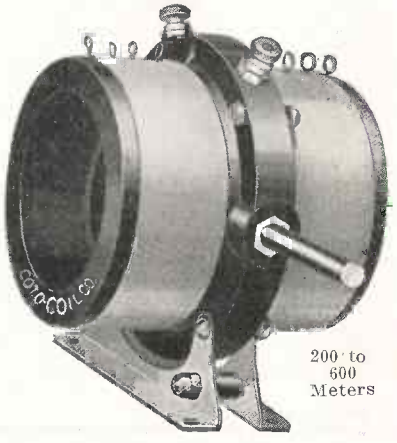
Type 3505
.0005 Mfd..... **$5.00**

Other capacities are .001 Mfd. $6, and .00025 Mfd. $4.50.

And a Real Compact Variocoupler in Polished Brown Bakelite

The compactness of the Coto Air Condenser and this popular variocoupler enables you to build your set on panel 5 x 10 or even 4 x 8 inches. Size of variocoupler is only 3¼ x 3 x 3¾ inches, yet it operates perfectly over the whole broadcasting band of wavelengths. Mounts either on base or panel.

Type
9000. . . . . **$5.50**



200 to 600 Meters

If Your Dealer Fails You, Clip This Special Coupon

Don't attempt to substitute parts if you want best results. Enclose coupon and money order with letter giving dealer's name.

We will ship through him the same day your order is received.

Coto-Coil Co.

87 Willard Avenue

Providence, R. I.