Radio in the Home

Edited By HENRY M. NEELY

...io in the home of
... Bu... Esq

VOL. II. No. 1 JUNE.
PRICE 20 cts.
Published Monthly by the
... PUBL...

ONE OF THE GERACO PROVEN RADIO PRODUCTS

Music Master
RADIO AMPLIFIER

Rich Resonance that Only WOOD Can Give

They call MUSIC MASTER the "Stradivarius Among Amplifiers." For its horn is WOOD, with that pure, mellow-sweet tonal quality of the human voice that wood alone can simulate. (Phonograph experts proved the principle before radio.)

A powerful amplifying unit in the art-metal base of MUSIC MASTER sends sounds up through a cast-aluminum "gooseneck"—cast aluminum, so it won't vibrate. This conveys true tones to the wooden horn, where they are beautifully enriched, humanized and given to the audience as they are actually sung, played or spoken.

There is only one MUSIC MASTER. Get it and you won't *regret* it! Hundreds of orders are pouring in daily. Demand actually exceeds supply, so get your order in NOW! Comes complete, ready to attach in place of headphones. No extras to buy. Hear MUSIC MASTER at your dealer's today. COMPARE it with any other amplifier, regardless of price! Literature on request.

14-inch Amplifier, complete..... $30

21-inch Amplifier, complete..... $35

Ask about the GERACO Phonograph Attachment which makes an efficient radio loud-speaker of your Victrola or Columbia. Only $10.

GENERAL RADIO CORPORATION

Makers and Distributors of High-Grade Radio Apparatus

Chicago **Philadelphia** **Pittsburgh**

S. W. Cor. 10th & Cherry Sts.

JOBBERS—DEALERS
A MUSIC MASTER will be sent to you with full privilege of return.

GERACO PROVEN RADIO PRODUCTS

Write for full description of the GERACO line and prices.

VOL. II
NO. 1

RADIO IN THE HOME

JUNE
1923

CONTENTS

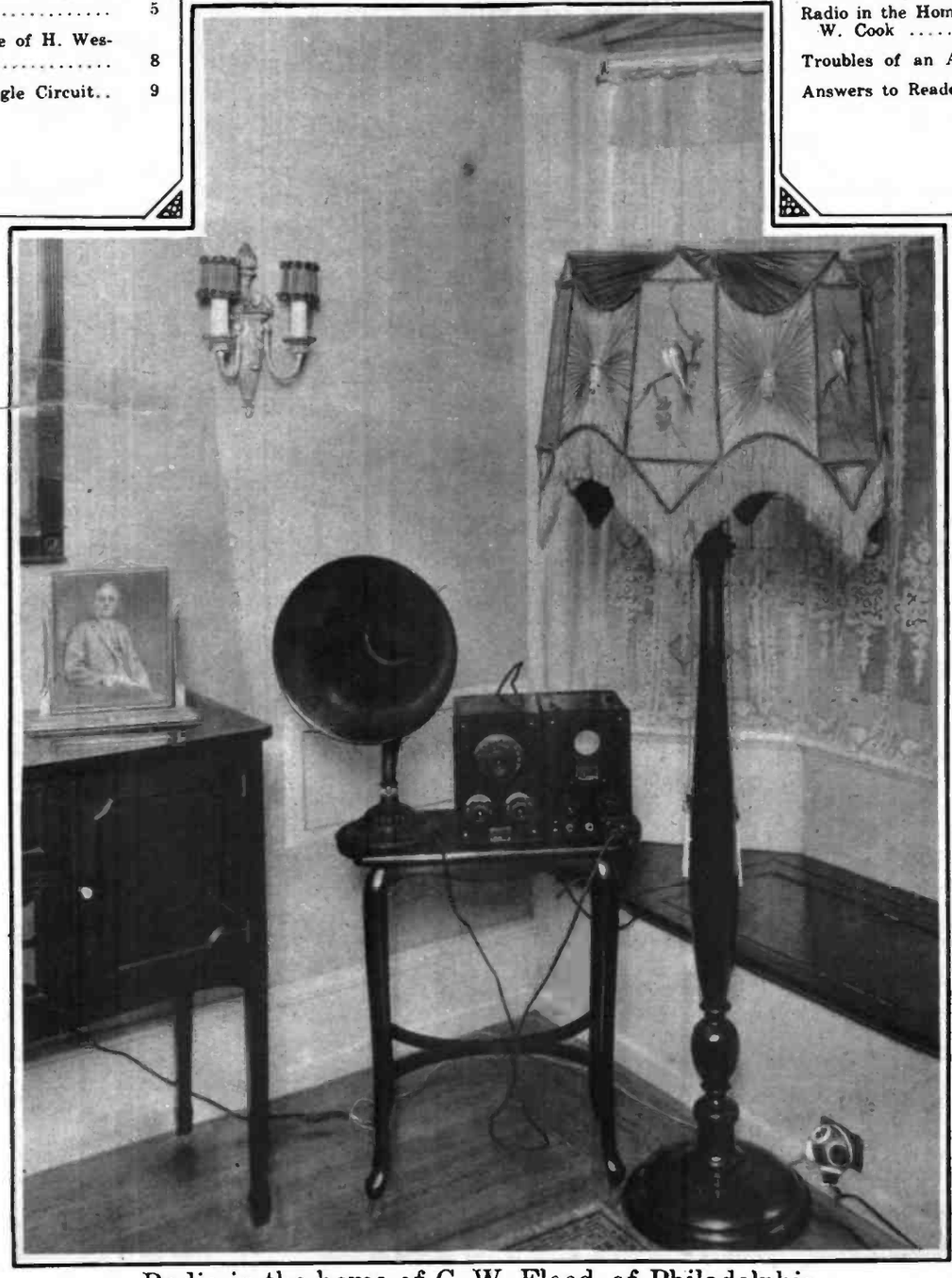
Published Monthly by the
HENRY M. NEELY PUBLISHING COMPANY
608 Chestnut Street, Philadelphia, Pa.
Bell Telephone—Lombard 8431
Experimental Station (3XP), Delanco, N. J.

HENRY M. NEELY.....*President and Editor*
G. W. KRAFT.....*Secretary and Treasurer*
FRANKLIN N. SUPPLEE.....*General Manager*
NORMAN NEELY.....*Art Editor*
THEODORE F. VOLLTEN.....*Technical Assistant*

Radio in the Home is sold at 20c per copy at all newsstands, radio shops and bookstores. Subscription in the United States and Canada $2.00 per year.

Entered as second-class matter May 26th, 1922, at the Postoffice, Philadelphia, Pennsylvania, under the act of March 3d, 1879.

CONTENTS
(Continued)



Radio in the home of C. W. Flood, of Philadelphia
Photo by Harry S. Hood, Courtesy of General Radio Corporation

Radio in the home of J. C. Van Horn, of Philadelphia

Photo by Harry S. Hood; courtesy of Wireless Sales Corporation

Radio Opera—From Stage to You

The diagrams on this page and most of the photographs on the two succeeding pages are used through the courtesy of "Telephone News," published by the Bell Telephone Company, of Phila.

PROBABLY nothing that has happened in radio during the entire past season has caused quite so much favorable comment as the broadcasting of grand opera performances by Station KYW in Chicago. Stations in other cities would undoubtedly have followed suit if it had been possible, but in the case of the eastern cities, at least, contracts of artists with the Victor Talking Machine Company have made it impossible for them to perform over the radio.

Except for the Chicago season, the only other season of grand opera that I know of was given by Station WIP, in Philadelphia, of which I was director. We were able to do this because a company came from Europe to give a season of Wagnerian operas in several cities, and they were not in any way hampered by contracts. Consequently, it was possible for us to make arrangements with them to broadcast three of their performances on the first visit and two on their second, and it was as interesting an experience as a radio man could go through.

Radio listeners-in have no idea of the amount of forethought and careful planning necessary for broadcasting a performance of this kind. It seems to be the general impression among amateurs that when an event is broadcast from a concert hall or an auditorium over land wires, and thence from a radio station, all that is necessary is to connect an ordinary telephone and let the sound go through that.

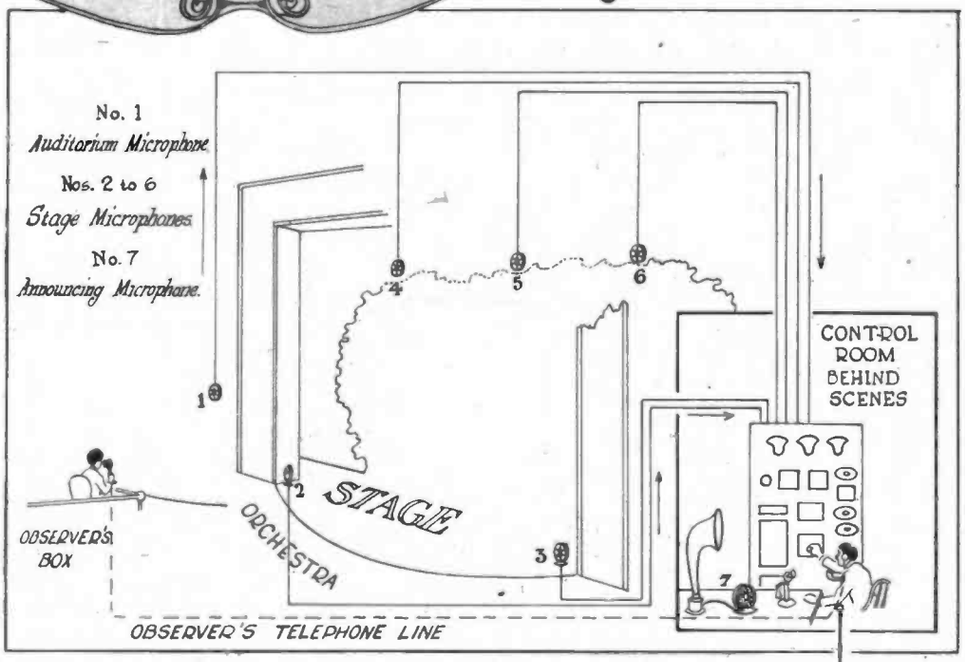
But this is by no means possible. Telephone conversations are accomplished in ordinary practice by many noises on the line, and these noises, if transferred to a radio transmitting set, would be amplified to such an extent that the music and speech would be totally ruined when received by radio.

In all such installations as this it is necessary to place virtually an entire transmitting set in the hall or the auditorium where the performance is being given. This transmitting set does not send out signals from an aerial, but does send the signals over the land lines.

It is necessary to lease two pairs of land lines for the transmission and two pairs for the control operators. These duplicates are necessary in case one pair breaks down and it is necessary to plug in at once on the spare.

The grand opera performances of which I speak were given in the Metropolitan Opera House in Philadelphia, and this building is so vast in its proportions that no one microphone could possibly be adequate to transmit all of the opera and the orchestra as well.

It was necessary for us to place seven separate microphones in various parts of the stage and the orchestra pit and the house in order to be sure to catch any sound that was made by musicians or singers, no matter where they might be stationed. All of these microphones were connected by cable to the transmitting apparatus known as an "8-A amplifier" in a special control room behind the scenes, and this transmitting set was also connected by a special telephone line to a box in the center of the balcony, where several men were posted to keep the operators in the control room informed of everything that was going on.



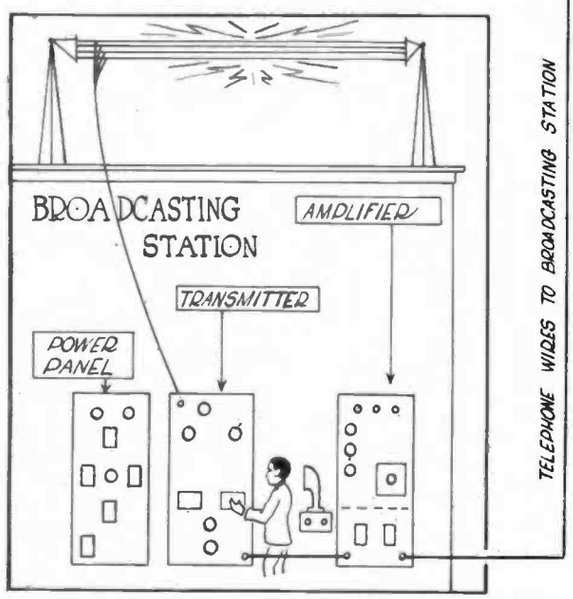
These diagrams will give a clear idea of the process of broadcasting a performance of grand opera from the opera house, over the land telephone wires to the broadcasting station and thence by radio to your home.

Essentially, it was much like artillery fire control in modern warfare. When a singer came down the stage and started to sing, the man at the telephone in the box would phone down to the control room, "Microphone No. 2."

Then, as the artist continued to sing and perhaps walk across the stage a little distance, as he was walking the man in the box would phone down, "Get ready for No. 3; switch." As the man walked still further along the stage, the man in the box would phone into the control room, "Get ready for No. 4; switch."

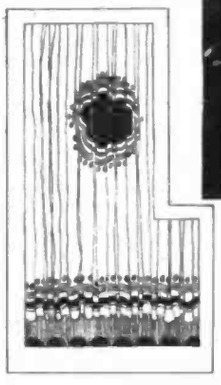
In this way the microphone nearest the singer was always kept in operation and the actions and movements of the artists were followed from one side of the stage to the other, on into the back, and even behind the scenes.

(Continued on Page 29)



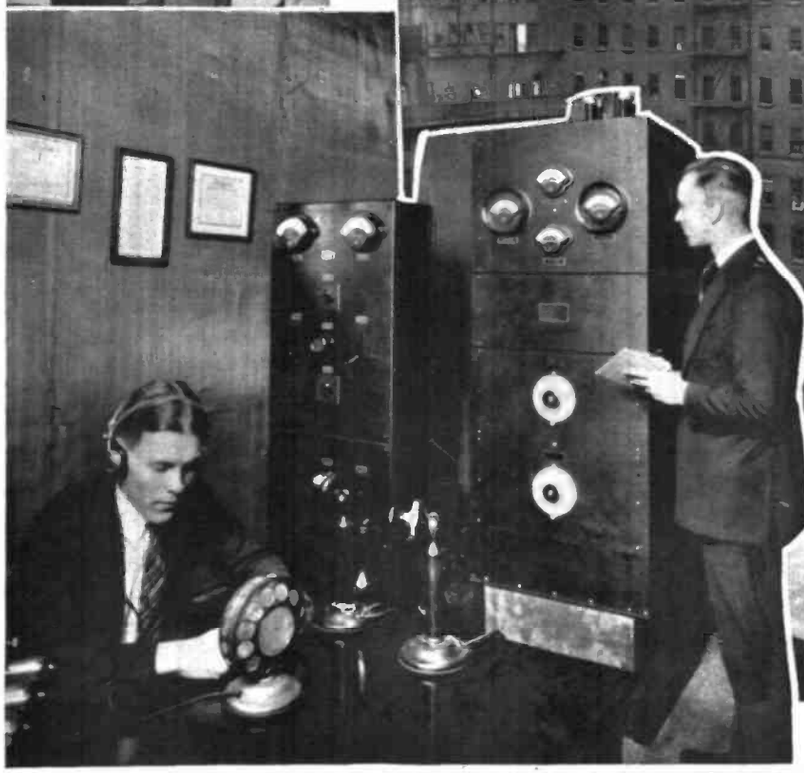
Radio Opera From Stage to You

Below is one of the microphones mounted over the footlights of the Opera House.



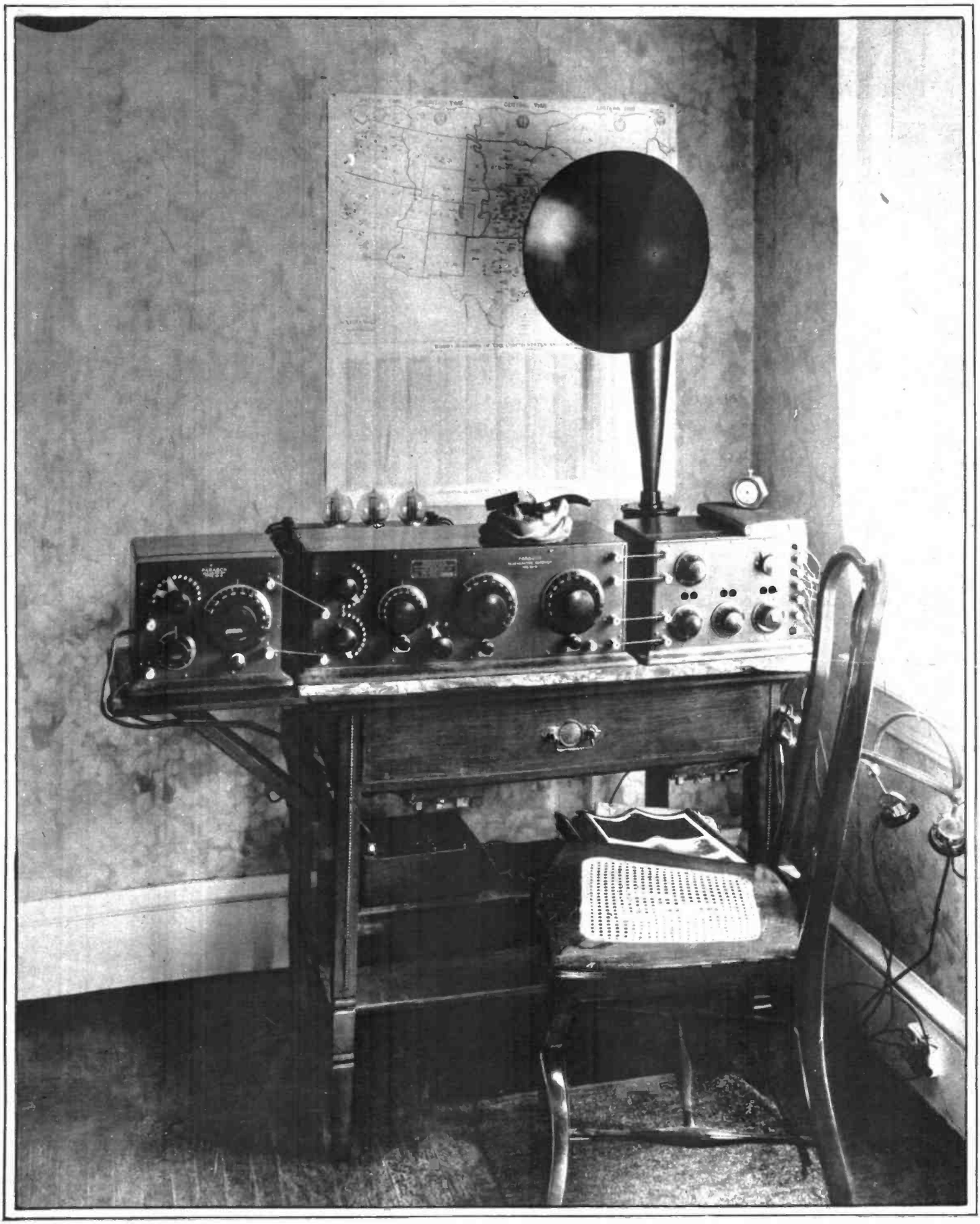
At the top is the observer in his box at the opera telephoning instructions to the control room. Below him is a photograph of the Metropolitan Opera House, in Philadelphia, and beneath that a photograph of the stage, showing the prompter's box in the center and a microphone on each side of it over the footlights.

To the left is a strip of moving picture film of Henry M. Neely telling the story of the opera between the acts from the control room. At the right is an operator working the apparatus in the control room, and it is from the microphone in front of him that Mr. Neely did his talking about the opera. The operator shown on the right did all of the switching of all of the various microphones in accordance with instructions telephoned to him from the observer's box.



Above is the control room of station W I P, from which the grand opera was broadcast.

Above is an exterior view of the Gimbel Store, showing the great aerial installation of station W I P, from which the grand opera performances were broadcast.



Radio in the home of H. Weston Taylor, of Chester, Pa.

All about the Single Circuit Hook-up

The Little Lady of 3XP finds it easy to tune the single-circuit set. Incidentally, the Little Lady is known to radio fans as Mrs. Henry M. Neely, soprano soloist at the Sunday afternoon orchestra concerts from Station WIP.

EVERY time a new hook-up appears in a newspaper or magazine, all of the radio fans go wild over it for a month or so and editors are flooded with letters telling of the wonderful results achieved. But I notice that, once the furore has subsided, many of the fans go back to their old single circuit regenerative sets and when all is said and done, get pretty much the same results with them with a great deal less trouble.

I do not mean to say by this that the simple single circuit regenerative set is by any means the best that it is possible to use.

There is, however, no doubt that, so far as simplicity of operation and economy of construction are concerned, this hook-up has stood the test of time, and it has several things in its favor that are just as much in its favor today as they were in the past.

It is, for instance, about the best set to construct if you are going to leave your radio receiving instruments at home for your wife to entertain herself with or to use for the entertainment of any of her friends who may drop in of an afternoon.

It is extremely easy to tune, and any child of fourteen will have no difficulty in getting good signals with it. In fact, I know several friends whose little children tune in the bed-time stories for themselves with this circuit.

It is also an economical set so far as the prices of the materials are concerned. It uses nothing but standard stuff that is very easy to buy at any time and which is always available without too much demand upon the pocketbook, and it is so simple to connect the various wires that go to make up the circuit that almost anybody can put a set of this kind together.

I am going into it in this article in its several phases. I am giving, for instance, the simple tuning circuit with one bulb used as a detector. I am also giving a hook-up so that later on you can make a cabinet containing two amplifying bulbs and hook it directly to this one. I am also giving the circuit for the detector tube and the two amplifying bulbs to be included in the same cabinet. And then in addition to this there is a hook-up for one stage of radio frequency amplification (shown on page 29) and, if the fan decides to build this one, he can later build the separate cabinet for the two stages of audio frequency amplification and hook it directly to the radio frequency and the detector.

Let us take up the list of parts that will be necessary for building just the tuning set and the detector.

We will need four binding posts for the front of the panel and four binding posts for the base board to which we make the battery connections. Then we will need a forty-three plate variable condenser and an ordinary variocoupler with a dial for each one of them.

We will need enough contact points for the taps of the vario-coupler and two switch levers. We will need a grid condenser of .0005 mfd. with a grid leak of about 1 megohm, a good bulb socket, a rheostat, a double circuit jack, a bulb, and of course the storage battery and the B battery of twenty-two and one-half volts.

This completes the detector circuit.

For the two stages of audio frequency amplification, we will need two audio frequency transformers, two sockets, two amplifying bulbs, two rheostats, two double circuit jacks, four more binding posts for the front of the panel, and either three or four binding posts for the base board for connection to the batteries.

In mounting these instruments myself I find that the detector unit will go on a panel seven inches high by thirteen inches long and the two stages of audio frequency amplification will go on a panel seven inches by seven inches. The base board in each case should be about seven inches deep.

These same proportions hold good in any combination of the set and the cabinet shown in the photographs containing a detector and two stages of audio frequency amplification has a panel seven inches high by twenty inches long. The instruments can be crowded into a much smaller space than this but I do not recommend it as these sizes give plenty of room for working around the pieces of apparatus and also for making any future repairs or adjustments that may be necessary.

In choosing a variocoupler for this circuit, let me warn you not to take one of the cheap makes which have only a comparatively few turns of the wire on the rotor, or the movable ball form inside of the coupler.

For the single circuit regenerative set, this rotor should have at least sixty turns of wire on it—that is, there should be thirty turns of wire on each side of the shaft.

You should also get a coupler with at least eighty turns of wire on the primary or outer coil.

The variable condenser used should be a forty-three plate one and a vernier is not necessary though, of course, it does make sharper adjustment. Still I notice that an extremely fine setting of this condenser is not necessary in the position shown in this diagram.

With this article I am giving diagrams of all of the combinations of the single circuit that the average amateur will care to have. In the hook-up for using one bulb or detector alone, I show two binding posts that go on the right hand side of the panel and these are for connection to any amplifying unit which you may add later.

I am also showing this second unit in both its hook-up and its finished form. It contains two stages of audio frequency amplification. It is made to match the detector unit—that is to say that, in both units, the panel is seven inches high, the detector unit panel being thirteen inches long and

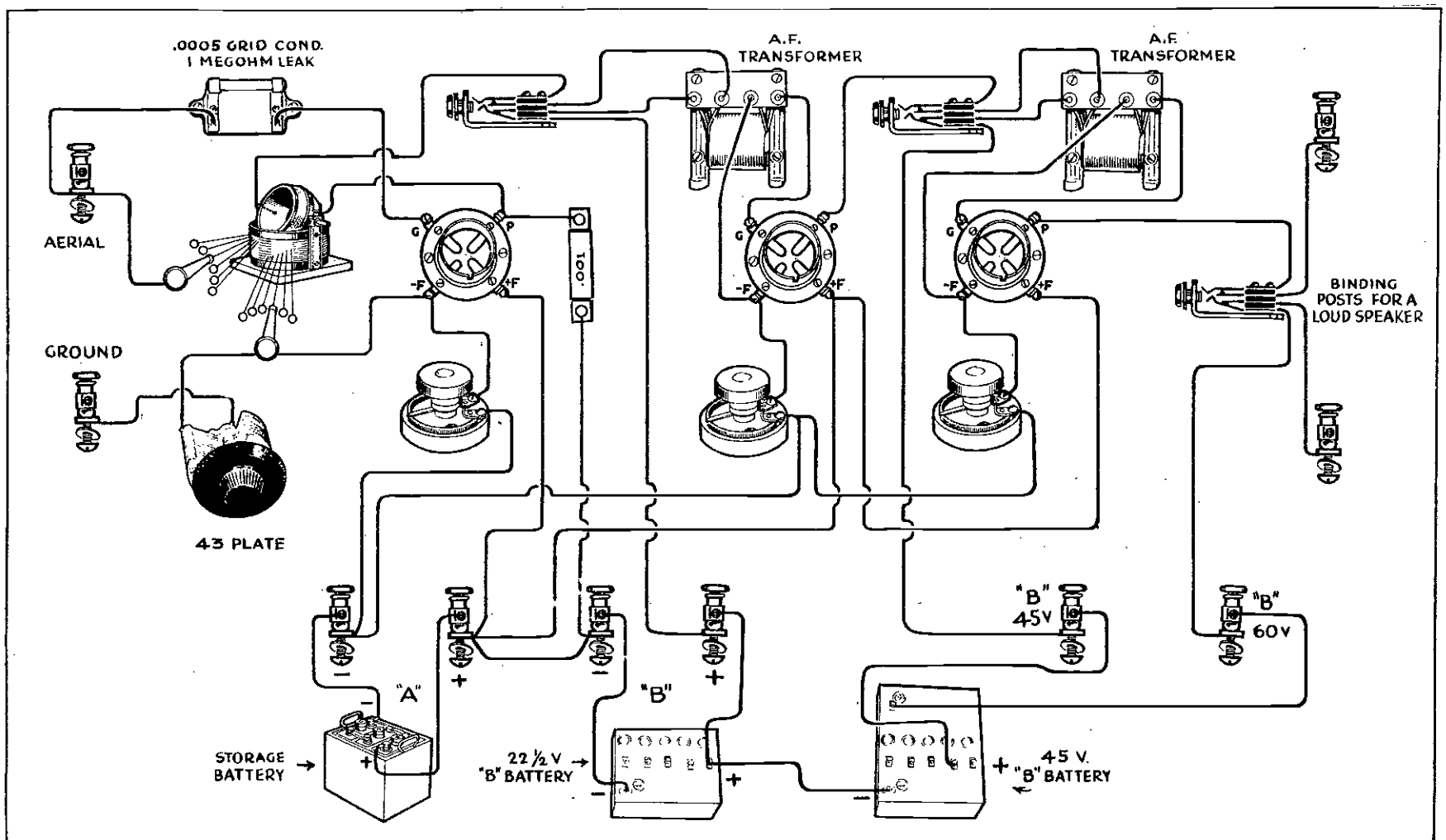


Diagram drawn by C. B. Fayko

Here is the complete hook-up for the single circuit set with detector and two stages of audio frequency amplification.

The three-bulb set shown in the photographs with this article was made at Station 3XP from this hook-up.

the two-step amplifier panel being seven inches long.

When the amplifying panel is placed alongside of the detector panel, the two binding posts on the right of the detector and the two on the left of the amplifier are simply connected by two wires running across the open space and then, for the battery connections, the plus and minus A battery binding posts on the back of the amplifier panel are wired to the like binding posts on the detector base board. The plus B battery binding posts are wired to the proper contacts on the positive side of the B battery. There is no minus B battery binding post on the amplifier panel as the B battery minus side is connected to the whole set entirely through the detector panel.

In addition to these I am showing the detector and two-stage amplifier diagram complete with the three bulbs and am also showing photographs of the same hook-up mounted in a cabinet just as I have it at 3XP, our experimental shop at Delanco, New Jersey.

I am also giving on page 29 a hook-up for one stage of radio frequency and a detector. This unit also, like the detector unit alone, has two binding posts on the right hand side of the panel and it is possible later, when you build the two stages of audio frequency amplification in the unit already spoken of, to hook the two-audio-panel alongside of this radio-detector panel, connecting the binding posts across, and then you have a four-bulb set consisting of one stage of radio frequency amplification, a detector and two stages of audio frequency amplification.

This is about as far as anybody will care to go with a single circuit regenerative set and it is a very efficient hook-up, particularly if you use the two potentiometers which I show in the hook-up giving the stage of radio frequency amplification.

In every one of these hook-ups, it is possible to get still more efficiency and still sharper tuning qualities by using a twenty-three plate vernier variable condenser in addition to the apparatus shown in the diagram. In using this condenser you simply wire one side of this to one of the binding posts for the secondary—or the rotor—of the coupler and wire the other variable condenser binding post to the other binding post of the rotor. This is what we call wiring the condenser "in parallel" with the rotor.

This additional small condenser is really very well worth while and I advise every one to use it, though it is not absolutely essential and I do not show it in the diagram because I want to give this particular hook-up in the simplest form possible so that even the unskilled amateur can build it.

In using the single circuit regenerative set for nearby stations, I have never yet found that it makes any diffrence whether I had a grid leak in the circuit or not. In tuning for distant stations, however, a grid leak is greatly desirable and I advise a variable grid leak.

Just to be sure that you have everything hooked up correctly, I am giving here a "check-up" list of the different wires and I advise you to have somebody read this list to you as you go over your wiring and see that everything is all right. Here is the check-up list:

A wire from the aerial binding post to the shaft of the unit switch.

A wire from the aerial binding post to one side of the grid condenser.

A wire from the other side of the grid condenser to the grid binding post on the socket.

A wire from the ground binding post to one side of the variable condenser.

A wire from the other side of the variable condenser to the shaft of the tens switch blade.

A wire from that same side of the variable condenser to the binding post for the minus side of the A battery.

Another wire from that binding post on the minus side of the A battery to the center of the rheostat.

A wire from the side of the rheostat to one filament connection on the socket.

A wire from the binding post for the plus side of the A battery to the binding post for the minus side of the B battery.

A wire from the binding post for the plus side of the A battery to the other filament connection on the socket.

A wire from the binding post for the minus of the B battery to one side of a phone condenser (.001 mfd.).

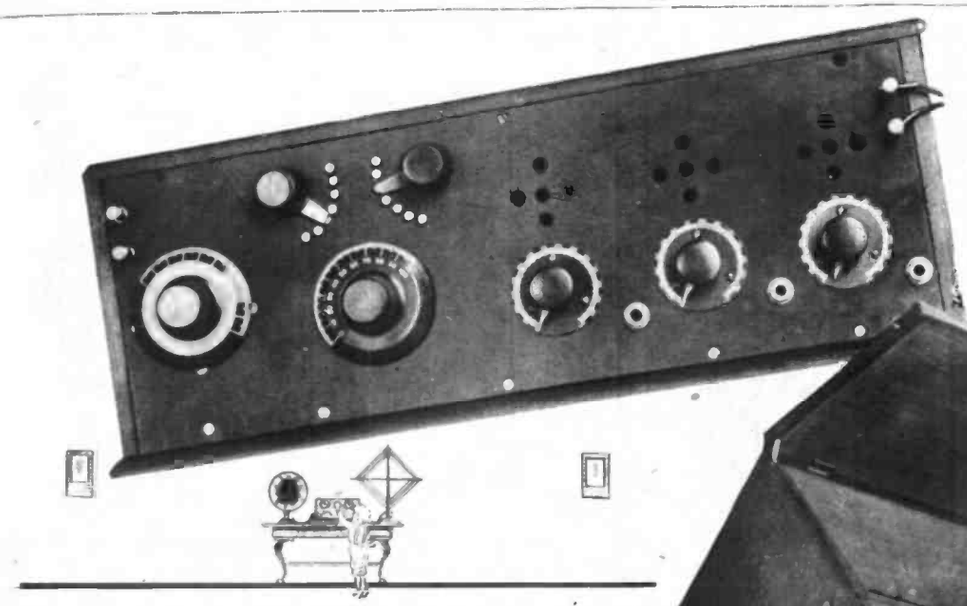
A wire from the other side of that phone condenser to the plate binding post on the socket.

Another wire from the plate binding post on the socket to one side of the rotor of the variocoupler.

From the other side of the rotor of the variocoupler to the upper outside blade of the jack.

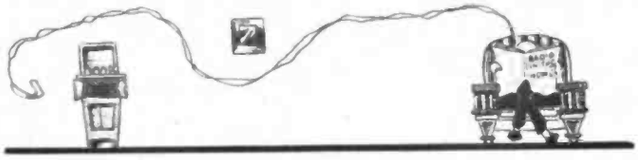
A wire from the lower outside blade of the jack to the binding post for the twenty-two and one-half volt positive side of the B battery.

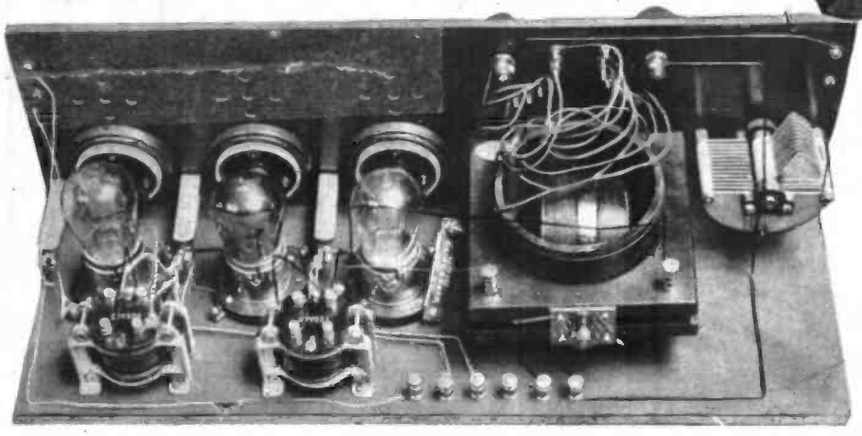
(Continued on Page 12)



The photograph to the left shows the single circuit set with detector and two stages of audio-frequency amplification mounted on a panel. The two binding posts on the left are for aerial and ground. The two binding posts on the right are the permanent connections for the loud-speaking horn, and when the phone plug is pulled out of the last jack, this horn is automatically connected into the circuit and the music comes out to be heard by everybody in the room.

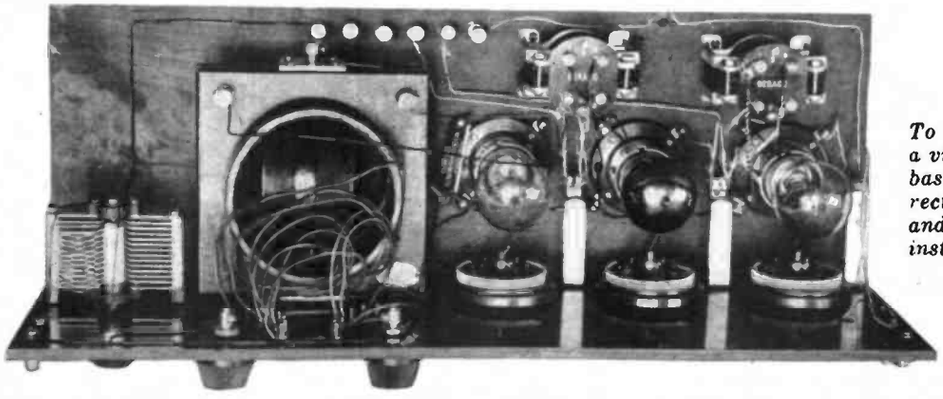
The whole outfit is mounted on a panel with a baseboard, and this slides into the cabinet and is screwed fast top and bottom. The top lid then can be lifted at any time to take out bulbs or make any minor adjustments that are necessary.





To the left is shown a back view of the baseboard and panel looking down upon it. In the very foreground are the six binding posts which are intended to go to the storage batteries and the B batteries. There are holes bored in the back of the cabinet corresponding to these binding posts, and the battery wires are slipped through the holes, and the operator then opens the top lid of the cabinet, puts his hand in, inserts the wires in the binding posts and screws them down tight. This keeps battery wires out of sight and makes a much neater job.

From left to right we have first the variable condenser, then the variocoupler and tap switches with the battery posts behind it, then the detector bulb, grid condenser, rheostat, jack with the first transformer behind the jack, then first step amplifier bulb and rheostat and jack and the second transformer behind it, and then the second amplifier bulb, rheostat and jack.



To the right we have a view of the panel and baseboard looking directly down upon it, and showing how the instruments are placed.

With these various views of the single circuit with the detector and two stages of amplification, taken together with the diagram given on page 10, even a beginner should have no difficulty in hooking up this set and building it into a neat and attractive cabinet which will not only give him satisfactory service, but will also be a decoration for his home.

It is essential in getting satisfaction from a set of this kind to use only the very best of material, and no cheap apparatus should be included in this hook-up.
A little extra money spent on the best of standard makes is more than repaid by the long life of the set and the increased enjoyment which comes from perfect reception.

(Continued from Page 10)

A wire from the upper inside blade of the jack to the upper binding post on the right hand side.

A wire from the lower inside blade of the jack to the lower binding post on the right hand side.

Here is a check-up list for the wiring for the panel containing the two stages of amplification:

A wire from the upper left hand binding post to the second *primary* connection on the transformer.

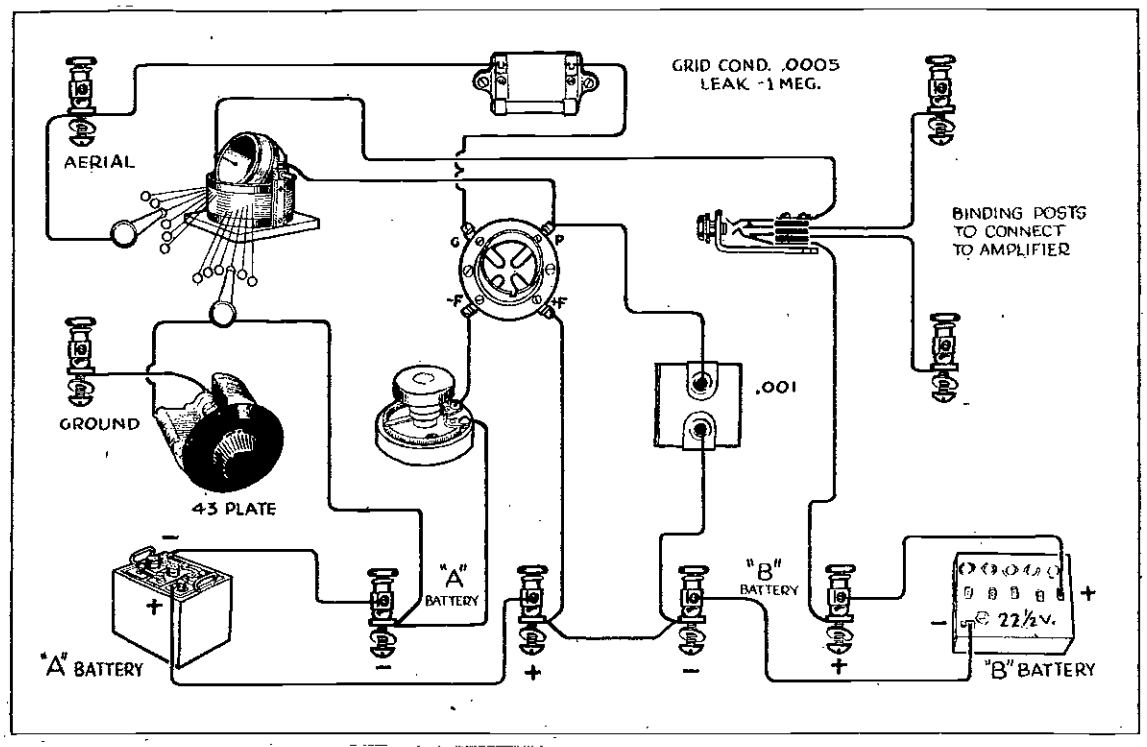
A wire from the lower binding post on the left hand side to the first primary connection on the transformer.

A wire from the first *secondary* connection on the transformer to the minus filament connection of the socket.

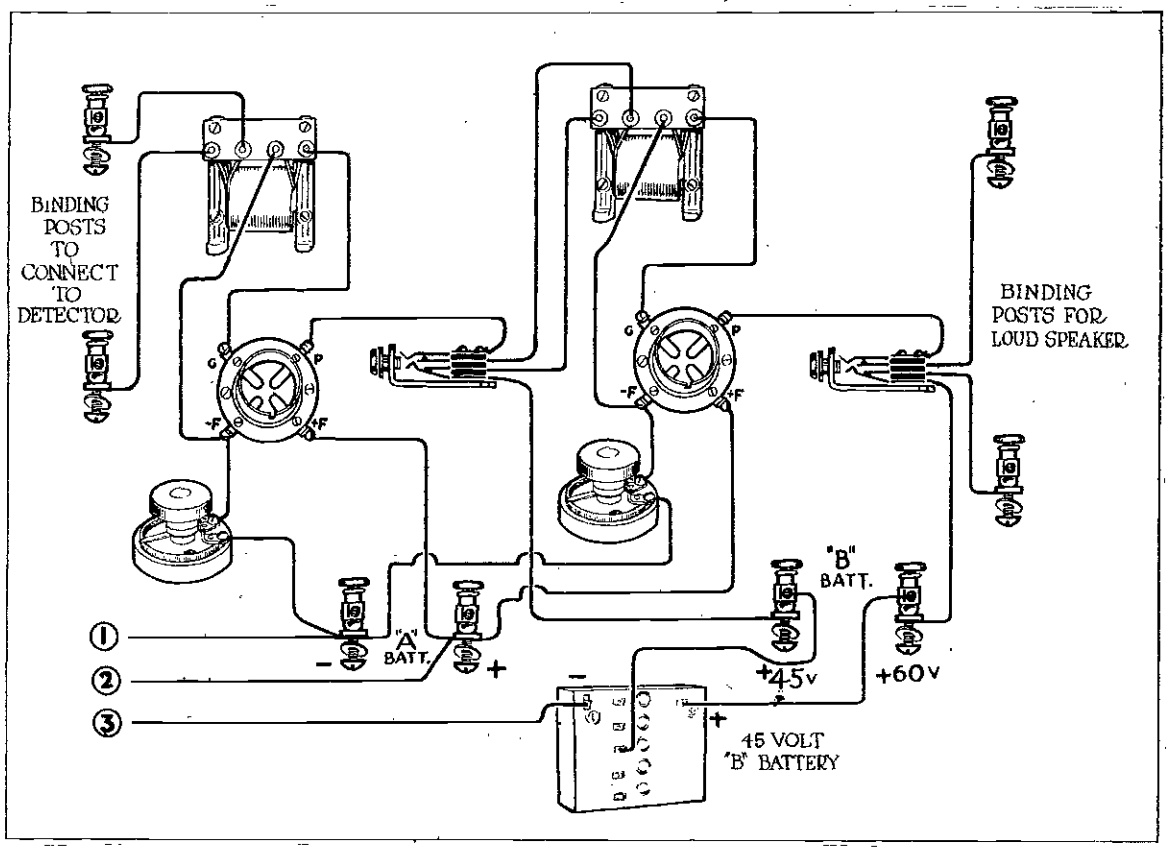
Another wire from the same filament connection on the socket to the outside connection of the rheostat.

A wire from the middle connection of the rheostat to the binding post on the minus side of the A battery.

A wire from the second secondary connection of the transformer to the grid connection of the socket.



This hook-up gives the complete circuit for the detector bulb with the single circuit regenerative set. The two binding posts on the right hand side are put upon the panel so that you can connect directly across later when you build a two-stage amplifying set.



This diagram shows a complete hook-up for a cabinet to contain two stages of amplification to add to the detector unit shown above. The two binding posts shown on the left of this hook-up are simply wired to the two binding posts shown on the right of the other hook-up. The wires marked 1, 2, 3 are connected: No. 1 to the minus A battery binding post on the detector panel, No. 2 to the plus A binding post on the detector panel, and No. 3 to the plus B binding post on the detector panel.

A wire from the plate connection of the socket to the upper outside blade of the first jack.

A wire from the lower outside blade of the jack to the binding post for forty-five volt positive of the B battery.

A wire from the other filament connection of the first socket to the binding post for the plus side of the A battery.

A wire from the upper inside blade of the first jack to the second connection of the *primary* of the second transformer.

A wire from the lower inside blade of the first jack to the first primary connection of the second transformer.

A wire from the first connection of the *secondary* of the transformer to the minus filament binding post of the socket.

A wire from that same minus filament binding post to the outside connection of the second rheostat.

A wire from the center connection of the second rheostat to the minus binding post of the A battery.

A wire from the second secondary binding post of the second transformer to the grid binding post of the second socket.

A wire from the plate binding post of the second socket to the upper outer blade of the second jack.

A wire from the lower outer blade of the second jack to the binding post for 45-60 volts positive B battery.

A wire from the upper inside blade of the jack to the upper right hand binding post.

A wire from the lower inside blade of the jack to the lower right hand binding post.

A wire from the other filament connection on the second socket to the binding post for the positive side of the A or storage battery.

If you are not going to build these two separate units, but intend to build the entire detector and two-stage amplifier in one cabinet, you can use this same pair of check-up lists for wiring, remembering only that the inside blades of the first jack do not lead to the binding posts on the detector panel but lead directly to the primary of the transformer as shown in the hook-up for detector and two-stage amplifier.

All of the other connections will be the same on the check-up lists and you will have no difficulty in following them.

Let me say in conclusion that the single circuit regenerative hook-up is not a particularly selective one—that is to say, that if two broadcasting stations are on nearly the same wave length it will be very difficult for you to tune a loud one out and a faint one in with this hook-up.

However, for the man or woman who wants to get the pleasure of having the local broadcasting come into the home on a loud speaking horn, I think that this set is about as satisfactory as any that can be devised because it does give very great strength of signals and it gives them clearly and without distortion if it is tuned properly.

It is just here that the single circuit has a great advantage over most circuits. That is in its ease of tuning.

Any woman or child can learn to tune this set in a very short time and it is about as good as any that I know of for all-around home use.

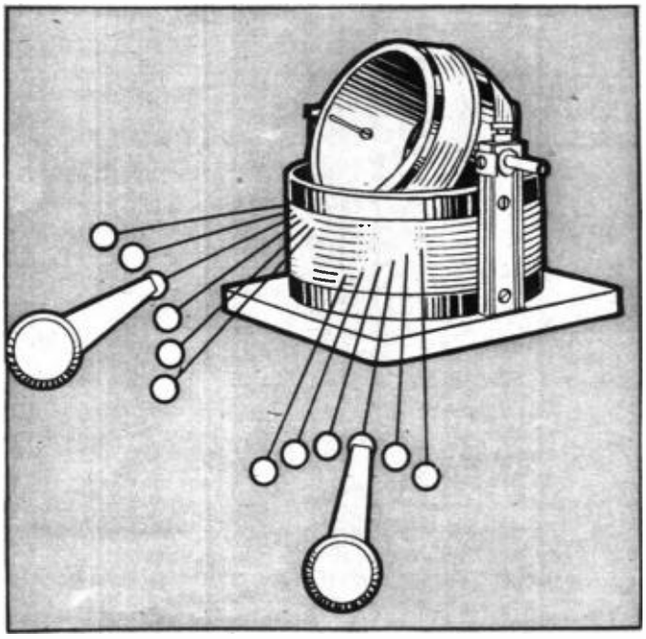
Do Radio Terms Confuse You?

IF WRITERS on radio would only learn to talk simple, every-day English they would make a lot more converts to this new and most fascinating of all hobbies.

Nothing deters the average layman more than to glance through a catalogue or an advertisement of radio goods and to be confronted with a lot of long and complicated looking words whose appearance is much more forbidding than their actual use.

So, too, the average article on radio is totally unintelligible to the person who has not made a study of electricity and a pretty deep study at that. Men who become sufficiently expert in the science to write about it begin to lose all track of words of one syllable and seem to get the idea that the more they use long terms, the better impression they will make of their scientific knowledge.

That may be perfectly all right. They may make this impression among fellow scientists. But they do one thing which totally destroys their value to the average reader; they scare him away in the very first paragraph and he does not go any further with their article.

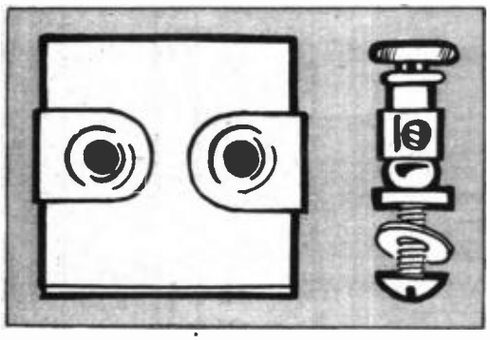


A variocoupler. The movable form on the axis is the rotor sometimes known as the secondary. The windings around the outside cylinder are the primary windings. The lines going to the arcs of small circles represent tap wires going to contact points and there is a switch blade with a knob for each arc of contact points.

As a matter of fact, there are not more than a dozen or fifteen words in radio that it is really necessary to use in any article dealing with the subject. By that I mean technical words, which are not words in ordinary conversation.

Even these words seem to discourage a great many people, particularly women who are becoming interested in the subject.

And yet it was only a few years ago that the same feeling was quite widespread against the then new hobby of automobiling. I can very distinctly remember some fifteen or twenty years ago, when I first began to think of automobiles, that my interest in them was postponed a year or two — more by the long technical terms that I saw in all catalogues than by anything else.



To the left, a standard form of fixed condenser. To the right, a standard binding post.

It is not too much to say that there are more technical words connected with an automobile than there are connected with a radio set. And yet automobiling conversations are filled with these words today, and they are part of our every-day English language.

Your automobilist of today—even the woman driver—will talk quite glibly about carburetion and ignition, and will think nothing of it. She can discuss needle valves, mixing chambers, vaporization, proportions of mixtures and all of the other things connected with the gasoline end of the motor. And yet a few years ago this was all Greek to ninety-nine people out of every hundred.

The average person now can also talk quite freely about the ignition system of the car, and yet this system in itself contains almost as many forbidding words as it is necessary to use in discussing any radio sets today.

Let us just take up the single-circuit set, which has been dealt with in another article of this issue of *Radio in the Home*. You can take that machine just as it is shown and, starting at the left side of the panel, you can very quickly learn what is inside of it and just what the terms mean.

First, of course, you come to the two binding posts on the left.

A binding post is virtually nothing but a small bolt which slips through a hole in the panel, and instead of being made fast with a nut it is made fast with a special head which contains the thread which acts as a nut and which also contains a hole into which a wire can easily be slipped and clamped down by means of a screw. These binding posts are used in several parts of a radio circuit because they are the most convenient thing to which to attach wires.

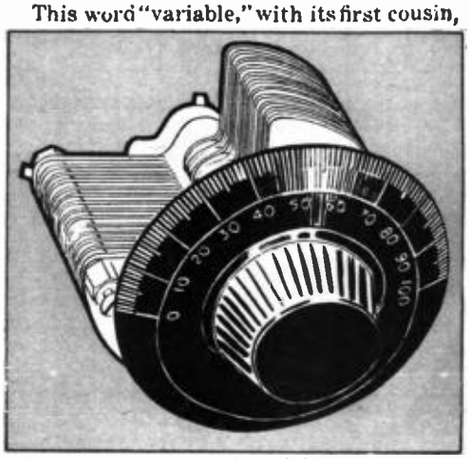
The aerial binding post is, of course, the binding post into which you slip the wire that comes from the lead-in from your outdoor aerial. This wire is slipped into the hole on the front of the panel and the electricity flows through the binding post and down the wire which is attached to the head of the bolt on the back of the panel and so the electricity gets into the set and does the work expected of it.

The ground binding post is used as a connection for the wire which leads the electricity out of the set and on down into the earth, sometimes by being attached to the cold water spigot and so allowing the electricity to flow down the cold water pipe or perhaps by being led down a wire on the outside of the house, this wire being attached to a pipe driven into the ground. No matter how the connection is made, the object is to permit the currents of electricity to escape from the radio set and go into the earth.

In other words, the aerial binding post is the entrance into the set, and the ground binding post is the exit from it.

Next we come to a dial by means of which we turn a shaft in an instrument known as a "variable condenser." Here we come to the type of term that seems to make radio a forbidding subject to the layman.

This word "variable," with its first cousin, "vario," is quite a common term in radio, but there is nothing at all forbidding about it. It simply means that the effect which is caused by the instrument in the receiving set can be varied. There are many ways of varying these instruments, but the



The standard form of variable condenser

most common and the most convenient is by means of turning a shaft which causes the effects to be varied. That is why we have a dial on the end of the shaft, and the dial is marked off into divisions so as to show us the exact setting of the movable part of the instrument behind the panel.

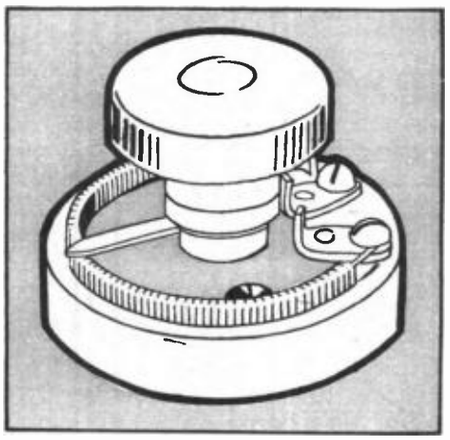
A variable condenser is, then, a condenser which can be varied. So your next question will naturally be, "What is a condenser?"

We come now to the fundamentals of radio, and the average amateur who has already built one set will turn up his nose and wonder whether I am trying to get him into the kindergarten class again. I am not. This article is not for him, but is for the absolute beginner. The amateur who has learned so much that he does not need any more can skip this article and go on to the rest of the magazine.

A condenser, then, might be described as an instrument which condenses or stores up a certain form of energy, much as a tank or a reservoir might store up water. Just exactly how this is done is too deep a subject for the beginner. In fact, scientists themselves do not know all about it. They simply know what effect is has and how they can use this effect.

When you have two metal plates near each other, the one charged with positive and the other charged with negative electricity, you create an effect in the space between these two plates which can be used in tuning a radio circuit. This is known as "capacity," and that word really explains itself, just as it would be perfectly simple for you to understand me if I spoke of the capacity of a tank. That is really what the term means in relation to a condenser—it means the capacity it has for storing up the effect which we want.

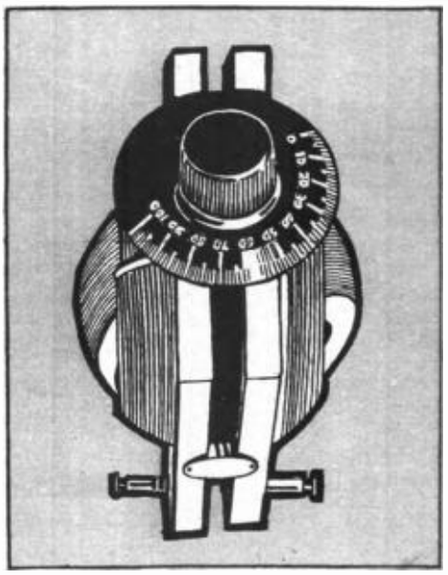
Two metal plates of, let us say, one square inch, separated by one-sixteenth



A rheostat is an arc of resistance wire and the movable blade which touches it governs the amount of resistance which we include in the circuit which lights our bulbs.

inch, will have a certain amount of capacity. If we use four metal plates, we double this amount of capacity. If we still only want to use two plates, but double the amount of their surface, we will still double the amount of this capacity.

Remember that these two plates do not touch each other, and that the effect which we call capacity is built up in the space between them.



In a variometer, the wire wound around the outside is directly connected to the wire wound around the ball shaped form which we call the rotor.

Capacity has a very decided influence in tuning a radio circuit. It is very important that we use condensers, and also that we be able to change the amount of the capacity at will, so as to change the tuning. In this way we hunt for signals and bring them up to their greatest strength.

The most convenient way to change this capacity is to let one plate be stationary and mount the other plate upon a shaft which we can turn around. In this way we vary the amount of surface of one plate which is directly opposed to the surface of the other plate. We can take one plate entirely away from the other plate by turning the axle half way around. On the other hand, we can put the entire surface of one plate opposite to the entire surface of the other plate.

The more plates we have and the greater the surface of the plates, the greater the capacity.

Thus we have three-plate condensers and nine-plate condensers and eleven and twenty-three and forty-three plate condensers. The size of condenser that we use is governed very largely by the kind of circuit we are using and the place in that circuit in which we are using the condenser. All that it is necessary for you to know is the simple fact that a condenser is two sets of plates, not electrically connected, but capable of building up a certain electrical effect between them, and one set being capable of turning on an axis so as to bring more or less of the surface of the plates of that set opposite to and close to the plates of the stationary set. The turning plates we call the rotating plates.

The amount of the capacity of a condenser is measured in a very confusing term that is known as "microfarad." You need not bother to try to understand what a microfarad is. We might just as well say quarts or bushels or tons. All you have to know is that the little abbreviation mfd., which is seen attached to descriptions of variable condensers, is a measure of this capacity.

Radio receiving sets and also radio transmitting sets are fundamentally various combinations of capacity and another form of electrical energy which we call "inductance."

It is unfortunate that we have to use these words and as a matter of fact you need not bother with the word inductance very much because, for all practical purposes, the inductance in your set will take the form of some kind of coil of wire. Wherever you have a coil of wire with electricity flowing around it you will have inductance. As a matter of fact, you also have inductance where you have a single wire with a current of electricity flowing through it, but this does not figure very much in a radio set and so you need regard inductance simply as a coil of wire.

The combination of inductance (or coils of wire) and capacity (or condensers) does most of the work in tuning the radio set.

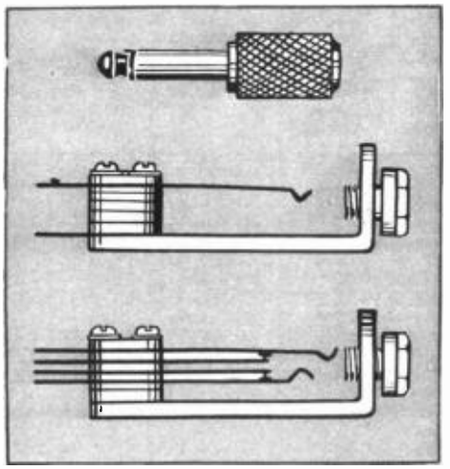
Now, there is a very interesting and remarkable thing about the inductance of a coil of wire.

Suppose you were to take an ordinary oatmeal box or salt box and wind fifty or a hundred turns of wire around it very close together. Suppose you were to connect one end of this wire to the aerial binding post of your set and the other end of it to the ground binding post. This would make a clear path of electricity from the aerial through your lead-in, then through the aerial binding post and into the coil of wire and around this coil and on out through the ground binding post into the earth.

This is a very simple picture to get in your mind. It is just the same as a pipe carrying a stream of water around a coil.

But in the case of electricity a very remarkable thing happens when this current goes around this coil of wire. In some mysterious way it sends out through the insulation a very strong effect upon the ether about the wire and this effect is what we call magnetism.

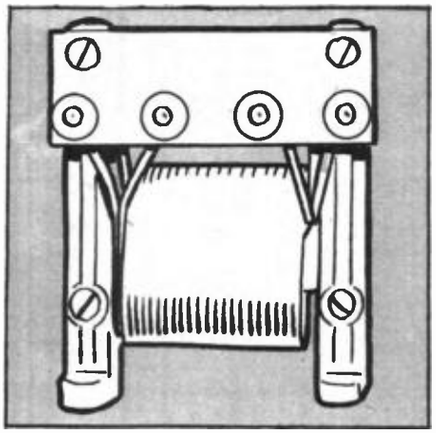
In other words, the current of elec-



Above is a typical phone plug, and beneath it two jacks. It can be seen that if the plug is inserted in the jack it makes contact with the blades.

tricity coming from the aerial does not confine its entire energy to the wire itself. It throws out some effect into the ether along the wire, just as a fast-moving express train will cause a very strong current of air in the neighborhood of the train.

Now, if we have another wire and place it near to this coil on the oatmeal box, at



This is a typical transformer used for what is called "audio frequency."

such a distance that the magnetism thrown out by the first current will reach the second coil, this magnetism will create an actual current of electricity in the second coil even though the two coils are not connected to each other by any metal.

We say that the current in the second coil is caused by "induction" from the first. The strength of this second current will depend very largely upon the nearness of the second coil to the first one or upon the relative direction of the two coils—that is to say, whether the second coil is parallel to or diagonal to or opposite to the first coil.

The magnetic influence which causes this second current is the induction and the position of the second coil with reference to the first is called "coupling." As this coupling governs the amount of current in the second coil it is important that it should be capable of being varied, and this we do by means of winding the second coil on some sort of ball or cylinder form that can be turned on an axis. This varies the coupling and we get what we call a "variocoupler."

A variocoupler, then, is simply an instrument which contains two coils of wire which are not directly connected to each other. The current of electricity goes through the first coil and, by means of this induction or the magnetism thrown out by the current, creates another current and a similar one in the second coil.

There are many forms of couplers, but the one which is in most common use now is the variocoupler which has the second coil mounted upon a shaft that can be turned around, and this is the kind of instrument which you use in most of the receiving sets today.

I spoke of the first coil as being similar to a pipe carrying a stream of water around the oatmeal box. Let us carry this similarity even further. Let us imagine that each of the first ten turns of this coil of pipe has a spigot in it and each tenth turn of the coil after that has a spigot in it.

Let us even imagine that this coil of pipe is used for refrigerating purposes. It then will follow that the more turns of coil through which we run the brine, or whatever it is that is creating the cold—the more turns of coil around which we run this—the greater will be the cold created in the atmosphere about the coil.

Now, suppose we open the very first spigot which allows the brine to run around only one turn of pipe. You can very easily see that the air around the coil would not be nearly so cold as though we had opened the spigot at, let us say, the fiftieth turn and allowed the brine to run around fifty turns of the coil.

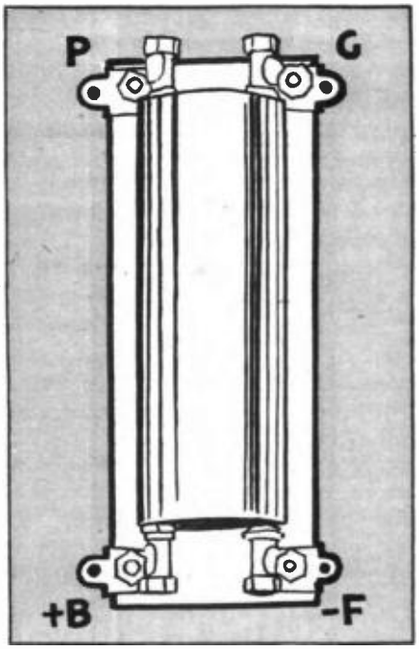
A wire is the pipe of electricity. Just as the number of turns of pipe we use varies the amount of cold around the coil in the refrigerating system, so the number of turns of wire around which we let the electricity flow will vary the inductance of the coil.

Instead of having spigots, we attach short pieces of wire to the various turns of the coil and lead these short pieces of wire to little metal contact points over which a switch blade can revolve. When the switch blade is on a contact point, it opens that particular spigot and allows the electricity to flow down.

So by moving the switch blade we can allow the electricity to flow around one turn of the coil or around five turns or ten or fifty or any number of turns we want, and this also varies the induction and changes the tuning of the set.

You will find these switch blades and contact points on almost all receiving sets, and that is the purpose for which they are intended—to open different spigots to allow the electricity to escape after having gone around whatever number of turns of the coil we wish it to.

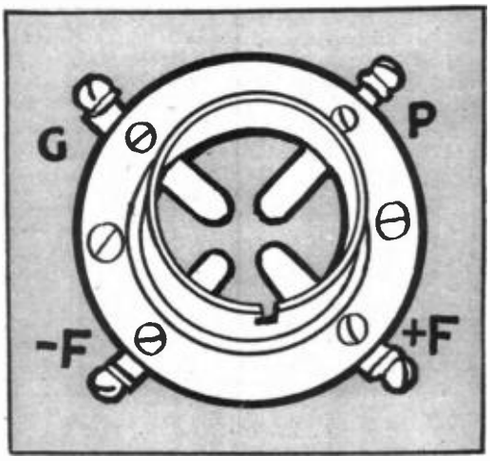
These switches are known as "tap switches" and there are usually two of them—one set which taps each single turn of wire for a few turns and the other set which taps the wire in larger blocks. By using the combination of the two tap switches we can use any number of turns of wire that we want—that is, we can let the electricity go into the coil at the third or the fourth tap and let it come out of



This is a standard transformer made for what we call "radio frequency."

the fiftieth or sixtieth and so get odd or even numbers or any combination of numbers of turns of wire that we desire.

A variometer is much like a variocoupler in so far as it consists of two coils of wire, one wound around a form which is



This is a view looking down upon a socket for a tube. There are prongs in the base of the tube which make contact with the blades shown inside the socket.

stationary and the other wound around a form which may be either a ball or a cylinder which turns on an axis and so varies the inductance.

But the difference lies in the fact that, while in the variocoupler the coil of wire which turns is not connected to the coil which is stationary, in a variometer the two coils are actually connected by metal and the electricity flows first around the outside coil and then in and around the inside coil which turns.

This virtually means that we make the current of electricity have an inductive effect upon itself as it goes through the second coil. You need not bother to know why or how this is done, but need only know that by turning this inside coil we can vary this amount of inductance and so vary the tuning.

I do not show a variometer in the single-circuit set dealt with in the other article in this issue of *Radio in the Home*, but they are commonly used instruments and very useful and so it is well for you to know just what they are.

Next to the variocoupler on the panel we see a little knob with a pointer that revolves around a little scale. This is the knob of the "rheostat." Here is another word that confuses the average beginner and yet, like all of the other terms used in radio, it is really very simple.

A rheostat is simply the spigot by which we regulate the amount of electric current that we allow to flow in and light the filament of the bulb. A rheostat is made of wire, but it is a different kind of wire from that which we have around variocouplers and variometers. In the variocoupler, the wire is made of copper, which forms the easiest possible path for the flow of electricity. In a rheostat, however, the wire is made of a material which offers the most resistance possible to the flow of the electric current so that, with a certain amount of this wire in the circuit, the resistance will be so great that no current will flow.

When we turn the handle of the rheostat we move a blade on the back of the panel and this blade passes over this resistance wire in such a way that it includes more or less of the resistance wire in the circuit or else cuts the resistance wire out entirely and allows the full amount

(Continued on Page 29)

Editorially Speaking—*and*

THIS issue of "Radio in the Home" is dated June. The last issue of "E-Z Radio" was dated April. The May issue was dropped in order to give us time for reorganization and perfecting plans for this larger and more ambitious form. Subscribers will therefore have their subscriptions extended one month to make up for the lack of this May issue.

By HENRY M. NEELY

RADIO today is suffering from a serious congestion of big words.

The average man, who cares nothing whatever about the scientific end of it, is being constantly repelled every time he picks up a newspaper or a magazine, by seeing new words whose inventors seem to be after the marathon record in adding syllable upon syllable. Every time a scientist — who knows nothing whatever about human psychology—invents such a word as "super-heterodyne," "neutrodyne," "capacitatively coupled," and so forth, he holds back by a certain decided percentage the onward spread of radio as a popular hobby.

These words have no business in a general discussion of radio. You may think that I am making much out of a minor matter, but it is really of major importance, as I think any one will admit who has followed the merchandising plan of the automobile, the piano, the talking machine and other such widely used appliances.

If the manufacturers of the automobile in the early days had attempted to use long descriptive, scientific names for each new type which was put out, the automobile would not be one-half as far advanced in its use as it is today.

Very, very few people know the difference in mechanical design or technical construction between a Packard and a Ford car. Everybody knows the difference between a Packard and a Ford so far as performance and class and quality are concerned.

The greatest selling argument in the world today is an individuality—a personality. The moment you attach a man's name to a product you individualize that product, and the public does not care about the technical insides of the apparatus that the factory puts out. Smith Brothers' cough drops are the most popular cough drops, not only because of their advertising, but because the Smith Brothers are personalities in the popular mind.

The ignorance of popular psychology that has marked the development of radio so far is one of the most flagrant examples of the stupidity which is holding back the development of this new hobby. This ignorance has manifested itself in no way more strikingly than in the confusing and repellent-looking terms that are applied to each new circuit that is developed.

The two most popular circuits for beginners during the last year have been the Flewelling and the Reinartz.

Very few amateurs know the principles involved in these two circuits, but they were easy to talk about and attractive to think about because each one had a man's name attached to it and each one was first individualized.

The Flewelling circuit and the Reinartz circuit are no better than many circuits that have been gotten out recently, and yet they have made a very widespread appeal, and I attribute it almost wholly to the fact that they are named after personalities, and not after scientific terms which attempt to embrace the entire method of operation in their many-syllabled completeness.

The "inverse reflex" circuit is a much better circuit that either the Flewelling or the Reinartz, and yet 50 per cent of the possible users of it will be kept away from it merely because of the complicated looking name which has been attached to it. That is the circuit with three tubes which is given in this issue of *Radio in the Home* under the title of "The Ideal Vacation Set." If this circuit had only been called the Grimes circuit originally, as was the case with the Flewelling and Reinartz, I believe that today it would be a lot more popular. Let us, then, simply refer to it as the Grimes circuit and let it go at that.

The latest development of radio, the "neutrodyne," is going to suffer considerably because of the unattractive look of the word which has been chosen to designate it. This word, as is the case with all words chosen by these laboratory scientists, is very inclusive in its meaning—if you understand its meaning. The trouble with such words is that they try to tell everything about a circuit as a scientific description.

The average fan is not interested in the scientific reasons for the circuit. If he knows that this circuit has been developed by Hazeltine he will think of it as the Hazeltine circuit, and it will then have a personality behind it and it will be individualized in his own thought. It will also be entirely free from that unattractive aspect of forbidding scientific difficulties which is suggested by such as word as "neutrodyne"—to say nothing of the difficulty of learning how to pronounce it.

Let us, then, forget these scientific terms and try to give radio a heart and soul and body and a personality by individualizing it with the names that can easily be remembered and that do not cause confusion.

So far as I am concerned, these circuits to me are hereafter going to be known as the Flewelling, the Reinartz, the Grimes and the Hazeltine. In their fundamentals one is no more difficult than the other, and it is a mistake to call them by names which will only result in confusion in the mind of a novice.

* * *

WHENEVER you see a new magazine come out on the stands, you turn the pages curiously and you look inside for a long dissertation on the editorial qualities that are going to be incorporated in the magazine.

For the benefit of those who are seeing *Radio in the Home* for the first time, let me say that no such dissertation is necessary here. This magazine is merely a continuation and enlargement of the magazine which I have been running for the past year under the title of *E-Z Radio*. That little magazine grew by leaps and bounds to such an extent that I found that the small form in which it was printed was totally inadequate to the demands made upon it by its readers.

I have, therefore, expanded in size and enlarged in editorial scope so as to take care not only of the very large portion of readers who want—and always will want—detailed instructions in hooking up the latest circuits, but will also take care of the growing proportion of readers who do not want to know so much about hook-ups, but who do regard the radio set as a necessity in the modern home, and who want to be kept informed of the most attractive kinds of sets that are being put upon the market and the best methods of installing them in the home, so as to make them an added attraction in the furnishings.

Radio in the Home, then, will simply be a continuation of *E-Z Radio* with the addition of this home feature.

The title of this magazine has been chosen deliberately. For the past year I have been writing a daily series of radio articles for a newspaper syndicate, and these articles have been published under the title of "Radio in the Home, by Henry M. Neely," in thirty-three newspapers in

still Editorially Speaking

various parts of the United States and Canada.

The popularity which was accorded this series showed that the title was well chosen, and I have, therefore, simply adopted it for this enlarged form of *E-Z Radio* magazine.

Unlike any other radio magazine, *Radio in the Home* will be strictly a personal organ. I write virtually all of the stuff myself, and I do it for the simple reason that I do not care to adopt the theories and opinions of other people until I have had an opportunity to try them out very thoroughly myself.

This magazine maintains a completely equipped radio station at Delanco, New Jersey, with a special experimental license 3XP.

Here my technical assistant, Theodore F. Vollten, and myself build and operate every set which I write about in this magazine. I do not describe sets which are developed by others until we have tried them out ourselves and have been convinced that they are sufficiently easy of construction and operation to make them available for the general public.

It is for this reason that I have not dealt with the Armstrong "super-regenerative" circuit or with the Flewelling circuit. Both of these circuits are delivering wonderful results to certain people, but are total failures in the hands of the average novice. I have therefore considered them unsuited to the general reader and have not dealt with them.

The readers of this magazine can depend upon it that every set in its pages has first been thoroughly tried out and found good at station 3XP.

* * *

ONCE more the summer is upon us, and once more comes the bugaboo of lightning.

In spite of all the assurances to the contrary, the average person still regards a radio antenna as something that will attract lightning and endanger his house.

I wish I could print in letters a foot high across the face of every radio magazine the statement that a properly constructed radio aerial is the best safeguard against lightning that modern science has yet developed.

There has never yet been recorded a single instance where lightning has struck a house equipped with a properly constructed aerial.

Most people will admit that a lightning rod is a protection to any house. If they could only be shown the scientific aspect of a radio aerial they would see that a properly constructed and installed aerial is a thousand lightning rods all molded into one and that the protection offered by the ordinary rod is increased a thousand-fold by a well-equipped aerial.

Some day owners of houses will realize this, and they will put up radio aerials as protection against lightning whether they have radio receiving sets or not.

* * *

MAY I be pardoned for being rather personal for a paragraph or two? It is made necessary because of a great many letters received asking why it is that radio fans around Philadelphia no longer hear me announcing from station WIP. They want to know whether I have severed my connections with that station.

I have and I have not. That is to say, I have retired as director of the station in order to devote more time to the establishment of this magazine on the basis of prosperity which we all hope it will achieve. For that reason I resigned as director of WIP, but have not altogether severed connection with it. Mr. Gimbel asked me to remain as consulting director, and that is the title that I now hold—if it means anything.

This more or less theoretical relationship was established in the hope on both sides that I would be able to have this magazine sufficiently systematized by the fall to rejoin the staff at WIP, and I can assure radio fans that there is nothing I would rather do. I thoroughly enjoyed running a broadcasting station of that kind, and my association with WIP has been delightful in every way.

* * *

RADIO is going to play a very much more important part in our lives this summer than it did last year.

A year ago the broadcasting stations were very largely in an experimental stage. The transmitting sets were very fine of their type, but in the last twelve months this type has been immeasurably improved, and today we have powerful Western Electric transmitters that will ride right through the worst kind of summer static for a radius of fifty miles or more.

I do not mean to say by this that static is not going to be a nuisance. It will be this summer and for many years to come, but it will not interfere with reception of signals this year nearly so much as it did twelve months ago.

The power that is developed in a broadcasting station of today is so great as to make the music and speech clearly audible even though a young lightning storm is hovering around the horizon of the receiving station. The static will be heard, but the strength of the signals will submerge it and it will not be nearly so annoying as it was in the past.

Last summer there was virtually no attempt made to use radio sets. This summer all signs point to the opposite condition.

Just within the last two weeks I have received a letter from the editor of a leading yachting periodical asking me to write a series of articles for him on how to install radio sets on small motorboats and yachts. I know of two other outdoor publications which are planning this same kind of series.

This indicates that the radio set is going to be a part of the equipment of a large percentage of vacationists this year. The broadcasting stations are also looking forward to an active summer, and are arranging their programs with a view to furnishing the kind of music and talent that will be most fitting for the summer holiday season and that will carry best through whatever static there may be.

Radio in the Home is joining in this movement to continue the radio enthusiasm throughout the warm weather. You will notice that we have in this issue an article on an ideal set for the vacation, and we are preparing others showing how to hook up small sets in such a way that they can be used in camp or in the summer cottage or on the motorboat or automobile.

So don't put away your radio set this summer when you go to the country. If the one you have is too big to be carried around, build such a one as the Grimes circuit shown in this issue or one of the others that we will show next month and the month following.

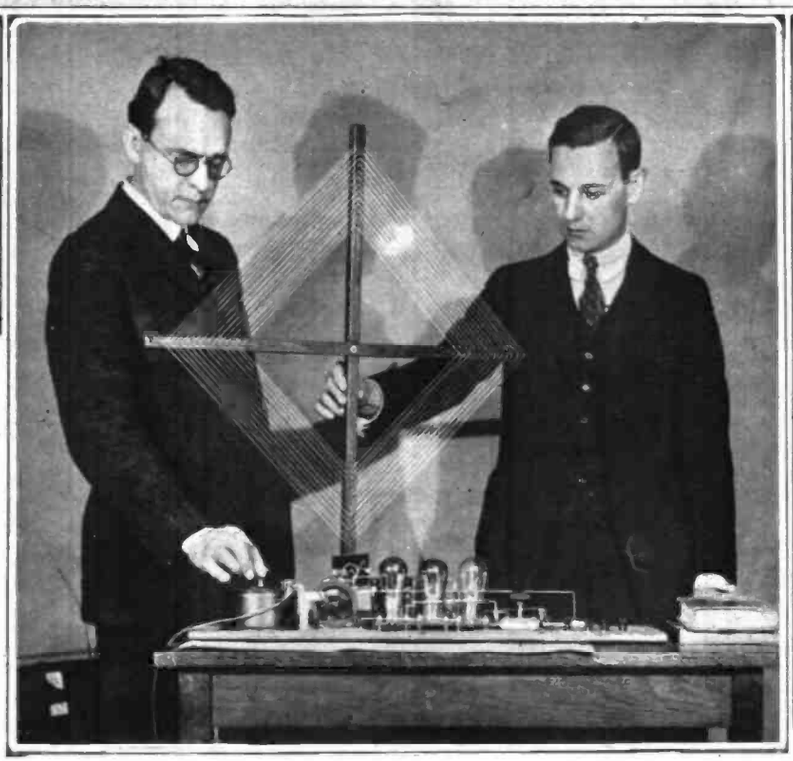
* * *

THAT steady whistle that you sometimes get when you are listening to a local concert is a terrible nuisance, isn't it? You usually think that there is trouble in your set and you start in to try to adjust it. You turn every knob you have in the place, your turn your bulbs down and up and fuss around and fume, and still you cannot get rid of the whistle. You try putting condensers across your transformers and you try everything that you can think of and still the whistle persists.

As a matter of fact, it is usually not trouble in your set at all. It is what we call a "heterodyne." That means that the

(Continued on Page 25)

An Ideal Vacation Set



Henry M. Neely and his technical assistant, Theodore F. Vollten, testing the first rough layout of the three-tube inverse reflex hook-up.

OUT at station 3XP, which is the experimental shack for RADIO IN THE HOME, we have been working for some time to try to pick out for you radio fans the ideal set to be taken on your automobile or your motorboat or your canoe this summer. We wanted something that would not have more than three bulbs in it and that would not require an outdoor aerial, and that would work just as well on dry-cell tubes as it would on the storage-battery type.

By "we" I mean the editor of this publication and his technical assistant, Theodore F. Vollten. We have tried out Lord only knows how many hook-ups that have been introduced to the public with the blowing of trumpets and the ringing of bells and we finally settled upon the circuit that is known among radio engineers as the "Grimes three-tube inverse reflex." This is a name which is enough to keep you away from the hook-up, but let me tell you right here that the name is a good deal worse than hooking up the set and nothing could be sweeter than the way the set operates when you once have it hooked up correctly.

You need not bother to know what an "inverse reflex" is, though I am going to tell you in this article before we get through, but it does not matter whether or not you understand my explanation just so long as you get your apparatus put together as it is shown in the illustrations here. The set will work whether you understand it or not.

First we built this set flat on a board for experimental purposes and found it to be so good that we then tackled the problem of putting it into a box suitable for the vacationist to take to camp or in his automobile or in his motorboat. I am showing in the illustrations with this article two different sets just as we hooked them up and tried them and we found each one to be so entirely satisfactory that I am sure you will be satisfied no matter which way you build it.

The table mounting of this set is perfectly good and the box mounting is fine for vacation purposes, though, of course, it is a good deal more complicated to get so much apparatus into a small space. Still I think with the photographs of this boxed-up set which are given on another page you will be able to solve your difficulties, although I doubt if you will get your set in quite such a small box as we did—or rather as Mr. Vollten did, for my clumsy fingers never would have accomplished it.

This circuit uses the tubes first as radio-frequency amplifiers and then it uses the same tubes over again as audio-frequency amplifiers.

Now right away the question comes to your mind, "How is this possible? Why don't the two frequencies mix?" This is easily explained by likening the tubes to a bowl filled with beans and walnuts. The beans represent the radio frequency and the walnuts the audio frequency.

If we take this bowl and shake it we find that the beans will all settle to the bottom of the bowl, while the walnuts will all rise to the top of the bowl. No matter how much we shake it the results will always be the same.

Now, the radio frequency that is coming into our set has its own path to travel and stays in its own part of the bowl, while the audio frequency, like the walnuts, stays where it belongs. So, with this in mind, we can readily see why two frequencies which are so different in relationship to each other as the beans and the walnuts, can go through the same tubes without interfering with each other.

This method of using the same tubes for two different operations is called the reflex system, and is very popular in Europe, but it has its disadvantages in this respect—that it overloads the last tube by making it carry the heavest amplification of both frequencies.

This is illustrated in the little sketch by the use of scales. Each pair of scales represents a vacuum tube and the arrows and lines represent the incoming radio signal. Let us say for convenience that it pulls the scale down so it reads a pull of one pound, and the next scale reads a pull of two pounds and the third scale reads a pull of three pounds. These increased pulls represent the increase of amplification of each tube.

Now, as shown in B. Fig. 1, the output of scale No. 3 goes back to scale No. 1 where, in the form of audio frequency, it again pulls the scale down another pound, and from there it goes to the next scale and pulls it down another pound and so on to the next. You can see that scale No. 1 has a total pull of two pounds, while scale No. 3 has a total pull of four pounds as against scale No. 3 in A., where it has a pull of only three pounds.

By this illustration we can see that scale No. 3 is carrying the greatest strain and also the greatest amount of amplification.

Now to get back to the term, 'inverse duplex." This is illustrated by the use of the same scale as shown in Fig. 2. The incoming radio signal acts on the scales the same as shown in Fig. 1, A. But instead of the output of scale No. 3 going back to scale No. 1 it goes to scale No. 2 and pulls it down another pound, and from there it goes to scale No. 1, where it pulls it down one pound.

By looking at the total pull on all the scales we find that the pull on each is more uniform than that of Fig. 1, B. and also that

(Continued on Page 20)

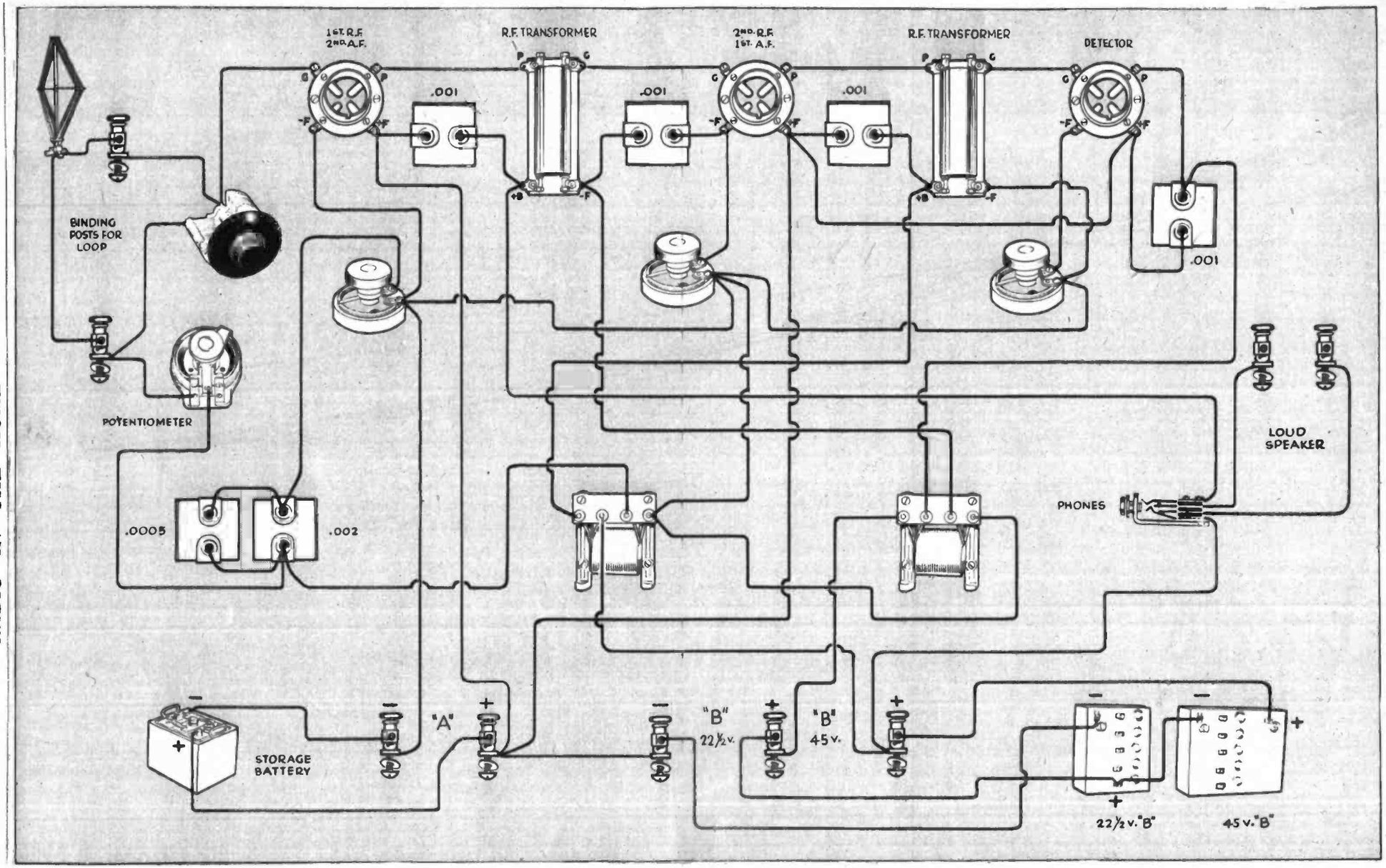


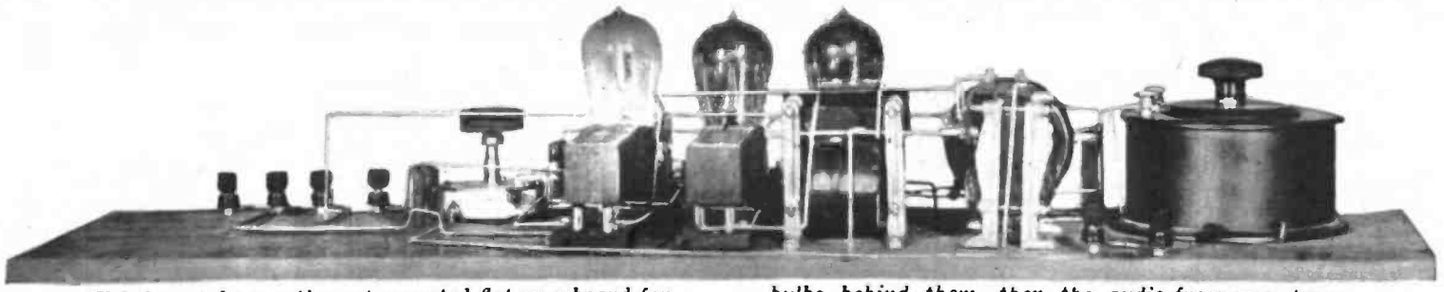
Diagram drawn by C. B. FAYKO

This is the complete hook-up for the Grimes "inverse reflex" circuit dealt with in this article. It is essential that condensers of the exact capacity shown in this hook-up be used. Any variation in these condensers will result in unsatisfactory signals or in total failure.

The wiring diagram must be accurately followed and short leads are desirable with an avoidance of two wires running parallel close together for any length.

The two binding posts shown connected with the two inner blades of the jack are for the permanent connection for the loud speaker.

The signals are tuned in by inserting the phone plug in this jack and when they are tuned sharply and loud the phone plug is pulled out and the signals are automatically transferred to the loud speaker.



The three-tube vacation set mounted flat on a board for testing looks like this from a side view. On the left we see, first, the binding posts and then the potentiometer, then the two radio-frequency transformers with two bulbs behind them, then the audio-frequency transformers with one of the bulbs behind the left-hand one, and then the variable condenser.

(Continued from Page 18)

the maximum strain is distributed between the first and the last scales.

By substituting vacuum tubes the idea would be the same. Instead of pull, there would be amplification distributed between the first and last tubes. This method prevents the overloading of the last tube.

The vacation set uses this arrangement of tubes, and the following is a description of how we built this set:

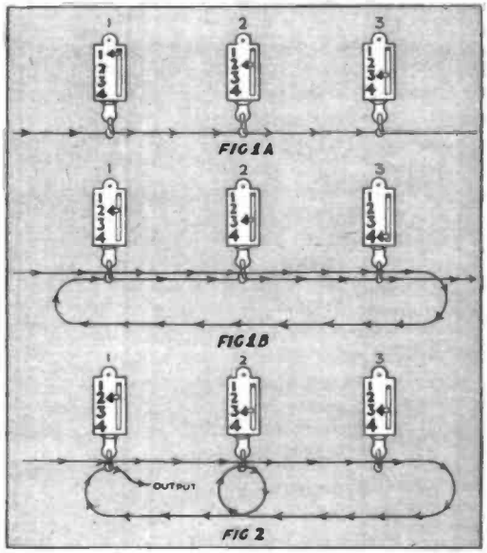
We chose the Grimes circuit for the vacation set because of its compactness and also its operation without having to have an outside antenna. We decided first to make a temporary hook-up and find out the good points. We used a board about twenty inches long and eight inches wide. On this we placed the parts necessary for its operation.

On the first try-out it worked fine, and on a small one-and-one-half-foot loop we got remarkable signal strength from station WDAR, some fourteen miles away, and the beauty of it was that we had no difficulty in tuning them out either by the use of the condenser or by turning the loop.

The parts necessary to construct this receiver are:

1 23-Plate variable condenser (vernier);
3 Tube sockets;
1 Vernier type rheostat;
2 Radio-frequency transformers;
2 Audio-frequency transformers;
1 400-ohm potentiometer and rheostat (Acme Pot. Rheo);
4 .001 Dubilier Micadon 601 condensers;
1 .0025 Dubilier Micadon 601 condenser (or one .002 and one .0005) joined as shown in the diagram);
2 UV-201 tubes;
1 UV-200 tube;
1 45-volt B battery;
2 22½-volt B batteries;
1 pair telephones or loud speaker;
1 Loop, 1½ foot square, wound 14 turns of No. 22 silk-covered wire.

Now for the arrangement of the pieces of apparatus. The two radio-frequency transformers should be placed behind the tube sockets, as shown in the photo, and the last socket is to be the detector. The transformers are to be so placed that the grid and plate leads can be run very short to their respective sockets. In fact, it is always desirable to run all leads this way. The shorter the wires can be run the better the set will operate, but care must be taken that no leads touch each other and you should try to run them so that no two wires are running alongside of each other close together.



These diagrams show the action of an "inverse reflex" circuit, as explained in the article.

The audio-frequency transformers are placed to the left of the tube sockets, and should be placed so that they are at right angles to each other.

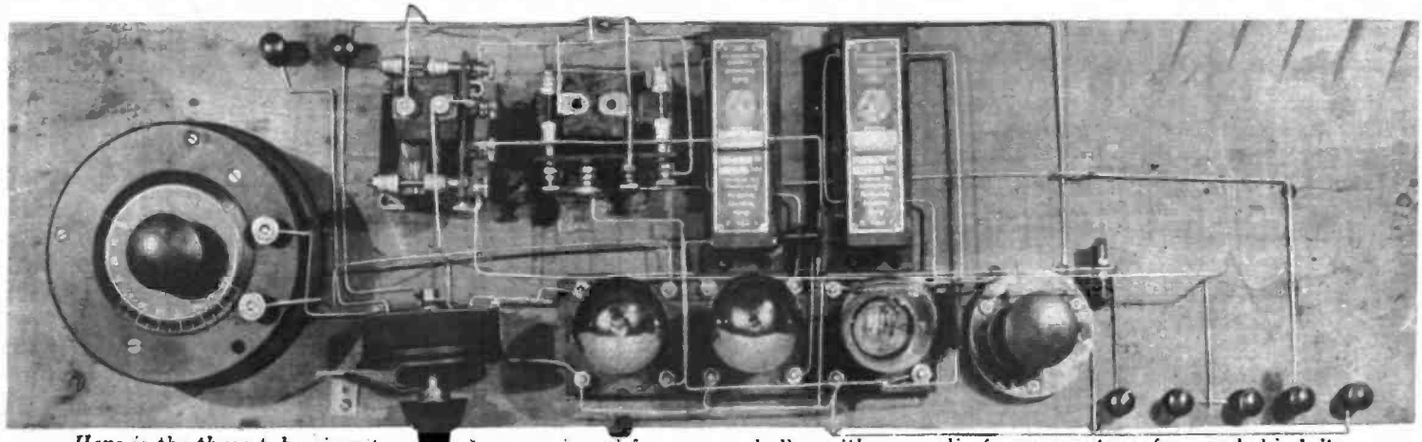
Take the vernier rheostat and place it near the third tube socket, because this is the detector tube and a fine adjustment is necessary. The other rheostat controls the filaments of the other two tubes and should be placed near them.

Now let us say that we have the receiver all finished and are ready to give it a trial. First, we place tubes in their sockets. The first socket and the second hold the two amplifier tubes, which are the UV-201's, and the third socket holds the detector tube, which is the UV-200. We turn on the two rheostats to light the filaments of the tubes. The rheostat that controls the two amplifier tubes is turned on full and the detector tube rheostat is turned on about three quarters of the way.

Then point the loop in the direction of the broadcasting station and slowly turn the variable condenser until the signals are loudest. The detector tube rheostat will have to be either raised or lowered to get the greatest signal strength.

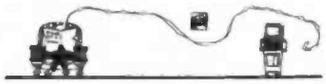
There are several things in this receiver

(Continued on Page 28)

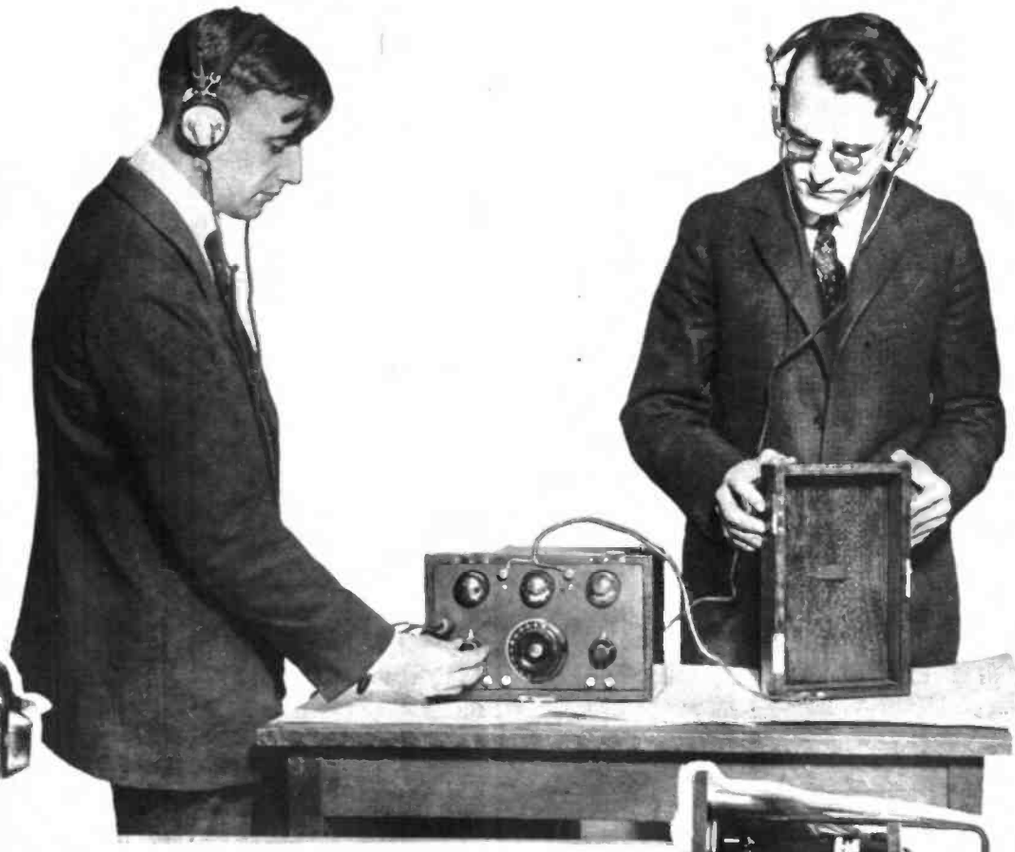


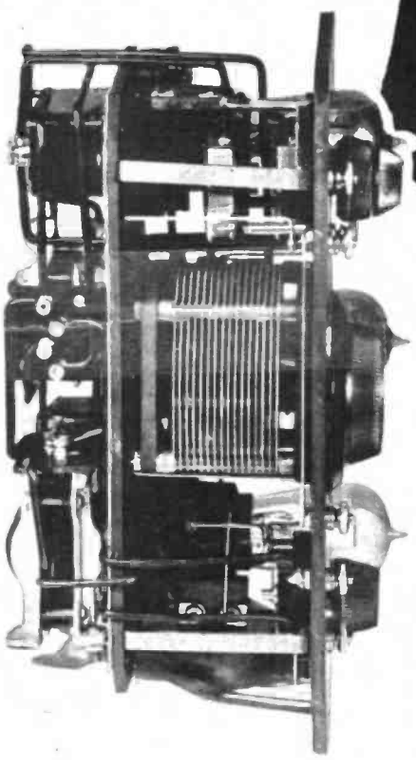
Here is the three-tube circuit mounted upon a board for testing, the view being taken looking straight down on the board from above. On the left we have a variable condenser, then the double rheostat with one of the audio-frequency transformers behind it, then one of the bulbs with an audio-frequency transformer behind it, and then two more bulbs with two radio-frequency transformers behind them, and then the potentiometer and to the right the various battery binding posts

THE IDEAL VACATION SET IN ITS NEAT LITTLE CABINET



The new three-tube Grimes circuit described in this article can be mounted very compactly and efficiently in a small box as shown in these pictures. The loop aerial is wound on the inside of the lid of the box and this lid is detachable.
To the right, Mr. Vollten is tuning the set and Mr. Neely is turning the loop to get the loudest strength of signals.

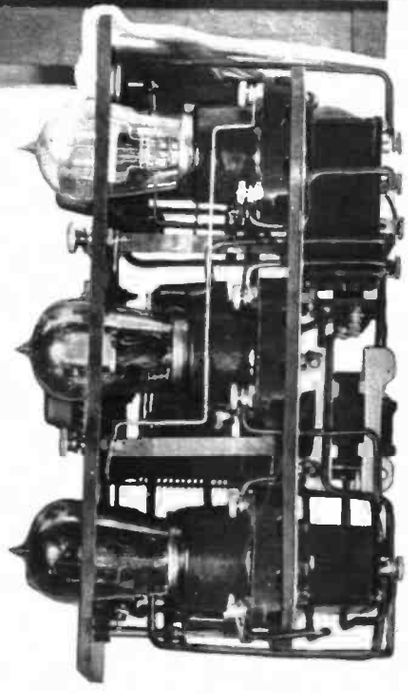


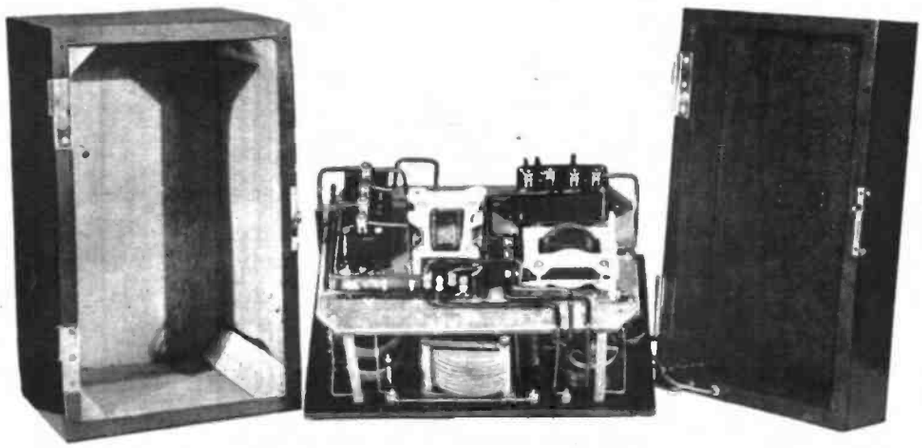


The pictures to the left and right show the insides taken out of the cabinet in the picture above. The two photographs show the front and back of the apparatus and give a good idea of the compact way in which all of the various parts are mounted.

There are really two panels, one for the dials of the instruments and for the holes through which the bulbs are slipped, and the other for the sockets of the bulbs and other parts of the apparatus, and on the back of this second panel are placed the four transformers.

The back of this panel is also shielded with a sheet of aluminum and this can be grounded if desired in order to prevent the annoying phenomenon known as "body capacity".





To the left is the vacation set taken apart. First there is the box in which the set is inclosed. Next is the set taken out of the box. Then there is the detachable lid of the box, around the inside of which is wound the loop aerial.

Entertaining with Radio

BY SIDNEY LEAR

Heading by Norman Neely; illustrations by Neely McCoy

SIDNEY LEAR

THERE'S something new in the way of entertaining, at last! For years people have been trying to find it. They've given huge, elaborate parties, calling them by queer names, and dressing them up in gorgeous and amazing decorations.

But they never fooled anybody. You went, you spoke to your hostess, you felt rather foolish in your trick costume, you danced, or you were bored with dancing and played bridge, lost a lot of money perhaps, and at last went home thinking the good old thought, "There's nothing new under the sun."

Times change. Just in the last two months, a new kind of party has sprung up. "Mr. and Mrs. John J. Johnson," the society columns began to announce, "gave a radio party last evening in honor of their daughter, Miss Jacqueline Johnson." And further down, "Mrs. Thomas T. Thompson entertained at a radio luncheon on Tuesday afternoon at her home." Something really new. At last!

"Oh, well!" you may sniff, disdainfully, "that just means that they had some people in for the evening or for lunch, and then they all sat around afterward listening to Father or Little Jimmy get distant stations!"

Now, just wait a minute, scoffer! Maybe you have been to some parties like this, but that was before radio became so established as it is now.

However, it isn't necessary now to be satisfied merely with the thrill of listening in on somebody's radio. if the hostess does a little bit of preparing before her guests arrive. The usual method is for every one to sit facing the loud speaker. in a semicircle. Conversation is interested and vivacious at first. but in time the hostess is sure to notice. if she's on the lookout, that old Mrs. Jones has a somewhat set expression in her smile, and that her daughter, Mary, is plainly fidgeting with embarrassment.

That's the time for the hostess to get busy. And this will work just as well if she has a really large, more formal party. It's very simple, her method of injecting pep into the evening—just a tiny pad of paper, and a pencil for each guest, and the injunction, from the hostess, to write down their guesses of the call letters and location of the next selection they hear over the radio.

There's nothing like a guessing contest to clear up a sleepy brain and brighten a dull eye. Old Mrs. Jones' smile will sharpen into real delight when she finds that her guess was the correst one, and if the hostess is thoughtful enough to provide some little prize, such as a favor of some kind mounted on a cake of chocolate, even Young Tom Jones will be glad to turn his attention from the working of the set to the contest.

Another game suggests itself, to be played as a variation from the other, or to while away the time during the broadcasting from some local station which may be uninteresting—it's impossible to please all the people all the time, you know—and yet hard to tune out.

This also calls for pads and pencils, and consists in "building a radio set"—that is, writing down as many names of necessary parts as can be remembered without asking or looking them up. Some of these lists will be pretty funny, as there are a great many persons who still think that the code is an important feature of a set, and that a variocoupler is just a fancy name for a condenser. so it will be worth while to have them read aloud.

The radio dance is an old story, but it is too delightful an affair to be left out. With games, occasional listening in, or some singing by the guests themselves, filling in the time until the late dance music begins from some cafe or hotel, these parties have become regular features of social life.

Where the set is placed near a window, it is possible to dance on the lawn of a moonlight night, and at other times there are various way of providing enough light to prevent the dancers from bumping into one another. And any member of the younger set will agree that that's all you need!

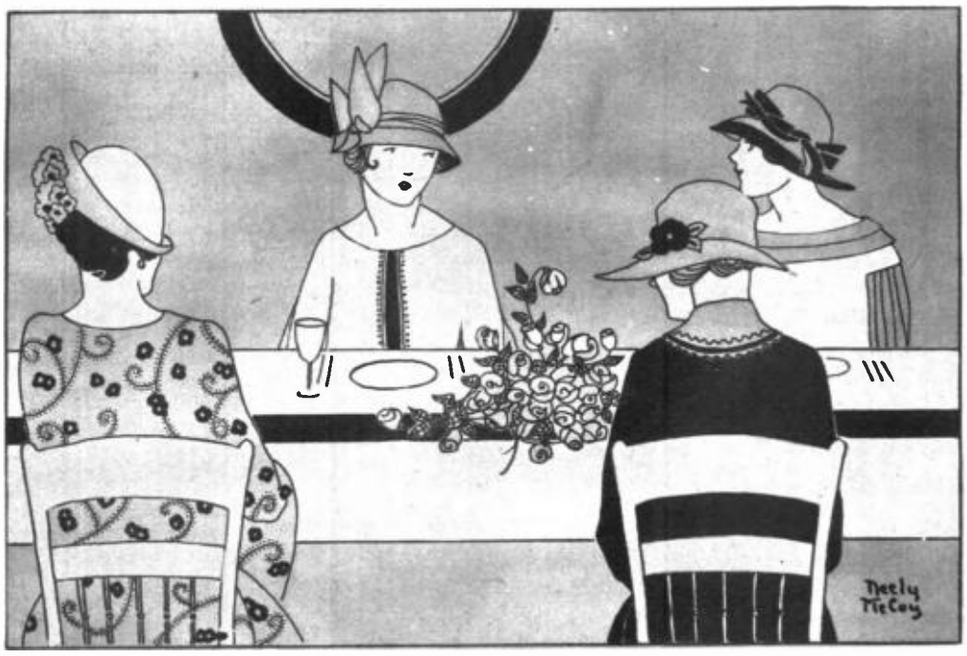
One such dance, held recently at a large place in which the drive encircles a plot of smooth grass just exactly large enough for a few couples to dance in comfortably, was lighted by automobile lamps. Several of the guests had come in their cars, and these were driven, nose-front, up to the edge of the dance "floor," their lights being kept on.

Incidentally, June is the month of bazaars, fairs, fetes, all kinds of sales for charity, called by as many kinds of fancy names. And May is the month in which plans are laid for these affairs.

The committee that is expecting to hold its sale on the lawn of some one's beautiful country place will have a money-saver as well as maker, if the house is equipped with a good radio set and powerful loud speaker, as this can be used for the usual dancing. A floor could be put down somewhere near the house, and a gate-keeper appointed to exact

an admission fee from every would-be pair of dancers. The floor should be surrounded by either electric lights or Japanese lanterns, hung on specially erected wires.

And another special feature for the summer fete will be the bedtime stories, reproduced, of necessity, loud enough for everybody to hear. But only by paying five or ten cents will the little tots and their mothers or nurses be able to sit down on nice comfortable chairs while they listen.



A springtime luncheon — somehow it never seems like summer until June—is always pleasant, with the windows of the dining room open to let in the soft fresh air, the song of the birds and the sweetness of the new flowers in the garden. But a luncheon given recently by a prominent society matron was an even greater success than such entertainments usually are, in spite of the fact that it was a difficult occasion. The guests knew one another only slightly, having come from different cities as delegates to a convention. There were not many, as those invited were only the members of a committee of which their hostess was chairman. But the ice was thick and cold when they assembled in the living room of the lovely country house, and the hostess might well have been worried about how she would break it if she had not prepared for that very possibility.

She led the way to the dining room with her head high and her mind serene. And sure enough, a little murmur of admiration cracked the ice a bit as the delegates took their places.

The table, beautifully appointed in every way, was covered with a white cloth, the length of which ran a wide American Beauty ribbon. In the center of the table was a mass of roses. Just that. There was no visible bowl or vase or holder of any kind, just a mass of glorious roses, with trailing asparagus waving gracefully in the light breeze.

Everybody began to talk at once. This enthusiasm lasted all through the fruit cup, and Mrs. Boston and Miss Richmond almost got acquainted over it. But of course it died down, as all such bursts of enthusiasm do, and the ice almost froze over again, when, without warning, a man's voice, beautiful, sympathetic, tenor, rose from somewhere singing a solo, to the accompaniment of a delightful touch on the piano. Mrs. Boston turned to Miss Richmond in astonishment, but Miss Richmond was staring out the window. Mrs. New York City dropped her dignity and laid a beseeching hand on the arm of her hostess.

"Where does it come from?" she begged "Is it really under the roses? Have you a tiny Victrola there? You couldn't have a radio set under the table?"

The ice was broken into little pieces, and everybody became friends in the general questioning and wondering and surmising, until the hostess explained the mystery.

The voice—it had now become a violin solo—really did come from the midst of the roses. She had placed the earphones of her radio set, a powerful one, in a glass bowl, which acted as semi-loud speaker. The dark-covered wires were curled up in the bowl, the ends being connected to a line of thin wire. This was carried out of

the bowl, down the length of the table, under the ribbon, to the hostess' place, where it fell to the floor and was taken on out of the room to the set, the end spliced to a shorter piece and both fastened to the horn posts of the loud-speaker power box. The bowl was covered with a wire fly-screen of dome shape, this, in turn, concealed by the roses thrust through the openings in the wire. And the asparagus masked any uncovered bit of either bowl or screen. An operator, stationed at the set in the next room, with another pair of phones, manipulated the knobs and cut out tell-tale announcements.

And teas! Somehow there's something about a tea, even if it isn't a debutante affair, which makes you want music. Most families cannot afford to have both a good caterer and an orchestra, and so they compromise on the expensive caterer. But now that radio has reached this wonderful state of perfection, and is so constantly growing and improving, it is perfectly possible to have both the good food and the good music, with a radio set instead of a blank corner over there back of that mass of palms and rubber plants.

A set is now made on a tea-wagon, with a loop aerial on a standard attached to the table, so that it can be wheeled about to any room in the house, out on the porch, or down into the garden. The cost for the whole set is $500. Just to see it makes you want to give a party, if only for the sake of letting your friends see how attractive it is.

Out on the porch of a summer evening pretty girls in pretty frocks, swinging a gayly cretonned hammock in time to some music, joining their own young voices now and then to those of some chorus singing a well-known song, boys perched on porch railings smoking meditative pipes as they listen to a love song, plaintively played by some violin hundreds of miles away—that little teacart with its marvelous power would be right in its element.

There are few women who would take the long trip from their suburban or country homes into town on a hot morning to hear a lecture, even if it happened to be given by some expert cook, or a traveler with wide, varied and exciting experience. But none of them would refuse an invitation to spend a morning or an afternoon sewing, knitting or just resting in a comfortable chair on the shady side of some one's garden, while the lecturer's voice was being caught and radiated by this tea-wagon radio set. Another tea-wagon, bearing sandwiches and lemonade, would turn this into a party in no time.

Did somebody say just then, "Well, this is all very well if you have a big expensive set, but how are you going to entertain with a crystal set?"

The answer to that is, you can't, unless your guests are willing to take turns with the earphones. With four pairs of phones, you can have a nice small party at which everybody can listen in at the same time.

A most enjoyable "song - fest" would be possible in this way, with the harmony close in every sense of the word. But it is impossible to give a dance with the aid of a small set. The crystal set is like the individual tart for dessert — perfectly delicious, but very exclusive.

However, the radio fan who has just one pair of earphones and a mere crystal set can do something that nobody else can do half so well, in the way of entertaining. And that is, ask four people in to play bridge of an afternoon or evening. It is well known that anybody who talks above a whisper during a bridge game is a nuisance and would be immediately put to death if the players had anything to say about it. And so, of course, any host or hostess who insists upon connecting a loud speaker to "entertain" the guests at this time is in the same criminal class as the talker.

Radio in the home of E. G. Keyenthaler, Wynnefield, Pa.

Photo by Harry S. Hood; courtesy of N. Snellenburg

But it is also well known with five playing, one person must always be cut out, and that person is likely to have a dull time. There is usually little to do except stroke the soft fur of the Angora until she spits angrily, play with the dog until somebody at the table protests, or look through all the old magazines on the table.

Consequently, this fifth person is seldom invited—never, in fact, unless he is the guest of a guest or some such unavoidable addition to the party. With the radio, however, extras may be included in the invitation with perfect impunity as the one who cuts out can be amused and entertained by listening in until the hand is over. This makes possible the neighborly habit of asking two nearby couples to "drop in for some bridge" without causing awkward explanations and self-effacements.

Children's parties may be enhanced in bright spots for the little tots by using the privilege of listening in as a prize for some of the games. Incidentally, this will save mother and dad the price of a prize or two, which is an advantage not to be overlooked! As a measure of safety, though, have the children and the radio in separate rooms except when the children are listening in, as otherwise there will always be the danger of having some adventurous and curious young mind wonder too concretely just what the crystal is made of, or how the batteries work.

Being left out in the game of "Going to Jerusalem" could be turned into a pleasure instead of a disappointment, if it meant being allowed to wear the earphones until the next player dropped out. It would be exciting, too, to see how much of a selection you could hear before you had to stop.

Then, as a finish to the party, a grand march with the radio set as the ultimate goal would send each child home with something fresh in that busy young mind to tell mother and daddy.

How thankful mother is nowadays for this invention which brings sunshine into the nursery on rainy days. In summer a stormy day is especially hard on her, since the warm weather makes young hearts long for the outdoors, and the restriction of the house makes young legs restless and young people spirited. How lucky for her that she has this method of entertaining to grant as a special favor when toys seem to lose their charm and animal spirits threaten to break loose.

With glue, some tissue paper, a hat box and a piece of picture wire she can also rig up a game that will cause giggles of delight to chase away the frowns of discontent.

The very mystery with which she holds up a warning finger and says, "Now, wait, I have a game you've never played before!" and then gets her strange ingredients from some hiding place, will make them stop, look and listen right from the start.

Then their interest and suspense will grow as they watch her cut a generous round hole in the middle of the bottom of the hatbox and paste a piece of tissue paper over it so that the edges are well covered. This box is then hung up on the wall by means of string fastened to one side of it and looped over a picture hook or sidelight fixture. It is placed with the open side toward the wall, the lid being discarded, so that the paper-covered hole presents a convenient target at a comfortable height for a child.

"Now," explains mother, putting the paste away very carefully in her sewing basket and picking up all the pieces of paper and hatbox, "that's a radio crystal, and the hole is the sensitive spot. Here's your cat's whisker; who wants to be the first to try to find the spot?"

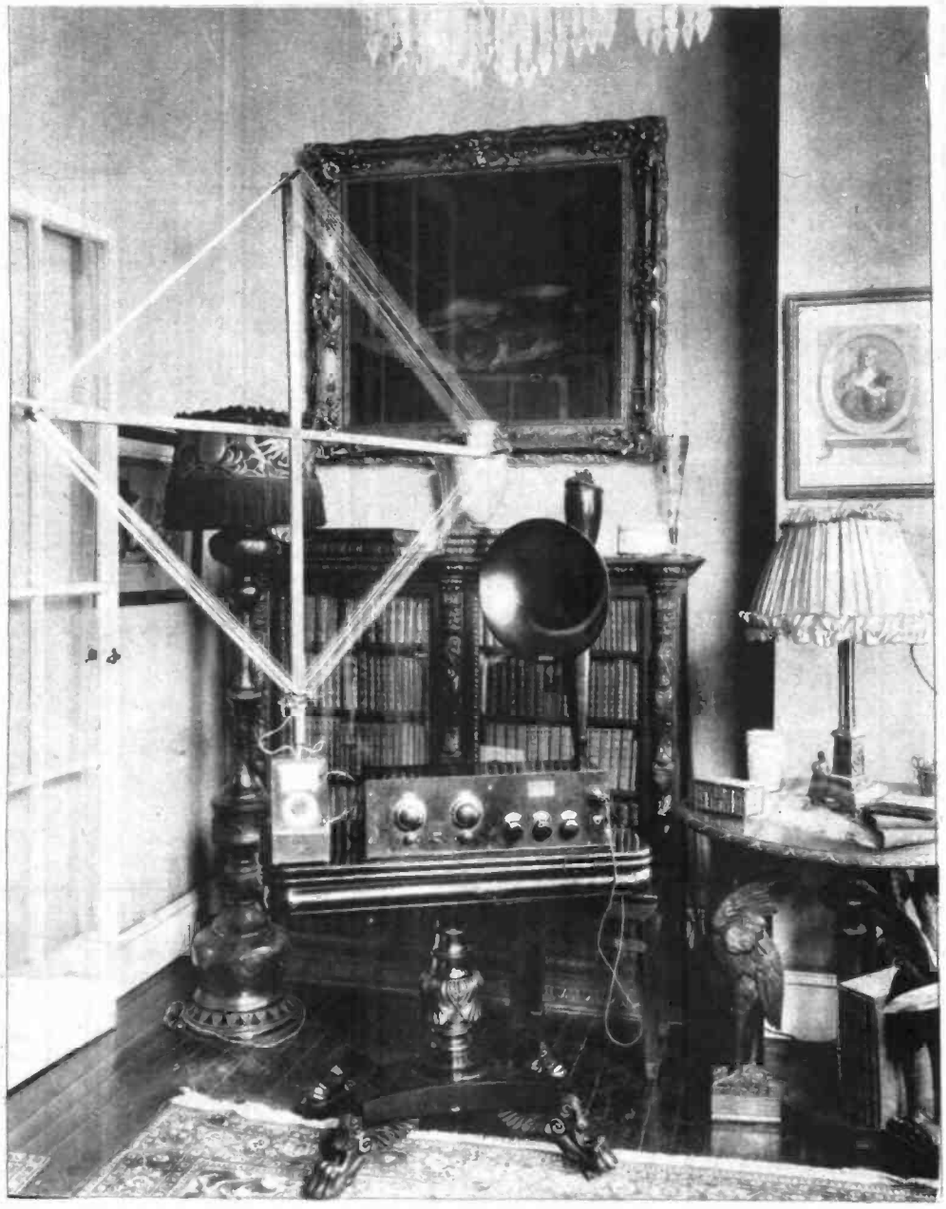
Choosing one child out of the rush that results, she blindfolds him with one of daddy's big handkerchiefs, gives him the piece of picture wire curled like a detector, turns him around three times, in the immemorial manner of the old "pinning the tail on the donkey" game, and starts him in the right direction. If he can break through the tissue paper with one straight thrust — he is allowed three! no feeling

is permitted; each must be a lunge—he is permitted to listen in until somebody else is successful. Yes, and all the time the hole in the "crystal" is being repaired with new tissue paper he can listen, too.

As it seems to be the fashion to say that radio is "just in its infancy," we may say that radio entertaining is also just a babe in arms as yet. A number of different ways and means have been mentioned here; no doubt by the middle of summer as many more will have suggested themselves. By the time of opera season next year we shall probably have box parties in our homes of men and women in business dress enjoying Puccini, Wagner, Verdi and the rest simultaneously with the gorgeously clad audience in the diamond horseshoe.

We shall probably have—but, as far as that's concerned, we may by that time be dancing in time to music played by some orchestra on Mars. Radio's young, but it's an astonishingly healthy baby!

And just watch it grow during the coming winter!



Radio in the home of Gustavus W. Cook, Philadelphia
(The set that received Los Angeles on inside loop)
Photo by Harry S. Hood; courtesy of Walker & Kepler

The outdoor dance is the leading form of evening entertainment in summer colony life. The broadcasting stations know this and are arranging to furnish a great deal of popular dance music from now until next September.

With the new circuits developed during the last six months, it is now possible to hook up a set that occupies a very small space and that will yet give efficient reception of this dance music on loud speaking horns, so that vacationists can enjoy their dancing this summer with a very much finer class of dance music than they have ever had heretofore.

All of the broadcasting stations have also arranged to furnish an unusually complete service in giving the results of various sporting events every evening, so that the man in his camp, cut off by all other methods of communication from civilization, can still keep track of his favorite baseball team or his golf heroes or any other hobbies which happen to be his.

Editorially Speaking

(Continued from Page 17)

beat or the frequency of vibration of the local station that you are listening to is just slightly higher or lower than the beat or frequency of vibration of some other station which is more distant, but which is still coming in strong enough to interfere, and these two beats coming at slightly different periods come together every so often per second, probably a thousand times or more, and this is the note that you hear as a whistle.

To test this, wait until the local station has signed off for a few minutes, or wait until there is a pause between the numbers, and then tune down your own set a little lower or up a little higher. In almost every case you will there find the station that is doing the heterodyning.

This whistle is caused, not by the signals themselves, but by what we call the "carrier wave." The heterodyne, or whistle, will continue even where there is no speaking or singing so long as the two carrier waves are on the air.

But let the local station sign off for a few minutes or let the distant stations sign off for a few minutes and take the carrier wave off the air, and immediately the whistle will stop.

Most of the up-to-date stations nowadays have test stations within a few miles of them to listen in and report by private land line to the operating room just how the signals are coming across. These test stations, being in charge of experienced operators, can detect this whistle, or heterodyne, immediately. The first thing they do is wait for a pause and then find out what station is doing the heterodyning, and then they call up the operating room of their station and tell them to raise or lower the wave, whichever seems to be the easiest to do to get away from the heterodyne.

Many stations do not have these test stations, and so, if you hear this constant whistle during a transmission period, you would be doing no more than your duty if you were to call the station up and tell him that some one is heterodyning him, and, if you can possibly find out by tuning your own set in the pauses, tell him what station it is and whether the heterodyning station is on a wave length below or above him.

You must understand that when I speak of this whistle I am talking now of a whistle that is constant and almost of even tone, and that is persistent throughout the entire period of reception. I do not refer to the little whistles that come and go and sound like dickey-birds. These are caused by some kind friend in your neighborhood who has a regenerative set and who is trying to tune out the local station and find Cuba or Hawaii or Mars. He gets his bulbs oscillating and becomes a small transmitting set as long as the rotor of his variocoupler or the rotors of his variometers are in a certain position. As he is constantly tuning these things back and forth you get this little whistle or chirp, and it comes and goes. This is not the fault of the transmitting station,

(Continued on Page 29)

"I have been advised that you are an authority——"

THE TROUBLES OF

ILLUSTRATIONS BY

Mr. Henry M. Neely,
Dear Sir:

I have been advised that you are an authority on matters pertaining to radio reception, and would like to ask your advice on several matters which have puzzled me for some time.

I have a 5-KW, double-barreled, 9-passenger, triple-valve, non-skid Testinghouse outfit, complete with U. S. Safety appliances (Standard) and Timkin rear axle, which I use in connection with a 210-volt, hammerless, self-winding, automatic, 16-jewel, nickel-plated Marconi antenna with pneumatic tires.

Have had a great deal of trouble with my galena since using Lydia Pinkham's vegetable compound, but get better results by painting it with iodine. I can get undamped waves all right with my regenerative vacuum sweeper in dry weather, but on Sundays I find that my rheostat keeps interfering with the differential, so that it is necessary to cut in a small .0045 M. F. washboard between the piano and the kitchen sink.

On taking the matter up with Mr. Edison, he advises that if I use cylinder records instead of my present intermittent shock absorbers on C. W. my capacity will be increased about 8½ per cent Fahrenheit, but Einstein thinks my clutch is slipping, and I ought to use a little more yeast and a copper boiler.

This, of course, is purely a matter of taste, and I am sure you will agree with me that the overload release will work just as well with a mica commuter and a 4-inch by 4-inch coupler shank as long as the piston rings are well oiled and I use plenty of sand on the hills.

I get S. O. L. and P. D. Q. practically every night by tuning to C sharp, and I think I can get A. W. O. L. and H^2O by cutting in an interlocking relay between the honeycomb and the Washington Monument.

"It is practically impossible to get good spread-rods since the country went dry——"

AN AMATEUR IN RADIO

C. D. TEEPLE

Do you think I would get better wave lengths if I connect a circuit breaker in series with the tabulator key and used weather-proof conduit in the magneto? Neither do I, but it is practically impossible to get good spread rods since the country went dry, and unless I use something to cut in more static and decrease the potential of my monometer, the fluctuations of the variometer will tend to synchronize with the alternations of the high-frequency kickback preventer and burn out the windings of the eccentric bushings.

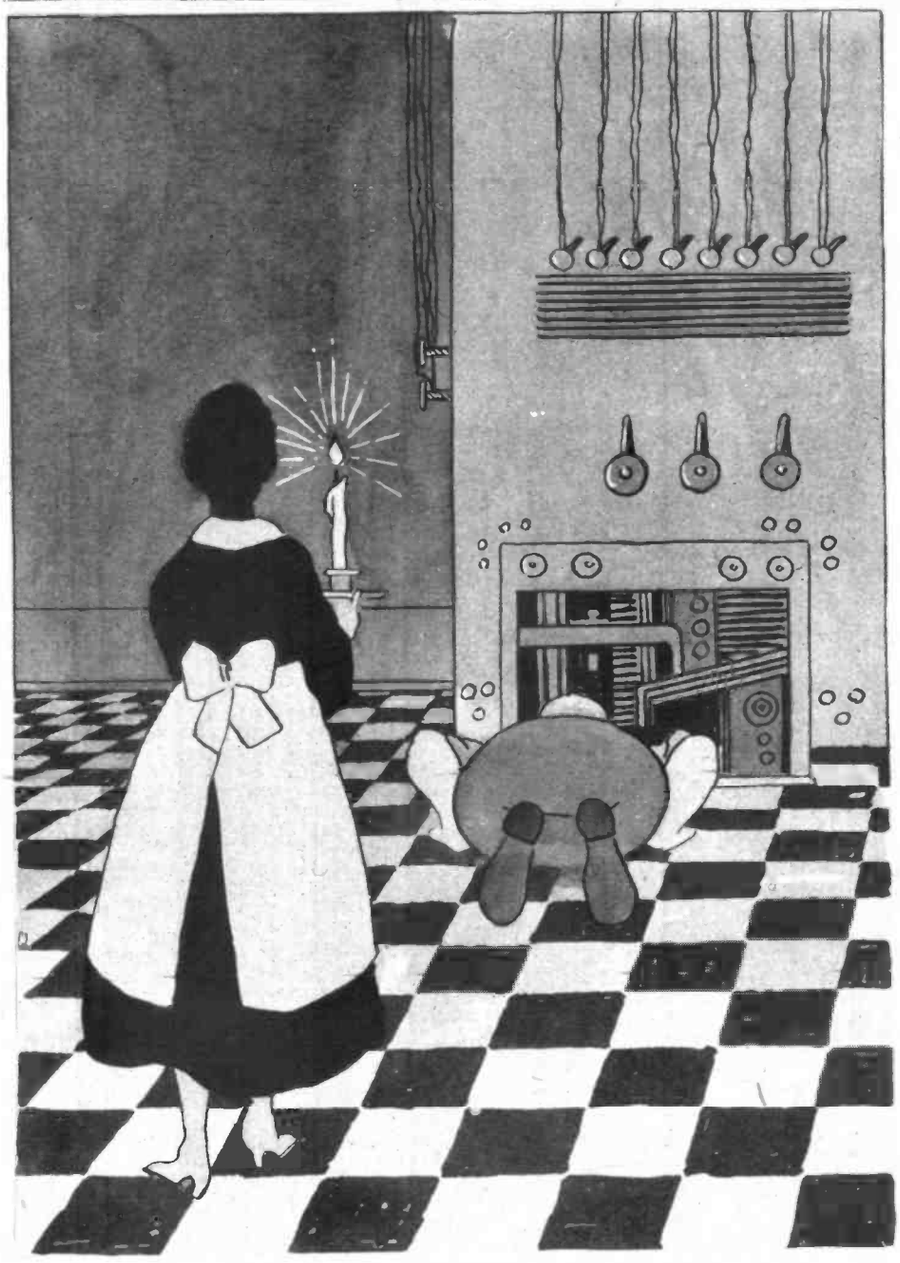
Until recently I used a 5-string, tenor, hardwood amplifier with 240 turns of No. 4¼ barb wire around the front sight cover, but I found that with this arrangement the follicles of the heating element had a tendency to become impregnated with the pigment from the valve stem, so, on the advice of General John Pershing, I removed the drift slide and substituted a Duplex automatic stoker, which allows the left dorsal ulna to oscillate between the hydrometer and the upper sling swivel, and prevents the choke coils from short circuiting the permanent wave length.

I was wondering if by placing the blow-off cock in juxtaposition to the universal joint on the loop aerial and using an emergency application of air on the primary windings, would the cubic capacity of the variable fixed condenser in any way affect the centrifugal dirt spreader on the three-way switch of the microscope, and if so, would there be a reversible reaction?

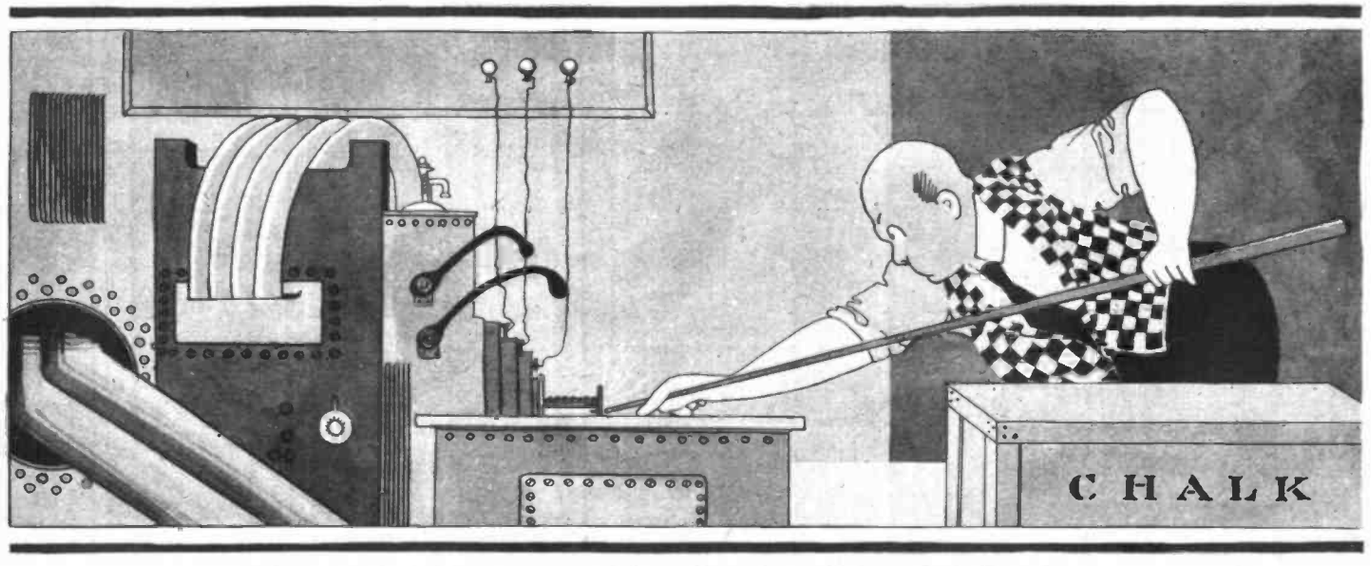
Also do you think by using more chalk and a little English on the cue ball, would the pilot beam interfere with the insulation on the superheated cold air duct?

Any suggestions you have to make will be appreciated by me if you will inclose a stamp to pay for the one I am using.

Yours very truly,
MIKE ROFONE.



" * * substituted a duplex automatic stoker."*



"Do you think, by using more chalk and a little English on the ball,——"

The Ideal Set For the Vacation

(Continued from Page 20)

that I have held off until last, and they are the 400-ohm potentiometer and the Dubilier condensers.

In receiving broadcasting from nearby stations, a great deal of radio-frequency amplification is not necessary because the detector tube will only carry a certain amount of energy and if we try to crowd too much energy into this tube it overloads and the energy is wasted. To prevent this we put in the 400-ohm potentiometer. It used to cut down the radio frequency to a point where the detector tube is not overloaded. Another way to cut down the radio frequency is to reduce the filament of the first two tubes, but if we do this we also cut down on our audio frequency and we find that our signals are greatly diminished; so, to get away from doing this, we have to use the potentiometer.

If we allow too much radio frequency, it gives the broadcasting station to which we are listening a poor quality which is known as distortion. On distant stations, however, we do not have to use any resistance of the potentiometer. It is used to cut down coming in is weak, and we have no fear of overloading the detector tube. So a point to remember is that when you are receiving signals from a nearby station turn the knob of the potentiometer so that all of the resistance is being used, and when receiving from a distant point, see that none of the resistance is used.

Now about the fixed condensers. This circuit uses five altogether. Four of them have the same capacity, which is .001, and the other has a capacity of .0025. This last condenser has a capacity that I don't think you will be able to buy, so to get around this difficulty you can take a condenser of .002 capacity and another of .0006 capacity and place one on top of the other so that each end of one condenser is fastened to each end of the other condenser.

I specify Dubilier Micadon condensers in this circuit because, if you use condensers other than those having mica insulation, you will run into trouble. The condensers must be free from any leakage that may occur between the plates, because if there is a leakage, a horrible crackling noise will be heard in the receivers or loud speaker and this will kill your signal. The Dubilier Micadon is very compact and I find that they work well in this circuit.

Why are these condensers necessary?

To answer this, we might say that radio frequency possesses the knowledge of a dimension that is unknown to audio frequency. We might say that we know three dimensions—height, breadth and width—while in darkest Africa there is a tribe of natives that know only two dimensions—breadth and width. They have no knowledge of height.

There is a story told that at one time these natives captured some white people and placed them in a hut that had only four sides to it and no top. Of course, the natives having no knowledge of height, thought that the captives were safe from escaping. The white people climbed over the top of the hut, much to the surprise of the natives, who then hailed them as gods and worshipped them.

Now to get back to the condensers: The audio frequency is like the natives. It knows only one way to travel and that is through anything that will conduct it. It will not pass through a condenser. Radio frequency will also travel through a conductor, but it will pass right through a condenser just as if that condenser were a conductor of electricity instead of an insulator.

If we look at the circuit we see that these condensers are so placed that they allow the radio frequency to flow through them instead of through the audio-frequency transformers. Electricity always follows the path of least resistance, and the coils in the audio-frequency transformers offer a greater resistance to the radio frequency than the condensers do, so naturally the radio frequency flows through the condensers. This is very essential because the radio frequency would cause a great deal of disturbance if it were permitted to enter the audio side of the circuit.

In past issues of E-Z Radio magazine I have talked about both radio and audio frequency amplification, but this combination will either delight you or turn you away from radio forever.

The circuit must be made exactly as it is shown, and it will not stand for any changes. When we first tried it out we thought we might make some startling changes that would put our names about two feet higher than either Edison or Armstrong, but it can't be done.

Our first attempt was to try to change some of the wires and then try to use different size condensers. All this done, we lighted the tubes and turned the variable condenser and then we left the floor about six inches because we thought a thousand demons were hammering on our eardrums. After this we decided to stick to the diagram.

A few words about hooking up the variable condenser: It is advisable to put the wire that comes from the 400-ohm potentiometer to the variable condenser on to the movable plate side of the condenser, as this will prevent any body capacity when you make adjustments for different wave lengths.

Another good practice is to put the rheostats always in the negative or minus side of the filament lighting battery. By doing this we lower the resistance of the "filament return," which is generally the positive side of line, instead of making it go through the resistance of the rheostat.

In the full page of photographs I show the same set when it is completed and put in a box for easy transportation on vacation.

The box is twelve inches by seven and one-half inches by eight inches high. The loop is wound in the lid, which has slip hinges and can be removed for locating different stations.

If you are fortunate enough to possess three WD-11 or WD-12 tubes it might be well to add here that this circuit will work wonderfully well with them, as they are very good radio-frequency tubes. Then you will be able to carry the complete set without bothering about a heavy storage battery.

With this hook-up we had sufficient volume to operate a loud speaker so it could be heard all over the house, in spite of the fact that we were using only the little loop aerial inside the box lid.

In the photograph of the completed set you see that we had to make a few changes. They are changes in the transformers. In the layout on the board we used DX radio-frequency and Acme audio-frequency transformers. But in building the complete set in the box, we found that the lack of room made it necessary to change to Acme radio frequency and 3YQ audio frequency.

You will also note that the panel that holds the transformers is shielded from the sockets by a sheet of aluminum. This was done to prevent any radio frequency in the tube sockets from leaking into the audio-frequency transformers.

Do Radio Terms Confuse You?

(Continued from Page 18)

of current to flow into the bulb and so permits the filament to burn at its greatest brilliancy. In this way we turn the light of the filament up and down and the brilliancy of the light very largely governs the qualities of signals which we receive.

With amplifier bulbs this adjustment of the brilliancy of the bulb is not very critical, but with the detector bulb it is usually a very great assistance in tuning and there will be one point or one setting of the rheostat at which the signals will come in with a maximum amount of volume and clearness.

Next to the rheostat is a little metal arrangement with a hole in it. The instrument is called a "jack." On the end of your telephone cord you will have a plug which fits into this hole and the purpose of the jack is to change the path of the electric current when you want it to go through the telephones.

The jack has four metal blades behind the panel and these blades are of spring metal and are so constructed that, when the jack is at rest, two blades touch each other and permit the current to flow around and into other parts of the circuit. When you put your phone plug in, however, it spreads the two outside blades apart and breaks this current and diverts the electricity around through the phones instead of into the other part of the apparatus.

The two inside blades of this jack are connected to two contacts on the "transformer." You need not bother to know the technical work of a transformer. All you need to know is that it is designed so that it will take a weak current of electricity and build it up to a current many times the original strength.

There are two kinds of transformers and their names seem to confuse the novice about as much as any names used in radio. We might as well face this problem now and discuss in a few brief words the difference between a "radio-frequency transformer" and "an audio-frequency transformer."

The word "audio" is easily understandable if you will realize that it is simply a scientific way of saying audible—that is, of expressing the idea that it can be heard by the human ear.

As you know, the human ear contains a diaphragm known as an ear drum, and this drum, comparatively speaking, is a stiff and not easily moved object. It is capable of vibrating up to a certain speed, let us say a thousand or fifteen hundred times a second, and this is about as high frequency as it is possible to make the ear drum respond to. We therefore speak of the frequency of a thousand or fifteen hundred times a second as an audible frequency or, as they express it in radio, an audio frequency.

But in radio we use currents that vibrate very much oftener than this. Some of them vibrate at the almost unbelievable speed of a million and a half times a second. This is far too fast to cause any motion in the ear drum or the diaphragm of a telephone and so it is not an audible or audio frequency. We speak of it therefore as a radio frequency.

Transformers are designed for two purposes. One kind, known as the radio frequency, is designed to build up the strength of these currents vibrating at the tremendous rate used in radio, and this type is intended to give the more distant stations.

The other type of transformer, the audio frequency, is designed to build up the signals already audible in the telephone and to get sufficient volume to put them on a loud speaker.

Theoretically the ideal set is one that consists of enough radio-frequency transformers to get even the faintest and most distant stations and build the signals up strongh enough to permit them to be fed into the audio-frequency transformers and there build them up into sufficient volume to work a loud speaker.

This has not yet been accomplished with perfect satisfaction, but there are sets on the market that do it very wonderfully and some day we will have it perfected.

Personally I much prefer the terms used in England for these two transformers. There they speak of radio frequency as "high frequency" and audio frequency as "low frequency." That is about the best way to summarize it; the radio frequencies are vibrating at a very high number per second and the audio frequencies are vibrating at a comparatively low number per second so that they can work the diaphragm of the telephone.

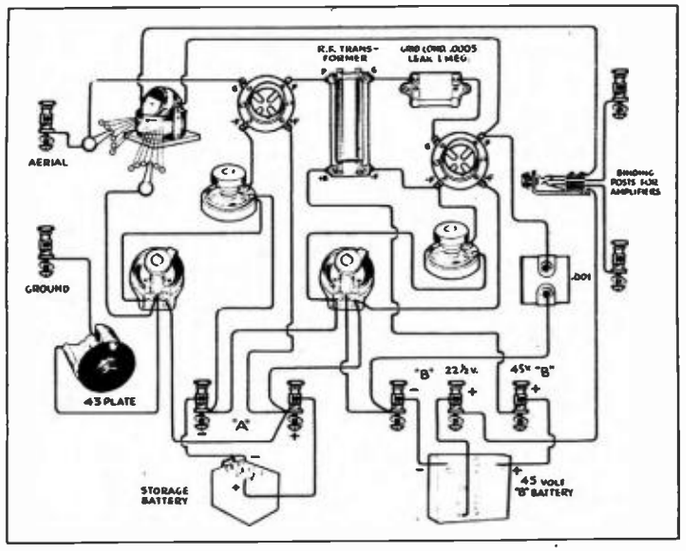
Only one more point of importance remains to be dealt with, and that concerns the four connections that are found on the socket into which your bulb fits.

These four connections are labeled "F plus" and "F minus" and "P" and "G." The F stands for filament. These are the two connections to which your storage battery is wired and they are for the purpose of allowing a flow of a current of electricity in order to light the filament and make the lamp burn.

Inside of the little bulb is another arrangement which is much like a wire mesh which is known as a grid, and there is also a metal arrangement which is known as a plate. These are connected to the base of the socket, the grid to the connection marked G and plate to the connection marked P.

You need not trouble to study the effects that these have on each other, but all you need to know is that the grid and the plate and the filament connections of the bulb must be wired to certain parts of the apparatus.

In conclusion, let me say that you can work your sets perfectly well without knowing all these things, but it is just as well for even a beginner to have some knowledge of what the various parts of apparatus are, even though he does not care to go into a very deep study of radio.



This is the hook-up for the single circuit with one stage of radio frequency amplification. The circuit is fully described in the article on Pages 9 to 12.

Radio Opera From the Stage to You

(Continued From Page 5)

When the orchestra was the most important part of the music, one of the microphones on the footlights would be connected if it was soft music; or, if it was sufficiently loud, the microphone hung from the ceiling in the very center of the house would be connected.

This microphone in the center of the house also was responsible for some of the most thrilling moments that the radio listeners-in had. This was not during the music, but at the end of the acts, when the storm of applause broke forth through the seated audience. This applause was sent out over the radio, and all the cries of "bravo," "hurrah" and "encore" went with it.

Many of the thousands of letters which were received by Station WIP after these three operas spoke about the thrill that came to the listeners-in when the applause broke forth, and how many of them involuntarily started to applaud in their own homes.

During the intermissions the story of the opera and an explanation of all that was going on were given by the writer from the control room.

It will be seen from this that the broadcasting of grand opera is not by any means the simple matter of taking an ordinary telephone off the hook and letting the sound go out over the phone wires.

Editorially Speaking

(Continued from Page 25)

so do not bother the operator by calling him up about it.

And this, and the coming of spring, leads me to burst forth into song, thus:

REGENERATION

Hear the little dickey-bird
Calling for its mate,
With its variometer
Whistling in its plate.
How I love the dickey-bird
And its plaintive lay,
For it says my neighbor is
Hunting far away.
Hunting far away, lads,
Scorning local stuff,
For the best at home here
Isn't good enough.
So the little dickey-bird
Is calling for its mate
With its variometer
Whistling in its plate.

(Oh, slush!)

Questions From Readers of "E-Z RADIO"

Q. L. F. Albright, Collingswood, N. J.—Sends diagram of two-stage audio and wants to know if it is correct.
A. Your diagram is correct. If your transformers are not marked, here is given a method for finding the correct posts for plate and grid leads; the inside lead of the primary goes to the plate and the outside lead of the secondary goes to the grid.

Q. W. Z. Hunt, Mt. Airy, Phila.—Wants to know a good transformer.
A. There are a lot of good transformers on the market, such as General Radio, Federal, Radio Corp. 3YQ, Amertran, Acme, Geraco and others.

Q. W. E. Weinstein, New York City.—Inquires where the negative B battery goes.
A. The negative B goes to the plus A battery.

Q. E. H. Warren, Kenmore, N. Y.—On winding a large spider web coil.
A. The only advantage in winding a large coil is that you can tune in a longer wave length. In tapping this coil the single taps are ten in number and the rest of the coil is divided so that there is a tap every ten turns.

Q. G. E. Hartshorn, Kensington, Md.—About the Gibbons hook-up using two honeycomb coils.
A. The coils are movable and are spaced so that they can be coupled to each other. The range of this set is about the same as the single circuit. but it will tune very sharp, which the single circuit will not do.

Q. Robert Roth. Phila.—Wants hook-up of Gibbons set using two-stage amplifier.
A. The hook-up you want of the amplifiers is shown on page 28 of the December issue of E-Z Radio. Use this hook-up with the Gibbons set shown on page 33 of the March issue.

Q. Mever Tobias. Phila.—Wants hook-up for WD11 tube.
A. The hook-up you want will be found in the Supplement issue of E-Z Radio.

Q. Karl E. Williams. Phila.—Has a three-circuit receiver that won't get distance.
A. The trouble you are having is due to not having sufficient B battery. Try 45 volts on the plate of the tube. Sometimes the WD11 tube requires that voltage to make it oscillate. Also read the article on aerials in the April E-Z and see if yours is right.

Q. D. S. Cassel, Phila.—Sends in diagram of his set that won't get distance.
A. Look at your antenna. That's where most of the DX trouble is found with sets that get local stations satisfactorily.

Q. John Rogeri, Swarthmore, Pa.—Wants a good crystal hook-up.
A. In the November issue of E-Z Radio there are any number of hook-ups that will work very well.

Q. J. W. Smooth, Scranton, Pa.—Can a peanut tube be used with the Lindh hook-up?
A. Yes, the peanut tube can be used. About the transformers, use 3YQ, Acme or Atwater-Kent.

Q. M. D. Orazie, Phila.—Loading coil for Gibbons hook-up.
A. A 35-turn honeycomb will be large enough to boost your wave length. This coil should be placed in the antenna. If your set is oscillating you will be able to get rid of local stations.

Q. Roy E. Zimmerman, Camden, N. J.—Wants to know a good hook-up for three-tube set.
A. In the December issue of E-Z Radio, on pages 15 and 28, you will find the circuits you desire.

Q. Charles Stoffel, Phila.—Inquires about the reflex circuit.
A. This circuit is given in this issue of "Radio in the Home."

Q. A. G. Loechner, Bristol, Pa.—Has howls on third stage audio amplifier.
A. From your hook-up that you sent me I see that you have been using grid condensers that are made of paper and tinfoil. These are most likely your trouble. Whenever you use a grid condenser, always use the ones made with mica insulation. You will find that if you use Dubilier Micadons No. 601G you will have a grid condenser that is free from leaks. Another thing that will help you is to put a condenser across the secondaries of both the last two transformers. These condensers have the value of .00025 or .0005.

Q. A. M. Melvin, Royersford, Pa.—All batteries all O. K., connections all right, but set won't oscillate.
A. It is the detector tube that is giving you the trouble. Something has happened inside the tube to prevent it from oscillating. Try changing the detector tube.

Q. J. M. Rolin, Laurel Springs, N. J.—Gibbons hook-up with two honeycomb coils won't bring in distance.
A. Try putting a .0005 micadon in the antenna circuit. This will help the set to oscillate and bring in DX stations, if your aerial is right.

Q. S. M. Brown, Eddystone, Pa.—Has hook-up he has been experimenting on and wants to know if it is all right.
A. The hook-up you show is the single circuit with a few changes that you have made. In the diagram that you sent me, I see you have placed the B battery across the phones. This I would change because it will run the B batteries down in a short while.

Q. C. Lange, Bronx, N. Y.—Has no results in amplifying the crystal.
A. Look over your hook-up again. There must be something wrong, because we have tried all the hook-ups published and work fine.