

May, 1924

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# RADIO IN THE HOME

TWENTY CENTS

ed by HENRY M. NEELY



## KENNETH HARKNESS *Joins Our Staff*

**K**ENNETH HARKNESS, originator of what is admittedly the best one-tube circuit yet developed, has joined the staff of *Radio in the Home*.

Beginning with the next month's issue, Mr. Harkness will write regularly for this magazine and will not write for any other publication.

Mr. Harkness has just signed an agreement with us giving our readers the exclusive right to his services.

This includes the development of certain circuits which seem to be very much needed in the present trend of radio and all im-

*(Continued on Page 4)*

**KENNETH  
HARKNESS**

*Drawn by  
H. Weston Taylor*

LOS ANGELES



KANSAS CITY



ST. LOUIS



TERRE HAUTE



SANTA FE

## Selected Wood Produces Faithful Tones

**L**ISTEN! The Sextette from Lucia! The living voices of the great artists—as if floating in through the window on wings of magic!

MUSIC MASTER, Radio's musical instrument, catches the softest tones, the most delicate shadings, the personality of each artist's voice—and the illusion of their presence in your home is perfect.

The wood amplifying bell of MUSIC MASTER eliminates blast, rattle and thin nasal tones and substitutes in their stead full, clear, resonant tones—faithful and life-like, a delight to the ear.

There is a scientific reason for the material, size and design of every part of MUSIC MASTER—developed and perfected by men who have spent more than a score of years in the study of sound reproduction.

Go to your dealer and let Music MASTER speak for itself; or, better still, have one sent to your home to test and prove on your own set.

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Connect MUSIC MASTER in place of headphones. No batteries required. No adjustments.

14-inch Model, for \$30 the Home  
21-inch Model, for \$35 Concerts and Dancing

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Chicago PHILADELPHIA Pittsburgh

**Music Master**  
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There are still a few very desirable openings for jobbers and dealers who want to handle MUSIC MASTER Radio Reproducers and other products





**Crosley Model 51**  
**\$18.50**

**IN 24 DAYS THE CROSLLEY MODEL 51**  
**Became the Biggest Selling Radio Receiver in the World!**

On Monday morning, February 11th, Powel Crosley, Jr., returned to his desk after a two weeks' hunting trip in Mississippi. He brought with him the idea of an entirely new Radio Receiving Set to be added to the Crosley line.

A short conference with his engineers followed. On Tuesday morning, February 5th, a model had been completed and tested. These sets were put into production immediately after the model was approved.

On Tuesday afternoon, February 5th, night letters were sent to the leading distributors of The Crosley Radio Corporation announcing this new model which had been called MODEL 51. Wednesday afternoon, the orders commenced coming in, showing the faith of the distributors in anything brought out by this Company. Announcements were made in leading metropolitan newspapers of the country on Saturday and Sunday, February 9th and 10th. Shipments commenced about February 13th, and were immediately followed by an avalanche of complimentary letters and orders, and have increased steadily ever since.

Production started at 50 a day—was increased to 200—then 300—and on February 23th, just 21 days after the thought of this set had been put into being, the production reached 500 a day. Orders were received on February 23th for 1,115 of these sets—every effort being made to increase the production to 1,000 sets per day to supply the phenomenal demand for this new model. This message was written on February 29th in the face of promises of an even greater record than is indicated here.

The demand for this set has not in any way lessened the sale but has increased the orders on various other models in the Crosley line.

**Now What is This Set That Has Made Such an Enviably Record? Which in 24 Days Has, We Believe, Become the Biggest Selling Radio Receiving Set on the Market?**

It incorporates a tuning element made famous in the Crosley Model V, the \$16.00 set used by Leonard Weeks, of Minot, N. D., in his consistent handling of traffic with the MacMillan Expedition at the North Pole; a genuine Armstrong regenerative tuning and detective circuit.

Now, to this has been added a one stage of audio frequency amplification. With the well-known Crosley Sheltran 9 to 1 ratio transformer, giving an unusual volume. Thus, this set uses 2 vacuum tubes.

It is the ideal all-around receiver. For local and nearby broadcasting stations, it will operate a loud speaker, giving phonograph volume in the home. Under reasonably good receiving condi-

tions, it will bring in stations up to 1,000 miles, with sufficient volume for the average sized room.

When receiving conditions are bad, however, head phones should be used on distant stations.

This Receiver is unusually selective—it incorporates standard sockets so that all makes of tubes can be used. The various units are mounted on beautifully engraved grained panels, and mounted in a hardwood, mahogany finished cabinet, which completely encloses all parts and tubes.

A glance at this beautiful instrument sells it, and the results it gives create many friends for it. Perhaps the most startling thing of all is its price—\$18.50. Add 10% West of the Rocky Mountains.

Licensed under Armstrong Regenerative Patent No. 1,113,149

**THE CROSLLEY RADIO CORPORATION**

POWEL CROSLLEY, JR., President

Formerly The Precision Equipment Company and Crosley Manufacturing Company

560 ALFRED STREET

CINCINNATI, OHIO

**CROSLLEY**

Better—Cost Less  
Radio Products

# Editorially Speaking

By HENRY M. NEELY

EVERY reader knows that it is customary to bring up into the front part of a magazine the most important articles in each issue. It is the editor's job to size up his material and lead his publication with the headlines. In this issue of *Radio in the Home*, I am doing something which may seem to be a viola-

**The Problem of Defective Tubes** am bringing up to the front of the magazine the current installment of my "Radio Kindergarten." If you will turn over the next page, you will find it there, just as though it were a regular article by a real writer.

I am doing this only because it happened that this particular lesson deals with a subject which is becoming of more and more vital importance to every user of a radio set. This is the subject of defective tubes.

In this Kindergarten lesson I am showing as simply as I can how any tube may be tested with an apparatus that any novice can easily put together and that any dealer can purchase already assembled at a most reasonable price. And I am advocating the adoption by all dealers of the habit of testing every tube before it is handed to a customer, and I am also urging the adoption by the customer of the habit of buying tubes only from dealers who will do this. When I speak about defective tubes, I want it distinctly understood that I am making no unfavorable comment upon the manufacturers of the tubes.

The making of such tubes as are used in radio reception is about as delicate a process as any manufacturer has to face. From the time the elements of the tube first go into the process of manufacture until the time when the completed and marketed article is placed by the consumer in the socket of his receiving set, the chances are just about fifty-fifty, or even worse, that the tube will not survive in perfect condition.

If the making of these radio tubes were as simple and as certain a process as the making of ordinary electric lights — if eighty or ninety per cent of these tubes could be depended upon to survive in good condition, the price of tubes could easily go down to a dollar or two. You will frequently hear people in the radio business sneeringly remark that there must be a tremendous amount of graft in the making of these tubes because in their line of reasoning they compare it to the making of an ordinary electric light. If this comparison were fair, there would be some basis for



*Kenneth Harkness and H. M. N. at the door of Station XFP. Needless to say Harkness is the one who is all dressed up. The rest of us don't wear store clothes at XFP*

## KENNETH HARKNESS JOINS OUR STAFF

(Continued from Front Cover)

provements on his present circuit and all developments which he makes along other lines will be announced first in this magazine before they can be brought out in any other way.

In next month's issue, Mr. Harkness will give a resume of his one and two tube circuits and will write an article summarizing the most common questions that have been asked by various novices who have built the circuit.

In other words, the article in the June issue will be the latest and most complete data on these two circuits which have already become so popular in so many parts of the country.

We have asked Mr. Harkness to devote his attention after that particularly to the development of what we consider the ideal small receiving outfit.

We have felt for some time that the conditions to be fulfilled in such an outfit are at least two stages of radio frequency amplification in order to get distance, a tube to be used as detector in order to take (Continued on Page 49)

their sneers, but the comparison is most unfair. To explain just exactly what conditions cause the delicacy in the manufacture of these tubes would be to involve readers of this magazine in a technical discussion which would very soon get them far beyond their depths in radio and, incidentally, it would also get me so far beyond my own depth that I would really not know what I was talking about.

But, as one of my many betters has so historically said, it is a condition that we are confronting and not a theory. The condition is that a considerable percentage of failures of radio sets to function properly are not due to the sets themselves but are due to defective tubes.

This does not even mean that the tube was defective when it was bought from the dealer. It may have been in perfectly good shape when it left his hands and it may have given excellent satisfaction for a short time in the set of the purchaser, and then, as the days went on, the signals received on the set may have begun to die down until they almost entirely disappeared.

Tubes will go bad; there is no doubt about that. And I for one do not know what causes it. They will go bad without any undue mechanical stress or injury and will simply lie down and die.

Fortunately, the very large majority of tubes are good. Unfortunately, the ones that are bad get into the hands of people who have no facilities for testing them and who do not even suspect that their trouble is in tubes. Consequently they go all over their sets and test their batteries, and finding everything all right blame the hookup or the poor, unfortunate magazine editor who has printed the hookup.

Under the present conditions the legitimate dealer who handles tubes has an arrangement with the manufacturer by which defective tubes may be returned and replaced by good ones. This will be done providing the filament will still light, proving that it has not been burned out carelessly and providing no mechanical injury has been done to it.

Some dealers make this same arrangement with their customers; they will replace tubes without question if the customer declares that the tubes do not work — providing the filament is not burned out. There are a great many more dealers, however, who will not replace tubes once they have been sold to the customer. The dealer says, "The tube was all right when we sold it to you be-

(Continued on Page 49)

**RADIO IN THE HOME**

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# Bristol Single Control Radio Receiver

## USING GRIMES INVERSE-DUPLEX CIRCUIT



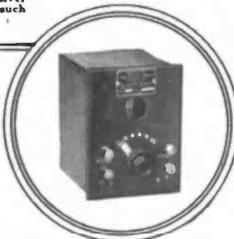
The Bristol Single Control Radio Receiver is completely equipped to use Loud Speaker. The Bristol One Stage Power Amplifier is incorporated as the last stage of amplification. This set is designed to give satisfactory results with Antenna or Loop, and in most cases Short Antenna. The case is solid mahogany with walnut finish, a suitable piece of furniture for the finest home. The price for Bristol Single Control Radio Receiver is \$190.00. This does not include accessories such as tube, batteries and loud speaker.



The Bristol Junior Audiophone

### Bristol One-Stage Power Amplifier

Designed to use with any good receiving set to build up amplification so that, when a loud speaker is used, the distant stations will come in like the locals. It is the same Power Amplifier incorporated as the last step in Bristol Single Control Radio Receiver. However, in this convenient single unit form, it can be instantly connected to and used with other receiving sets. A third stage of amplification without howling. No "C" Battery required. Price \$25.00.



The Bristol One-Stage Power Amplifier.

### Audiophone Loud Speaker

*A Real Reproducer of the Original Broadcasting*

It is easy to listen to the Audiophone reproductions because they are so perfect. The speech, songs, and instrumental music are not blurred or disguised by mechanical distortions. You get all the fine shadings and every inflection. In fact, the very personality of the artist seems to be present as you listen. No auxiliary batteries are required for magnetizing.

Made in three models—

- Senior Audiophone . . . \$32.50
- Junior Audiophone . . . 22.50
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Chicago	Detroit	St. Louis	San Francisco



The Bristol Senior Audiophone

# The RADIO KINDERGARTEN

By HENRY M. NEELY

## HOW TO TELL GOOD TUBES FROM BAD ONES

EIGHTH LESSON

**B**EFORE you start this lesson in our kindergarten I want you to get out last month's issue of this magazine and once more read the seventh Kindergarten lesson which was given there. Perhaps you think that you remember everything that was in that lesson, but I can assure you that you will not understand this one unless you once more refresh your mind by going over again lesson Number Seven.

In that lesson, we learned something about the action that takes place in a vacuum tube when we receive a radio signal. In this lesson I want to carry that thought a little farther in order to give you a little more complete knowledge of this very important phase of radio reception.

And incidentally, but most important, perhaps, I will show you how to tell a good tube from a bad one.

I am reproducing here a diagram which may look very forbidding to the average student and which may sound even more forbidding when I tell him that it is the "characteristic curve" of a vacuum tube. This term "characteristic curve" sounds tremendously scientific and unintelligible, but I am telling you right now the very worst part of the news, because I want to show you in this lesson how really simple it is to understand what this characteristic curve denotes. In the Seventh Lesson of this Kindergarten, we talked about the flow of current from our B batteries through our head telephones and to the plate of the tube and we learned that the amount of flow depended very largely upon the voltage that was on the grid of the tube.

If you had the kind of instruments which we have at Station 3XP for "plotting" the characteristic curves of tubes, you could tell at once whether a new tube which you have just bought is going to be satisfactory or not.

As a matter of fact, I believe that the radio dealer who installs these instruments in his store and who shows the customer who is about to

purchase the tube just exactly what the characteristics of that tube are is the dealer who is going to win the greatest respect and confidence of his patrons. These instruments can be bought very reasonably or they can be built almost as cheaply as a crystal set, so that there is really no excuse for a dealer not having one.

The hookup of such a testing set is extremely simple and I should be very glad to send it to any dealer who is interested. All that is necessary besides the actual set, is a

how it was made. This curve was one which was actually made on a new tube in our laboratory and it is typical of a 201A or 301A tube in good condition. As a matter of fact, this curve, by its very steepness of slant, proves that the tube was an unusually good one.

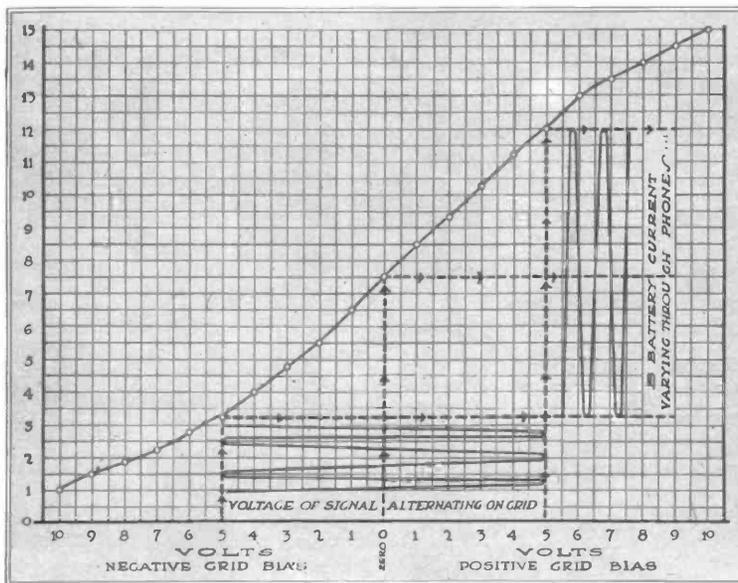
First let us look at the row of figures which run up the left-hand side of the drawing. They start at zero and go up to fifteen. This might be considered almost the same as the scale of a thermometer, but instead of marking the amount of heat, it marks the amount of current that is being drawn from the B batteries under varying conditions. When I say "current," you

must remember one of our previous lessons and realize that current refers to the quantity of electricity being drawn from the battery and that it does not refer to the voltage or the force which is pushing that current along. The B battery voltage on this curve was kept constant at ninety which is the normal operating voltage for an A tube used as an amplifier.

Ordinarily, we measure current in what we call amperes, but that is rather a large amount, and we never can draw anything like that from the B batteries through the plate of our tubes. An ampere is really quite a large current. When you are burning a

UV200 or C300 tube at full brilliancy you are using just about one ampere of current. When you use a WD11 or 12 or a 201A or 301A tube you are using only one quarter of an ampere, so that you can use four of these tubes with the same amount of current that is taken by one 200 tube.

With the UV199 or the C299 tube, the current consumption becomes quite small. Each one of these tubes uses only six one-hundredths of an ampere. In dealing with the current taken from a B battery however, we do not go up even as far as that. Six one-hundredths of an ampere is the smallest current that we can successfully use now from an A battery to light the



direct current milliammeter which will measure milliamperes from zero up to about twenty and a voltmeter such as a Weston Model 489, which will reach to 150 volts for the plate current and up to seven and one-half volts with decimal divisions for the grid voltage.

That, of course, has nothing to do with this kindergarten lesson, but I really hope that a number of dealers will write to me for this hookup, because I believe it will result in much greater satisfaction to their customers from radio. The tubes that are being put out today are very uneven in their performance and more dissatisfaction is caused in reception by bad tubes than by any other one thing—although the inexperienced user does not know that this is the cause of his lack of success. And now let us turn to this characteristic curve and see just



(Continued on Page 46)



# MAGNAVOX

## Radio Reproducer

### M1~\$35<sup>00</sup>

The highest quality of radio reproduction ever achieved with an instrument which requires no battery for its operation

*I*N developing this reproducer, Magnavox engineers drew upon unequalled experience and resources and no higher tribute can be paid the M1 than to point out that its instant success has paralleled that of the famous Magnavox electro-dynamic Reproducers R2 and R3.

M1 reproduces with perfect fidelity the entire register of broadcast music and speech—without requiring a battery for its operation.

Owners of M1 have been gratified to note also that this quality of reproduction is maintained without the slightest deterioration after long and constant use.

Definite features responsible for this efficiency are:—

1—The diaphragm being correctly designed cannot become stretched

Magnavox Radio Reproducer M1 is designed for operation with any vacuum tube radio set and is particularly desirable for use with dry cell sets.

*Magnavox Radio Reproducers, Combination Sets and Power Amplifiers can be had of good dealers everywhere. Illustrated catalog on request.*

**THE MAGNAVOX COMPANY, OAKLAND, CALIF.**

NEW YORK OFFICE: 350 WEST 31st STREET

Canadian Distributors—Perkins Electric Limited, Toronto, Montreal, Winnipeg



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*Why wait for the sporting page to serve it warmed over when Magnavox recreates every play as real as it can be told?*

*Whatever type of receiving equipment you may have—or however you make use of it—to get full satisfaction have it Magnavox equipped.*

**There is a Magnavox for every receiving set**

"THE AIR IS FULL OF THINGS YOU SHOULDN'T MISS"



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YOUR radio batteries have served you well and faithfully over the long winter months. Now a great radio summer is at hand. To enjoy summer radio at its best, equip your receiver with the best batteries you can get. Put in new Eveready Radio "B" Batteries and see what wonderful, long-lived service they will give.

Made especially for radio use, Eveready "B" Batteries will operate the loud speaker at maximum volume for long or short periods, depending on how rapidly the current is taken out of them. Packed full of pep and punch and go, Eveready "B" Batteries pour out their power the moment you turn on the tubes. Scientifically made for long-lived radio service, the cells renew their vitality when idle—responding instantly with fresh vigor.

Eveready "B" No. 767 is the standard amplifier "B" Battery, and gives 45 powerful, dependable, zippy volts. Five sturdy Fahnestock Clips make this big "B" Battery available for soft detector tube use as well—varying the voltage from 16½ to 22½ as required.

Insist on Eveready "B" Batteries, remembering that they are the product of thirty years of experience and know-how in battery making. Designed and made under the supervision of the finest electro-chemical laboratory known to science, the quality and efficiency of Eveready Radio Batteries are assured. For maximum battery economy and service buy Eveready Radio Batteries—they last longer.

Manufactured and guaranteed by

NATIONAL CARBON COMPANY, INC., New York San Francisco

Headquarters for Radio Battery Information

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Informative and money-saving booklets on radio batteries sent free on request. If you have any questions regarding radio batteries, write to G. C. Furness, Manager, Radio Division, National Carbon Company, Inc., 130 Thompson Avenue, Long Island City, N. Y.



No. 767 "B" Battery  
45 volts. Variable taps  
Fahnestock Clips

Eveready  
6-watt Storage  
"A" Battery



No. 766 "B" Batteries 21.5  
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Spine Clip Connectors

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Saver. Vertical 21.5  
volt "B" Battery

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Eveready Radio "A"  
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battery for use with  
dry cell tubes

No. 771 "C"  
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tube and pre-amps  
"B" Battery life



# EVEREADY Radio Batteries

—they last longer

# RADIO IN THE HOME

## The Story of Reflex and Radio Frequency

By DAVID GRIMES

Chief Engineer Sleeper Radio Corporation; Consulting Engineer to Bristol Company and Mercury Radio Products Co.

OF all radio circuits that have held public attention during past years, perhaps the most interesting and most efficient is the famous reflex with its many possibilities. And yet, in a way, reflex is not a circuit, it is a system of amplification. It is for this reason that it has so many adaptations.

For those not entirely familiar with this fascinating arrangement, a few descriptive words will not be out of place. The reflex principle is one that permits a vacuum tube to be used in a dual role *simultaneously*. It allows the amplifying tube to be utilized for both radio and audio amplification at one and the same time.

"Wonderful," you remark, "and extremely clever. What will radio next produce? New ideas are occurring hourly!"

But we will have to disillusion you. There have been really very few new ideas recently in radio. Most of the ingenious circuits recently presented as "new" are quite old, relatively speaking.

The work during the last two years has been of a commercializing nature—attempts to reduce laboratory models to factory possibilities. Among these old circuits stands the super-heterodyne, the super-dyne, the neutro-dyne and, foremost of all, the reflex. After all is said and done, you know, the most popular circuits can all be reflexed at a saving of tubes and batteries.

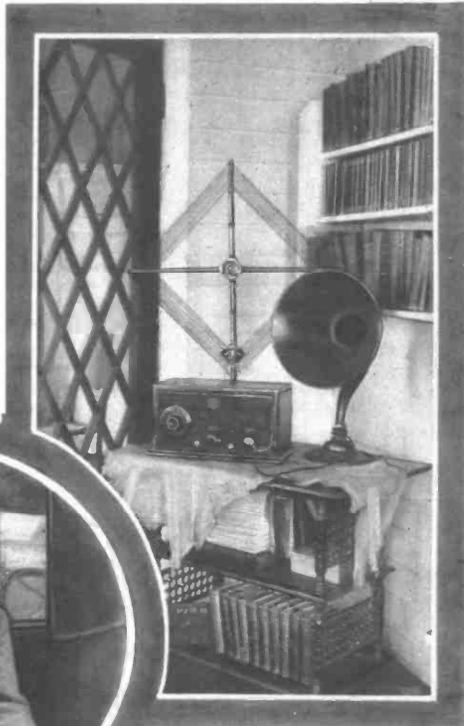
But, alas! Not even the reflex is new. It is the oldest of them all. It apparently even antedates regeneration. It was developed during 1912 and the early part of 1913. It is the result of work done by Wilhelm Schloemilch and Otto von Bronk, of Berlin, Germany, and is covered by a patent issued to them in this country on February 17, 1914.

This patent, No. 1,087,892, is a radio masterpiece. It is undoubtedly one of the most important patents ever issued by the government, and as time goes on its gigantic contribution to the art will be increasingly appreciated.

It seems peculiarly significant that during the World War this valuable monopoly

Circle—David Grimes, inventor of the Inverse Duplex

Right—The modern combination of all the patents spoken of in this article. David Grimes' own set in his home—A Sleeper Monotrol with Music Master horn



granted by our government should return and become the common property of us all. The patent is now owned by the United States Navy.

The sudden widespread interest in this patent has caused an unavoidable shortage of the printed copies. As a result, many thousands desiring patent information on the reflex have been unable to obtain copies of it. We, therefore, are showing several pages and drawings of this patent. A casual

glance at the patent will reveal four sketches, three of which, it will be seen, have nothing to do with reflexing. It is these four sketches that make this a masterpiece. Reflexing, alone, would not be sufficient to put it in this class, but it also covers radio frequency and tuned radio frequency amplification for the first time. In fact, the patent is primarily a radio frequency disclosure, Figure 4, covering reflex, being added somewhat as an afterthought or byproduct.

As this article is concerned only with the story of reflex, we will not discuss Figures 1 to 3. These will be taken up in a later issue, when we will tell the story of radio frequency amplification.

Referring, then, to Figure 4 in the Schloemilch and Von Bronk patent, it will be observed that the radio frequency is brought into the grid of the tube through transformer "g" from the aerial "f." From the plate of the tube it passes through the primary of a tuned radio transformer. A

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# UNITED STATES PATENT OFFICE.

WILHELM SCHLOEMILCH AND OTTO V. BRONK, OF BERLIN, GERMANY.

MEANS FOR RECEIVING ELECTRICAL OSCILLATIONS.

1,087,892.

Specification of Letters Patent.

Patented Feb. 17, 1914.

Application filed March 14, 1913. Serial No. 754,287.

To all whom it may concern:

Be it known that we, WILHELM SCHLOEMILCH and OTTO VON BRONK, citizens of the German Empire, and residing at Berlin, Germany, have invented certain new and useful Improvements in Means for Receiving Electrical Oscillations, of which the following is a specification.

Our invention relates to means for receiving electrical oscillations by means of an arrangement by which the amplitude of the oscillations is increased to a suitable extent, and which permits the use of a detector such that the oscillations can be perceived more distinctly in a telephone receiver employed for perceiving the oscillations.

arrangement comprising a detector connected into the circuit of the tube itself, Fig. 3 is a like view showing an arrangement in which the amplitude of the oscillations is repeatedly increased by several tubes, and Fig. 4 is a like view showing an arrangement in which the amplitude of the oscillations is repeatedly increased by one and the same tube.

In the diagram shown in Fig. 1, *a* is the vacuum tube which contains the oxidized cathode which is heated by means of a filament. The tube further contains the anode and the auxiliary anode which is preferably in the form of a spiral.

crystal detector "e" is shown connected across part of the secondary circuit. This stunt of connecting the crystal across only a portion of the tuning circuit is done to

increase the sharpness of the tuning—the crystal being a resistance loss. The radio current is rectified by means of this crystal "e" and is transformed into audio current

Here are the title and diagrams from the original patent papers for the reflex circuit

in the condenser "p" and the transformer "o." From here it passes onto the grid as audio current through the transformer "g" and from the plate, as amplified audio, it passes through the audio output transformer "q" and into the telephone receiver "m."

This circuit arrangement will bear close study because of its perfectness even to the smallest details. Such things as bypassing condensers are all there. In fact, it is the standard one tube reflex we see so much today. The only addition that ten years have added has been the tuning of the grid circuit instead of the aerial circuit by what are now known as "fixed couplers." This was done shortly after Schloemilch's patent was issued.

The only regrettable thing in this reflex situation is the general tendency among some of our would-be radio inventors to take the circuit shown in Figure 4, arrange it on paper so that it looks different and then tack their own names onto it. Not content with this, they proceed to claim all credit for reflexing, never even mentioning the development here shown. So many of us try to travel to success on somebody else's ticket! How w (Continued on Page 34)

W. SCHLOEMILCH & O. VON BRONK.  
MEANS FOR RECEIVING ELECTRICAL OSCILLATIONS.  
APPLICATION FILED MAR. 14, 1913.

1,087,892. Patented Feb. 17, 1914.  
2 SHEETS—SHEET 1.

*Fig. 1.*

*Fig. 2.*

Witnesses:  
*William H. Knight*  
*Harmon Johnson*

Inventors:  
and *Wilhelm Schloemilch*  
*Otto von Bronk*

By *Harmon Johnson*  
Att'ys

W. SCHLOEMILCH & O. VON BRONK.  
MEANS FOR RECEIVING ELECTRICAL OSCILLATIONS.  
APPLICATION FILED MAR. 14, 1913.

1,087,892. Patented Feb. 17, 1914.  
2 SHEETS—SHEET 2.

*Fig. 3.*

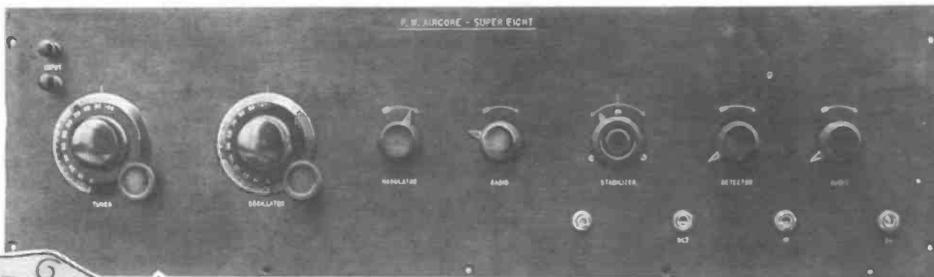
*Fig. 4.*

Witnesses:  
*William H. Knight*  
*Harmon Johnson*

Inventors:  
and *Wilhelm Schloemilch*  
*Otto von Bronk*

By *Harmon Johnson*  
Att'ys

To the right is the panel front and below it a view looking straight down on the base board



# The Aircore Super-Heterodyne

WITH the super-heterodyne hysteria sweeping the country I have been kept in hot water for the past two months trying out all sorts and conditions of new sets of this type.

In fact, I have devoted almost all of my time to it lately because I have realized that readers of this magazine all over the country are waiting until they can learn something definite about the various super-hets that are being called to their attention.

I have already given the hookup for one very successful super-het. That one, given in the March issue, used iron core transformers. Among radio technicians it is quite a disputed point as to whether iron core or air core transformers are best for this purpose, and I have been interested in trying sets using both types.

Here is a super-het which is proving very popular in Philadelphia, and as it uses the air core type of transformer, I have paid an unusual amount of attention to it. The set is known as the P.W. Air Core Super-Eight. One of its designers, J. C. Van Horn, has been a radio friend of mine for fifteen years. As "Van" was largely instrumental in putting out this super-het, I insisted upon his writing an article about it, and he has complied on the promise that I make the preliminary explanation that he is not an author and never intended to be one.

The opinions expressed here are his. He and I differ in some of them. But we don't differ in the opinion that the set he describes here is a mighty good set and one of the very few satisfactory super-hets that I have used. Its sharpness of tuning makes it particularly valuable for the man who lives near a broadcasting station and wants to get through it for DX.

H. M. N.

By J. C. VAN HORN

THE important feature of any multitube set is the type of transformer used. In the P. W. Air Core Super-Eight it is, as the name implies, an air core transformer in the radio frequency part of the set.

The reason for air core transformers in radio frequency and, perhaps I should say, the reason why we consider the air core transformer to be more efficient is in the prevention of distortion through eliminating all audio frequency amplification.

A radio frequency transformer designed as are the air core transformers, to amplify on three thousand meters, practically prevents any audio frequency currents passing through because the air core—or rather, we might say, the absence of iron—reduces the power of audio amplification to one-thousandth of that which would be possible in an iron core transformer.

This is especially true on a super-heterodyne. The only apparent reason why iron cores have been used in radio frequency transformers has been to broaden the wavelength range so that they would work on the band of wave lengths used by the broadcasting stations.

This feature is the opposite of that required for radio frequency transformers in super-heterodyne work. We want a sharply defined wave length, not a wide range of wave lengths; therefore, the necessity for even a limited amount of iron is not apparent, and in addition we think that many advantages are found in carefully wound air core transformers that are not possible in iron core transformers.

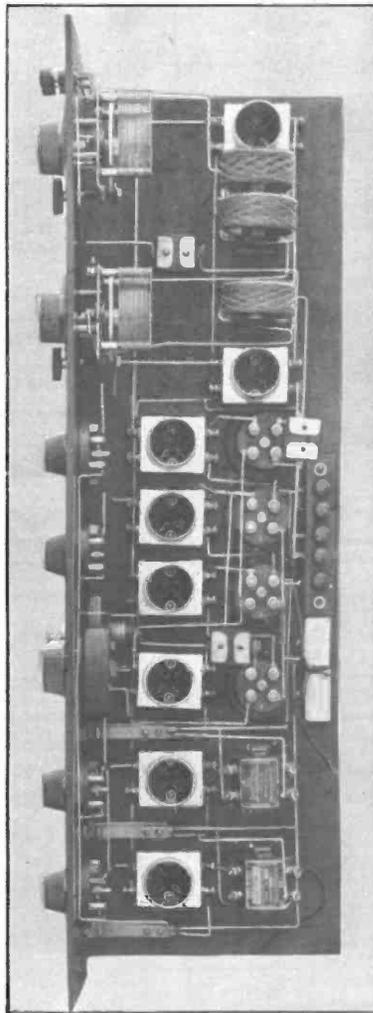
The tube noises or audible squeals, static, other noises such as automobiles, motors, etc., are not amplified with the air core transformers, and this is very important because reception on a super-heterodyne depends on getting signals above what is known as the "static level." The super-heterodyne is very sensitive. Even a passing automobile may be heard on your super-eight if adjusted at a resonance peak of the auto's wave length. The wave of three thousand meters or one hundred thousand cycles in itself is not conducive to passing any audio frequency currents compared to a transformer of ten thousand meters or thirty thousand cycles.

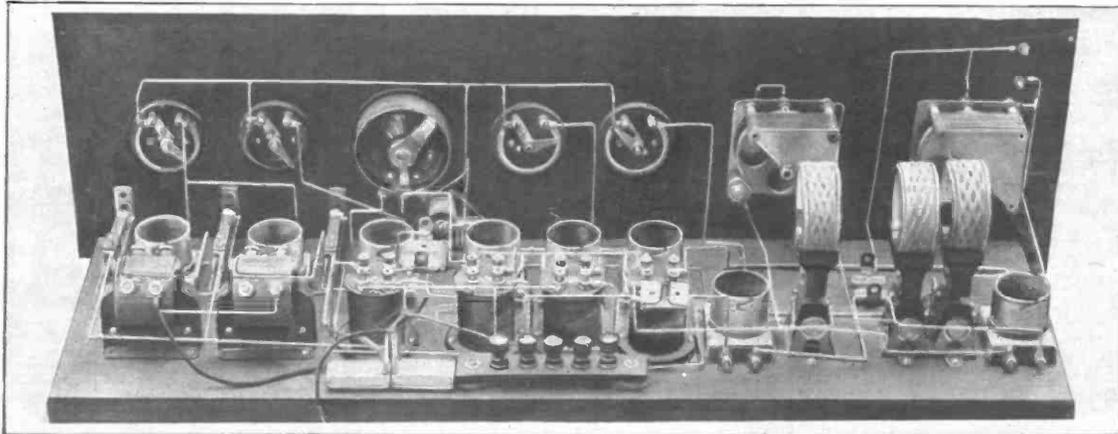
The first two actions of a super-heterodyne, each controlled by a separate tube, do not contribute in any way to increase the amplification.

The oscillator which "heterodynes" or changes the incoming wave length to three thousand meters, and the modulator, which is actuated by this same incoming wave, rectifying and at once modulating the three thousand meter wave length (which we wish to amplify), do not increase the volume of the signals.

In other words, the first two tubes of the set are contributory to selectivity and prevention of distortion. I make this explanation because most people think of an eight-tube set in comparison with a two, three or four tube set and say, upon first hearing it perform on local signals, that the volume is not greatly increased.

The first two tubes do not really function to increase volume. However, the volume is really increased in that more perfect reproduction is obtained by the use of the oscillator and modulator. In other





The placing of all the parts with the battery binding posts in the rear. The two loose flexible wires are for the C battery

words, the super-heterodyne is an improvement over straight radio frequency receivers, and is at its best, or perhaps I should say, is of more value in long-distance reception because, as most every one knows who has looked into the possibilities of radio receivers, radio amplification is not a great improvement upon local signals.

This, of course, is due entirely to the fact that the detector will only handle certain input voltage and as soon as the maximum is reached it proceeds to choke and it becomes necessary to turn down the detector or the reception is distorted.

Hence, on local signals, the volume is only increased to the point of saturation by the detector tube. However, we do obtain volume on the first audio amplifier tube equal to any three or four tube set of other circuit designs than the super-heterodyne.

A rather large loop seems to be essential. The RCA loop or loop of similar dimensions and size has been found better (3 feet on a side and 9 turns), because sufficient input energy must be obtained to modulate the incoming signals properly or

the volume will suffer. A smaller loop, such as the Calvert loop, which is twenty-four inches on the side, is very successful for moderate distances, but if results equal to the larger loop are to be expected a very simple method is to wind two or three turns of flexible lamp cord on the small loop and connect the ends to antenna and ground. That is, the antenna, the lamp cord and the ground form an independent primary circuit and have no direct connection to the main loop. The loop is left connected to the set in the usual way. Thus the antenna circuit acts as a "pickup" and transfers the signals by induction to the loop.

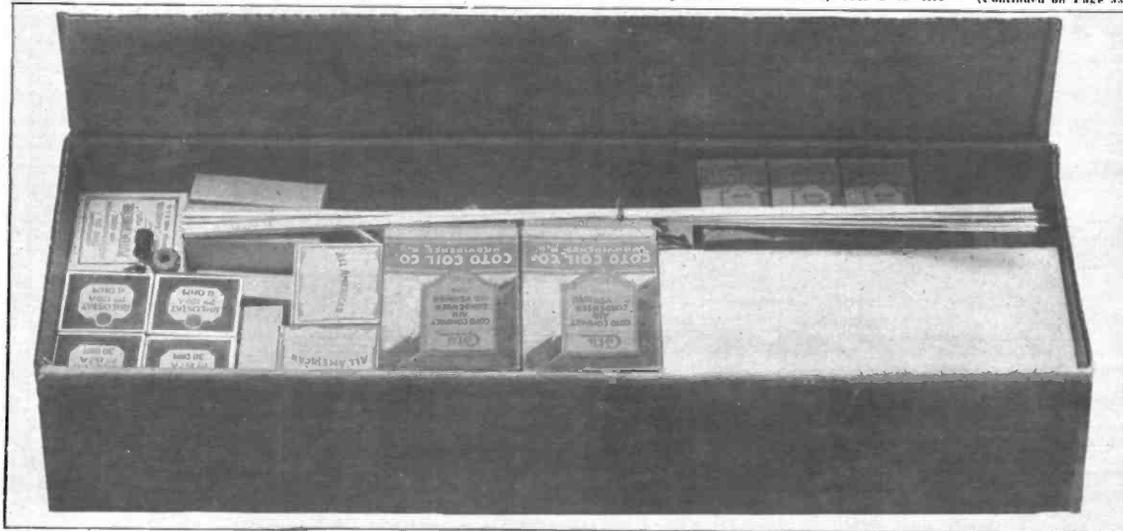
In this instance an indoor antenna is usually sufficient. Something of the concealed type still eliminates the necessity of an outdoor antenna, at the same time making unnecessary the use of such a large loop to which Mrs. Radio Fan usually objects (and I don't blame her). The electric light system, with a Ducon plug, sometimes makes an excellent antenna for this purpose. So will a connection through a fixed condenser to a screw on the telephone.

The layout of the P. W. Air Core Super-Eight is intended to prevent the use of long leads, especially the grid and plate leads from the tube sockets to the transformers. The condenser across the primary of the input transformer should be fastened close to the binding post and not located somewhere around the baseboard. The location of the bypass condensers does not seem materially to change the results obtained.

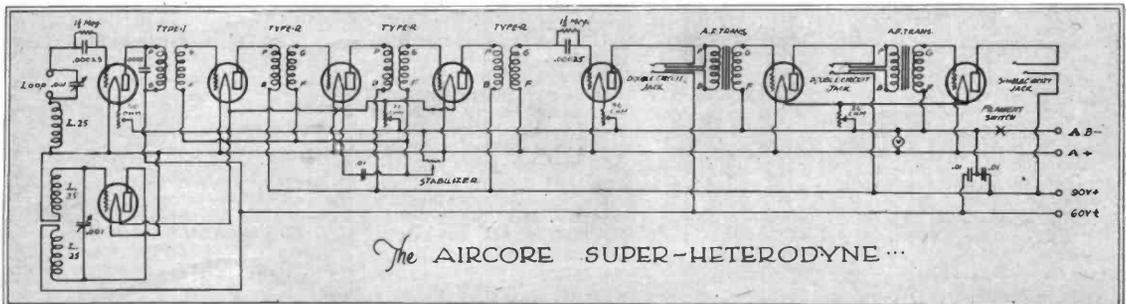
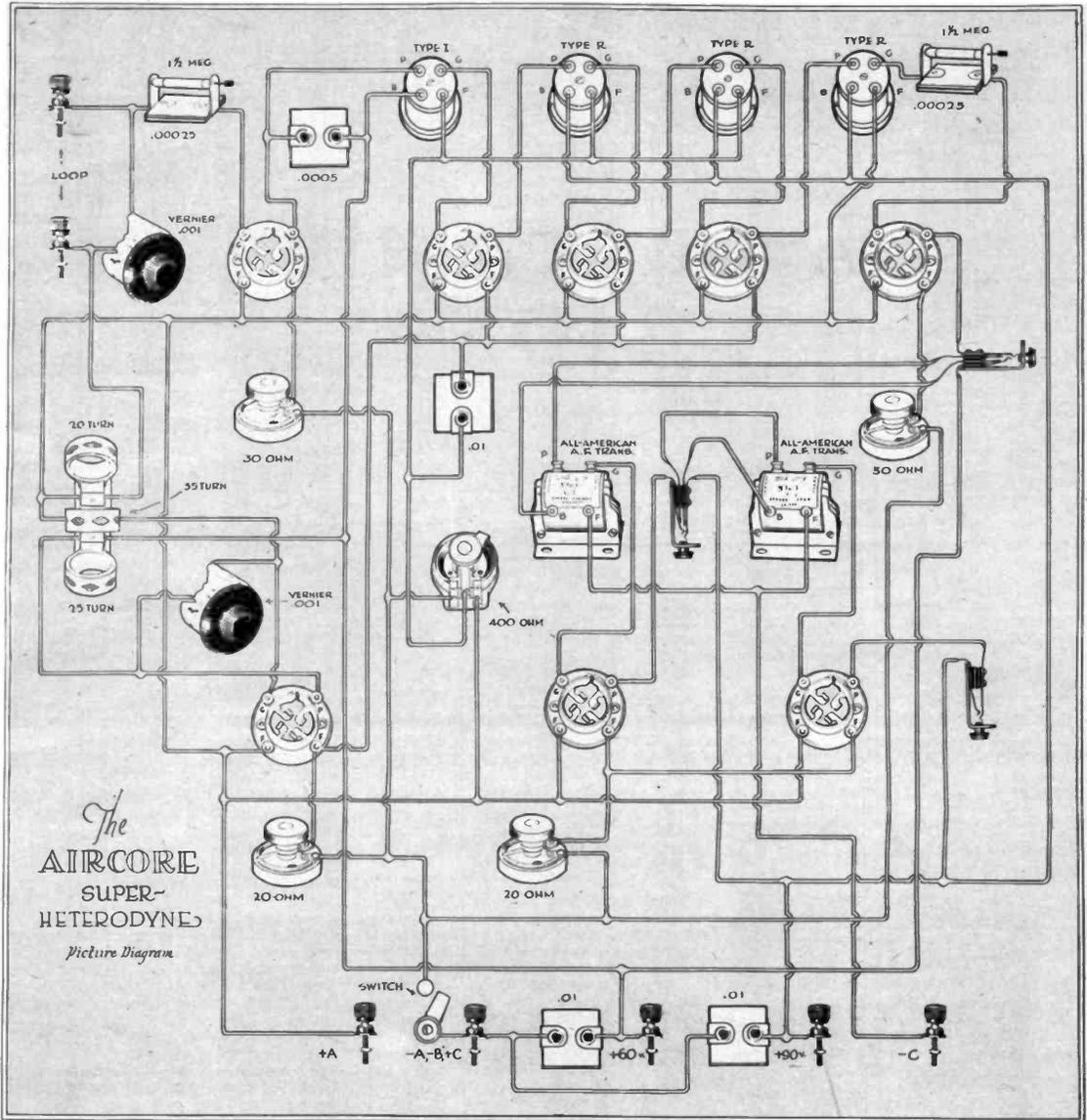
The use of spaghetti we have found in many cases to be detrimental, although a few sets have been built by some of the more expert radio fans using spaghetti very successfully. But this depends on the individual and the quality of spaghetti used.

The location of the coils is given on the layout and should not be changed. A great many fans have spaced the coils wrongly and run into grief because they did not follow the diagram closely. The first coil to the left is twenty or twenty-five turns and the coil adjacent to it is thirty-five turns, the coil two inches away is twenty-five turns. Coil 1 is the part on your tuning circuit, coil 2 is the

(Continued on Page 33)



Every single item necessary to the construction of the set is neatly and compactly inclosed in this box for shipment





Exterior view of Station WCBD, showing towers and Shiloh Tabernacle in the background

**E**VERY now and then, I sit and listen to the religious services and the music broadcast from Station WCBD at Zion, Ill. Friends of mine have spoken to me about this station and have wondered just why it was founded and how it is being maintained and what its objects are.

And so I got in touch with Station WCBD and asked them if they would not have some member of their staff prepare an article and take a number of photographs so that the readers of RADIO IN THE HOME could get a clear idea of just what this station is.

H. M. N.

**Z**ION, the little city founded in the northeast corner of Illinois, by John Alexander Dowie, over a score of years ago, and now ruled over by Wilbur Glenn Voliva, his successor, has been always in the public eye during the vicissitudes of its short life. Since the advent of radiophone broadcasting it is rather better known than ever.

One of the surprises to the radio public has been that the city, which has less than six thousand population, could obtain talent to operate a broadcasting station. Those acquainted with the problems of a program director will at once admit that the task would seem insurmountable.

All talent performing in concert programs at Station WCBD is local, all being members of the Christian Catholic Apostolic Church and residents of the City

of Zion. This is probably the only Class "B" station in the country that can claim this distinction. The solution of the question of artists lay in the unique life of the City of Zion itself.

The department of music of Zion Educational Institutions is under the direction of John D. Thomas, B. M., dean of the conservatory of music and art, director of all the musical organizations of Zion and program director for Station WCBD.

Mr. Thomas was born in Llanelly, Wales—that land of song—and came to this country with his parents in infancy. He was educated in Chicago, studying music with Price, Ap Madoc, Chatterton,

Phelps, Webster and Protheroe, receiving his degree of bachelor of music through the University Extension Conservatory. Before coming to Zion, he was active in church music and concert work in and around Chicago. He has been director of Zion's Musical Organization and conductor of Zion's White Robed Choir for over twenty years. He is a baritone and has written many choral works. The enrollment of the department of music last year was 800 pupils. At the last commencement, six students were graduated and two received their post-graduate diplomas, and 141 received certificates earned in the various branches of music. The

City of Zion has for the period of its existence had one of the largest and best trained choirs performing consistently in the United States. The choir numbers five hundred members and under the baton of John D. Thomas, conductor, sings every Sunday afternoon throughout the whole year at the regular services of Zion, which are held in Shiloh Tabernacle at 3 o'clock. Oratorios and cantatas are rendered three times yearly, at the All Night Service on New Year's Eve, at Easter and in July during the annual convocations of the church.

The Zion Band, under the direction of P. B. Newcomer, numbers fifty pieces and plays regular concerts throughout the year. Generous praise has been showered upon the band and Mr. Newcomer, who is also solo cornetist, and Wm. C. Dunn, euphonium soloist, in addition to the various combinations of group players, including the McElroy Saxophone Quintet, which is a very popular unit in radio concert work. The quintet is composed of George McElroy and his four sons. The work of Zion Band has proved to be one of the most popular features in the entertainment at WCBD.

Zion Orchestra, under the direction of L. J. Hire, numbers forty-five pieces, which makes a total membership of six hundred in the three main musical organizations. The orchestra is fortunate in having the services of so well seasoned a musician as L. J. Hire, who has been its director for ten years, and prior to that time a teacher and orchestra leader for fifteen years. Mrs.



Hire is a musician of rare attainments and for many years prior to her engagement with the Zion Orchestra was with the Red-path Bureau and on other circuits. One of her specialties is playing the Swiss Hand Bells. Richard F. Hire, although but twenty years of age has twice won first honors in the American Conservatory and has played at both Orchestra Hall and the Chicago Auditorium, accompanied by the Chicago Symphony Orchestra at the commencement concerts of this conservatory.

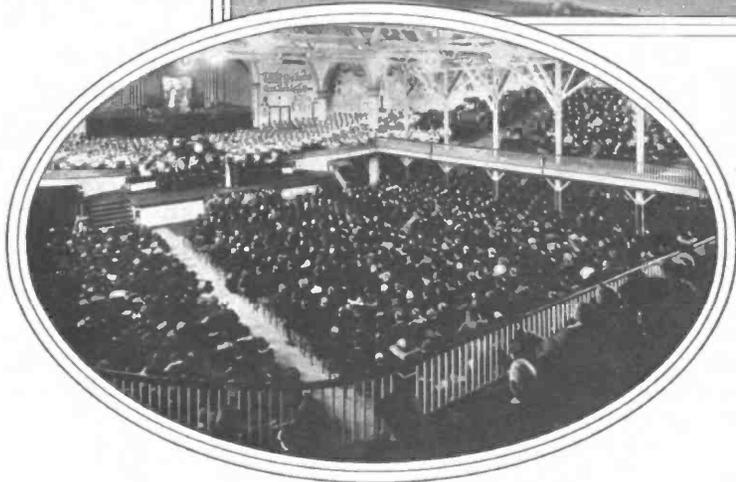
The prosaic monotony of studio broadcasting has been the problem of Station WCBD, the same as it has been the problem of all other stations. With no audience to cheer the artist, only deadened walls with not even a friendly resonance to bespeak life, the absence of the human touch has been a problem for the Program Director. A grim silence has greeted performers in the studio, who, facing nothing more cheerful than the cold critical microphone, have met an experience that calls for a new form of stoicism. To visualize the unseen audience of thousands—in some cases hundreds of thousands of silent and appreciative listeners—ah, that is the thing! The foreknowledge that their auditors would send

and most hated word—has as an organization for thirty years held services in the afternoon on Lord's Days. It is the judgment of many that Wilbur Glenn Voliva, the present leader of Zion, has one of the best radio voices in the country. He has been in public life, speaking continuously, for more than thirty years, yet his voice has timbre and is well sustained and therefore is admirably adapted to radio speaking. It is no unusual thing to receive letters from radio listeners twelve or fifteen hundred miles away saying they heard every word of a sermon distinctly. In fact, this station has achieved a reputation for perfect modulation and excellent enuncia-

tion was installed to enable intelligent control of the ten microphones operated from this booth. To follow through an afternoon service will best explain their operation.

Every Sunday there is a band or organ recital for thirty minutes preceding the afternoon service, alternating from Sunday to Sunday. Promptly at 2:30 the organist, Fred Fassen, seats himself at the console of the pipe-organ, which is one of the largest church organs in the world. The announcer makes his opening statement and signals the organist by flashing a small red light placed on the organ.

Seated in the booth, the announcer hears the concert and all other broadcast-



Above is a view of the spacious studio of Station WCBD, Zion, Ill. To the left is an interior view of the Shiloh Tabernacle, showing the audience, choir and speaker before the microphone

words of greeting from Alaska and the West Indies, and from Maine to California has lent an urge second only to the love the artists have had for their work and the feeling of loyalty to their audience.

After picking up the carrier wave of Station WCBD, the listener is first greeted with the sound of the signal chimes pealing out the first strain of the Doxology—"Praise God from Whom All Blessings Flow." All programs are opened and closed in this way. Zion—that best loved

tion on the part not only of the speakers but the singers as well.

When the Western Electric Company assumed the task of constructing this station in the summer of 1923, new problems faced the engineers, yet all issues were met and satisfactory solutions found.

A control booth for the announcer was placed in the rear of Shiloh Tabernacle where the speaker's platform, choir and band leaders, orchestra and organist could easily be seen. A system of signal lights

ing from the Tabernacle coming over the air as readers of *Radio in the Home* would, by using ear phones or loud speaker, picking up the station wave.

Succeeding numbers are announced and played to the close of the recital. Having finished, the organist flashes a light in the booth, informing the announcer that his work is done. Immediate announcement is then made of the processional to follow.

John D. Thomas, choir leader, mounting the dais, is the only member of the choir in view at the beginning. With the fall of his baton the first strains of the organ are heard in the rear room, where the choir has formed in two double ranks awaiting the opening of the double doors on each side of the platform, ready to march in procession. No sounds come from the main auditorium at the beginning of the processional, the music radio listeners hear is that of organ and song from the rear room, a microphone being placed there to carry off the first part of the processional.

The choir enters the auditorium headed by the juniors, 8 to 12 years, 125 in number, followed by the adult choir, all robed in cassock, cotta and trencher, about ten minutes being required for the counter march down the aisles of the auditorium



and into the choir gallery. As soon as the conductor begins to direct the processional the announcer turns on a microphone in the rear room and immediately the double doors to the auditorium are quietly swung open by uniformed guards, and, as the choir proceeds and the volume of sound increases, a second microphone in the auditorium is switched on and singing from both rooms is then heard. The organist later turns on the great organ in the auditorium and simultaneously the announcer cuts off the rear microphone, leaving the one microphone in the auditorium to carry off the full volume of song. Other microphones are used for the speaker, for solo work, echo organ and other purposes, all being controlled from the booth by the announcer.

Many comments have been made on the slogan of this station, which is "Where God Rules, Man Prospers." This slogan was adopted by the late John Alexander Dowie at the time of the incorporation of the City of Zion, and dedicated to the Theocratic Party, the local political organization of Zion. It was adopted by Wilbur Glenn Voliva, present leader of Zion, and successor to John Alexander Dowie, as the slogan for Station WCBD.

The closing salutation, "Peace Be Unto You," are our Lord's own spoken words to His disciples in the upper room in Jerusalem after His resurrection. This salutation was introduced into Zion and adopted by John Alexander Dowie and his people soon after the founding of the city in 1901. In commenting one Lord's Day in an early morning service on the nondescript salutations common on the streets, he spoke of the beauty of the Lord's salutation to His disciples and the salutation of peace used by the early Christians for centuries, and, in fact, used today by millions of Orientals. He stated it was his custom when a student in Edinburgh University to greet his language professor when they would meet in the morning with a respectful "Pax Tibi."



The top picture shows J. H. DePew, chief announcer, in the booth at the Shiloh Tabernacle. Oval—Wilbur Glenn Voliva, who is the owner of radio station WCBD, Zion, Ill., and to the right is a picture of John D. Thomas, B. M., program director of Station WCBD

The latter would reply, "Pax Tibi Multiplicatur."

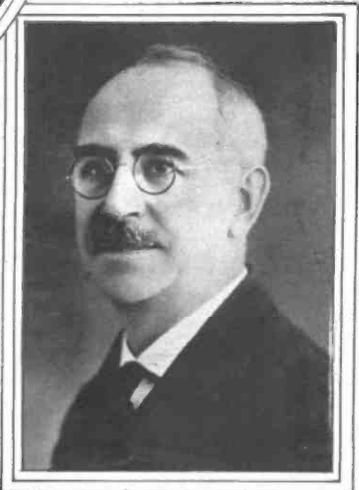
Dr. Dowie conceived the idea at that moment and asked the people thenceforth to use the salutation, "Peace to Thee," responding with, "Peace to Thee Be Multiplied." Thereafter, and since, under the regime of Zion's present leader, Wilbur Glenn Voliva, this has been the official

daily greeting and salutation among the people of Zion.

J. H. DePew, chief announcer and manager of Station WCBD, is one of the pioneer residents of Zion, having affiliated with the church founded by John Alexander Dowie in the early days of its history in Chicago. He was among the very first on the scene at the inception of the City of Zion in Lake County, Illinois. Mr. DePew was called into the service of Dr. Dowie in 1901 to help establish the first general merchandise store in the community. First as clerk and later as department manager, Mr. DePew remained in the Zion store until the population had grown from half a dozen workmen to a community numbering over two thousand, within slightly more than a year from the time of his arrival. He was elected the first city clerk and served several years in that capacity and later was chosen by Dr. Dowie as his personal attendant, accompanying him on his travels and acting as office man and factotum when at home.

When the financial difficulties in the city arose in 1906, Mr. DePew perforce joined the dispersion in common with many other young men, and sought elsewhere for employment, finally drifting to the Isthmus of Panama, where he engaged with the Government in connection with the work of digging the Panama Canal. The latter part of his five-year stay in the Canal Zone was as private investigator for General George W. Goethals, chairman of the Isthmian Canal Commission and chief engineer of the Panama Canal.

Early in 1912 Mr. DePew removed with his family to Zion and entered the employ of Wilbur Glenn Voliva, Dr. Dowie's successor as general overseer of the church, in the same capacity he occupied with Dr. Dowie, that of personal attendant and office man. He continued in this position until Mr. Voliva



decided to erect a broadcasting station, when he was made manager and first announcer. Mr. DePew is a native of the State of Texas, having spent the early years of his life on a cattle ranch in San Saba county.

F. B. Wamsley, assistant announcer, was born at Cleves, Ohio, of English parentage. He received his high school education in Cincinnati, Ohio, and was employed there in the banking and brokerage business for about twelve years prior to coming to Zion several years ago. Mr. Wamsley is connected with the Zion Institutions and Industries as cashier general, announcing at the radio station being his avocation.

Henry H. Albrecht, former Navy radio operator, who has seen service on both coasts and in various sections of the world, is chief operator for Station WCBD, handling all broadcasting with the assistance of Theodore Mason, junior operator.

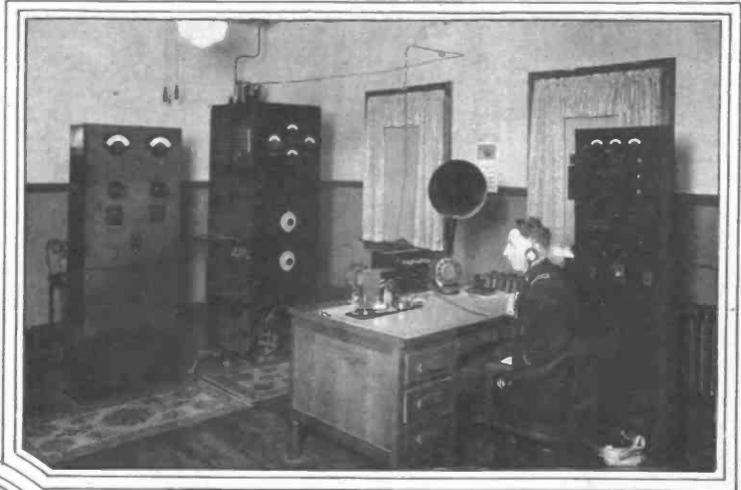
The radio building stands in the center of the temple site, a ten-acre tract of ground, which is surrounded by Shiloh Park, a reserve of two hundred acres, this building and Shiloh Tabernacle being the only buildings within this reserve. The radio station occupies the geographical center of the City of Zion, which is laid out with eight boulevards diverging from the center and running to the limits of the 6500 acres which comprise the city and environs. The steel towers are 150 feet high and stand at an elevation of eighty feet above Lake Michigan, which is a mile

nil, and when nothing but millions of dollars of debt and seeming disaster stared the people of Zion in the face.

From this inauspicious beginning, with no assets but a loyal people, he grappled a problem to quail the stoutest heart. Mr. Voliva has built up the Zion Estate to its present great proportions. Last year these institutions and industries, twenty-six in number did a business of more than \$4,000,000. A constant flow of visitors is received at the radio station, especially

the highest point of the surrounding country. Every day throughout the whole year visitors are received by courteous guides and shown the workings of the radio station and Tabernacle.

Broadcasting Station WCBD was erected by Mr. Voliva for the primary purpose of spreading the Gospel in speech and song. The service and programs broadcast by this station have resulted in a most satisfactory class of correspondence received from every stratum of our popula-



Above is shown a picture of the operating room and Henry H. Albrecht, chief operator. To the left is a picture of F. W. Wamsley, assistant announcer of the station



during the warm months, when thousands of tourists driving through the city on Sheridan road are greeted by signboards of invitation and welcome. Many of these tourists are equipped with radio receiving sets and while camping beside the road in various adjoining States they listen to a concert and hear an invitation something like the following:

"This is Radio Station WCBD, Zion, Illinois. We specially invite the tourists in this section to visit this radio station

when passing through Zion. As you drive through the city on Sheridan road, you will see the towers and radio station a half mile to the west. Officers of the church are in attendance at Shiloh Tabernacle at all hours and will show you through both the Tabernacle and the radio station, which are located near each other on the Temple Site."

Driving along Sheridan road, which is the main artery of travel between Chicago and the Great Northwest, countless thousands of tourists have seen the graceful towers of the radio station, with Shiloh Tabernacle in the background, standing on

each mail bringing many letters from representative men in business and professional life, in addition to the constant stream of mail from city homes and suburban population. A morning mail will contain letters from captains of industry, a professor of English in an Eastern college, men of the field, soiled letters written with pencil from a humble cot in a Southern State, letters on crested stationery breathing of the boulevards, and one from the frozen regions from the outreaches of Canada, stating that dog sledges had borne it 250 miles to the nearest postoffice. Here is a typical letter from an Ohio city:

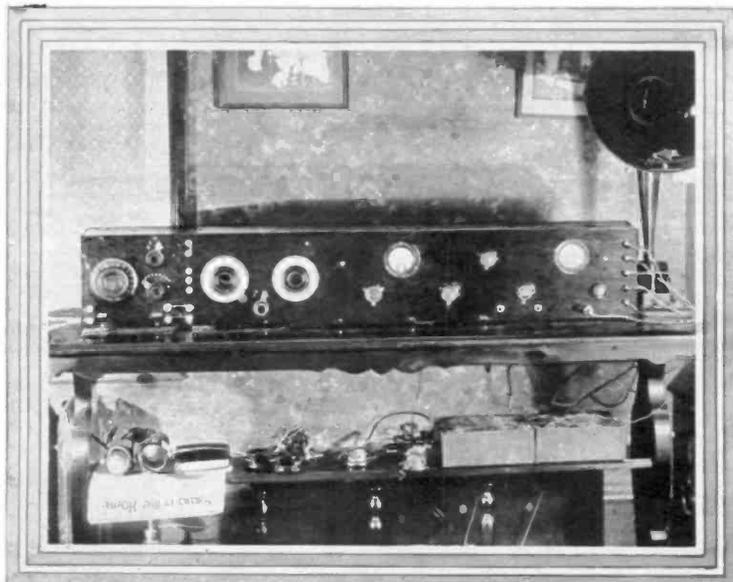
"I would be remiss in my duty if I did not write to say how much I appreciated your concert last night. Having been deaf—not hard of hearing, but deaf—for more than twenty years, I heard for the first time in all the period the selections, 'In the Sweet By and By,' 'The Little Brown Church in the Vale,' 'Tramp, Tramp, Tramp, the Boys Are Marching,' and others which I sang myself years ago. The concert carried me back to the time I sang in church choirs. The cornet solo by Mr. Newcomer, 'Lead Kindly Light,' was wonderful. The tears trickled down my cheeks as I listened in to the wonderful music, as I had never expected to hear these songs again. It was as if angels were singing especially for me—a deaf man. The request numbers which you gave were just what I would have requested. Others in my home listened in also, but I surmise that they were watching me as much as listening to the pro-

(Continued on Page 29)

and a half to the east. The radio station is in plain sight of Sheridan road, a paved thoroughfare which runs from Houghton, Michigan, to St. Louis, Missouri, through the North Shore and the City of Chicago.

The Chicago and Northwestern Railway runs through the eastern part of the city, and the Chicago North Shore and Milwaukee Electric Railway serves the western part of the town.

The City of Zion was founded by John Alexander Dowie in 1901. Wilbur Glenn Voliva succeeded John Alexander Dowie in 1906, at a time when the organization had fallen into disrepute, when its credit was



The final triumph. The complete set with Magnavox and, of course, a copy of "Radio in the Home." That last feature is really the reason we are printing the photograph

## A Raw Amateur's Experiences

By FRANK C. PARKER, M. D.

WE READ of circuits and circuits and still more circuits—and circuits that are more still than circuits—till we become so hypnotized with their possibilities, real or imaginary, that we know not which way to turn, at the same time developing a longing for something which we have not.

It was while in one of these trances after absorbing considerable literature and trying out various hookups that I read of the super-heterodyne's pleasing personality. This super-heterodyne seemed to have the earmarks of just what I was looking for—selectivity and volume. My good friend, Alvin D. Beyer, of Norristown, suggested that we take the plunge. My reply was, "You know me, Al." So off went an order for two sets, the particular set under discussion being a most extensively advertised model.

*Note.—This set is NOT advertised in "Radio in the Home."—H. M. N.*

After the customary long wait required as a set standard by most saleshouses nowadays, the various parts began to arrive. Strange as it may seem, the first things received were the loop and B batteries—the last things needed—but as B batteries improve with age we, of course, had no kick coming, especially from the B batteries.

Next a few transformers and condensers presented themselves, followed at two-week intervals by panels, cabinets, sockets, rheostats, gridleaks, oscillator coils, radio frequency coupler coils, binding posts, ammeters, voltmeters, bus wire, spaghetti, et al, the whole family, after securing their reservations, arriving approximately two months subsequent to placing the order!

What a sight it was! Here they were apparently in excellent health and guarded by several large fatherly looking blue

prints resembling the constructional details of the new 1935 Ford equipped with individual shock absorbers beneath either seat.

Before wandering farther we will here enumerate the various parts and their values, other than commercial. Here they are:

- 1 Variable condenser of .001 capacity, for the heterodyne.
- 1 Variable condenser of .00027 capacity, for wave length.
- Potentiometer of 400 ohms resistance.
- 3 20-ohm rheostats for controlling the two detector and one heterodyne lamp.
- 1 7-ohm rheostat controlling the three radio and two audio tubes designated the master rheostat.
- 8 Tube sockets.
- 2 2-meg. grid leaks.
- 2 Fixed condensers, .00027.
- 2 Radio frequency transformer fixed condensers, .0025.
- 1 By-pass fixed condenser, .001.
- 2 By-pass fixed condensers, 1 mf.

- 1 Radio frequency coupler consisting of two coils composed approximately of 925 turns in layers of about 20 turns number 32 cotton covered wire.

- 2 Audio transformers, 4½ to 1.
- 3 Radio frequency transformers, type UV-1716.

- 1 Oscillator coupler composed of three coils of Number 20 cotton covered wire, coil L having 6 turns; L1 having 21 turns, and L2 having 41 turns. This coupler is of special design, the coils being one within the other.
- 2 Closed and 1 open jack.
- 2 wire-wound resistors.

Panel, cabinet, wire, screws, spaghetti, binding posts and, if you prefer, a voltmeter, ammeter and filament control switch.

The loop is of the solenoid type, each side being three feet and wound with 9 turns spaced about five-eighths of an inch.

A variable condenser, .0005, is used to

tune the loop.

An antenna adapter is furnished for use on the outdoor aerial. This adapter consists of three coils and a variable condenser.

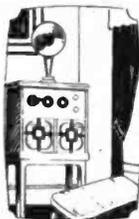
Eight lamps, preferably C301A or UV-201A, are necessary. Other lamps may be employed.

A B battery of 90 to 100 volts is required as well as a C battery of 4½ volts. (As far as signals are concerned no difference was noted either with or without the C battery. However, B battery current is saved by its use.)

Outside of the above few trinkets nothing else is required save a certain amount of patience and at least eight hours' sleep each night. If you get into trouble, go to bed and forget about it until the morrow, when things may right themselves unexpectedly.

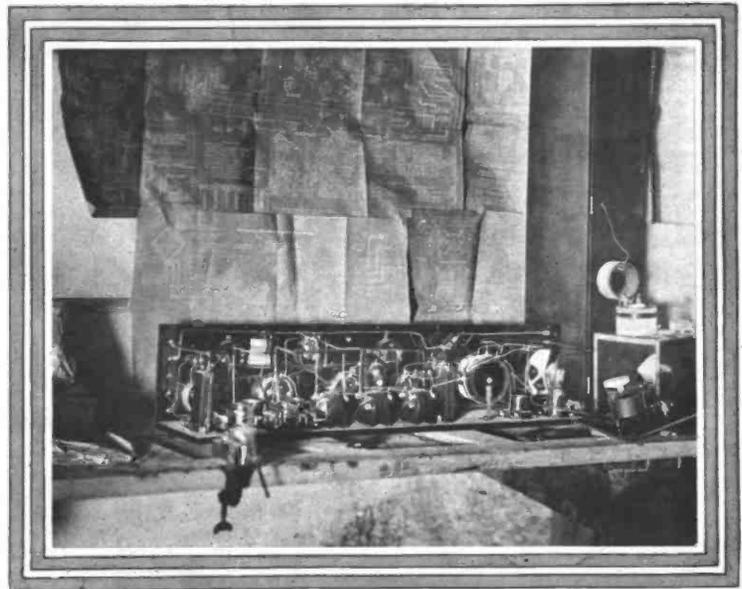
After making a thorough survey of the situation it was decided that in order to gain the proper perspective and keep on an even keel we had better come up to leeward of the diagrams and examine them carefully if not most minutely, so at it we went. We traced every wire from beginning to end—that is, those which had ends—and after following many of them through the streets of the forbidden city, would slip off a grid leak and fall into the yawning jaws of a condenser waiting to receive us with outstretched arms. We knew from the old scarabs lying about that His Honor King Tut lay buried there and that the rooms were already occupied, so we would be compelled to retrace our steps in another direction.

I might add right here that it is always a good plan in looking over these or any other blue prints, to hold them to the light for closer inspection, as many, many dark secrets are concealed in the watermarkings in the paper, which may never come to light unless pressure is brought to bear. They are most reticent and at times can be coaxed out only by the gentlest persuasion. While we found the blueprints to be most



After you solve the intricacies of Mah Jong, you will be able to tackle the intricacies of these blue-prints and this array of apparatus

## with the SUPER- HETERODYNE



commendable and thorough, the lower right-hand corners bearing the signatures of the various dignitaries associated in the plot, who each and every one had passed upon them and had given them their O. K. by attaching their signatures, still quite a few errors slipped by. For instance, the two coils "L" and "LI" of the oscillator coupler were shown connected, when as a matter of fact they have not been on speaking terms for some time, as evidenced by later appearing diagrams.

Some condensers were marked .0027 in preference to .00027, which is now considered more in keeping with the Parisian mode. Data relative to the C battery and kind of lamps employed did not seem to approach the standard set down by Daniel Webster in his classical novel.

However, I must say, leaving all hilarity aside, that the blueprints, outside of the errors, were elegantly done and most imposing. They were very thorough and carried out in the most minute detail. We are all liable to error and I really think the designer did exceptionally well to get through his task without more defects presenting themselves.

We had heard of four of these super-heterodynes having been constructed without success and we wondered whether or not it might not have been just this little slip which has had something to do with the failure to perform.

Approaching the serious, let me say right here that the data furnished with this particular outfit is most complete, and after the errors are eliminated the affair should work out satisfactorily, if not otherwise.

Running along now to the various units, we find that the excellent instruction book accompanying the outfit with a \$2.00 ticket, lays stress upon testing out each piece of apparatus before setting it up. This may seem superfluous as the individual units are all new and fresh from the factory. Having been through this thing before we concluded the above to be good advice and accordingly proceeded to carry out the plan.

Out of four variable condensers we found two "shorted"—plates rubbing. One we were able to straighten out, the other was returned and we received a duplicate without any quibbling on the part of the dispensers of the set. Let me say that we have had no trouble in having defective parts replaced. Our principle difficulty lay in getting a rise from any letter asking for information. Three letters brought one reply after a wait of three weeks. Of course, this is part of the "service." Our only object in citing these instances is to give the reader an idea of about what he must expect in case he desires his set in a "hurry." As our Louisville friend says, "Make your own time allowances."

After the condensers, we turned our attention to the radio frequency transformers, type 1716. Out of six we found one broken and two with open secondaries. These were sent back and after a most annoying wait of over six weeks we succeeded in getting them from another source. We have reason to believe, however, that the inability to supply these transformers was not due to any fault of the dispensers of this knock-down set. The hunt for these 1716 transformers was a prolonged and tiresome one and held up the completion of the second set for over six weeks. Radio shops all over Philadelphia and New York were appealed to without success. The transformers apparently were not being released by the manufacturer for some reason best known to themselves.

We are told that "All Gaul is divided into three parts." The word is misspelled. The "u" should be replaced by another "l." Regardless of the number of parts, the whole circus seems to be controlled by a select few. Uncle Sam appears to have discovered this fact recently.

Tripping along, we next turned our undivided attention to the four large by-

pass condensers. One of these we found "shorted" between lug and metal housing. This was easily corrected. One 'phone jack needed a slight adjustment to allow of proper contact with the inserted 'phone plug and one lamp socket was defective. Aside from these defects, any one of which would have Daughertyized the completed set, we found everything in good trim.

From the above you can readily see that you will save yourself much annoyance by following the advice to test out each part before proceeding with the hooking-up process.

Having satisfied ourselves that all was in readiness, we proceeded to place the parts as indicated upon the diagram. Here was a long box into which we were to put all this debris and wire it up. How in the name of William Jennings Volstead were we going to get inside this box to work? The instruction book did not say, so after much deliberate thought our son came to the rescue and suggested we take off the bottom of the box. How practical! Who would have thought of such a thing but a young son. We would advise every one to have a young son sticking around even though he does play with the grid leaks and drop them inside the condensers and takes the ammeters, tacking them on his express wagon for speedometers.

Well, we removed several screws and took off the bottom of the box. Easy. Next we attached the panel to this board and, strange to say, we found it just the exact length of the board. For once something fitted perfectly. This encouraged us immensely, so we lighted another cigar, gave the parrot an extra stroke on the back, and during the excitement of a retaliatory bite knocked a perfectly good tube off the table and destroyed its bias completely. Keep all parrots away, as they do not entuse. The various pieces of appa-





Fig. 1. Mr. Foote finds the two wires of the fence around the cow pasture make a successful aerial and "counterpoise," even though the farmer didn't dream of such a thing when he put them there

By  
**BRAINARD  
FOOTE**

**B**ESIDES the ordinary ability to "work" and to "work" anywhere and everywhere, what are the primary requirements of the portable radio set?

I would say that compactness is paramount, and along with that, convenience, neatness and ease of adjustment. A truly portable one-tube receiver ought to be small enough to be tucked away in a corner of one's handbag—battery supply and all. It ought to be ready for work at a second's notice; it ought to stand considerable abuse without internal disruptions; it ought to be readily accessible for battery and tube renewals and its make-up ought to be condensed in dimensions in comparison to the big loud speaker set, just as a wrist watch is but a mere shadow of the grandfather's clock in the hall.

## TAKE ALONG A MAGIC MUSIC BOX

### Try These Combinations for Aerial and Ground

MANY combinations can be tried for best aerial and ground connections for this and other portable sets. Put spring clips on the ends of your flexible aerial and ground leads and then try—

ONE CLIP ON	OTHER CLIP ON
Upper wire of fence	Lower wire of fence
Telephone stand	Water faucet
Telephone stand	Electric light socket
Electric light socket	Radiator
Electric light socket	Water faucet
Binding post of doorbell	Water pipe or radiator
Frame of automobile	Wire fence or water pipe
Metal frame of large chandelier	Water pipe or radiator

Nor need the portable set be thought of solely as an addition to picnic party or auto luncheon. What about our immense moving population—the traveling men, salesmen, actors, speakers, lecturers, or folks off on a pleasure tour? The portable set becomes to them more of a utility than an amusement if it weighs little and brings much. Not only will it while away the hours of an evening in some strange town, but it will prove a companion ready always to soothe with soft music, to amuse with comic songs and plays, to bring voices from one's home city, forecast the weather, set one's watch and perform a myriad other little friendly services.

The traveling man's hotel offers several workable means for bringing to his very room the radio energy which his portable set will translate into en-

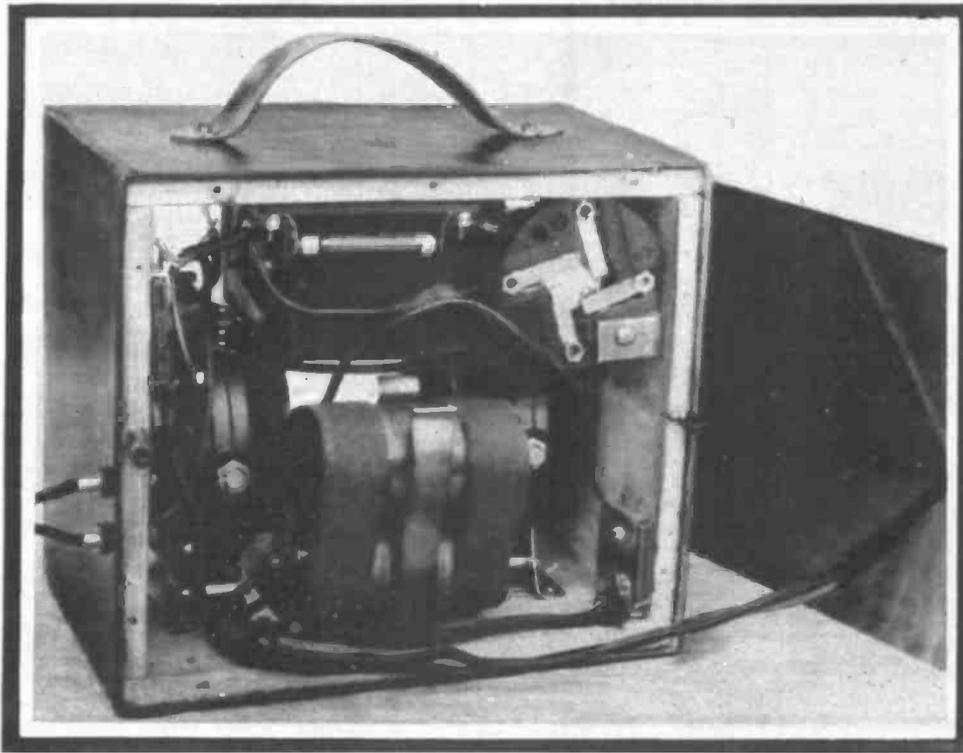


Fig. 2—Removing the back panel, we can see some of the parts inside. Note the two-unit flashlight cells for the A battery, the grid leak, UV199 socket and the two compact variometers

tainment at his bidding. There are the electric lighting wires, the telephone, the "bell-hop" push-button and even the wires in the bedspring. Sometimes the telephone wire acts most satisfactorily as the aerial, yet in other locations, the lighting wires are more successful.

And a properly built one-tube affair will take advantage of these natural (may I call them?) aerial systems.

The accompanying illustrations give you my suggestions and I see no reason why you cannot carry them out without ever having had previous acquaintance with radio. Of course, you ought to have some slight ability with simple tools, but most folks have that anyway. The total expenditure falls in the neighborhood of twenty-five dollars, probably somewhat less. You need nothing more, as your aerial has already been provided by thoughtful power and phone companies.

Technically, the circuit is "Tuned Plate Regenerative," using two small variometers for controlling the wave length setting and the volume and a special coupling scheme which permits of free attachment to all manner of aeriels without regard to their size or other purposes for which they are to be used at the same time. The variometers are indeed the instruments which make so small an outfit possible and their manufacturers are to be congratulated for making miniature instruments so efficient.

The external dimensions of the set are 6 by 7 by 4 3/4 inches, not including the connecting cord and the phones.

**PARTS NEEDED**

Numbers corresponding to the parts listed below appear on the circuit diagram to aid you in identifying and connecting them:

1. Two small nickel plate connecting clips.
2. Twenty feet of flexible lamp cord (single).
3. Two .002 mfd. Dubilier Micadon condensers.
4. Two Coto-Coil "Compact" variometers.
5. Two Eveready "Unit Cells," No. 950.
6. One battery switch (may be homemade).

7. One .00001 mfd. Dubilier grid condenser (or .00025 mfd.).
8. One 2-megohm grid leak and mounting, R. C. A. type.
9. One General Electric (R. C. A.) socket for UV199 tube.
10. One UV199 or C299 tube.
11. Two "Cord Tip" jacks, Carter recommended.
12. Two 6 by 7 inch Radion panels.
13. Two small Amsco 0-50 or small dials used for rheostats.
14. Leather-covered case, to be described.
15. Small headset or single phone.
16. One Eveready No. 763 22 1/2-volt B battery.
17. One separable plug for lighting socket.
18. About 10 feet magnet wire, about No. 20 in size.

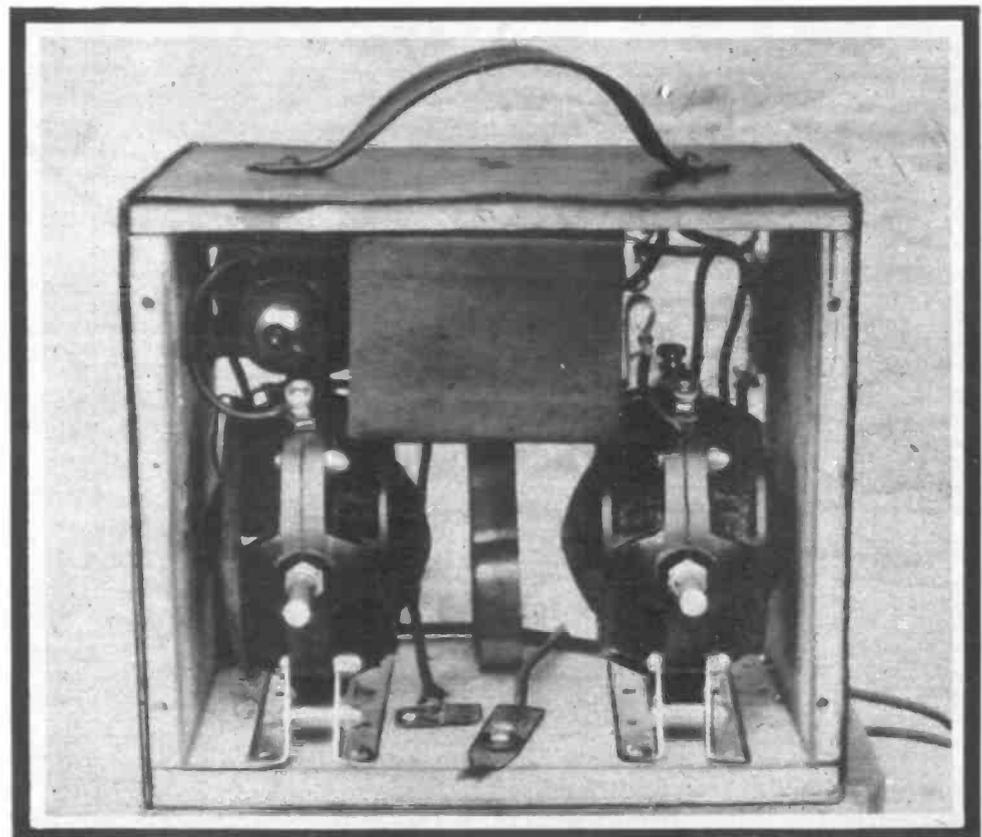
The photographs will show you just what many of the above parts look like and will help you in your purchase. The battery switch may be purchased, but most of the manufactured type have so stiff a spring that the whole set would be moved around when you turn the current to the tube on and off. A very neat switch may be made out of a strip of copper or brass, which doesn't have this draw-back.

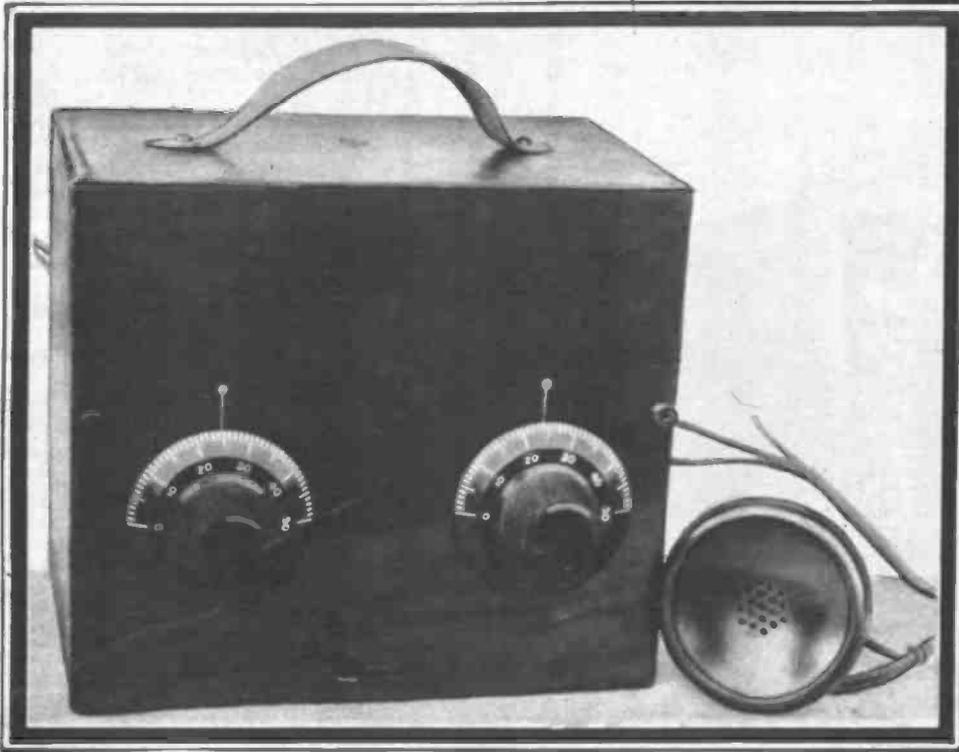
The cabinet is the first thing to make, and you will need a piece of wood, not too hard, 4 3/8 inches wide and about 26 inches long. Its thickness should not be over 5-16 inch. Cut two pieces for top and bottom 7 inches long and then cut two others long enough to make the height of the box just 6 inches. With 5-16 stock, the side pieces are 5 3/8 inches long each.

Nail the pieces together with small brads. The Radion panels are to form the front and rear covers. You will observe in Figures 2 and 5, the rear views, that the panel is held on by two lengths of threaded rod embedded in the side pieces of the case. Two thumb screws go on the outside. These may be small brass binding posts with the screw heads cut off with clippers or hack-



Fig. 3—Doesn't it look simple? No rheostat is necessary, and the switch at the bottom turns the current on and off. See the tube at the upper left? The B battery fits tightly between the top of the case and the frames of the variometers





saw, or they may be one-inch lengths of threaded rod.

Drill a hole considerably smaller than the screw and then turn the latter in with a pair of pliers or a screw-driver, first applying a drop of glue to the end. Allow the end to project about  $\frac{3}{8}$ -inch. The rear holding screws are placed on the center line, while those in front are slightly higher to allow for the dials—put them  $2\frac{1}{2}$  inches down from the top. Then drill corresponding holes in the panels and fasten them on.

Your local harness maker is next called into service. Have him put on a good leather covering, sewed at the four corners. The leather should project over the Radion panels—in other words, it should be  $4\frac{3}{4}$  inches in width. Stiff leather will fit closely to the panel and result in a neat camera-like exterior. It should be blackened and a leather carrying handle screwed on top by the harness maker, who will probably charge you a dollar and a half for the job. Don't try it yourself unless you're good at it, though!

The photos will show the approximate location for the cord tip jacks, holes for which are drilled through leather and wood. The ordinary phone jack occupies altogether too much space for the purpose, however. The size of cabinet described will just hold the parts comfortably and without wasting any considerable amount of space.

Rubber-covered wire is to be used for the connections, for reasons of convenience in wiring and for flexibility afterwards. Slide off the cloth covering from five feet of your rubber-covered flexible cord. Place the variometers first. These are held to the bottom of the case with several short wood screws, and should be mounted as far front as possible, allowing room for the shaft bushing. If you fasten them with their supporting strip just one inch from the rear of the bottom of the case, there will be just room enough at front.

Next comes the socket. Fasten four wires about 8 inches long to the binding posts beforehand, as you won't be able to

Fig. 4—The outside dimensions are only  $6 \times 7 \times 4\frac{3}{4}$  inches, yet it is complete with tube and batteries inside

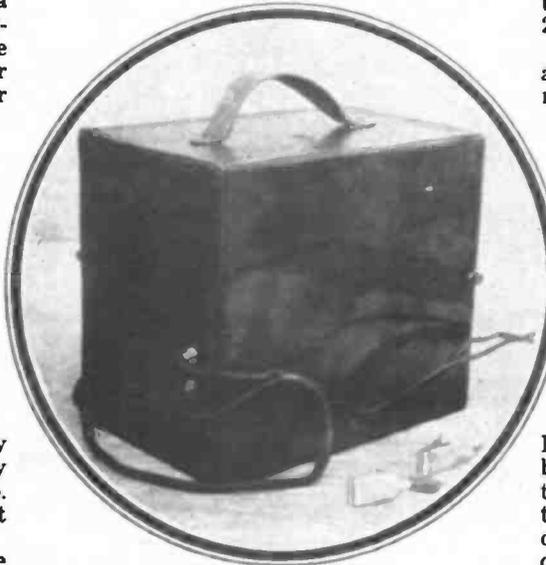


Fig. 5—Circle: Here's how the "Music Box" looks from the rear. Note the "cord tip" jacks for connections to the phone and the flexible connecting cords for making quick contact to the telephone line or lighting circuit as the aerial

reach the connections once the socket is inside. It is held in place by a brass angle and a one-inch 6-32 machine screw and nut, as Figure 2 depicts.

The tube is in a horizontal position, but this will not cause the filament to sag as some may claim because the filament is held taut by spring tension. The socket is mounted in from the rear only about  $\frac{1}{8}$  inch, and the tube will fit right in the corner of the case just above the variometer. You may see the placing of the grid leak and mounting in Figure 2.

Figure 3 will show the battery switch clearly enough to make further explanation unnecessary. The rounded handle of the blade is allowed to project about  $\frac{3}{8}$ -inch in front of the panel and both blade and contact are held by short wood screws.

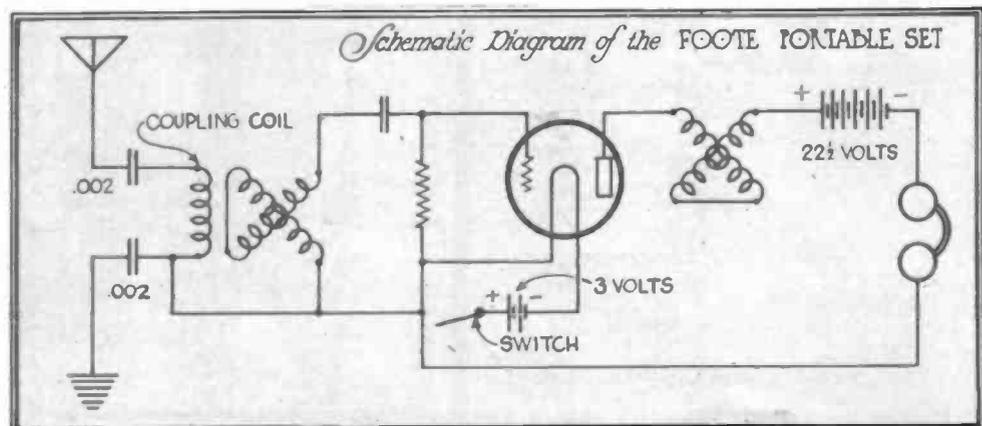
You are now ready for the "coupling coil." This consists of nine turns of the magnet wire wound into a sort of doughnut or ring slightly larger in diameter than the outer flange of the stator winding of the variometer. The coupling coil may be seen in Figure 2 on the right side of the right-hand variometer, and in Figure 3 on the left side of the left-hand variometer. The turns are held together by three strips of bicycle tape and the coil pressed over the edge of the variometer frame, where it will stay if the diameter is just right. A bottle or other cylinder may be employed as a "form" on which to wind this coil.

The .002 condensers are next in order—one being placed at the bottom right, Figure 2 and the other the upper left, Figure 2. A wood screw holds each in place.

Figure 6 is the circuit diagram. Make all the connecting wires as short as possible, reserving space as indicated in the photos for the B battery and the A battery. Solder the joints not made to binding posts, wiping off all excess soldering paste with a clean cloth. Make the connections tight enough so the solder will not loosen its grip when you pull on the wires.

It is easy to solder to the metal ends of the Dubilier condensers if you scratch or roughen the surface with a sharp screwdriver first. This picks up little "shavings" of copper which the solder can grip firmly. Solder to the battery switch in a similar manner. Be careful to observe the connections to the binding posts on the variometers. Have the leads for the B battery long enough so that you can insert them in the Fahnestock clips when the battery is outside in front of the case and coat the ends of the flexible wires with solder so that they will not break off on change of batteries.

The leads to the A battery should project at the rear. A neat holder for the flex-



ible wires for connections to the ground and aerial may be bent from a half-inch length of copper strip, and a similar strip, though much longer, forms the "holder" for the A battery.

The A battery itself is made of the two unit cells ordinarily employed in round flashlights. The cells are placed side by side, with one of them upside down. A piece of copper strip or a wire is soldered from the bottom of one cell—the zinc—to the copper contact in the center of the other one, as pictured in Figure 9a.

Two small Fahnestock clips, which may be purchased or cut off from an old B battery, are soldered to the corresponding points at the other end and form the binding posts. See Figure 9b.

The A battery wires are inserted in these clips—the lead coming from the blade of the battery switch being fastened to the positive terminal of the battery. This, by the way, is a 3-volt unit and no rheostat need be employed, as the correct voltage is automatically applied to the tube when the switch is closed. The battery is slipped into the holder, the sides of which are bent to conform to the "curves" of the cells. Two strips of bicycle tape hold the cells together, and the tape should be wrapped to extend over the edges of the cells for protection from contact with anything else in the set. The finished unit measures 2¾ inches long, 1⅜ thick and 2½ high.

To attach the back panel, it is only necessary to drill a hole at the bottom center through which the two flexible cords may pass, and to push the panel into position. The two thumbscrews hold it there.

For the front panel, three holes must be made besides the two for the thumbscrews. Two of these are made with a drill about 5-16-inch in diameter, or larger. Mark the positions for these with pencil, measuring in from the sides and up from the bottom to the centers of the variometer shafts. A slot for the handle of the battery switch is made by first drilling a row of holes in the proper place with a small size drill and then filing the slot smooth. A nail file is useful in performing this operation.

When you push the front panel into place, see that the variometer shafts do not rub and that the switch has sufficient latitude of motion to make and break contact cleanly. Now you are ready to insert the tube. After it is securely in position in the socket, connect the B battery, being careful to connect its positive terminal to the front binding post of the right-hand variometer, as in Figure 3. The negative terminal goes to the phone jack, as in Figure 6. The two flexible leads

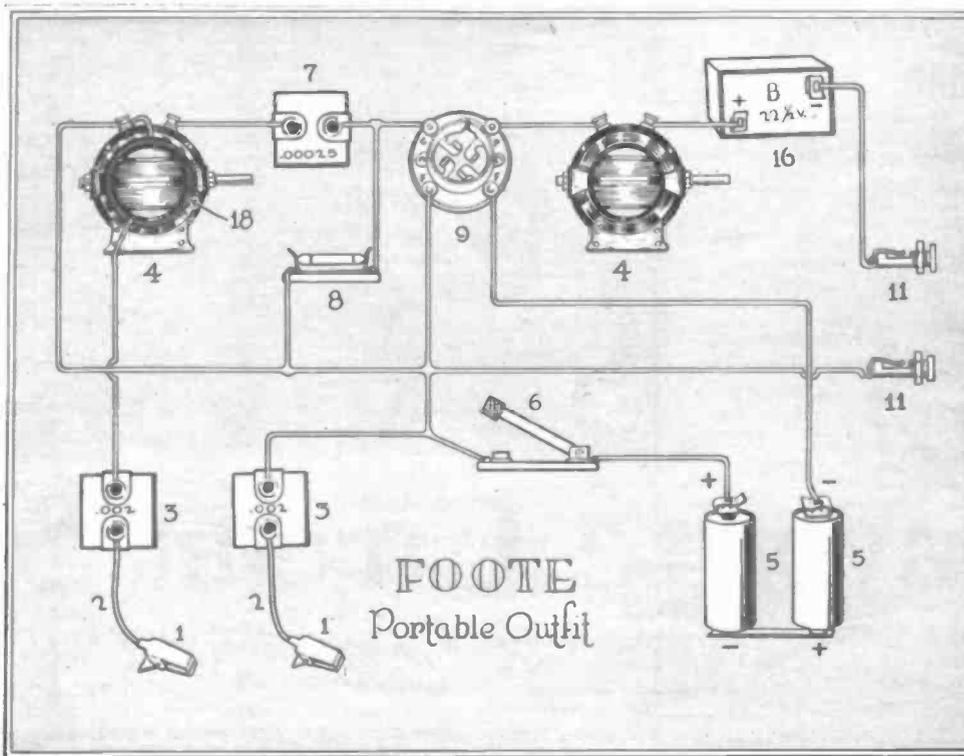


Fig. 6—Above—It's a "Tuned Plate Regenerator." Condensers "3" permit you to connect to lighting circuits and bell systems without possibility of short circuits or interference. Be sure to connect the binding posts of the variometers as indicated



Fig. 7—Above—Here are the necessities for contact to the electric lighting socket. Turn the switch off before you insert the copper strip, also when you change the strip over to the other side of the line

should be about six feet long and their ends are provided with spring clips for quick contact. Solder these points and tape the ends for neatness and for ruggedness.

The set is then complete, but you will require an electric light connector. The "screw" parts of the separable plug may be used for this purpose in accordance with Figure 7. A 1½-inch length of copper strip is cut with a shoulder, as in Figure 7, so that the small end will slide into either side of the receptacle. The clip may then be attached in the usual way. Figure 8 illustrates the method of connecting the clip to the lighting socket.

Now we're ready to get down to "brass tacks." Suppose you try the telephone circuit as the aerial first, as this is more commonly successful than any other. You do not interfere with the telephone service in the least, because the .002 condenser prevents any sort of current but that set up by the radio waves from passing along the wire which you connect to the phone. Just clip to the fastening screw at the top of the stand, and attach the other to a water faucet or to the little nickel plated relief valve on the end of the radiator.

To set the dials of the set properly, turn the shaft all the way around to the left—look inside and turn the shaft back a little to the right until the rotor is parallel or "even" with the stator. The dial should then read "zero." The indicator marks illustrated were made with a small screwdriver, and the round top with a drill which was permitted to make a slight conical depression there. If the dials are too far off the panel, saw off a short piece of the variometer shaft.

Push the switch to light the tube, setting the right-hand variometer at zero and the left-hand at about half scale. By the way, the best sort of scale for the dials should cover a semi-circle of the circumference, provided such (Continued on Page 28)

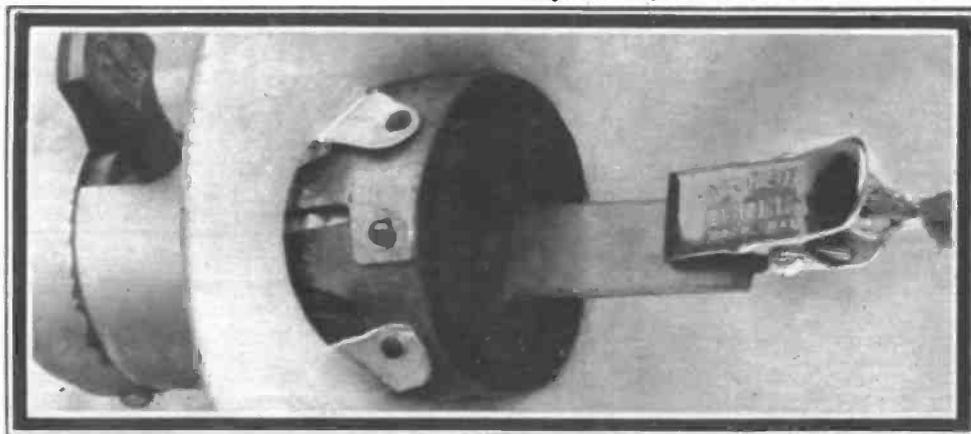
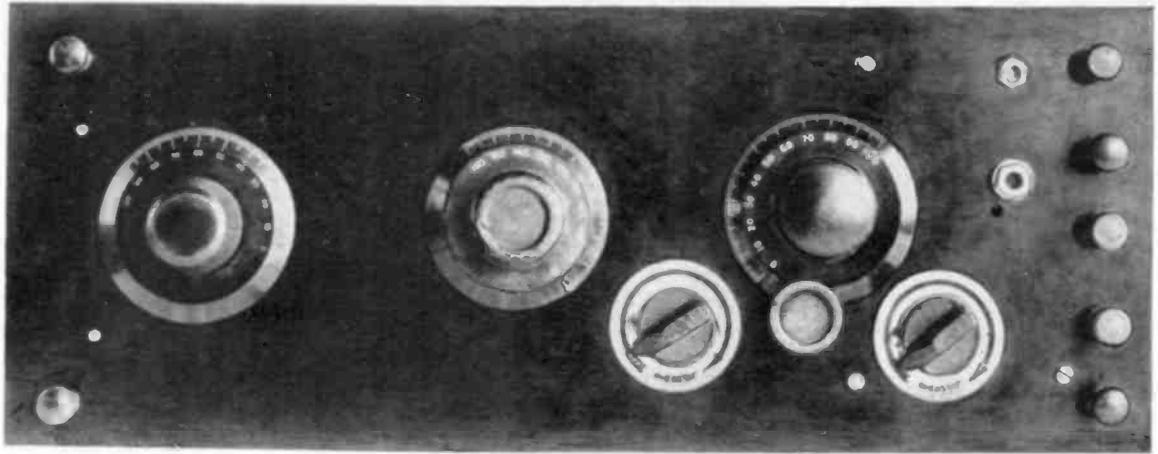


Fig. 8—Left—This is how you fasten the clip to the copper strip and use the lighting wires for your radio eavesdropping

The set makes a very neat appearance when mounted in this way on a panel



A

# Favorite Circuit Simplified

SOME TIME ago, when in the hospital where I spent a few years, I formed the habit of experimenting with radio receiving circuits. It's a good habit, though at times a very expensive one.

Now that I am home once more I still experiment, and once in a while I find a new circuit, one that can truly be called an improvement on other circuits. More often I find a method of improving a standard circuit—one that has been tried by many radio fans and not found wanting.

There are many circuits. Some are good, many are not. Some are complications of standard circuits, with a few useless parts added and given a high-sounding name. You have seen many of these circuits; perhaps you have dismantled your set to try them and been disappointed with the results. I, too, in the days when my knowledge of radio was nil, have dismantled my set in order to try the latest so-called new circuit. Now I can tell at a glance whether or not it is new, or the same old circuit with a nice new name and some extra parts. I have learned this by experience, an experience which has cost money and many hours of labor. However, it has been worth while.

I, too, am guilty of changing standard hookups, but my changes are made to simplify whenever possible the hookup, so that other apparatus may be used, and still remain as efficient as before. Not to complicate, and give a new name to old circuits, but to *simplify* old circuits so that they will be more useful.

By W. FRANCIS GOODREAU

In this article I wish to introduce you to an old friend of mine—one who helped to pass the long dreary hours away, when hours were weeks, and weeks seemed months and often years.

It is a standard circuit. It was a standard circuit when I first knew it. It is a standard circuit today. I have changed nothing in the wiring diagram; all I have changed is the type of parts used.

It is best known as a honeycomb coil circuit. It is very good as a honeycomb coil circuit, but many fans (and I am one) do not wish to use honeycomb coils in our broadcast receivers. The main reason for my objection to them is the fact that they take up too much room. If mounted on the front of a panel they do not look well; if used in back of panel they take up too much space.

What I have done is to simplify the circuit and to adapt it to apparatus that will compare well with our other broadcast receivers.

What have I used in place of the honeycomb coils? A Kellogg split variometer. How have I simplified it? By reducing the number of controls. In the original circuit using honeycombs, there are the following controls: Coupling, which is variable; tickler coil, also variable, and two variable condenser controls. In the set as I use it the controls are as follows: Variable tickler and two variable condensers. The coupling between primary and secondary

is fixed, thereby doing away with one control. I have tried the original, and the one I describe, and I find them equally efficient. They are sensitive, selective and the distance and volume are all that could be desired.

To build this receiver you will need the following parts:

- One variable condenser, Cap. .0005 Mf. (Vernier if desired).
- One Vernier Variable Condenser, Cap. .0005 Mf.
- One Split Variometer.
- Two Standard tube sockets.
- One Variable Grid Leak.
- One Grid Condenser, Cap. .00025 Mf.
- One Audio Transformer, ratio about 5 to 1.
- One By-pass Condenser, Cap. .001 or .002 Mf.
- One Open Circuit Jack.
- One Double Circuit Jack.
- Three Dials for Variometer and Condensers.
- Seven Binding Posts.
- One Radion Panel, size 7x18x3-16.
- One Base, size 5x7 in. May be of Radion or wood.
- Two Rheostats. 30 Ohms.
- Two Mounting Brackets for mounting panel and base.

Before we start to build this set, a few words about the parts used would not be amiss. The variable condensers may be of any good make. If you are not sure what a good condenser is like, I suggest that you look in the advertising columns of this magazine. You will find several there from

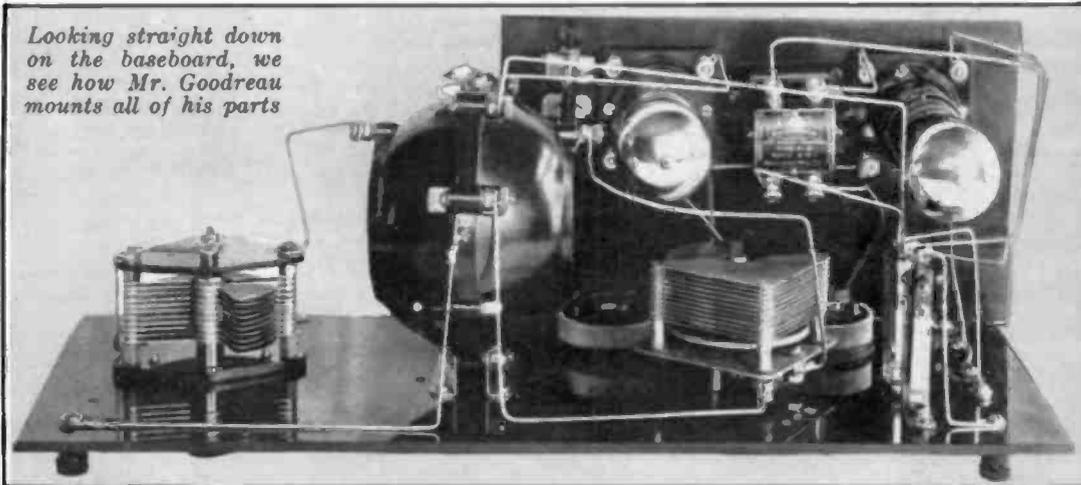
which you may choose, and any one of them will prove satisfactory, as this magazine does not accept advertising of any apparatus that will not pass standard tests.

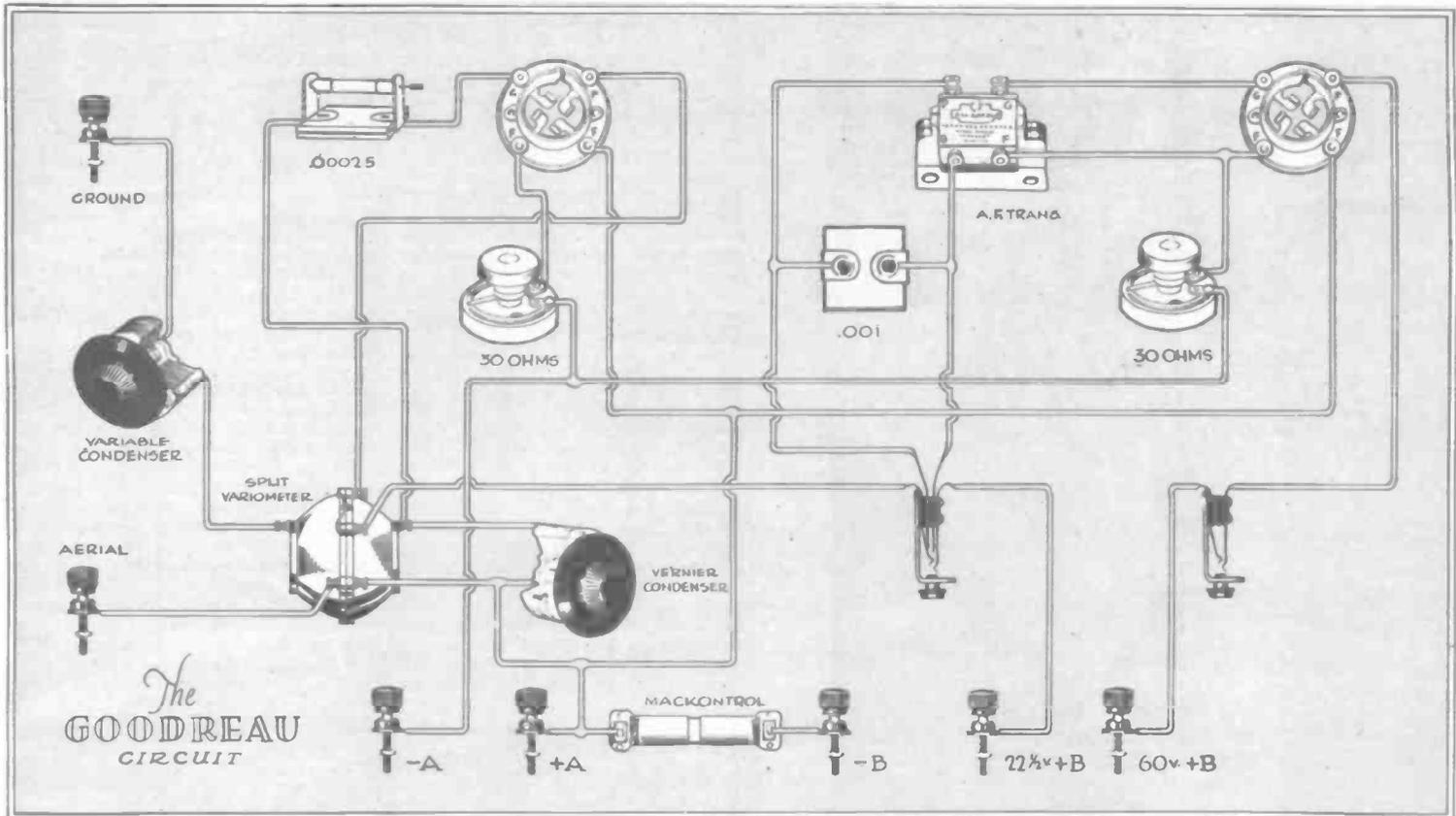
The grid leak should be variable. Only one of these condensers needs to be vernier, but both may be vernier if you wish to use them.

The mounting brackets are simply small brass angles and are used to fasten the panel to the base.

I have used a Radion panel here. Any other good panel may be used, however. The size used by me was as stated in list of parts. However, a longer panel could be used here, say one about 7 inches by 22 inches. This would allow you more space for the instruments and also give you a chance to put all your

Looking straight down on the baseboard, we see how Mr. Goodreau mounts all of his parts





controls in line. Now that we have all our parts, we are ready to build the set. This is not a hard job; it is really simple. Build it slowly and carefully, mount each part right, and when it is completed you will have a set that will please you, both in looks and in operation.

Many start out slowly, but when the set is almost done, they rush to complete it, hoping to have it ready for the next concert. They are careless in wiring, and when the set is complete it refuses to work. The work has to be done all over again, and nothing has been gained by rushing. "Haste makes waste"; this is true in radio as in everything else. Take your time, make sure everything is right. Let us begin our set. Are you ready? Let's go.

First, let us drill our panel and mount the parts. You will see where they are mounted by looking at the pictures of the set. Study these pictures a little while before you mount the parts.

First, we will drill the holes for the binding posts. There are seven of these, two on the left-hand side of the panel and five on the right-hand side. The one in the upper left-hand corner is the antenna post. This is set in one inch from the edge of the panel and one inch from the top of the panel. Drill this first, then drill the one in the lower left-hand corner. This is the ground post and is set in one inch from the edge and one inch from the bottom of the panel.

Next drill the holes for the battery binding posts on the right-hand side of the panel. The top one is set in

*A view directly from the rear shows the mounting of the apparatus on the panel*

one inch from the edge and one inch from the top of the panel. Next drill the one in the lower right-hand corner. This is set in one inch from the edge and one inch from the bottom of the panel. The other three posts are set in one inch and spaced as equally as possible.

Next drill the holes for the variable condenser, the one without the vernier. This is to be mounted on the left-hand side of the panel. You will no doubt find in the box your condenser came in a paper template for drilling these holes. After you have drilled these holes, try the condenser on the panel to make sure they are right. Also make sure that the center hole is large enough for the condenser shaft to turn freely.

The variometer is next. If you use a Kellogg you will find a template with it and no trouble will be found in mounting it.

Next mount the vernier variable condenser. This is mounted on the right-hand side of the panel. Mount this very carefully and make sure that both vernier and main plates can be turned freely.

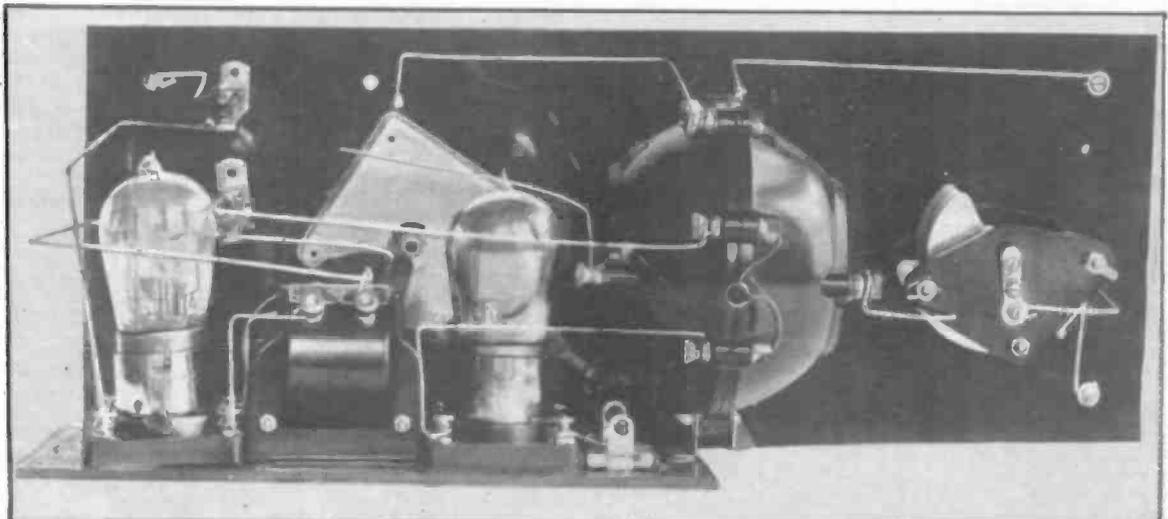
The jacks come next. The first one to be mounted will be the open circuit one. This will be mounted on the right-hand side of the panel, on a line with the top binding post and about an inch or more away from it.

The closed or double circuit jack should be mounted on a line with the second binding post from the top and directly under the other jack.

The rheostats are next to be mounted. If you will look at the pictures you will see where they are mounted. Be sure and space them so that they will not touch the variable condenser, and also make sure that they will not prevent you from mounting the panel to the base.

This completes the panel mounting; we are now ready to mount the other parts on the base.

On this base we are going to mount the grid condenser and leak, the audio transformer and the tube sockets. First, we will mount the grid condenser and leak. This will be on the left-hand side, in the upper corner, about half an inch from the



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**I**NCREASED production facilities have lowered the manufacturing costs of the Dubilier Duratran Radio-Frequency Transformer.

And the public receives the benefit in a big price reduction.

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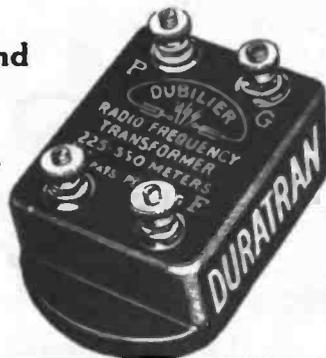
Think what this means.

The Dubilier Duratran is designed to bring in all the broadcasting stations—not just one or two. And it does this with an amplification factor of over twenty for all broadcasting wave lengths.

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**Dubilier Condenser and  
Radio Corporation**

46-48 West Fourth Street.  
New York



edge and the same distance from the back of the base. Fasten this condenser to the base with two small machine screws. To do this you will have to drill two holes in the base. The grid leak fits in the clips on each side of the condenser.

The detector tube socket is next. Mount this half an inch from the back edge of base and as near the grid condenser as possible.

Next mount the audio transformer close to the detector tube socket and placed so that the post marked P on this transformer will be near the post marked P on the detector tube socket. If you do this you will find the posts marked G and F on the transformer will be close to the posts marked G and F on the second tube socket. This means that the leads from the transformer secondary will be very short, and the shorter you can get them the better the set will operate.

Now mount the second tube socket, making sure that the posts marked G and F are near the transformer posts having the same markings.

The next and final mounting job is the small brackets which are used to fasten the panel to the base. Two of these are enough for this small base, one on each side of the panel in front. Make sure, by placing the panel and base together, that these

wire. If you use bare wire it tends to make you more careful about spacing. Let us wire as many of the parts on the base as we can, as this will save hard work, which sometimes results when we try to wire parts on the base when it is fastened to the panel.

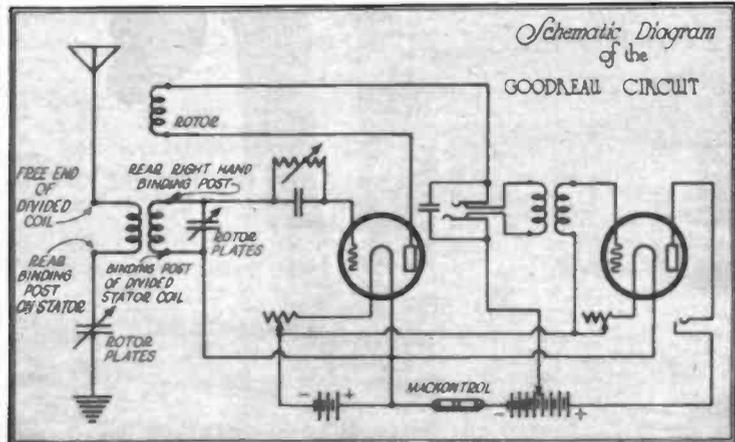
From one side of the grid condenser connect a wire to the post marked G on the first tube socket.

Now from the post marked G on the audio transformer we will connect a wire to the post marked G on the second tube socket.

From the post marked F on the audio transformer we will connect a wire to the post marked F on the second tube socket.

From the other post marked F on this second tube socket connect a wire to one post marked F on the first tube socket. Now for wiring the panel.

In wiring the instruments on a panel, it is wise to start with the hardest job, which in this case seems to be the rheostats. Now if we look at our wiring diagram we will see that these rheostats are connected in the negative filament leads. We will connect a wire from the negative A battery binding post, which on this set is the bottom one on right-hand side of panel, to the center post of one rheostat. From this center post on the rheostat a wire goes to the



brackets will not interfere with the rheostats on one side nor the binding posts on the other.

Fasten the brackets to the base with small machine screws and nuts. Then drill two holes in the panel for the other two mounting screws. All the drilling is done now; mount all the parts in the proper position on the panel, and we are ready to wire the set.

This wiring is where most novices fall down. It is so easy just to rush through the wiring, so as to get the set working as soon as possible. But if good results are expected we must take pains with the wiring. A good wiring job takes time, but the result, both in the neat appearance of the set and in its operation, proves it to be worth while. What kind of wire to use? Well, that is largely a matter of individual choice. There are many different kinds of wire that can be used here. Soft copper wire, in sizes from No. 18 to No. 14, may be used if desired. However, it would be wise to cover this wire with rubber tubing, otherwise a short circuit may result, because this soft wire will bend and may touch other wires. This should be used only when a quick job must be done.

Bus bar wire is used a great deal in wiring sets. It makes a neat appearance and may be covered with tubing or not, just as you prefer. When used bare it will remain upright without sagging, as it is hard

center post of the other rheostat. It ends right there.

The next thing is to prepare the split variometer for this circuit. I am showing a Kellogg. Look it over, you will find that one binding post on this has two cotton-covered wires connected to it. Disconnect them. Look at the wiring diagram and you will see that we have three separate coils—primary, secondary and tickler. The rotor of the variometer serves as the tickler coil, so we do not have to touch that.

Now on the stator of this variometer we have two separate windings, but they have been connected to the binding post mentioned, and so they are in "series," making one coil instead of two. We will have to separate them.

Now that we have them separated, we must make sure that we will know which is the primary and which is the secondary. To do this, get your phones and a dry cell. Connect the negative terminal of the battery to the binding post on left-hand side of variometer in the rear. Now connect the positive terminal of this battery to one of your phone tips and touch the other phone tip to the wires you have disconnected from the binding post. One of these will cause a sharp click in the phones when touched. Connect the one from which no click was heard back on the binding post and leave the other free.

Let us continue our wiring. Con-

nect a wire from the binding post in the upper left-hand corner to the end of the coil we have left free. It would be advisable to solder this connection, making sure of a good contact.

Now from the other end of this coil, which is the rear binding post on left-hand side, we will connect a wire to the stationary plates of the variable condenser on left-hand side of panel. Now from the rotor plates of this condenser we will connect a wire to the ground binding post, which is the one in the lower left-hand corner. This completes the wiring of the primary circuit.

The secondary circuit is next. From the binding post on the variometer, from which we have taken one wire, we will connect a wire to the rotor plates of the vernier variable condenser, and from there this same wire will go to the positive filament terminal. From the binding post on the variometer, the one in the rear on the right-hand side, we will connect a wire to the stationary plates of the vernier variable condenser and from there it should be connected to one side of the grid condenser and leak. To do this we must mount the base and panel together with the brackets.

The next circuit to be wired is the plate or tickler circuit. We will wire the plate circuit of the detector tube first. Connect a wire from the 2 1/2-volt B battery post, which is next to the top on the right-hand side of the panel, to the lower connector of the telephone jack. From the upper connector of this same jack, a wire will run to one binding post on the rotor of the variometer. From the other rotor binding post of the variometer a wire will run to the post marked P on the detector tube socket.

Now from the post marked B on the audio transformer, a wire will run to the lower of the two remaining connectors of the jack in the plate circuit of the first tube. From the other connector of this jack a wire will run to the post on audio transformer marked P. This completes the wiring of the plate circuit of the first tube. The by-pass condenser should now be connected across the primary of the transformer.

Next we will wire the rest of the filament circuit. From the left-hand post of the rheostat on the right (looking from rear of set) we will connect a wire to post marked F minus on the first tube socket.

From the post on the other rheostat, the one on the left-hand side, we will connect a wire to post marked F minus on second tube socket.

Now from the positive A battery post, which is the one next to the bottom on the right-hand side of panel, we will connect a wire to the post marked F on the second tube socket. From the positive A battery post we will connect a wire to the B minus binding post, which is the post above the A post.

*Note—In this place I recommend the insertion of the new device known as the "Mackontrol" as an insurance against burning out the tubes in case of accidental shorting of the B battery through them. The wiring then becomes—from the positive A battery post to one side of the Mackontrol and from the other side of the Mackontrol to the B minus post.—*  
H. M. N.

Now we will wire the plate circuit of the second tube. From the upper binding post on the right-hand side of panel we will connect a wire to the upper connector of the open circuit jack. From the lower connector of this jack we will connect a wire to the post on the second tube socket

marked P. Now our wiring is done. It wasn't such a hard job, was it?

What next? Well, let's decide what kind of tube we wish to use in this set. Our rheostats have resistance enough so that we may use any type of tube without changing.

I have used UV201A in this set. The large tubes give best results. For the most sensitive detector use UV200. This tube requires fine adjustment of filament and plate voltage. I have used UV201A because it is not critical. It is also very sensitive, though not as good as detector as UV200.

For operation on dry cell tubes use WD12. I have found this tube to be very good as a detector and amplifier. However, do not expect the same results with these tubes as you would get with the large tubes.

The 199 or 299 tubes may also be used successfully.

After the type of tubes to be used has been selected, connect the batteries, antenna and ground to the set. For types UV200 and UV201A tubes you will need a six-volt storage battery. For WD11 or WD12 you will need one dry cell for each tube. These dry cells should be connected so that they will last longer and yet give the same voltage as one cell. To do this connect the center post of one cell to the center post of the other cell, and connect one outside post to the other outside post. If you connect these otherwise you will destroy the tubes.

To operate this receiver after everything is connected up, insert telephone plug in detector jack, that is the jack in the plate circuit of the first tube. Turn on rheostat almost all the way. Set both condenser dials at zero, then turn variometer dial until a sharp "click" is heard in phones.

Leave variometer dial alone when you hear this click and rotate the primary condenser dial—that is the one without vernier—until whistle is heard; when whistle is heard set dial where whistle is loudest, then turn vernier condenser dial until you hear a louder whistle. Then turn variometer dial slowly until whistle clears up and music comes in. Decrease or increase filament current, which will make music much louder and clearer.

*NOTE—But for heaven's saks don't keep this whistling going on any longer than necessary. That's probably re-radiating and spoiling the concerts for your neighbors.*

H. M. N.

Now insert telephone plug in the other jack and turn on rheostat of second tube, when the music should be heard much louder.

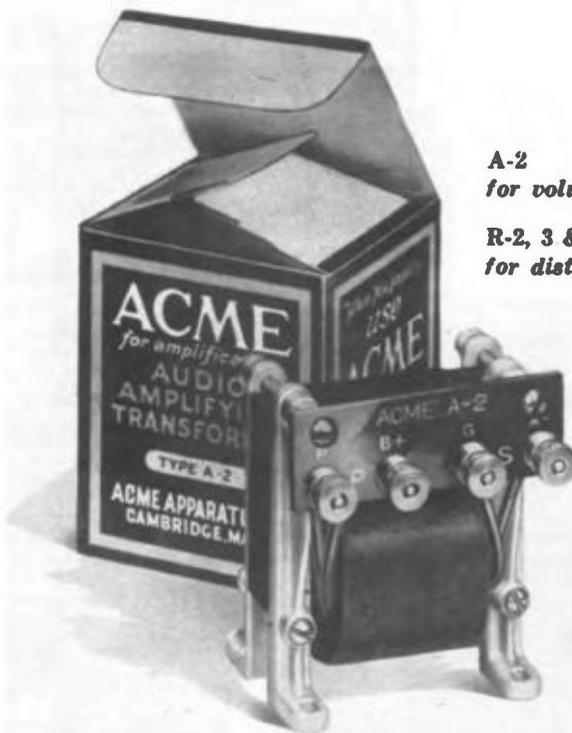
This receiver is very simple to tune and you will soon learn how to get the most out of it.

It is impossible to tell how far this receiver will reach in every location, but you will find it a good distance-getter, comparing favorably with other standard two-tube sets.

If you are using a short antenna and find that you cannot reach certain wave lengths with this set, it would be advisable to change the connections in the primary circuit, that is, instead of connecting the condenser and coil in "series" as I have done, connect them in parallel, that is, connect the rotor plates of the variable condenser to the ground and also to one end of the primary winding, connect the stator plates to the other end of the coil and to the antenna.

I would like to hear from all who try this receiver and shall be glad to help you as far as I can with any trouble you may have with this set. Address all letters in care of the editor of *Radio in the Home*.

# Ask your neighbor —he knows



A-2  
for volume.  
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ACME Transformers are used by thousands of radio owners to get increased range and louder, clearer radio. Acme Transformers give maximum amplification without distortion. Each transformer is tested and carries a guarantee tag. The name "Acme" is a guarantee of best results. Use Acme Transformers in the set you build. Look for them in the set you buy.

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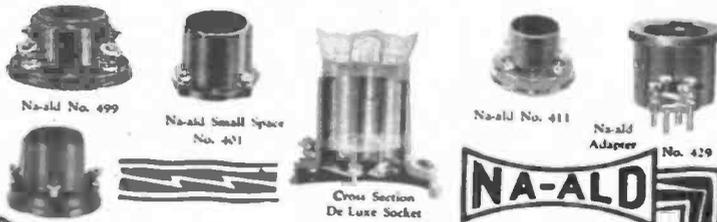
## You won't know you have Murdocks on

**MURDOCK** Radio Phones weigh only 13 ounces. The new headband is feather-weight, enabling the user to wear these 'phones for hours without discomfort. Murdocks are made with the precision of a delicately wrought instrument. All parts are imbedded in moulded insulation—assuring firmness, strength and permanence of adjustment. You can get distant stations with volume and clearness. Get a pair of Murdocks today and test them out. They are fully guaranteed. Write for **FREE BOOKLET** — "The Ears of Radio."

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Na-ald De Luxe  
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## IT'S THE CONTACT THAT COUNTS

The best radio engineering practice of today calls for the elimination of as much material as possible in the neighborhood of those parts of the set which carry the radio frequency current. This applies not only to metallic substances, but to insulating materials as well.

Na-ald Sockets provide for this by having uniform walls of Bakelite, giving the material its highest di-electric properties.

"Frying" noises, often attributed to B batteries, are in reality caused by poor connection. Na-ald De Luxe contacts not only press on the bottom of tube terminals but cut into the sides, automatically making a bright, perfect connection. No. 400 De Luxe is the standard for Neutrodyne and Super-heterodyne Sets.

Send 15c or cover of Na-ald dial or socket carton for new rotogravure booklet, "What to Build."

**ALDEN MANUFACTURING COMPANY**  
Springfield, Mass.  
Dept. T. 52 Willow St.

## Take Along a Magic Music Box

(Continued from Page 23)

can be found in the radio shops, and it makes no difference whether the highest number is 10 or 50 or 180. The numbers merely serve as identification points.

As soon as you light the tube you should hear a bell-like ringing sound as you move the set about or tap it with your fingers. This is caused by the vibration of the elements within the tube.

Now turn the right-hand dial to the left so as to increase its scale reading. At about 10 there should be a sharp click—which is the sign of oscillations. Never allow your set to remain long in this condition, as it then becomes a weak transmitter of

"click," which signifies that your tube is "oscillating" or transmitting. You do not want it actually to oscillate, but you want to keep the right-hand dial near enough to the point of oscillation for good sensitivity. A little practice will explain to you what I mean more clearly than a page of further advice.

You want "regeneration" for sensitivity, but you do NOT want "oscillation," as this not only bothers other listeners, but also spoils the clearness of speech and music.

Always think, then, of your two dials in this way: Left dial, Tuning; Right dial, Volume.

The left-hand dial with a zero to

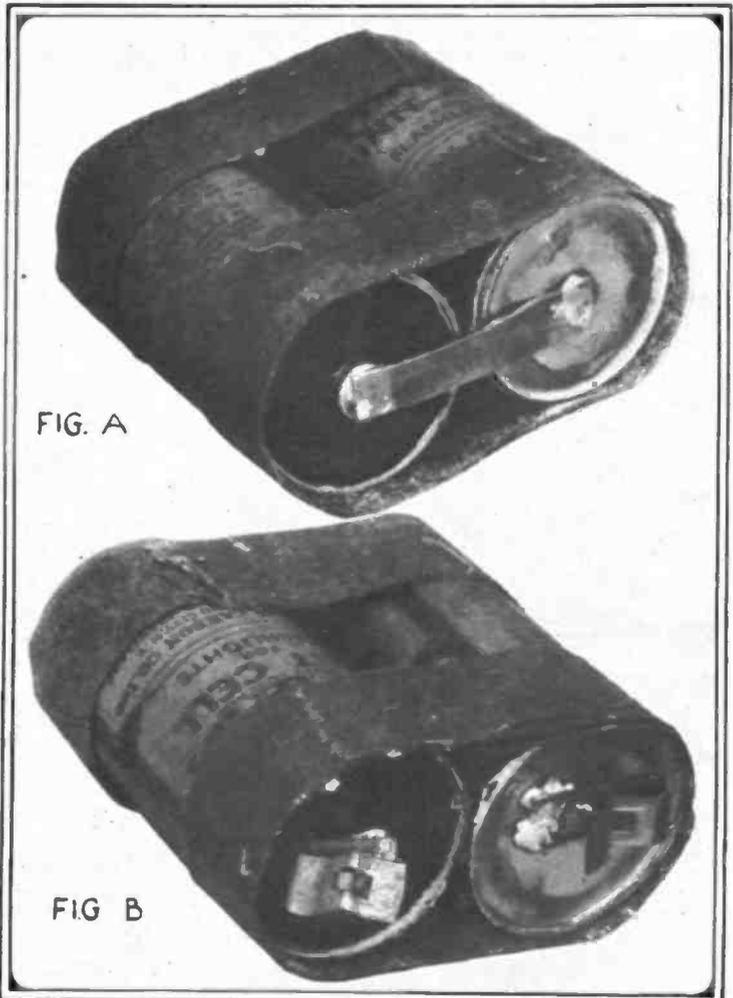


FIG. A

FIG. B

Figure 9a—In making up the A battery, one cell is inverted and the connection made from positive of one to the negative of the other

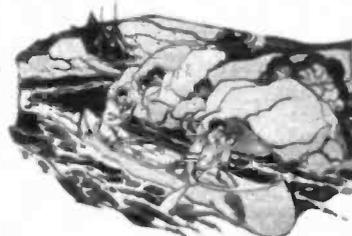
Figure 9b—Two spring clips provide connection to the cells, and the 3-volt battery is easily made in this form

radio energy and may possibly interfere with clear reception by some one else. Always strive to have the right-hand or "regeneration" variometer a little nearer the zero mark than the point at which the click is heard.

The left-hand dial controls the wave length settings, and as you rotate this dial notice the relationship between the two dial readings for the

50 scale, as shown in the photo of Fig. 4 tunes in WIP at about 44, WEA F at 40, WCAP at 35, WJZ at 31, WOR at 24½, WDAR and WFI at 23, WGY at 21½, WDAP at 19½, WBZ at 17 and KDKA at 16.

Your dial should follow along in about the same manner, with scale readings in corresponding positions, depending upon the nature



of the scale on your particular dial. Dial adjustments on the volume dial need not be remembered except roughly, as they vary slightly with the age of the filament battery and with aerials of different sizes.

Please do not tune by the "Whistle Method," because you then are likely to cause some interference with others in the same building or within a half block of you. Keep your volume dial at a slightly lower scale reading than is necessary to produce a "whistle" when your tuning dial passes the wave length of a broadcasting station.

It is best to consult the local newspaper for the daily programs and to listen at the proper times. After you have heard some of the local stations, try some of the other aerial combinations given with this article.

You see, it is possible that some of these combinations will work better than others.

If the lighting wires are elevated on poles in the streets or if you are high up in a hotel or apartment, it is likely that the lighting socket is the best. Try them all and you'll have some fun.

In an apartment in New York City, for instance, I hooked the set to the telephone line and a radiator during the daytime. The location was up-town, and while WHN, WJZ and WJY came through very well, WEF was comparatively weak and WIP didn't come in at all.

After switching to the metal frame of the chandelier (which connects by its large electrical "capacity" to the lighting wires) WEF came in louder than any other and WIP was picked up faintly. Probably the telephone line was shielded in certain

### SCHEDULE

## Zion Radiophone Broadcasting Station

### W C B D - Zion, Illinois

Wave Length 870 Kilocycles—345 Meters  
Owned and Operated by Wilbur Glenn Voliva

STATION BLOGAN "Where God Rules Man Prospers"  
CLOSING SALUTATION "Peace Be Unto You"

*All Broadcasting done on Central Standard Time*

<p><b>J. H. DEPEW</b> Manager Chief Announcer Publicity Director</p> <p><b>JOHN D. THOMAS</b> Program Director Conductor of Zion White-robed Choir</p> <p><b>P. B. NEWCOMER</b> Conductor of Zion Band</p> <p><b>L. J. HIRE</b> Conductor of Zion Orchestra</p> <p><b>FRED FAASSEN</b> Organist Shiloh Tabernacle</p>	<p><i>Broadcast from Shiloh Tabernacle:</i> <b>EVERY LORD'S DAY (SUNDAY):</b> Bible School from 9:00 to 10:45 a. m. Zion Orchestra plays from 9:00 to 9:30 a. m. Principal Service of the Entire Week, from 2:30 to 6:00 p. m. Special music by Zion Band or Organ, and Zion White-robed Choir. Address by Wilbur Glenn Voliva, General Overseer of the Christian Catholic Apostolic Church in Zion.</p> <p><i>Broadcast from the Studio:</i> <b>CONCERTS:</b> Every Monday and Thursday evening, 8:00 to 10:15. <b>EVERY THURSDAY:</b> From 2:30 to 3:45 p. m. Sacred Solos and Duets. Address either by Wilbur Glenn Voliva, General Overseer of the Christian Catholic Apostolic Church in Zion, or one of his representatives. Special sacred concerts every Second and Fourth Lord's Day (Sunday) evenings in the month, 8:00 to 10:15.</p>
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directions while the lighting circuit did not happen to be affected in that way.

Fig. 1 shows another stunt which works astonishingly well. Find a barbed-wire fence (if you're off in the country for the day) which has two wires running along with one or two feet of separation—the farther they go the better.

Fasten one clip on one wire and the other clip on the other one—makes no difference which. Even if the wires actually come together somewhere, the results are good. If you can find a break in the fence, for

a gate, perhaps, clip to the two sections of the fence and you'll hear plenty of stations.

The automobile body to fence or ground is also interesting, as it demonstrates plainly the fact that it is only necessary to find two metal bodies of some kind which are separated from each other. The radio wave strikes one of them before it reaches the other, and in the case of the car the rubber tires act as insulators, keeping the car off the ground.

The set works well on outdoor aerials, too, although you will be surprised to discover that practically as

good results may be had with the lighting wires or telephone line.

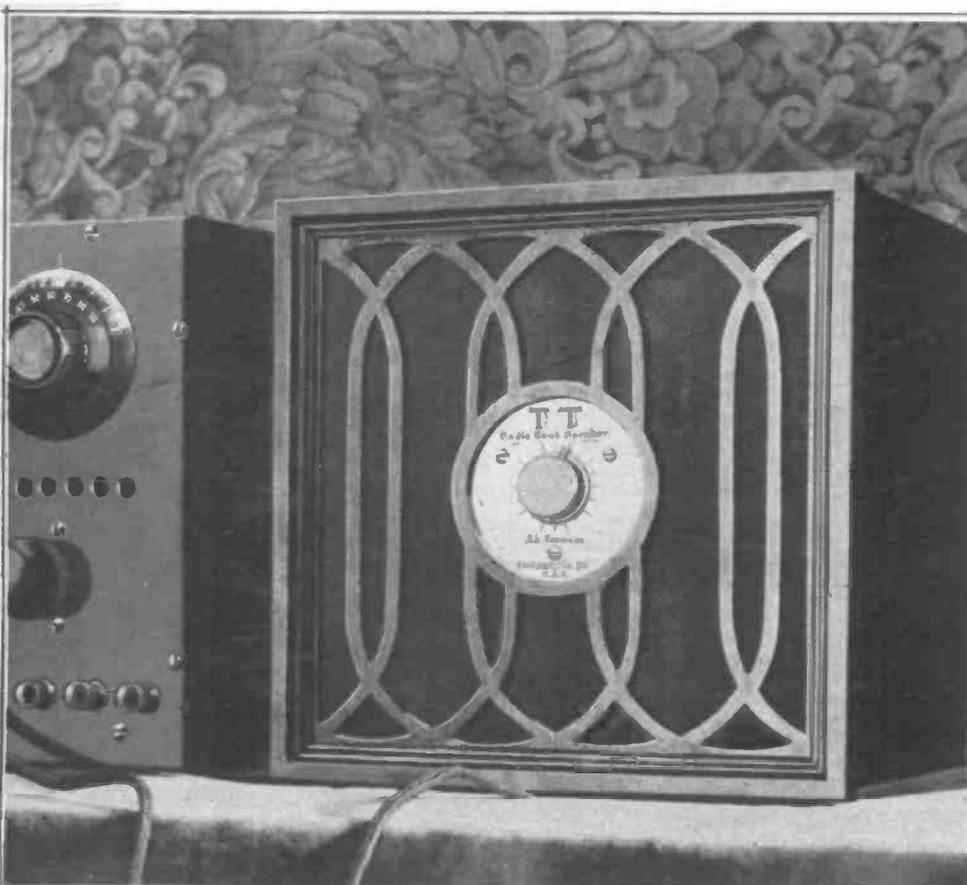
And it is not limited to local stations during the evening either. You'll hear quite a good deal of "DX" if your aerial happens to be fairly good, and the set is quite selective, tuning out unwanted stations in favor of weaker ones if the wave lengths aren't too nearly the same.

Next time you travel don't be lonely. When the bell-hop closes your hotel room door pull out your little Magic Music Box, clip the two cords in place, snap the switch over and enjoy yourself.

### Broadcasting Zion

(Continued from Page 17)

gram, for I surely was carried beyond the realms of earth by the wonderful, wonderful music. On Sunday afternoon, I heard Mr. Voliva and I also heard several others preach, but somehow or other it seems that Mr. Voliva makes it easier for one to follow the footsteps of his Master, to be a Christian and lead a right life. His talks are not so complicated. They seem inspired, and the Word of God is made so plain, so clear and so definite, that one finds the way easier. Let me thank you and all of your singers and musicians for the very remarkable and wonderful strains of old-time songs that you presented last night. In all the world, there never was and never will be anything so thrilling to me. I could not have heard this music if I had been located in your Tabernacle, for the music would have only been a noise, but here, hundreds of miles away, it came in clear, distinct and resplendent in volume, clarity and sweetness."



### Eventually All Loud Speakers Will Be in Cabinets

This is a development that is bound to come just as phonograph horns were put into cabinets. There is no sacrifice of tone because of being in a cabinet. As a matter of fact, tones from Timmons Talkers, being "reflected," are pure, true and absolutely without distortion. Because of this Timmons Talkers make an especial appeal to musicians.

This "reflecting" of tones is accomplished by using two horns—one facing the other—and is similar in principle to the strings and sounding board of your piano.

We'll be glad to send you a cut-away view showing all the details of Timmons Talkers, including "Reflected Tone." Our folder, "Volume Without Noise," will be sent at the same time.

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COMPARISON tells. Listen to the Thorophone and learn how perfect a loud speaker can be. Every tone, every note is given its true value. You would think speaker or musician were right before you.

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National Radio Institute Established 1914 Dept. 54-BA Washington, D. C.

*A Raw Amateur's Experience With the Super-Heterodyne*

(Continued from Page 19)

ratus were now placed in position and fastened by handsome nickel-plated screws which should have been used on the panel, but for some reason, or other there was a shortage of screws, so we used the nice looking ones to save time. Rheostats, potentiometer, condensers, voltmeter, ammeter, binding posts et al were attached and the wiring begun. The latter was carried out with No. 12 bus wire and covered with Empire cloth spaghetti.

All joints were carefully soldered, using a flux composed of alcohol and rosin from the old violin case. You will find the alcohol much more difficult to obtain than the 1716 transformers. The soldering fluxes on the market thin out and run, making numerous short circuits more than a possibility. This is not an imaginary occurrence. It is decidedly real and too much stress cannot be placed upon this flux proposition, not only in the construction of this, but in the making of any set where the slightest leakage will do damage.

There is one prepared combination of flux and solder which melts easily and holds tightly but which, when heated during the soldering process, causes a dissemination of flux over everything in reach. A certain hollow wire solder containing an acid flux does the same thing and what better conductor could be desired than the acid which forms the flux within his solder wire? Don't use these prepared articles for radio unless you wish to court disaster. An acid flux will be likely to eat and corrode any metal if used in excess and should be religiously tabooed.

Note—At Station 5XP we always use rosin core solder and avoid this difficulty.—H. M. N.

The first set was wired using black spaghetti furnished with the outfit. After completion, in checking up it required close application to business to follow each wire from the mass of connections and in wiring up the second set we made use of colored spaghetti.

On the positive wires, red was used; on the negative, yellow, and on the radio frequency, green. A real Christmas tree, you will say. Possibly so, but the ease in checking up the completed set makes this colored spaghetti advisable. However, be sure to secure good spaghetti and not the cheaper brands so commonly found on the market.

Plate and grid leads were kept as far apart as possible and the shortest distance between two connecting points maintained.

As heavy bus wire was used, each connection required much more time and more careful fitting than would have been demanded with a smaller sized, flexible wire. However, the heavy bus wire makes a neat job and one which leaves a set free from disturbances due to vibration, to say nothing of the lessened resistance offered by the larger wire.

Connecting lugs were soldered onto either end of every wire. When one stops to reflect, the question arises as to just what is gained by soldering on a lug and then attaching the latter by means of a screw. It does not seem consistent and in the future we would be tempted to use round-nose pliers, make a small loop and with a hammer flatten out this loop, doing away with much excess work and making a really stronger connection

without any joints whatever save the one attachment to the socket, transformer or other piece of apparatus.

Much fitting is of course necessary in order to use the least possible amount of wire, and instead of cutting and recutting various sections of heavy bus wire, we took a piece of thin, flexible wire and made our rough connections to, say, a rheostat and lamp socket. Leads to and from each connecting wire were temporarily attached and after satisfying ourselves that the shortest possible path had been secured, we proceeded to duplicate in bus wire. In this way much unnecessary work was eliminated.

One of our most annoying errors which occasionally popped up was to solder on the lugs and then discover that the spaghetti had not been slipped over. As this required removal of at least one lug, it finally became impressed upon our minds that it was most advisable, if not absolutely necessary, to slip over the spaghetti beforehand, saving time, solder and temper at one operation.

We found that as the work progressed it became more than advisable to make use of an electric soldering iron. Much time was saved, but the most important thing was that the electric iron always had a clean point; and as a clean, brightly tinned point is essential to good work, especially with rosin and alcohol as a flux, much annoyance and labor can be saved by employing an iron of this type.

In attaching the wires to the fixed condensers, extreme care must be exercised lest flux find its way into the condenser, or the capacity be changed by too intense heating. The two large by-pass condensers can be very easily shorted by allowing solder or flux to run down the sides of the lug which projects through the metal housing. This is one of the many places where the prepared solder gets you into trouble.

Note—There is not the same danger if you use rosin as rosin is a fine insulator.—H. M. N.

To facilitate matters the "A" battery connections were first made as these run close to the panel, and after lamps, voltmeter, ammeter, rheostats and potentiometer are hooked up, the "A" battery circuit can be tested out before proceeding further. If the lamps do not light properly or the rheostats do not have the proper control, or the meters fail to register correctly, the remedy can be applied without disturbing any more wiring than is necessary.

Note—This is ALWAYS the best plan. It is an insurance against getting the B batteries accidentally hooked up to the filaments.—H. M. N.

It must be remembered that the voltmeter and ammeter must be connected up according to their polarity else they will register backward.

Having satisfied ourselves that everything was O. K. as to the "A" battery connections to rheostats, meters, lamps, etc., we proceeded to connect up the variable condensers, oscillator coupler coils and the radio frequency coupler. As these coils are adjustable, we used flexible wire cord to allow of any movement of the coils during the later necessary adjustments.

Care must be exercised in connecting the proper winding terminals of these coils—outside and inside turns having to be kept in mind or trouble will ensue. The easiest way to keep



**"See! Dad how much stronger it's coming in since you bought me Burgess Radio Batteries"**

SOMETIMES it's Dad who does the buying for his radio family, but you may be sure that that youngster of his sits in on the advisory board.

In all events, whether it be the boy or his father who buys receiving set equipment, the service of Burgess Radio Batteries provides a most satisfactory and economical means to greater enjoyment of the evening's radio entertainment.

"ASK ANY RADIO ENGINEER"

**BURGESS RADIO BATTERIES**

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track of things not only in this but in other parts of the set, is to *check off each connection being worked upon at its completion.* In this way by crossing off on the blue-print every lead as it is completed, you will not overlook anything.

Following the completion of the wiring of these oscillator coils we proceeded with the radio frequency amplifier and then in turn the audio frequency transformers. In the latter the blueprints show two wire-wound resistors, Radio Corporation 38A, but we were able to secure only two of these for the one set. Upon wiring up the second set we tried to obtain these wire-wound resistors, but were sent 2-meg. gridleaks instead. No explanation was given as to just why the blueprints called specifically for wire-wound resistors in one section of the set and 2-meg. gridleaks in another part and then, contrary to this data, the two or three attempts to secure these resistors brought gridleaks instead. Was the "Trust" hand again at work? One is not satisfied with something "just as good" when he understands a certain part is advised.

Another annoying feature was that after placing the two variable condensers on the panel and wiring up the whole set, we discovered upon turning the set around and attempting to put on the dials, that one condenser shaft was too long and had to be sawed off, while the other condenser shaft was too short and had to be lengthened by soldering on an extension, a minor detail, but most annoying. Sawing off the shaft of a condenser in situ does not make for a tighter fitting of the bearing and is to be shunned when possible. Take nothing for granted. Try out the fit first before proceeding with the wir-

ing. Also, to make matters easier, slip on the dial and determine whether or not any unusual force is necessary to slide it on the shaft. Should a tight fit be in evidence, take a piece of emery cloth and smooth off the condenser shaft. There is nothing more vexatious than trying to slip on a tight-fitting dial. There is a temptation to hold the rotor plates while doing this with a great possibility of loosening or bending them.

Before placing the lamp sockets, put a lamp in each and test for good connections.

A peculiar defect in one of the lamps which refused to give service was discovered after a long hunt. We found that the prongs of this one lamp in question did not register properly as to grid, plate and filament connections. After checking up it was found that the small projecting pin on the side of the metal portion of the lamp was a quarter-turn out of position. This lamp was replaced by the Cunningham people without argument.

Having completed our wiring the whole outfit was gone over and checked up. The battery currents, both "A" and "B," were applied and each socket tested out with one lamp at a time rather than taking a chance on all eight lamps at once. This came soon enough.

Everything being in readiness, the completed set was brought up out of the hold to the upper deck on the first floor where the final installation was to be, and placed in position. This was one of the wisest moves we made as the following night a water pipe burst direct over the spot where we had been building the set and flooded everything in sight—a veritable "Wave from Lake Erie." We shook hands with ourselves and got

out the loop, connected it up and plowed in.

Now that you are possibly getting warmed up as to just what happened when the phones were put on, I will stop bluntly right here and tell you at a future date what luck we had and how the superheterodyne performed.

Just to whet your appetite I will whisper right now that we had WDAP, Drake Hotel, Chicago, on the Magnavox with volume enough to be heard all over the house without aerial or ground, a distance of 800 miles.

*Note by H. M. N.—On receipt of this manuscript, I wrote Dr. Parker and asked him to give me further details of the performance of his sets. I told him that I had used the same set and was not at all pleased with the quality of its reproduction. Dr. Parker answered:*

Norristown, Pa.

My Dear Mr. Neely—Thanks very much for your letter. Now as to answering your query about the performance.

As you will note in my article I have put together two of these sets. The first one went off in great shape, amplifier stages et al. Not having had any particular experience with the neutrodyne I cannot compare the quality of tone reproduction, but I really think the quality is very good in this super. As to the second set the detector and first step are all that I would ask for. I have had the devil's own time keeping the second step from howling even in absence of a full moon. I had been unable to

secure the 38A Lavite resistors until last week when I picked two up on Market street. The people I bought my sets from three times sent 2-meg grid leaks when these 38A's were asked for and stated that they would act equally well. Another manufacturer told me the same thing, and when you stop to think it is a resistance that is needed, you would suppose that the action would be the same. However, the fact remains that I did not get rid of my howl until I replaced the two 2-meg grid leaks with the Lavite resistors 48,000 ohms Western Electric.

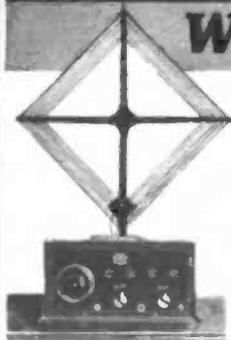
I am fully aware of the fact that I may have done something in changing the distribution of the wiring to have accounted for the change. Also I might mention that I tried standard variable grid leaks, 2 to 10 megs., without result. As a consequence I am attaching some importance to the Lavite resistors, rightly or in error. I have tried .001, .002, .005 fixed condensers across the primaries and secondaries, but nothing happened until these Lavite resistors were used. Yesterday afternoon was the first that I have been able to use the second step without distortion. As last night was bad as to static I shut off for a better night when I hope to hear things on the second step.

As to the detector, the volume really on some stations at times is too loud for comfort and I have to decrease on the rheostats or stabilizer. I have worked WGY, KDKA, WDAP and the nearer stations on the Magnavox as loud as any three-tube set I have heard, and this without any aerial or ground, the antenna adapter coils acting as the pickup. I did this on New Year's night in the presence of the vice president of the New York Coil Company, who was in the neighborhood and heard that I had one of

# SLEEPER MONOTROL

REG. U.S. PAT. OFF.

With the Grimes Inverse Duplex Circuit



**Dealers Please Note**  
Absolutely dependable in operation at any time of year, you will find the Sleeper Monotrol particularly saleable in Summer.

## Through the Summer With a Loop

The Sleeper Monotrol is free to rove with you this Summer. It is not fixed in any spot—moored by aerial or ground connections. You can move it out upon the porch for Summer evening concerts. You can carry it and listen-in while riding in your car—set it up on mountain top or beach—

point the loop towards stations that you want to hear and *hear* them with that sweetness, clarity and purity of tone that you get *only* through a loop in sets especially *built* for loop reception. Your dealer will be glad to put a Sleeper Monotrol into your home *on trial*. Try it.

**SLEEPER RADIO CORPORATION, 88 Park Place, New York**

## How turning this knob gets more stations



### BALLANTINE VARIOTRANSFORMER

HERE'S evidence that turning the dial of a Ballantine Variable R. F. Transformer gives superior results. The lower curves (plotted from careful experiment) show you that fixed transformers do not give satisfactory amplification for many of the important stations. Why?

Because the fixed windings are out of tune. With Ballantine instruments you can accurately tune everything from 300 to 800 meters—by merely turning the knob. This adjusts the windings to the wave length of the station wanted.

#### Adds to Your List of Stations

Perfect shielding and pig-tail connections assure clear tones. Then, by keeping amplification uniformly high throughout the broadcast range, you get all there is within reach of your set.

SEND FOR THIS BOOKLET "Radio Frequency Amplification with the Ballantine Variotransformer," 28 pages of practical interest. Mailed to Radio experimenters upon request.

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724 Fanny Road, Boonton, N. J.



## Fans Draw Silhouette by Radio



On the left—A profile of Mrs. Eleanor Poehler, managing director of WLAG, Minneapolis-St. Paul radiophone central, as broadcast by WLAG. On the right—Here is the way E. Stanton King, of Minneapolis, got it to win first prize of \$10 offered by the dealers

MINNEAPOLIS, Minn., April 20. NORTHWEST radio dealers, jobbers and sales representatives will ask no patent upon their process for transmitting photographs by radio, despite the success of their recent venture from WLAG, the Minneapolis-St. Paul radiophone central, on the occasion of their first annual program from the station.

The photograph broadcast was that of Mrs. Eleanor Poehler, managing director of WLAG, and more than 300 fans "copied" her likeness and submitted their efforts in competition.

The first prize of \$10 was won by

E. Stanton King, of Minneapolis. Entries came from nearly every State in the Union and several provinces in Canada.

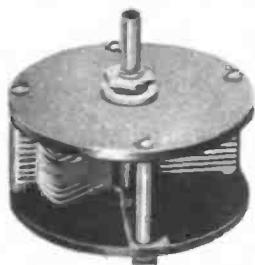
Listeners-in were asked to construct a graph of horizontal and parallel lines, designating the intersection of the squares on one side from A to Z and on the other from 1 to 26. Forty-four numbers then were read, each designating a particular point on the graph. Connecting the points formed the silhouette reproduction.

Entries came in pen, pencil, crayon and water color, and varied from a few inches square to three feet square.

# RATHBUN SINGLE-HOLE MOUNTING SUPERIOR CONDENSERS

## Special 13 Plate NEUTRODYNE CONDENSERS

GIVE that absolutely precise control of capacities which is the whole secret of a successful neutrodyne receiver. Plates lastingly aligned; stator plates anchored in accurately milled tubes and rotor plates revolving smoothly on hard, non-wearing bearings that permit no variation at any point. Single hole mounting prevents any possible torsion in mounting. No iron or steel to produce magnetic fields. Rathbun Neutrodyne Condensers make enough difference to be worth insisting upon no substitution.



Capacity .0003 MFD. LIST \$3

Write TODAY for the name of the nearest Rathbun dealer and for illustrated literature.

**RATHBUN MFG. CO., Inc.**  
Jamestown, N. Y.

these sets. He told me that the set was one of the most, if not the most, sensitive he had seen. He also told me that I was getting great volume, practically no tube noises and wound up by telling me it was the "best" set he had heard. He spent two hours "playing" with it. Naturally, I made sufficient allowance for his opinion as we had never met before and I knew he wanted to be polite.

Now, as to the impression gleaned from the "ads" of this set. One gains the impression that he is not going to hear any code. I have never heard so much code as I have heard on this set.

Also one thinks by the use of the loop static will be more or less eliminated. Never heard more static than I have heard this winter.

The heterodyning principle is not always a guarantee that two stations will not be heard at the same time. Every now and then this occurs. I have had the Philadelphia stations pass out over a space of about 5 to 10 degrees or 2 or 3 degrees, and again I have had WOO spread all over the dial. I have had WOR (405), PWX (400) and WFI (395) separated clearly and all within a space covered by 3 degrees on the dial inclusive, using antenna (not loop).

About one month ago I sat up four nights within a period of two weeks especially to tune in Los Angeles. Within five minutes I had them on each occasion, but, who in thunder wants to listen to Los Angeles through so much code and static when better programs are on nearer home?

I must confess, since dabbling in this game the last three years, I have

gotten over the late-hour business and take the good programs offered earlier in the evening.

Last week I received three of the new radio-frequency transformers now being used on this model made by the General Radio Company, in place of the 1716. I have put them in and there is no question as to their superiority as to volume. As to selectivity I haven't had a chance to try them out as I only made the change yesterday, and last night was too scratchy to bother listening in.

As to the quality of the signals I will advise you as soon as I give the set a new tryout.

I had formerly been using an Armstrong spiderweb (Goodman) three-circuit home-made set and I have covered as great distances as I have so far obtained on the heterodyne; of course, not as loud and much more difficult to locate. My son has a Gibbons ultra-audion rigged up in a cigar box, which is as selective a thing as I have ever seen. Hastings comes in on this set (one tube) clearly and distinctly. One degree will usually knock the worst offender off.

I really think the average user of a radio set, if he or she is not what might be termed a "bug" hunting trouble, will derive all the satisfaction as to reception of good concerts, talks and other matters of interest broadcast daily, with a good neutrodyne. Distance lends enchantment, however, and there you are.

Any time you may be in this neighborhood I would be more than happy to have you look this set over and pass judgment.

Very sincerely yours,  
**FRANK C. PARKER.**

## The Aircore Super-Heterodyne

(Continued from Page 11)

coupling coil, and coil 3 is the oscillator coil.

The grid condensers on the modulator tube and the detector tube should be located close to the sockets, and care should be taken that the modulator tube is connected to the modulator rheostat. This tube is not connected to the oscillator. *Many sets fail to work only because they connect the oscillator and modulator on the same rheostat.* The oscillator tube is connected on the radio rheostat, i. e., the radio frequency tube rheostat making four tubes in all connected to this rheostat.

*The adjustment on this rheostat is the most critical of any filament adjustment on the set and should be at a point where five volts is obtained across the filament of the tube.*

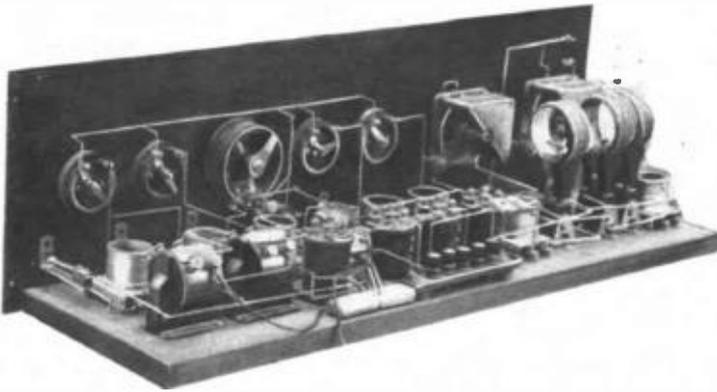
The potentiometer (marked "stabilizer") governs—or, rather, the adjustment of the potentiometer prevents—the radio frequency tubes from oscillating, and it is this control on the air core transformers which makes the fine modulation possible.

The detector tube, of course, has its own rheostat, and the two amplifier

jack, the plain cord going to the plate connection on the jack. This is readily determined by inserting the plug in the jack and noting which finger of the jack connects to the tip or end of the plug and which finger of the jack connects to the sleeve or shank of the plug, this determining which cord should be connected to the positive "B" battery. This matter is one that should be attended to on all receivers, and I have no doubt that in many cases better results would be obtained from the loud speaker if this feature were looked into.

We have placed the binding posts for this set a little to the right of the center at the back of the baseboard, and this is really the best place for them. It would be a very bad arrangement to locate this connecting block near the oscillator coil.

We have also found that the "B" battery or the "B" battery leads should be removed or at least kept six inches from the oscillator coils. While there is no "capacity" effect in passing the hand over or near these coils, still the "B" battery leads passing close to them have been found to



Another view which shows how the various parts are placed in relation to each other and how the wiring is done

tubes are also on a separate rheostat.

To look at the number of controls, one might think that there were too many for the novice to manipulate, but in actual practice all that is necessary to do, if your batteries are giving the proper voltage, is to turn on the switch, set your dials to the station desired and adjust the potentiometer or, as the panel is engraved, "stabilizer."

If a "C" battery is connected in the negative lead from the audio transformer it will reduce the "B" battery current about one-fifth, and while such a connection is not shown on the diagram, all that is necessary is to connect the negative of the "C" battery to the negative lead on the transformer and the positive of the "C" battery to the negative "A."

Another thing which many novices overlook is the "polarity" of the jacks. The jacks should be wired uniformly; the plate lead should be connected to the top or bottom of the jack, whichever you prefer, in each instance; otherwise when the loud speaker is plugged from one jack to another the polarity will be reversed on the speaker and thereby produce undesirable results.

Most loud speakers should be operated by carefully connecting the lead, having the colored thread to the positive or "B" battery side of the

make the set squeal, so that the "B" battery should be located behind the connecting block or to the right of it in placing them on the table. Better still, place them under the table if that is convenient.

Now for building the set. Fasten all of the parts down on the baseboard; then wire up the filament connections to the tubes. Next wire up your plate and grid leads to the transformers, following this by wiring up such connections between the tubes and the coils as may be necessary, together with the plate leads to the coils and the transformers.

Then assemble the parts on the panel, wiring up the common connections to your rheostats first, then fasten the panel to the baseboard and wire up the connections between the rheostats and the tube circuits. Then wire up the jacks and the variable condensers and the filter condensers.

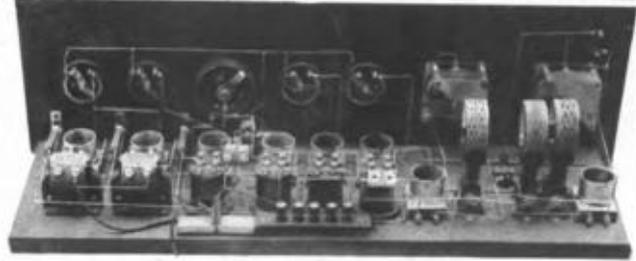
It really makes no difference, of course, which part of the set is wired first, but it is a matter of doing it the easiest way and the only way in which it can be done neatly, as it is almost impossible to make a neat job of the filament wires if the panel is fast to the baseboard. Similar care should be taken not to run wires around the location where the jacks will come when the panel is assembled, as this will only necessitate tearing out any

(Continued on Page 42)

## P. W. AIRCORE SUPER EIGHT A Real Super Heterodyne

Complete Parts  
**\$85.00**

Identically the same  
as tested by  
Henry M. Neely



Our Transformer is the heart of the Super Eight Aircore. 3000 meters absolutely prevents distortion and results in sharp tuning.



Set of four transformers including panel layout, base board layout and circuit diagram, \$25.00.

Complete package of parts including everything necessary to build your Super Eight identically as illustrated by Mr. Neely. Drilled engraved panel, base board and all parts ready to put together even including the solder.

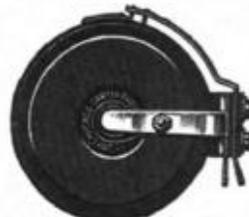
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6 ohms . . . . . \$1.50  
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Close tuning—vernier control brings in those distant stations and enables you to hold them—clear and loud.

# CARTER

Vernier Rheostat

Exclusive, original design, superior construction, complete vernier. Only one knob and only one operation. Gives filament control heretofore unobtainable, increasing the efficiency of your set amazingly.

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## MAHOGANITE Dials that match the set

Like all other distinctive products, Mahoganite has its imitators. But these imitations are on the surface only. Mahoganite is not a surface finish. The electrical values of RADION Mahoganite extend through the material.

The only way to assure yourself of genuine Mahoganite Panels, or Dials which match the panels, is to make sure that the RADION Trademark is on every one that you buy.

# RADION

The Supreme Insulation

## PANELS



Look for this stamp on every genuine RADION Panel. Beware of substitutes and imitations.

### 21 Stock Sizes Mahoganite and Black

6 x 7	7 x 14	8 x 26
6 x 10 1/2	7 x 18	9 x 14
6 x 14	7 x 21	10 x 12
6 x 21	7 x 24	12 x 14
7 x 9	7 x 26	12 x 21
7 x 10	7 x 30	14 x 18
7 x 12	7 x 48	20 x 24

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### For Radio Frequency

YOU MUST be able to get extremely loose coupling. The ordinary forms of coupler winding do not permit this. The

#### Simplex 180° Variocoupler

Solves the problem of efficient radio frequency for that set of yours. The special woven web form of rotor does it.

#### Simplex DX Tuner

Here is an instrument that is doing wonders. Let us tell you how to use it. Similar to the Variocoupler except that it is designed for the untuned primary.

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## Story of Reflex and Radio Frequency

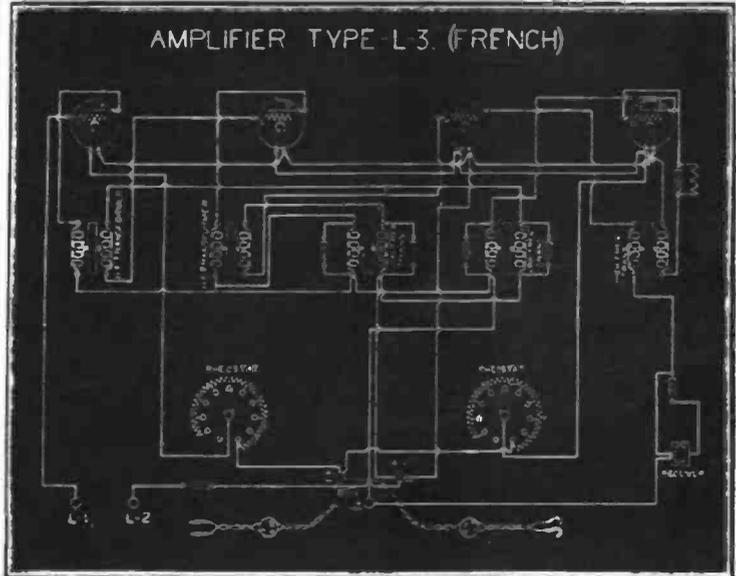
(Continued from Page 10)

many times have we seen the "So and So" reflex being described as the latest "Knock Out" set. Let's give credit where credit is due!

Along about the time that Schloemilch was working on this development, other discoveries were being made. Among these was the art of "cascade" connections—several tubes being used to give successive stages of amplification. The original reflex was a one-tube circuit. It remained for Marius La Tour, a French engineer,

granted patents Nos. 131,092 and 132,668. The first merely used a tube instead of a crystal for a detector and added one stage of straight radio frequency amplification ahead of the Schloemilch and Von Bronk reflex tube. The second patent, however, disclosed a cascade reflex, two tubes carrying both radio and audio.

The British patent, No. 132,668, is reproduced herewith, together with the drawing. Inasmuch as the reflex principle is a system of amplifier,



Above is the reflex diagram of the famous La Tour system and below the title page of the U. S. Army pamphlet describing it

## AMPLIFIER TYPE L-3 (FRENCH)

### FRENCH NAME :

Amplificateur L-3.

### USE :

This amplifier is used principally for receiving on loops, though it may also be employed with an antenna and any ordinary receiver, working best in the range of wave-lengths between 200 and 1,000 meters. It makes use of 4 standard French amplifier lamps. The first 3 lamps act as high frequency amplifier and the fourth as audio amplifier.

to combine cascading with reflexing in what has since become known as the La Tour Circuit.

La Tour reasoned that if it were possible to reflex one tube, it would be possible to reflex several tubes in the cascade arrangement. After considerable experiment, he arrived at what he considered to be the best possible combination.

He made two filings in the French Patent Office—one in April and one in November in the year 1917. He also filed in England, where he was

La Tour has only shown the amplifying circuits. He has not shown the radio tuning circuit, merely indicating two connections at the extreme lower left of the drawing.

A careful study of this drawing will show you that La Tour has employed three stages of transformer coupled radio frequency amplification, a detector tube and two stages of audio amplification. His radio currents pass through tubes 1, 2, 3 and into the detector (tube 4). Here they are changed into audio currents and fed back into

tube No. 2 and then out through tube No. 3 into the telephones. This is known as straight reflexing.

You will, no doubt, recognize this as the basis of the several commercial multi-tube reflexes on the market today. This circuit, like the Schloemilch and Von Bronk, has been taken as a ticket to success by several people who have not been willing to give credit where credit is due. So we have today several multi-tube reflexes, all bearing the names of their would-be discoverers—the circuits being nothing more nor less than the La Tour developments.

This brings the development up to the writer's own contribution in con-

not very new. It dates back to the war.

The wonder of the reflex is that it did not become generally known in this country long before now. Radio frequency and reflex have been the practice in Europe all during the time when regeneration was the "craze" in America. *It does not annoy the neighbors*; it delivers excellent quality and is fairly easy to construct.

It has its kinks and peculiarities, but once these are mastered, the experimenter will be rewarded for his efforts.

Perhaps the war brought reflex to this country by sending our radio engineers to Europe. The United States

**AMERICAN EXPEDITIONARY FORCES  
OFFICE OF THE CHIEF SIGNAL OFFICER**

## Amplifier Type L-3 (French)

When requisitioning radio equipment, use the name of the apparatus given in this bulletin, and when it is necessary to replace units or parts of this set, use the unit number or part designation given herein.

**RADIO APPARATUS DESCRIPTIVE BULLETIN No. R-23**

March 23, 1918

nection with reflexing, the story of which you have probably read before. It was while working in connection with the La Tour that he came to the discovery of the inverse duplex, a system of utilizing the vacuum tubes for both radio and audio wherein the three inherent disadvantages of the reflex are overcome. This has all been told before, so there is no need to repeat it here. It is sufficient to say that it is a decided improvement in three different respects over the straight reflex. And even the inverse duplex is

Army pamphlet, which was the radio leaven, as far as reflex was concerned, is shown here. This is the famous Bulletin No. R-23, describing Amplifier Type L-3 (French). This was the army set built upon La Tour's invention and was the source of inspiration that resulted in reflex development in America. It was also this army bulletin that led to the inverse duplex invention.

Unquestionably one of the important reasons for the rapid growth of radio during the last two years has



Q What voltage should a new dry B Battery show?

Q How long can it be used with satisfactory results?

Q Should it be discarded when no longer serviceable in the detector circuit?

Q When should storage B Batteries be re-charged?

**Can You Answer?  
These Questions?**  
IT'S EASY WITH THE

# Sterling

**POCKET METER  
No. 34C**

All these questions and many more can be easily answered if you have a Sterling "Right Resistance" Voltmeter.

These instruments are especially designed for the measurement of "B" Battery voltage. They may be used on either the dry cell or storage type of battery. The resistance of these meters, about 800 ohms, is such that they truly indicate the ability of the battery to deliver and sustain its voltage.



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*"Has the bulge on them all"*

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CAPACITY 5000 PANELS DAILY



We are supplying many of the largest set manufacturers with completely engraved, drilled and grained panels, at a cost lower than they, themselves, can manufacture them.



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Best Grade Celeron Used  
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# WORKRITE NEUTRODYNE GRAND



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### Coast-to-Coast on a Built-in Loud Speaker

Employing the famous five-tube Hazeltine circuit, this Workrite instrument will give the utmost enjoyment of radio reception. Simplicity of operation, clearness of reception and the ease with which the desired station can be picked up at any time, make the Workrite Neutrodyne Grand a most popular instrument.

**Workrite Neutrodyne Sr. Grand, \$200.00**  
**Workrite Neutrodyne Jr. Grand, \$140.00**

Send for complete catalog of Workrite sets and parts

**THE WORKRITE MFG. CO.**  
1834 East 30th St., Cleveland, Ohio  
(Branch Office, 536 Lake Shore Drive, Chicago)

been the fact that the Schloemlich patent was owned by the government and was available to all. This has enabled many organizations to engage in radio manufacture, to the everlasting improvement of the art and greatly to the public's benefit. It has successfully checkmated any attempt to monopolize the field of radio reception and has opened it up to strong, healthy competition.

Most of the popular circuits of the day are based fundamentally on radio

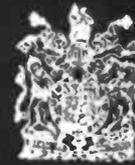
that the United States Navy owns the basic patent.

And even as we are writing, strong rumors are floating about that several combines have attempted and are attempting to obtain an exclusive license from the War Department on this important patent.

Patents are granted as a reward for accomplishment. We sometimes wonder what reward such a combine as mentioned above has coming to it for trying to "corner the market" at

132,668

PATENT



SPECIFICATION

Convention Date (France), Nov. 17, 1917.

Application Date (in the United Kingdom), Nov. 16, 1918. No. 18,836 1b

(Patent of Addition to No. 130,103. Convention Date (France), Apr. 15, 1916.

Complete Accepted, Sept. 25, 1919.

### COMPLETE SPECIFICATION

#### Improvements in or relating to Audion or Lamp Relay or Amplifying Apparatus.

I, MARIUS LATOUR, of 10, rue Auber, Paris, in the Republic of France, Engineer, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:

- This invention comprises an improvement in or modification of the invention claimed in my prior Application No. 3140 of 1918 in which is described in an amplifier with relay lamps wherein amplification is conducted in stages the use of a common source for supplying with current the plate-filament circuits of the lamps in various stages.
- In my prior Application No. 3140 of 1918 an amplifier is described in which the frequency of the signal to be amplified is

The first page of the British patent for the La Tour reflex system

amplification or reflexing and, as such, come under this patent. It will not expire until 1931. By great good fortune we have the benefit of this seven years ahead of its time. The result is the super-heterodyne, the super-dyne, the neutro-dyne, the reflex, the inverse duplex and several dozen other combinations. All of these would fall by the wayside were it not for the fact

the public's expense. It would be ridiculous if the oil lease scandals were not so recent.

The radio public is at the present time in grave danger and cannot be too wide awake in the matter. The time is coming when we will have to organize to accomplish desirable legislation for protecting the air and other things radio.

# QRM! QRM!

If you could read the dots and dashes you would constantly hear this frantic call. In wireless parlance it means that signals cannot be received because of

## INTERFERENCE

Interference! The bane of the listener-in! And it causes language that has to be expressed with more dashes than dots. QRM—QRM—Everywhere!

That's old fashioned now. Pfanstiehl has made interference as inexcusable as smallpox. Here's how:



PRICE \$8.00

The  
*Pfanstiehl*  
Silencer

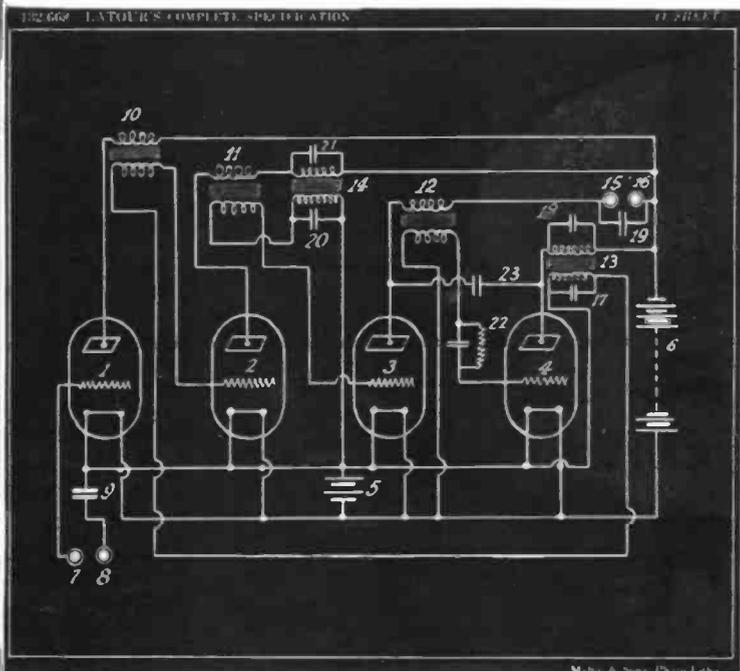
The Nineteenth Amendment to the Constitution of the United States—Prohibition of Interference. It doesn't require a law; it requires just one of these SILENCERS.

Pfanstiehl made and still makes:

- The original no-loss Reinartz coil.
- The original no-loss pure inductances.
- The original no-loss pure inductance universal

TUNING UNIT. And now  
THE PFANSTIEHL SILENCER

**PFANSTIEHL RADIO SERVICE CO.**  
Highland Park, Ill.



This Drawing is a reproduction of the Original on a reduced scale

## The Slant of the Trade on Radio

### TO BOOST SUMMER RADIO THROUGHOUT NORTHWEST

MINNEAPOLIS, April 20.

IF IT will sell and stay put in the Northwest, you can rely upon its being good.

This is an oft-repeated axiom in trade circles and holds as true with radio sets, parts and equipment as it does with other manufactured products.

The radio manufacturer who wants to get and hold a slice of the business in that great trade territory embracing Minnesota, North and South Dakota, Eastern Montana and Western Wisconsin, and including more than 7,000,000 population with Minneapolis and St. Paul as the gateway, in living up to this axiom must never lose sight of two things, namely: Consistently good quality and fair prices.

The manufacturer who sacrifices quality for quantity production in a

selling their products to Northwest jobbers has given radio fans in this section a service second to none in any section of the United States.

Speaking of service, however, makes it not amiss to record that it has remained for J. F. Thomas, of Minneapolis, Northwestern sales representative for the Alden Manufacturing Company, of Springfield, Mass., and the Sterling Manufacturing Company, of Cleveland, to give a broader interpretation to the word, at least in this section.

Mr. Thomas has fitted up a large room in his offices where jobbers or dealers may test out sets and apparatus. He has equipped it with long tables connected with A and B batteries and loud speakers. Here a jobber may, under very favorable conditions and in a homelike atmosphere, demonstrate his goods to the dealer and the dealer likewise to his customer. There is no charge for the service, and only one restriction. Competitive tests are not allowed.



Above is shown the office of J. F. Thomas, of Minneapolis, Minn., Northwestern sales representative for the Alden Manufacturing Company, of Cleveland, Ohio

mad effort to keep up with the demand soon will find his product on the bargain tables and no longer offered to the trade. A like fate awaits the manufacturer who expects the Northwest public to pay for a trade name.

A survey of Minneapolis and St. Paul radio jobbers and sales representatives reveals two other very important factors that must not be lost sight of in the shuffle.

One of these is advertising to establish a "speaking acquaintance" of the product with radio experimenters.

The other is service—a willingness to replace goods that fail to deliver either because of workmanship or material. The demand for this service has eliminated the "flooding" that characterized the early days of radio in the Northwest, when "seconds" were palmed off as first-class goods, and the wholehearted co-operation of manufacturer's now

One night fifteen jobbers and dealers took advantage of this service.

"I have two things in mind in offering this service," Mr. Thomas said. "One is to keep in closer touch with developments in radio, and the other to aid in raising the standard of radio merchandising in the Northwest."

This effort to create a demand for quality goods is being sponsored by sales representatives, jobbers and dealers alike. It has not been lost on the fans themselves, who long ago passed the crystal set stage. It is reflected in the fine discrimination being shown in the selection of parts.

There is no quibbling over prices where prices are fair for the article offered, nor is there a very heavy sale of equipment that is unquestionably overpriced or overcheap. It is the medium-priced parts of good quality that make up the bulk of the sales.

This demand for quality at a fair price is not confined to the larger

## Here's Henry M. Neely's FAVORITE RADIO HANDBOOK



514 PAGES  
50,000 SOLD

Compiled by HARRY F. DART, E.E.  
Formerly with the Western Electric Co., and U. S. Army Instructor of Radio. Technically edited by F. M. DOANE

"There are a great many books on the market, but I think the two best that I know of are one published by the United States Government for the Signal Corps and called 'Principles Underlying Radio Communication,' and the other the very compact and complete little 'I. C. S. Handbook for Radio Operators,' which has just recently been put out.

"I think that the readers of this magazine will undoubtedly find the I. C. S. Handbook better for them, because it is the more recent and has been compiled for their special benefit. Personally, I usually am able to find a copy of this handbook in my pocket, and if I ever find myself on a trolley ride or a train ride with a few minutes to spare, I take it out and delve almost anywhere in its pages and find information there which is of value to me at all times."

HENRY M. NEELY  
Editor, "Radio In The Home"

### Every Question Answered for only \$1

NO MORE need you turn from book to book, hoping to find what you want. It is all here, in 514 pages crammed full of every possible radio detail. Written in plain language, by engineers for laymen. Clears up the mysteries, tells you what you want to know. A complete index puts everything within your reach in a few seconds.

Under one cover. Yes, it is all in one volume of 514 pages of clear type with hundreds of diagrams and illustrations. Takes the place of eleven or more specialized texts, each costing from two to ten times the dollar you pay for this single book. Belongs in every radio-equipped home, on every amateur's table.

Send \$1 to-day and get this 514-page I. C. S. Radio Handbook—the biggest value in radio to-day. Money back if not satisfied.

IT EXPLAINS: Electrical terms and circuits, antennas, batteries, generators and motors, electron (vacuum) tubes, every receiving hook-up, radio and audio frequency amplification, broadcast and commercial transmitters and receivers, super-regeneration, codes, license rules. Many other features.

—TEAR OUT HERE—

INTERNATIONAL CORRESPONDENCE  
24 HOURS  
Box 8258-B, Scranton, Penna.

I enclose One Dollar. Please send me  
—post-paid—the 514-page I. C. S.  
Radio Handbook.

Name .....

Address .....

### MR. BOWDEN WASHINGTON, CHIEF ENGINEER OF THE Cutting & Washington

RADIO CORPORATION SAYS: "All-American Audio Frequency Transformers were adopted as standard for the Cutting and Washington Receiver after thorough tests in our laboratories demonstrated that they faithfully reproduce broadcasted music and voice with excellent volume and stand up in service better than any other transformers we have tested. We consider All-American Audio Frequency Transformers the best on the market."

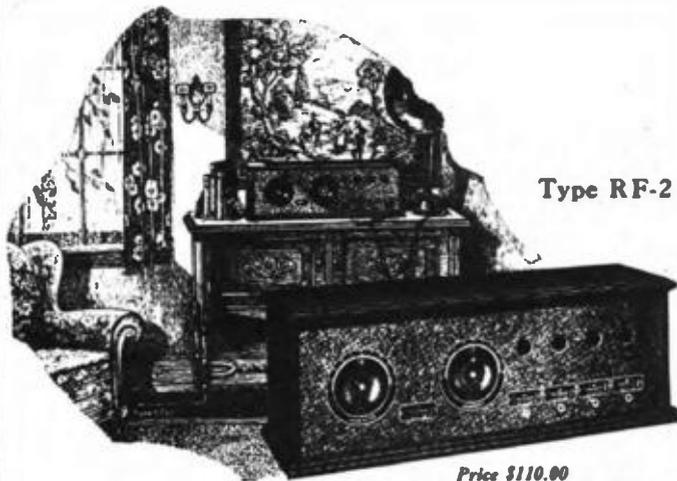
RAULAND MFG. CO., 2666 Coyne St.  
CHICAGO



A type for every circuit

# ALL-AMERICAN

AMPLIFYING TRANSFORMERS  
Largest Selling Transformers in the World



Type RF-2

Price \$110.00  
(Without Tubes and Batteries)

### Pride of Possession—

Ownership of the new Eisemann Broadcast Receiver imparts a sense of keen satisfaction.

Little is left to be desired—not simply because of distinctive appearance, but by reason of the remarkable performance of the RF-2.

New distance records have been reported almost daily since the introduction of this latest receiver.

A transformer-coupled tuned radio frequency circuit is employed, with two stages of audio frequency amplification.

#### ASK YOUR DEALER

*Descriptive Literature on Request*

**EISEMANN MAGNETO CORPORATION**

*William N. Shaw, President*

52 Thirty-Third Street Brooklyn, N. Y.



## Edison The Perfect Radio Battery

That is Clean, Beautiful and Indestructible. Running for months and months and months without charging or any attention. Always giving constant, unfading reception, that's the

### Edison 1000-Hour Battery

That it costs but \$12.50 to buy and half as much as dry cells to operate for equivalent service, is an incidental advantage. At present made only for WD 11 or 12 and 199 tubes.

**BARTLETT FACTORY EQUIPMENT CO.**

*Battery Specialists for Thirty Years*

B4, Exhibition Department BOURSE BUILDING, PHILA.

cities, but extends down through the smaller towns and rural communities where an antenna wire is almost as common a sight as a certain well-known make of automobile. Farmers have been buying sets and parts liberally, despite the depression of the last few years as a result of the low prices for farm products.

"Our sale of complete radio sets in rural communities in the last four months would indicate that every farmer in the Northwest has a radio," one of the largest Minneapolis jobbers declared.

While the volume of radio business has been large, it is the nationally advertised lines that have taken the cream of the business, in the opinion of A. A. Hume, of Minneapolis, Northwestern sales representative of the Carter, Bremer-Tully, All-American and Erla products.

"The radio business has been very gratifying, with the sale of parts leading the procession," Mr. Hume said. "This heavy sale of nationally advertised lines proves conclusively that the Northwest, while it may have been hard hit financially by low prices for farm products, will react to merchandise that has built up an acquaintanceship through advertising and lives up to its reputation for quality. It is merchandise of this class that has prompted the very noticeable demand for better apparatus."

Radio parts and equipment sales during last November, December, January and February broke all records for preceding years. Several Minneapolis and St. Paul jobbers had great difficulty in obtaining shipments rapidly enough to fill orders. First came a shortage in tubes. Then batteries had their fling, and lastly came a dearth of rheostats, potentiometers and radio and audio frequency transformers.

The W. S. Nott Company, of Minneapolis, handling the Crosley and Federal lines, and the Jones Radio Company, of St. Paul, jobbing Kellogg equipment, at Christmastime were reported heavily back-ordered and with new orders virtually equaling incoming shipments.

February brought the Twin City Radio Show, in conjunction with the Twin City Automotive Exposition, and more than 120,000 persons witnessed the radio exhibits in a week. It was estimated that more than 40 per cent of this attendance came from the smaller towns and rural communities.

The two last years have shown a noticeable slump in the sale of radio parts with the advent of warm weather, because of the belief of many that good radio reception cannot be had during the summer months.

This year, however, jobbers and dealers plan a campaign of advertising to counteract this impression and will feature sets and hookups employing radio frequency. This advertising will be directed particularly to the thousands of families who spend their summers on Minnesota's 10,000 lakes.

Portable sets for the use of automobile tourists, of whom many thousands come to this section during the summer, also will be featured.

### SUPER-HET WAVE FAILS TO HALT NEUTRODYNES

ST. LOUIS, April 25.

A "SUPER-HETERODYNE" wave has swept St. Louis during the last sixty days, leaving in its path a seemingly unquenchable "thirst" for information concerning the construction, operation and the fundamental

principle upon which the circuit is based, written in terms which the layman can understand.

Dealers generally attribute this unprecedented demand to two causes: First, to articles appearing in radio publications, including the fan magazines; and, second, to the placing on the market of two models of super-heterodyne receivers by a well-known corporation—after a campaign of nation-wide publicity.

"It has even spread to the country," one dealer remarked, "and we can't get the sets to sell when they write in their orders."

This same man ventured to say that the neutrodyne circuit, which was superior to anything previously known, had proven to the "fans" what was really possible, and, desiring even more and better results, they were anxious to learn more and then buy, although he did not believe that the super-heterodyne would ever—at least not in the near future—take the place of the neutrodyne.

"It will require more simplification yet," he said, "for it materially to affect the popularity of the neutrodyne. The neutrodyne circuit has made a place for itself, and it is going to stay."

One manufacturer in St. Louis is said to have begun the manufacture of super-heterodyne receivers, and this supply, with what can be imported, may partially supply the demand for these eight-tube receivers which sell at a price between \$150 and \$200 "stripped," but that remains to be seen. The number of requests for super-heterodyne parts, (selling for approximately \$80) seems small, in comparison with the universal demand for knock-down neutrodyne sets and parts.

That the neutrodyne pace, which reached its height during December and January, has not "let up," seems to be the consensus of opinion among the local dealers. Not only the parts, but the complete sets are still "moving" at a gratifying pace, according to a representative number of jobbers and dealers. Some of the finest workmanship yet to be seen recently made its appearance in the form of a five-tube neutrodyne receiver, attesting the fact that the demand is still "up."

The last two months have been bringing many requests for information concerning superdyne circuits and an even greater demand for superdyne parts. Parts for this circuit are unobtainable at the present time, one dealer said.

The demand for high-grade parts was no less during the last month than in the preceding month. One salesman said it was even greater, due to a reaction from buying cheap parts which had proven unsatisfactory. It is believed in some circles that the sale of ten-cent store accessories and parts has not injured the exclusive radio dealers' market, but—in the long run—increased his sales, for this very reason.

Small regenerative sets are still the best sellers, barring none. Both the Crosley and Michigan are popular, and, from all reports, are giving highly satisfactory results where more expensive sets failed.

Loud speakers are selling; most dealers agreeing that the Atlas was the greatest in demand. Next, in order of popularity, comes the Brandes, Music Master, Manhattan and Magnavox, the last named finding the greatest popularity among the country trade.

Loop aerials are still being sold, but they are seldom demanded; most "fans" being willing to erect outdoor aerials.

The shortage of vacuum tubes, instead of letting up, has become more

acute, and getting them in quantities is a problem which is staring every St. Louis dealer in the face. One dealer said he had three hundred un-filled orders on file, yet he could hardly obtain enough to equip sets sold complete. "A" type tubes are in a class of their own when it comes to popularity and they are few and far between in this locality. WD-12 tubes are also scarce, but UV-199 and C-299's are available in almost any quantity. Magnetrans are gaining in popularity, both the DC-199 and DC201-A being in demand.

**NEUTRODYNE AND SUPER-HET BATTLING IN MIDDLE WEST**

OMAHA, NEB., April 20.

THE mid-western farmer, notoriously hard to "sell" on just any new-fangled idea that happens to come along, is in a most receptive mood to be sold on the radio idea. To date farmers in this section as a rule have been too busy with their lands to bother about radio, and the estimate is made that only about one farmhouse out of twelve in Nebraska, Iowa and South Dakota is equipped with radio receiving apparatus.

It is a well-known fact that those in the rural districts have been hard

Mr. Rainbolt reports that in the month of February the McGraw Co. and those retailers to whom it sells, enjoyed more business, both in volume and receipts, than during any single month since radio broadcasting for the public began.

"Without a doubt the neutrodyne is the most popular set of today," said Mr. Rainbolt, "but during March sales of this line were slackened somewhat by the announcement of the new Radiola line by the Radio Corporation. Those who were good prospects for neutrodynes are now waiting for the commercial super-heterodyne; they are wondering if the super-heterodyne is not just a little bit better, and, of course, it has the built-in loop, which does away with the bothersome aerial and ground."

He said the first of the month saw only about a dozen "supers" delivered into this trade territory and the neutrodyne enthusiasts have adopted a watchful waiting policy until the newer line has been tried and proven.

Despite the lull in the manufactured set market (excepting the cheaper priced sets), the tube and the battery market and also the general accessories market has been exceptionally good. The advanced amateurs are reported to be buying heavily of



Radio in the home of D. G. Hopkins, care of Col. Morrell's Home, Torresdale, Pa. Set is a Crosley Model, No. 3-B  
Photograph courtesy of the Ross Music Stores, Phila., Pa.

pressed for money the last several years, but with conditions growing steadily better it is not a far-fetched prediction to say that the next broadcasting season will see one in six or eight farmhouses with long-range sets.

Ray Rainbolt, former announcer at WAAW, the Omaha Grain Exchange station here, who now is in charge of the radio department of the McGraw Co., one of the largest of the mid-West's electrical dealers, is authority for the statement that the farmer folk are being educated to appreciate radio by means of the station's broadcasting the market reports.

"Those of the farmers who do not now have their own sets are getting their daily market reports from a neighbor who has, and it is reasonable to believe that, with their interest developed to such an extent, they, too, will be on the market for a set soon."

super-heterodyne and neutrodyne parts.

Practically all of the Omaha jobbers and retailers agree that it would NOT be too optimistic to say that the mid-west is just entering into the radio game with the enthusiasm that it has enjoyed in other parts of the country, particularly in the East. The newspapers are devoting more space to the trade; they are giving columns daily and Sunday now to scientific articles, programs, etc., whereas only several months ago they were devoting inches.

J. L. Kellogg, Chicago, representing the Crosley Radio Corporation, Cincinnati, feels the radio pulse of this territory about as carefully as any one. He was here several days ago wearing the smile that just wouldn't come off. He said his sales report the last month resembled the financial statement of the Bank of England.

(Continued on Page 43)

# MODERN "Push-Pull" Transformers

These are the Transformers used in the book-ups illustrated and described on page 13 March "Radio in the Home"; also page 1419 April "Radio News."

Radio authorities everywhere are unanimous in their endorsement of the MODERN "Push-Pull" method of power amplification.

**MODERN "Push-Pull"**

Used in addition to one or two stages of audio. Assures clearer and better reception than has heretofore been secured from audio frequency reception.

**MODERN "Reflex"**

This is the transformer that makes one tube do the work of three in the Monoflex circuit. Ask for bulletin on the Monoflex circuit.

**MODERN Standard Audio 4 to 1 Ratio**

Designed especially for use in 2-stage amplifiers. Provides greater audibility than three stages using ordinary transformers.

**Ask Your Dealer**

Most good dealers sell MODERN Transformers. Go to your dealer today and ask for the MODERN Transformers you need and new bulletin of latest hookups. If your dealer can't supply you, write us giving dealer's name and bulletin will be sent you direct from the factory.

**Free Bulletin of Latest Hook-Ups**

Every radio fan should get a copy of the new MODERN Bulletin of latest hook-ups from his dealer. Get your copy from your dealer today.



**The Modern Electric Mfg. Co.**  
Toledo, Ohio

## MACKONTROL Saves Your Tubes!

HERE is an everlasting insurance against burnt-out tubes. Automatically controls the "B" battery voltage, preventing the burning out of the filament. Indicates a short circuit instantly. Will not burn out like a fuse. One Mackontrol will protect all your tubes indefinitely. Eliminates battery noises and improves reception by allowing only the proper amount of current to pass through. Whether you are using one or a dozen tubes the Mackontrol is an invaluable asset. Order yours today!

Type "A" just released. Price **\$2.50**

Your Dealer Will Demonstrate It

**THE MACK COMPANY, Manufacturer**  
1810 Market Street Phila., Pa.

**MACKONTROLS SENT PREPAID!!**

Don't fail to read the above manufacturer's advertisement. It is the only apparatus on the market absolutely guaranteed to protect your tubes. We will be glad to send you a MACKONTROL PREPAID on receipt of price. **\$2.50**

J. M. HETHERINGTON & CO., Direct Factory Distributors  
Hunting Park Avenue and E. Locoming Street, Philadelphia, Pa.

Fill This In →  
Clip off and Mail-NOW

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_

Without your paying a cent in advance we will send for your inspection a copy of Kenneth Harkness' famous book "Radio Frequency Amplification"—the book which contains more real information on one page than a volume of ordinary text books—the book which has brought a clearer understanding of the theory and practice of radio to its thousands of readers.

When the postman brings your copy pay him \$1.25 plus postage. Read the book from beginning to end. See for yourself how it expands your knowledge of radio. Learn how to build the famous Harkness Excitron. Then—if you don't think the book is worth at least double its price—send it back and we will refund every cent of your money.

**"As Interesting as a Novel"**

This is more than a textbook—more than a course of instruction. In his easy, lucid, entertaining style, requiring no effort on your part to follow his reasoning, Kenneth Harkness leads you step by step from the elementary laws to the advanced principles of radio science. One reader says, "The book is comprehensive, concise, accurate, scientific, interesting as a novel. . . . I wouldn't be without it for ten times its price."

**Makes Advanced Radio Easy**

This book explains to you in easy-to-grasp language the theory of radio reception from A to Z. It tells you everything you want to know about radio—answers all your questions. The very first day you start reading this book you will feel yourself growing in knowledge. Everything is so delightfully clear; the explanations are so simple and understandable that you will quickly and easily learn advanced radio. Kenneth Harkness wrote this book in your language—the language you use every day. His book fills an open gap in radio literature. He explains advanced radio—hitherto understood by mathematicians only—yet he explains it in simple, easily-understood English.

**New Complete Details on Harkness Reflex**

Illustrated by 136 drawings, diagrams and photographs, this book shows you how to build five different types of Radio Frequency Amplifying Receivers. The second edition, just off the press, gives new and complete information on the popular "Harkness Reflex" which operates a loud speaker with one tube. In a greatly enlarged and profusely illustrated chapter, Mr. Harkness shows you how to build his new, improved one and two tube receivers using the "Knockout" record-breaking Harkness circuit.

You've always wanted a real live practical radio book like this. You can have it for the asking—without paying a cent in advance. Just mail the coupon on the top of this page, and you will receive your copy by return mail.

**Fill in and mail the Coupon-Today!**

Read me a copy of Kenneth Harkness' famous book "Radio Frequency Amplification" that I will pay the postman \$1.25 plus a few cents postage. I have already satisfied myself that I may return the book not later than 15 days after receipt for a prompt refund of my money.

To: The Radio Guild, Inc., 256 W. Thirty-fourth St., New York, N. Y.

**Kenneth Harkness Joins Our Staff**

(Continued From Page 4)

advantage of its amplifying qualities and two stages of audio frequency amplification in order to get loud speaker volume on all signals within reasonable distance.

These conditions must be met with the added limitation of not more than three tubes and preferably the dry cell tubes if possible.

Naturally these conditions mean a reflex circuit and we have made another stipulation that the circuit developed must be so simple that any average novice with very slight experience can hook it up with a minimum of difficulties or problems.

Mr. Harkness is quite convinced that it is possible to meet all of these requirements. It will take time, of course; but there is no reason to doubt that the circuit will be developed exactly according to these specifications.

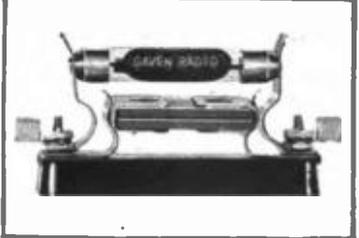
When it is, we will then be able to present to the public a set which will meet the requirements of the average man who has neither the desire nor the money to own or operate one of these exceedingly delicate multi-tube sets which are the rage today.

Such sets are very fine for the advanced experimenter and the man who wants the ultimate in radio. We ourselves use them.

But we have had an insistent demand from a large proportion of our readers for circuits especially designed for simplicity, efficiency, ease of construction and at moderate cost, and it was to satisfy this demand that we started the negotiations with Mr. Harkness which have led to his joining our staff as an Associate Editor.

**THIS MAKES IT EASY TO CHANGE CONDENSERS**

IT IS always a great pleasure to introduce fans to anything new that comes on the market that will be of genuine assistance to them in their efforts to find the ideal hookup. I have recently come across a little device which will be a blessing to the fans who are constantly experimenting with the latest circuits in which the exact value of fixed condensers or leaks is of prime importance. Such



circuits as the Grimes inverse-duplex, the super-heterodyne and the various reflexes are all subject to the necessity of having these fixed condensers or leaks exactly suited to the particular makes of instruments and tubes that are in use, and it has been very difficult to arrange for the substitution of one condenser for another because it has meant unsoldering connections and resoldering the new fixed condenser.

Here is a little double mount put out by the Daven Company, of Newark, which solves the problem for all fans. Wherever you see a fixed condenser in any hookup at all, it is now possible to put one of these mounts in the place of the fixed condenser and then, by means of the spring clips on the mount, it is a simple matter to slip in one condenser or leak, try

it, substitute another one and so get the exact value that gives the best results.

The double mount is also useful because it makes it possible to use both condenser and high resistance leak in the same mount. The upper clips will take either the Dubilier or the New York Coil Company fixed condenser. The upper mounts will also take the tubular condensers made by the Kellogg Company and so this little piece of apparatus, inserted wherever a fixed condenser is marked in the diagram, will give you the chance to use the three standard fixed condensers which are the best on the market.

**Editorially Speaking**

(Continued From Page 4)

cause we tested it here." But what is the "test" to which the average dealer puts the tube?

He simply inserts it in a socket, turns on a rheostat, and if the filament lights, he declares the tube to be good.

This is not a test of the tube at all. It is simply a test of the filament. Inside of the tube there are two elements—the grid and the plate—which are quite as important in radio as the filament. Such a test does not tell anything about those two extremely important elements.

The only way to test them is to place the tube in such a set as I am describing in the Radio Kindergarten this month, and while not going to the trouble of drawing the entire "characteristic curve," seeing to it that the increase in B battery current caused by swinging the grid bias from negative to positive is sufficient to prove that the tube is in good operating condition.

If dealers should make a habit of installing such sets, all tubes could be tested by them when they are received from the manufacturer or distributor and defective ones could be returned.

It would also not be asking too much of the dealer when you go to buy a tube to have him put it in such a set and show you that, as he swings the grid bias from negative to positive, there is a very decided increase in the B battery current drawn through the milliammeter.

**Radio Kindergarten**

(Continued from Page 6)

filament of a tube, but six one-hundredths means sixty one-thousandths and a set that uses that much current out of the B batteries would be extremely expensive in operation.

The one-thousandth of an ampere is called a milliampere and that is what we are measuring here in the scale of figures which runs up the left-hand side of our drawing. We therefore go from zero, or no current at all, up to fifteen milliamperes, or in other words fifteen one-thousandths of an ampere.

Along the lower line you will see the figures beginning in the middle with zero and running from that up to ten to the right, indicating a positive voltage, and from the middle over to the left up to ten for a negative voltage.

On our testing apparatus, we have made provisions for placing any amount of voltage on the grid of the tube and making it either positive or negative.

Now when I say that we place this voltage on the grid of the tube I do not mean that we make a current actually flow from the grid, because

we do not. When such a current does flow, the tube is "oscillating."

We give the grid what we call a "bias"—that is, we place upon it force which is waiting there ready to drive a current in case we furnish a path for that current to travel on.

This grid bias might almost be likened to a cartridge in a rifle. This cartridge has a certain number of foot-pounds of energy or force stored up in it, but the energy is not set into motion until we pull a trigger and start it.

We might almost say that the grid of our tube is the same. We can put a certain amount of energy on that grid ready to go into action if we want it to and this energy can be varied from the extreme positive and back through zero to the extreme negative. In fact, that is just exactly what does happen when a radio signal comes to our aerial and is led down through our tuning apparatus to the grid. The grid bias varies from positive to negative thousands and thousands of times a second.

Now in this testing apparatus, we simply duplicate the actual receiving conditions by putting an artificial bias of so many volts of positive or negative on the grid of the tube and then we use our milliammeter to measure how much current is drawn from the B batteries under these differing conditions of grid bias.

Now, before telling of the methods by which we get this curve, let us face the problem that confronts us in radio.

The incoming radio signals have considerable voltage change, but have virtually no current—that is, they have a certain amount of force behind them, but there is virtually no quantity of electricity in them.

To operate our phones, however, the problem is just the reverse; we want violent changes in the quantity or amperage, whereas the voltage does not matter so much. Therefore, knowing that we place our phones or loud speaker in the circuit leading from the B battery to the plate, we must see just what effect the change of the grid voltage has on the current or amperage flowing from the B battery to our phones. If we can make the change in grid voltage bias produce considerable change in the quantity or amperage flowing around the magnets of our phones, we can produce the signals that we want.

Now let us insert a 201A tube in the socket in our testing apparatus and set our grid bias at zero as shown on the bottom line of figures. The zero mark is on one line and if we follow it straight up until we come to a little dot and then follow the line to the left from that dot we will see that at "zero grid bias"—that is, with neither positive nor negative bias on the grid—the milliammeter in our plate circuit shows that there is about seven and one-half milliamperes of current flowing through the phones.

Now let us move the bias of the grid to one volt negative, which is shown to the left of the zero mark on the lower line. Let us follow the vertical line up from that one volt until we come to the other dot and then follow that to the left and we will see that we have now reduced the plate current to six and one-half milliamperes.

At two volts negative, following the line up to the dot and then to the left, we find that we have still further reduced the current in the phones to five and one-half milliamperes and so we go on to ten volts negative, reading our milliammeter and making a dot wherever the milliammeter (hori-

# PULLING POWER



Heavy Bakelite shells of rich brown color. Windings of correct gauge wire and properly proportioned for best reception. Large bearings assure smooth operation and long life. No sliding contacts; rotor connections made with special flexible wires, through hollow shaft to binding posts on stator shell.

The stops are a part of the stator and rotor and are positive. Bakelite especially treated to prevent distributed capacity. Arranged for either panel or base mounting.

## VOLUME!

THE variometer or variocoupler is responsible for the strength of the signals received. Therefore, the size, shape, gauge of wire and number of turns in the Kellogg variometers and variocouplers are the result of exhaustive tests for equipment that will give the best radio reception.

Therefore, it is to your advantage to demand Kellogg variometers and variocouplers and know that you will receive better reception, resulting in maximum entertainment, and value from your radio set.

If your dealer does not handle Kellogg, communicate direct with us.

**KELLOGG SWITCHBOARD & SUPPLY CO.**

1066 West Adams Street, Chicago

## RADIO in the HOME

*It Is a Reader  
Service*

*It is devoted entirely to better class radio—the only kind that is fit to go into the American home.*

### RADIO IN THE HOME

*is not in the market for general radio advertising. We make our own tests of apparatus, and we solicit advertising only from those manufacturers whose products we ourselves are willing to guarantee in the light of these researches.*

*This is to assure our readers that they can depend on the things they see advertised in our columns.*

## THE IMPROVEMENT

You Have Been Waiting For!

Price 40 Cents—  
At All Dealers



### NO LONGER NECESSARY TO SOLDER THE GRID CONDENSER

Permits changing Condenser instantly. Fits all standard Mica Condensers. It is electrically and mechanically perfect. This mounting also accommodates the DAVEN RADIO RESISTOR. DAVEN RESISTORS are constant and correct in value and positively insure clear, noiseless and distortion-free reception and amplification.

### MOISTURE-PROOF, INDIVIDUALLY TESTED, ACCURACY GUARANTEED

Daven Resistors are manufactured in all values from 5000 Ohms to 10 Megohms; suitable for every Radio Receiving circuit. Especially suitable for Resistance Coupled Amplifiers. If your dealer cannot supply you please write us. Literature sent free on request.

**Daven Radio Company**

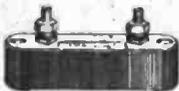
(Radio Resistor Specialists)

9-11 Campbell Street  
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## Radio Safeguards

### STORM KING LIGHTNING ARRESTER

Approved by  
the National  
Board of Fire  
Underwriters



\$1.00 at all dealers



Solders All  
Joints Per-  
manently.

**SOLDERALL CO.**  
NEWARK, N. J.

zontal) line crosses the grid (vertical) line.

Then we will do the same thing, moving the grid voltage bias over in the positive direction and we will see that as we do so, we are increasing the amount of current which is flowing through from the B batteries through the phones.

With these little dots made for each volt of grid bias, both positive and negative, we see that we have a series of dots going in a fairly smooth curve from the lower left-hand side of the diagram up to the upper right-hand side and if we connect these dots by a smooth line, we have drawn what we call the "characteristic curve" of that particular tube.

Now what does this show?

Let us assume that a radio signal is coming in and being placed, or, as we say scientifically, "impressed" on the grid. Let us assume that this alternating current in the signal goes up to five volts positive and then swings back through zero to five volts negative and then back up to five volts positive again and so on hundreds of thousands of times a second.

With this constant change in the bias on the grid, we can see at once from our chart what we are doing to the amount of current or the amperage flowing through the phones from the B battery.

With the signal voltage on the grid being five volts positive, our B batteries are sending twelve milliamperes through our phones. When the current is reversed and it becomes five volts negative on the grid, our B batteries are sending only about three and one-quarter milliamperes from the B batteries through the phones.

That means that with this very weak radio signal coming in and varying its voltage from five volts positive to five volts negative, we are creating a total change or current in the phones amounting to 8.75 milliamperes at every reversal of voltage of the radio current.

It is this change in the amperage flowing through the telephones from the B batteries that varies the magnetism and so moves the diaphragm and that gives us the signals that we want.

A good tube of the 201A or 301A brand will show just about the kind of characteristic curve that is reproduced here, varying slightly from over one milliamperes at ten volts negative grid bias up to nearly fifteen milliamperes for ten volts positive grid bias.

As the tube begins to get old and loses much of its efficiency, the characteristic curve which we get from a test of this kind would be very much "flattened out" and would probably go from about zero milliamperes at ten volts negative grid bias up to only two or three milliamperes at ten volts positive grid bias. That is to say, the characteristic curve would be almost horizontal and would indicate that changing the grid bias of the tube would not produce a sufficient change in the amperage flowing around the telephones to give us effective signals.

Next time you buy a tube, ask the dealer if he has a tube testing outfit and if he will put the tube in and show you the variations in current with the variation in grid bias. Hunt around among the stores of your town and find a dealer who has such a testing outfit as this and who is perfectly willing to test your tube for you before he sells it to you. The Jewell people make a most compact and efficient test set for this purpose.

The 201A or 301A tubes should run from something between zero and

two on the left-hand side up to something between twelve and sixteen on the right-hand side.

The 199 or 299 should go from about zero to around 6.5 with 60 volts of B battery, while the 11 or 12 tube, with 50 volts, should go from zero to 4.75. That was the average of our tubes at station 3XP when they were new.

It is particularly interesting to know that this method of deriving the characteristic curve of tubes was devised by Professor L. A. Hazeltine, at that time connected with the Bureau of Standards, but recently more famous as the inventor of the neutrodyne circuit.

Most radio fans think that Professor Hazeltine's greatest work was this neutrodyne circuit. Personally, while an ardent neutrodyne user myself and a great believer in its future, I think that radio really owes more to Professor Hazeltine's invention of the characteristic curve than it ever could owe him for any receiving circuit. It was this characteristic curve that gave us our first real knowledge of the miracles that are going on inside of our vacuum tubes, and it was by means of just such curves as this that we were able to study them and to take advantage of all of the things that they do.

The characteristic curve of tubes is now really a basic phase of all radio reception and transmission, and that is why I think it Professor Hazeltine's most important work.

### The Aircore Super-Heterodyne

(Continued From Page 33)

such wires. If you have followed the diagram and precautions outlined, you should be able to connect up the set and enjoy the entertainment.

A word about tubes. By all means use the best tubes. Many gyp tubes—so-called 201 A's—are not genuine. The UV 201A or C 301A is to be depended upon, as many sets have been found not to function simply because of one bad tube. Even though the tube lighted, it simply did not operate. We use the same tubes throughout. As will be noticed from the diagrams, sixty volts is used on the detector, modulator and oscillator plate, and the use of a soft detector tube would not be satisfactory. You can, of course, use the 216A Western Electric tubes in the audio amplifiers if you so desire.

While I have mentioned previously in this article some of the pitfalls, the usual reason why any set does not percolate at once is either a wrong connection or one or more connections you have left out, and I would strongly urge that you check up carefully with the diagram to see that they are all in their proper place, and before connecting the "B" battery, to connect up your "A" battery and see that all of the tubes light from their respective rheostats, as this will eliminate the possibility of having connected your "B" battery to the filament side.

I also wish to add that the "B" battery when connected will give quite a spark, due to the charging and discharging of the bypass condensers. If your potentiometer sparks it should be sand-papered slightly to make better contact.

I would strongly urge that storage "B" batteries be used for satisfactory operation of the set. The B battery drain, using A tubes throughout and with 4½ volts C battery, is 35 milliamperes, and this is too much to expect from dry-cell batteries.

This is E. M. Clarke operating a Super-heterodyne set which he himself built.



## RESULTS COUNT!

Thousands of satisfied buyers, and not a single dissatisfied customer is a record of which we proudly boast. Every day we get letters from various parts of the country thanking our Service Department for its helpful advice. Everywhere—fans are getting better results than what we lead them to expect, and results count! We simply must satisfy you—your money back if we don't!

### This month we offer: The New "PW" SUPER-HETERODYNE

This super is creating quite a little talk, and fans have asked us to quote prices.  
Complete "P. W." Super Kit—which includes drilled and engraved panel, base board, wire and all parts..... \$85  
Cabinet (extra).....\$15  
3 "P. W." Air Core K. F. transformers and the Input Coll..... \$25

### FOOTE PORTABLE SET

All parts including wire and leather covered case (but without tube)..... \$25

### NEW GOODREAU SET

Including full list of parts but without tube or cabinet..... \$35

### The Famous "M & H" 8-Tube SUPER- HETERODYNE

You all know the story of this wonderful super! It is the talk of the country.

Complete assembly of parts..... \$95  
Complete with tubes, loop and speaker, etc. \$175

### Special Note!

We want you to get to know our own "pet hookup." It is simple, easy to build, cheap, sharp and selective. We call it

### The "CLARCO"

It won't eliminate static completely—but mighty close. Excellent tone and volume—Loud speaker range 1500 miles.

Blue print and full description for 50c

Special Sets built to order—  
write for information

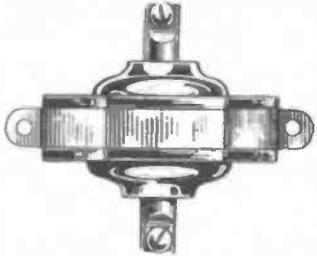
## CLARKE & CO.

W. J. J. MANNING  
E. M. CLARKE

### RADIO APPARATUS

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1520 Chestnut St.  
Philadelphia, Pa.

# KEYSTONE RADIO LIGHTNING ARRESTERS



The new Keystone, made of genuine Bakelite, approved by Underwriters. Absolutely weather, dust, damp proof and has no vacuum to lose.

At Your Dealers, \$1.50 each

Keystone Ground Fittings



Prices, complete, with instructions  
Size for 3/4" pipe, 90c  
Size for 1" pipe, \$1.10

Ground Fitting

**ELECTRIC SERVICE SUPPLIES CO.**  
Manufacturers of Over a Million Lightning Arresters  
17th & Cambria Streets, Phila.

## The Slant of the Trade on Radio

(Continued From Page 39)

In all seriousness, he said, the Crosley line is going splendidly.

Arch Strong, Minneapolis, representing the Magnavox Co., of New York and Oakland, was another local trade visitor and his was a report of how radio was going to play an important part in vacations at the thousands of Minnesota lakes this summer.

"There's no use trying to fool ourselves that we are going to overcome summer static this summer," he said. "It has been with us ever since radio was invented and this talk of DX-ing when the thermometer is 108 in the shade is pure bunk."

Strong is advising his trade to concentrate on their local stations when the real hot weather arrives. He explained that his system at one of the lakes last summer made a splendid hit with other radio enthusiasts at the camp. Here's the way he explained it:

"I built a selective crystal detector tuner and used a Magnavox power amplifier on the Minneapolis stations

this territory as we now have in the East."

### WLAG REACHES 8400 MILES

MINNEAPOLIS, Minn., April 20. STATION WLAG, Minneapolis-St. Paul radiophone central, boosted its distance record 1800 miles, when directors received a letter from W. K. Land, of Nelson, New Zealand, who said that for more than 15 minutes he received both music and an address on a loud speaker. His set is a three-tube De Forrest reflex.

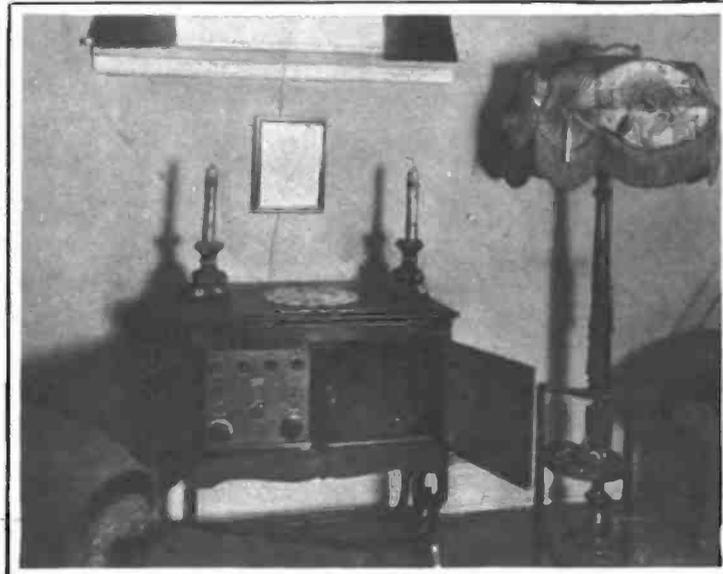
Nelson, New Zealand, is 8400 miles from Minneapolis.

WLAG's previous record was Batum, Russia, 6600 miles away.

### TOO MANY RADIO DEALERS FOR A HEALTHY BUSINESS

NEW YORK, April 22.

A RECENT shift has occurred in market conditions about the Metropolis, and many dealers are facing a serious situation. Today the trend of sales is entirely toward complete sets, and the parts business is being forced by a smaller and smaller army of dealer advertisers.



Radio in the home of Daniel Harbot, 3126 Disston St., Tacony, Pa. Mr. Harbot uses only the copper screen for an aerial and gets everything as far as Cleveland on the Magnavox loud speaker.

The set is a Crosley Model XXV

Photograph courtesy of the Ross Music Stores, Phila., Pa.

and the one at Northfield. It brought in genuine entertainment. You know how a crystal detects—but no use trying to reach out for the long ones. I contented myself and my friends with the splendid entertainments from the local stations and there you are."

E. E. Laufer, service engineer for the F. A. D. Andrea, Inc., builders of the "One Sixty" neutrodyne, was in Omaha after traveling territory adjacent to Chicago, Des Moines, St. Louis, Kansas City, St. Joe., Mo., and Lincoln, Neb. His prediction was that next fall would see neutrodynes and super-heterodynes in most every home where there now is a regenerative type. L. J. Chافتen, salesman for the Fada, was here several weeks prior to Laufer, and he, too, was enthusiastic concerning the outlook as it pertained to neutrodynes.

"The West has been a little slow to take to them, but they are gradually coming around and by next fall we will have as many of them sold in

Your correspondent has talked with many dealers regarding the situation and all are unanimous that, under the present conditions, a fair number of dealers will have to quit the game when real spring weather arrives.

"Look at the number of dealers downtown," said one of the best posted dealers who operates several stores and can afford to talk impartially because he is amply financed. "There's a radio dealer for every block and in some sections there are rows of radio stores, as along Fulton street, Warren, Church or Cortlandt. How can the business stand such distribution?"

"In drug stores, you have to walk four or five blocks to find a druggist. In phonographs, you will only find three or four in the same section. Clothiers, hatters or shoe stores—it is similarly true that there are fewer dealers and more prosperity.

"The trade is suffering from exploititius—with all the get-rich-quick dealers working every conceivable plan to get trade. The solution will

## Perfect Results on the Super Heterodyne

with M. & H. Superformers & M. & H. Precision Selector

THESE M. & H. Superformers and M. & H. Precision Selectors make the Super-Heterodyne the most remarkable circuit ever designed. Give selectivity never before possible. Increase distance, add greater clarity and amplify volume so that distant stations are heard with same loud-speaker intensity as local stations. Simple! Even novice can tune out local station and tune in a far-distant one, only five meters difference in wave length. Only two tuning adjustments. Dials always log.

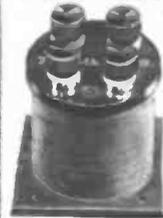
Henry M. Neely, *Radio in the Home*, March issue; N. Y. American, March 30; Philadelphia North American, and the Record, February 17; St. Louis Globe-Democrat and other newspapers and magazines paid highest tribute to these parts.

### Complete Parts for 8-Tube Super-Heterodyne Set

With Booklet giving full description and Plans \$96.50

How to Build..... \$96.50  
Sent Anywhere Parcel Post

Utilize your present parts. Build your own Super-Heterodyne by using these M. & H. Superformers and the M. & H. Precision Selector. Obtain wonderful results that will bring hundreds of far-distant stations to you.



### M. & H. Superformer

Designed especially for Super-Heterodyne Circuit for amplification at 6000 meters, and with correct impedance for use with UV-201A tubes and others of equal characteristics (C-301A, DV-2, UV-199, C-299). This Superformer has been selected by experts as best for the Super-Heterodyne. Small in size, minimum of "feedback." Unnecessary to shield them. Carefully insulated. Almost impossible to break down under high voltages. Insulated for voltage several times greater than ever actually used.

Open-core type, incased in hard rubber. Fully tested and Guaranteed..... \$7

Illustration is one-half actual size.

### M. & H. Precision Selector

The marvelous efficiency, selectivity, long-distance reception of the M. & H. Super-Heterodyne Circuits over those of other designs are due to this scientific instrument.

Requires no adjustment. Will last indefinitely if not disturbed. Mounted in hard rubber case, beautiful design, especially desirable for Super-Heterodyne builder \$10 who wants best results....

Illustration is one-half actual size.



Booklet giving full description with Plan how to build Super-Heterodyne Set. Mailed anywhere..... 25c

**MOSKOWITZ & HERBACH**  
512 MARKET ST., Phila.  
Established 28 Years.

Turn the knob until broadcasting station call number you have tuned in registers with the opening. Some sets bring in stations on several combinations, so work until the dial numbers the correct set.

### KEEP A RECORD

of Stations Heard  
Dial Adjustments  
Programs, etc.  
on the

## RADIOLOG

Handsome metal case with attractive finish.  
215 stations listed from coast to coast, United States and Canada.  
Spaces for dial settings and other data.

PRICE \$2.00 POSTPAID

Jobbers and dealers write for attractive discounts

### RADIOLOG COMPANY

511 Market St., Camden, N. J.

#### RADIOLOG COMPANY.

511 Market St., Camden, N. J.  
Gentlemen: I am enclosing two dollars for which send me one RADIOLOG postpaid.

Name.....  
Street.....  
City..... State.....

# SYCO KELCOIL



If your dealer has not yet stocked Kelcoil we will ship one to you Parcel Post Insured on receipt of \$6.00

**\$6.**

**THIS IS THE ORIGINAL AND ONLY KELCOIL**  
**DISTANCE—VOLUME—CLEARNESS**  
 ONE TUBE WILL OPERATE LOUD SPEAKER WITHIN 20 MILES  
 KELCOIL NEEDS NO WAVE-TRAP

**SENSITIVE**  **SELECTIVE**

USE KELCOIL AND ENJOY RADIO  
 Dealers Write for Discount Sheet  
 MANUFACTURED ONLY BY  
**SYCO RADIO PRODUCTS CORPORATION**  
 FORMERLY SILVERMAN, YOUNG & CO.  
 438-440 Drexel Bldg. Philadelphia, Penna.

# CALVERT



**RADIO-CABINET  
"KNOCKED DOWN"**

Manufactured by  
**CALVERT SPECIALTY  
COMPANY, Incorporated**  
 1312 Callowhill Street : : Philadelphia

Three-ply—vulcanized fibre center—Condensite veneer both sides. Mahogany color—polished and grained. Bindings—bright nickel plated brass.  
 Handsome—Strong—All standard sizes—Durable—Dignified. Harmonizes with any panel—Black, Mahogany or Metal.  
 Each cabinet is supplied in an individual carton "knocked down." Every hole bored, every thread cut and every screw (intended to match the trim) provided, so that only a few minutes and a screw driver are required to effect a complete assembly. Radio experts have been quick to appreciate the high insulating value of its construction compared with cabinets of wood, also the elimination of warping and the absence of hinges which may sooner or later become loose and strained.

**THE CALVERT CABINET**

Solves the problem of stock carrying—"knocked down" one to a carton, it takes less than one-sixth shelf-room occupied by an assembled one and is always ready to ship—can be handed to counter customer—no time lost.

ASK TO SEE ONE  
**FOR THE DISCRIMINATING—CALVERT  
CABINETS HAVE COME TO STAY**

be the elimination of the dealer who either hasn't capital or who can't buy lower than his competitors. Where we have fifty stores downtown now, it will be an unhealthy condition until that number is reduced to ten or twelve.

"In the phonograph trade, Victor doesn't let every Tom, Dick and Harry handle its lines. They protect the agent by giving him a section of the city and by so doing he is able to control prices, pay his bills and do a legitimate business. If the Radio Corporation would assume the same responsibility it would be a big blessing to the trade."

That the situation is changing will be noted from the fact that the radio tabloids put out by the newspapers are now about 60 per cent manufacturer's advertising copy against 40 per cent of dealers' space, whereas at the beginning of the year, there was almost 90 per cent dealers' space. The dealer no longer is able to run advertising and has finally convinced himself that it doesn't pay to advertise either location or service if you can't put way-down prices or easy-payments with it.

The trend is entirely toward time-payments. Many stores will install \$200 and \$300 sets on an initial payment of 30 per cent, or even 25 per cent. Most of these houses advertise "\$1 a week buys a radio set," and by operating in upstairs locations they do a close margin business regardless of cut prices in the cash market.

The big stories are complaining now of a dropping off in business. This is, of course, a fluctuating condition in which the sales vary with the effort made and the lines being pushed, but generally the stores are all alert for bargains. As soon as a serious slacking is felt the big stores will have their buyers out picking up lots of stock from bankrupts and forced sales and the merry war of bargaining will be on.

One chap who has done a good deal of speculating in this way has a regular clientele among big houses all over the country. He attends every auction, knows what jobbers may weaken on standard stocks and give him a shipment in quantity, and he conducts a regular bargain-counter business by telegraph.

Buying stocks under these conditions becomes a case of long pocket-book, plenty of out-of-town traveling and an uncanny sense of values and prices. But it does not pay necessarily and some of the cleverest buyers in price propositions have been hung up with stocks which are still unsold.

As for the public, the story is about the same: Neutrodyne still holds the center of the stage with super-heterodyne getting more and more attention. The recent paper presented by Major Armstrong on the harmonic-reflex type of super has caused quite a stir among both professional and amateur builders. The new Radio Corporation sets are completely embedded in wax and so assembled that copying is a tedious if not impractical proposition, so the number of builders who have duplicated Armstrong's circuit is rather small and will probably continue to be small. On the other hand, you will hear as many different opinions as there are observers when it comes to comparing the efficiency of the Super-Regenoflex and the standard iron-core Super-Heterodyne.

One of the interesting trends of the day has been for Haynes-Griffen, the large retailers, to put the Haynes circuit out again—but now under the license of the Clapp Eastham Company. These simple little tuners are an attractive buy in their new form and, by getting the Clapp

Eastham Company to manufacture the sets, Haynes-Griffen avoids any law suit for violating the regenerative patents.

Another interesting development has been the controversy between the Freed-Eisemann Company and the Independent Radio Manufacturers. It is understood that the set makers objected to paying royalties for some reason and as a result the once solid front of the Independents has been broken. Meanwhile, Hazeltine, Inc., which owns the patent on the neutrodyne circuit, has been floated as a stock issue and its \$1,500,000 worth of stock is said to have been entirely distributed. Word comes that the Hazeltine Company will advertise extensively to perpetuate the trade name Neutrodyne.

Opposed to the Hazeltine idea, comes the Polydyne Corporation, which is now organizing the parts manufacturers and offering them a special indorsement on their lines as well as protection from suits. The Polydyne people are said to be well backed financially and their ideas are getting the hearing of the most conservative.

Other familiar topics that continue to hold the public interest are: Re-radiation—what are you going to do about it? With no answer. Again: Is the telephone company monopolizing broadcasting? With the answer, yes and no—depending on how you look at it. Another question is: "Where's England?" and no one really thinks he gets an English station even with 2 L O strong and steady in his ears because, if he is sure, the fellow next door with a better set says he can't get it. Like the well-known phrase, "speaking of operations," you will hear a trolley or ferry boat conversation start off, "speaking about distance"—and the lying contest is on.

## WHAT READERS SAY ABOUT CIRCUITS THEY HAVE TRIED

IT IS always a great pleasure to hear from a reader who is honest enough to admit that his failure to get success with certain circuits has been found to be his own fault. Such a man proves two things: First, that the sentiment of square dealing is not altogether dead, and, secondly, that he is a genuine radio experimenter or else he would not have gone to the trouble to go all over his set and find the mistakes which he made originally.

On these two counts let us pin a medal on the breast of W. A. Creelman, 3 North Terrace, Maplewood, N. J. Mr. Creelman writes as follows:

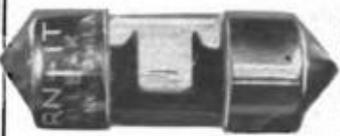
3 North Terrace,  
Maplewood, N. J.  
April 13, 1924.

My dear Mr. Neely:

Continuing my letter of February 18, with reference to the Grimes "Two-Control" System, I have the following to report:

First. That the stigma of dumb-bell which I qualified for will have to be removed, as I find that I had worked out your diagram correctly and would have had success from the very start, but was unfortunate to have installed three defective pieces of apparatus in the circuit.

The first discovery I made was that one of the audio transformers had a loose connection due to corrosion in the soldering of the terminals. My second discovery was a dirty soldered connection in the secondary of the aerial neutroformer. When my set wouldn't function I started looking around for loose connections, although



## TURN-IT

ADJUSTABLE  
GRID LEAK

Provide your set with perfect Grid Control and increase

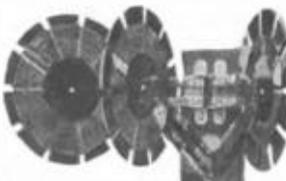
*Distance, Volume  
Clearness and  
Selectivity*

National Distributors  
**TURN-IT RADIO SALES, Inc.**  
30 Church St., N. Y. City

Manufactured by  
**CHARLES E. BONINE**  
20 S. 15th St., Philadelphia, Pa.

## TUNE HIM OUT!

Just a touch—and it's done.



Goodman Colls. in their beautiful mount, are an ornament to any panel. Their sharp tuning is a joy to any radio fan. They can be used in any of the standard hook-ups, and improve them all. Diagrams given in our pamphlet. Send for one. **\$6.00** and P. P. one postpaid

**L. W. GOODMAN**  
Manufacturer  
Drexel Hill, Pa.

You're Missing Real Radio Satisfaction When You Don't Use

## "Where I Go By Radio"

The Easily-Kept Radio Record Book

Unique, easy system. Every line a complete record. Makes possible easy "tuning in" again on stations desired. Accurate list of Radio stations. Other useful features. Popular edition, space for 300 records, 2 copies, \$1.00; Holiday edition, 700 records, \$1.50.

Get it at any newsstand or dealer or order direct from

Radio Record Department  
**PROGRESS PRESS**  
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## CODE MADE EASY

Just Published **\$1** Wireless Alphabet

learned in THREE simple, entertaining, FIVE MINUTE PICTURE LESSONS which you cannot forget.

A boy of eight learned ten consecutive letters in five minutes, without a buzzer. \$1 buys complete course of lessons for one student's use from

**KWIKKODE, Dept. E.**  
724 Borofoord Ave., Winnipeg, Man.

## Newspaper Tests Its Reader's Sets



HOW would you like to inspect and pass upon the merits of fifty or sixty radio sets a day? Sets with wood panels, sets with coils wound upon oatmeal cartons, sets improvised from everything under the sun, and again, sets of the finest parts and most skillful workmanship.

That is the pleasant duty of Harry A. Mount, Radio Editor of the Cleveland Plain Dealer, and his assistant, P. W. Mix.

Appreciating the importance of radio in the lives and homes of thousands of people in Cleveland and vicinity, the Plain Dealer fitted up a laboratory with every facility for the testing and inspection of sets and, in addition, provided an instrument for taking the characteristics of all types of vacuum tubes.

The laboratory was opened modestly, with no flourish of trumpets, but the response was immediate and a week-day average of 115 callers

has been maintained, not including a Saturday high-water mark of 400 people of which number eighty-five brought their sets for Mr. Mount's criticism, comment, or approval.

Besides these personal calls, a daily average of 100 telephone calls and fifty to seventy-five letters are answered. When the accompanying photograph was taken the room had to be cleared to allow a view of the testing table and equipment. Mr. Mount is seated at the table, taking a tube's characteristics for two young lady "bugs" and Mr. Mix is in the rear, making a "B" battery connection on the big bank of storage cells provided for the purpose.

The visitors come from all walks of life; the truck driver compares notes with the banker and each learns from the other. The Plain Dealer has done a real public service and the Cleveland enthusiasts are properly appreciative.

I knew that I had tightened everything. I found that when I touched the neutroformer my reception would come in. I took the neutroformer off the set and tested it out first with phones and then with an ammeter and the test was O. K. Of course, I did not use Wheatstone's Bridge, which would probably have shown me high resistance at the poorly soldered end. Nevertheless, as it was necessary for me to purchase three of these neutroformers, and as I had one spare I put the spare in place and had very good reception, receiving Hastings, Nebraska, on the loud speaker. It was not so loud that I had to put cotton in my ears, but could be heard in every portion of my room clearly and distinctly. This reception was without the aid of the detector lamp.

My third finding was that the radio frequency transformer worked intermittently, probably having a loose connection, due also to poorly soldered connections. I did not open this transformer to find out the trouble, but replaced it temporarily with a Sleeper transformer. I had splendid results immediately. I returned the other transformer to the manufacturer and received another one. I immediately put it in circuit, but am sorry to say this failed to work. I will give it a couple of more tests to make sure that it is still the fault of the transformer, as I had only time enough to make a quick test on the first installation. If I find the transformer all right I am going to make a comparison with that and the Sleeper, as it is just possible that the Sleeper may be better for my circuit, inasmuch as my audio trans-

formers have considerably higher ratio than you specified for your system.

The aerial I have is indoors, in the attic, where I operate my set, and consists of 4 wires 25' long, spaced approximately 6" apart.

In examining the circuit to try and find my trouble I noticed in two places where I could shorten wires, particularly with the grid leads by turning my lamps around 180 degrees.

Incidentally, I removed every portion of the circuit that was touching wood from the wood so that my whole circuit is now insulated from wood. I believe that a very large majority of my original loss of volume was due to the fact that some of my connections came in contact with the wood base. If you have had any experience along the same line I would suggest that a caution be printed in large type against making any connections that come in contact with wood.

Yours very truly,  
W. A. CREELMAN.

161 Huntington Ave.,  
New Haven, Conn.  
April 13, 1924.

My dear Mr. Neely:

You will probably be interested to know that I have tried out the Simplified Reflex Circuit (Mr. Foote's), published in the February issue of your magazine, RADIO IN THE HOME.

This circuit is without a doubt one of the best and most simplified circuits that I have seen and at the



## The Leading Jack

# PACENT

And in order to keep it always in the lead, improvements are made from time to time to increase its already well-known durability and neat appearance. Some of the recent improvements are listed below together with the new famous "Pacent Jack specifications."

- 1—A new design of tapered springs greatly improve its neat appearance and contour.
- 2—Heavier nipple construction, avoids any possibility of stripping threads or breaking.
- 3—A lock washer in addition to flat washer under the head of assembly screw increases sturdiness and prevents wear of insulation.
- 4—Finer micarta insulation.
- 5—Entire frame satin nickel finished. Pacent Jack specifications in addition to those listed above.
- 6—Coin silver contacts (riveted to springs). Genuine German silver springs. Nickel-plated brass frames (not iron). Extra booster springs.
- 7—Lugs fastened for convenient soldering. Provided with three washers.
- 8—Fits any size panel 1/4" to 1/2".

All details precisely accurate. Rugged construction throughout.

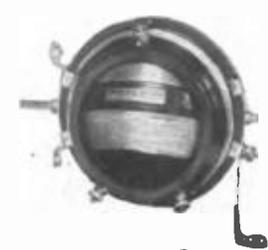
There are 10 types of Pacent Jacks—a Jack for every circuit.

Strict adherence to these specifications in making Pacent Jacks has won for them the distinction of being used as standard equipment by many of the leading set manufacturers.

Write for Catalog H-5  
**PACENT ELECTRIC CO.**  
INC.  
22 Park Place, New York  
Philadelphia Sales Office  
221 North 11th Street

## Pacent

### RADIO ESSENTIALS



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### LANGBEIN & KAUFMAN

#### TUNED RADIO FREQUENCY VARIOTRANSFORMERS

TYPE VT25 LIST \$8.50

Connected same as a fixed radio - frequency transformer, but continuously adjustable to the peak of the wave.

MAXIMUM AMPLIFICATION  
AT ALL WAVE LENGTHS

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Tuner Specialties

**LANGBEIN & KAUFMAN**  
654 Grand Avenue  
NEW HAVEN CONN.

**Write for New Bulletin**

Just off the press. Contains information on battery maintenance, station calls and wiring diagrams for basement installation of batteries.

**F-F Battery Chargers**

Charge a battery for about a nickel. Simple and Fool-proof. Type AB charges 2, 4 or 6 volt "A" or auto batteries and "B" batteries up to 120 volts at one time. Type C charges Radio "A" and auto batteries.

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**NEW**

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Tip-Top  
Post, 50c



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Philadelphia, Pa.

**get it clearer and louder!**

**FOOTE CRYSTALS**

Sold by all reliable dealers  
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Use **DURHAM** Price 75¢

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Fits all sets, home made or factory built. Snap a DURHAM in place of present fixed leak. Send for Folder H.

Satisfaction Guaranteed  
**DURHAM & CO., Inc.**  
1930 Market St., Philadelphia

present time four other reflex sets have been completed and three more are under construction or will be started shortly.

These sets were started after the various fellows had seen my set and results obtained started the radio fever and will say that the ones completed are giving very good results.

At the present time I am using the WD-12 tubes and am having very good luck with same, understanding that this set is not a DX set, but gives DX results and will say that I can pick up at night any of the following stations when they are sending.

Stations received at random are: KDKA, WBZ, WBS, WHN, WGY, WDAR, WFI, WHAZ, WOR, WJAZ, WJZ, WCAE, WDAP, WSB, WRC, WOC, WEAF, WIP and WOO, and the farthest stations received are Havana, Cuba; Little Rock, Ark.; Toronto and Ottawa, Canada, on an inside antenna.

So you can readily see why I feel so proud over the circuit you published and hope the good work will continue, as I enjoy every article that has been published in your magazine. At this time I would like to ask you in reference to this simplified reflex set how to overcome a ringing noise that sounds like a bell every time you hit the table or move the head-set wires or walk around. I understand that this set is very sensitive and have tried putting a small piece of rubber under the lamp sockets, but this does not stop the ringing noise.

I would appreciate hearing from you in regard to the ringing noise in the sets and hope the next issues will be just as good as the past.

Yours truly,

C. U. QUIMBY

(This ringing noise of which you speak is what we call the "microphonic" effect of the tubes. A small piece of rubber under the sockets will not do. You should put a fairly thick piece of felt and preferably put on top of that a piece of sponge rubber and mount your sockets on that.—H. M. N.)

SOUTHAMPTON, Pa., April 10.  
My dear Mr. Neely.

This letter is not asking any questions, but I thought if I had good success with one of your hookups I would just let you know how good it is. I built a Riley capacity circuit as given in February issue of *Radio in the Home*, and have found it to be very selective; in fact, I have had PWX on with Philadelphia stations and have been able to hear it very well, and have been able to tune in stations on low meters as low as 240. I dispensed with the potentiometer as I did not find it necessary. I am enclosing a list of stations I tuned in, not to show what I could do or to establish any record, but just to let you know what a really good circuit it is:

- |      |      |      |      |
|------|------|------|------|
| WCAU | WJAR | CKAC | WMC  |
| KFKX | WDAP | WBB  | WOO  |
| WTAS | WFAA | WOB  | WIP  |
| KFKB | WGY  | CKCH | WOAW |
| WLW  | WHAZ | WJAZ | KBD  |
| WSAI | WDAR | WJZ  | KSD  |
| WGH  | WFI  | WCAE | WRAX |
| WCAI | WTAM | WCAF | WTAT |
| KPO  | KHJ  | KFI  | WIAD |
| KDKA | WHAS | WRC  | WNAC |
| WBZ  | WOR  | WBAP | WABY |
| 6KW  | PWX  | WHAA | WCAT |
| WCBD | WDAF | WOC  | WAAB |
| WCK  | WHB  | WCAE | WSAD |
| WHN  | WLAG |      |      |

also several other stations which I failed to get an announcement of. This represents ten days' tuning.

Yours truly,  
P. E. Leedom.

EPHATA, Pa., April 17, 1924.  
My dear Mr. Neely—

I am hereby extending my appreciation for the Kelcoil "Triple Circuit Feed Back" hookup which was published in the February *Radio in the Home*. On February the 25th I had the set in working condition and since

that time have received the following stations:

- WFI, WIP, WDAR, WOO, WJY, WJZ, WEAF, WGY, WBZ, WBAK, WHAZ, WTAM, WJAX, WJAR, WCAE, WWJ, WRC, WCAP, WJAZ, KYW, WSB, WHAS, WOC, WLAG, WDAF, WHB, KSD, WOS, CKAC, KHJ.

I highly recommend this hookup to those people who want both volume and DX.

Very truly yours,  
DAVID E. GOOD.

**RADIO PROGRAMS FOR BLIND**

MINNEAPOLIS, Minn., April 20.  
FIRST publication of radio programs for the blind in the United States is claimed for the Minnesota Council of Agencies for the Blind in the Minnesotan, the first issue of which appeared in March.

Of the blind in Minnesota, the majority are reported as being very enthusiastic radio fans.

The new magazine will appear monthly.

Matters of interest in radio also will be published.

**TWO POINTERS THAT FANS SHOULD NOT OVERLOOK**

EVERY month the J. S. Timmons Company sends out a multi-graphed folder called "Trade Talks." I always look these "talks" over carefully, because they invariably contain something that is of value to me.

In the one just at hand, there are two items that it seems to me are of interest to all radio listeners-in. So I am quoting them here just as they appear in this issue of "Trade Talks."  
H. M. N.

Babson says that Radio is now among the important industries of the country.

At last some one has done it. We have always wanted to see radio compared with other business on a dollars and cents basis.

The Babson Statistical Organization has just finished a survey of the radio field and finds that the American people will spend approximately \$350,000,000 on radio during 1924.

Now for a few comparisons: Radio on the basis of these figures is nearly twice as great as the carpet and rug

business. It is one-third as great as the furniture business; one-quarter as great as the shoe and boot business, and three-quarters as big as the jewelry business, including clocks, watches and novelties. Finally, in 1924, there will be twice as much money spent for radio as for cameras and sporting goods of all sorts.

How's that for an infant industry? Quoting Babson:

"To sum the matter up, radio has passed through the fad stage and has become a utility. It has rightly achieved its proper permanent status among the important industries of the country."

NOW is the time to look for tube and B battery Trouble. The other day, we had a talk with a man in the vacuum tube industry, and he told us this, which was more or less news to us:

"Just about now dealers may expect to hear something like this: 'My loud speaker squeals and howls and makes a lot of frying noises. I have tried everything, but I can't get rid of it. What's wrong?'"

"Dealers here should first look to the tubes, for a large number of tubes are purchased around Christmas time and in October and November. In

**Stop** **the little leaks**

ENERGY that leaks away thru inferior quality in even the least important switch, means just that much energy that never gets to your phones. And that may be just the difference between getting the call letters of a faint station—or losing them!

Skilled craftsmen make MAR-CO small parts, with the precision to preserve weak signals!

See "MARCO" when you buy plugs, jacks, switches and other small radio parts—you'll get "leak-proof" service at no higher cost.

**MAR-CO**

**Push-Pulls—how to buy**

In selecting these important elements, your inspection should plover beneath a pleasing finish. Besides turn ratios, you should know that wire sizes, balance, and impedance are correct for the tubes to be used.

**NEW FOLDER—FREE**

This gives you details for a complete line of transformers—uniform in appearance, and uniform in the high quality of results obtained.

A postcard in the next mail will bring your copy quickly.

**THE RUBICON COMPANY**  
918 Victory Building, Philadelphia



**RUBICON Duplex**  
Pre-tested, pair... **\$12**

Audio, 3 1/2 or 5 to 1... \$6.00  
Radio, 250 to 600, m... \$6.00

**CURKOIDS**  
THE SUPREME INDUCTANCE

**RIEGER RESEARCH CORP. NEW YORK CITY**  
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many cases, these tubes are losing their efficiency now.

"In other words, they are getting 'soft.' The filament lights all right and that is what fools a lot of people. They think that the tube is good so long as the filament lights. This is not so.

"B batteries bought about Christmas time usually start to run down about now also. Between the two you can easily see why a set can squeal, howl and make a lot of frying noises.

Here's a suggestion which may result in your selling more batteries.

"It seems to me that it would be a good policy for dealers to have a few volt meters around which they would lend to their regular customers. In this way, these customers could see the condition of their B batteries and keep them up better. I believe that every time a man borrowed a volt meter, he would bring it back and purchase a B battery or two."

### OMAHA FANS ARE LUCKY; REACH ALL OVER THE U. S.

OMAHA, Neb., April 20.  
RADIO listeners in this section of the country—the very heart of America, as WHB, the Sweeney Station, as Kansas City so aptly named it—probably get more out of radio than any other section of fans.

The most fastidious listener can, with a great degree of certainty, pick his class of entertainment, thanks to the geographical location which places him within reach, under almost any condition, of any station in the country.

The writer can remember only two occasions during the winter just past when mid-Western listeners could NOT tune in on these stations and get them on a loud speaker if his set was so equipped:

WOAW, Omaha; WAAW, Omaha; KSD, St. Louis; KYW, Chicago; WDAP, Chicago; WOC, Davenport, Ia.; WOS, Jefferson City, Mo.; WFAA, Dallas, Tex.; WLAG, Minneapolis; KFNF, Shenandoah, Ia.; WHAA, Iowa City, Ia.; KDKA, East Pittsburgh; WTAM, Cleveland; KFKX, Hastings, Neb.; WBAP, Fort Worth, Tex.; WSB, Atlanta, Ga.; WCBD, Zion, Ill.; WFAV, Lincoln, Neb.; WGY, Schenectady, N. Y.; WHAS, Louisville, Ky.; WJAZ, Chicago; WJAX, Cleveland; WSAI and WLW, Cincinnati; WTAS, Elgin, Ill.

Ask any mid-Western fan and he will tell you that any one of these stations can be logged almost at will (at night) with almost any kind of a bulb set.

One occasion when they could not was when this section was visited by a severe snowstorm and the other was several weeks ago when the northern lights (aurora borealis) set up deafening interference.

Under normal conditions, the log of the average mid-Western listener looks like a directory of all cities and towns of the United States. When good radio weather prevails, as it generally does in these parts, the average fan with at least a two-bulb set can log stations on the four sides of the country.

When President Coolidge spoke from New York he was excellently received in Omaha and vicinity. Those fans who could not get him were advised that something was wrong with their sets.

One of the best broadcasting features of the mid-West the past month was the thirteen-hour continuous broadcast by WHB, Kansas City. Many or perhaps, to be ultra-conservative, several of the dyed-in-the-wool fans sat up from 7 P. M. to 8:35 A. M. the following morning without missing a word or musical note of this program, so they could proudly re-

port to WHB they "heard every word." So it goes with us listeners from "out in the great open spaces."

WOAW has been broadcasting a good standard of programs of late, and especially is this true of their dinner-hour program between 6 and 8 P. M. (Central standard time). WAAW, the Omaha Grain Exchange station, also is to be complimented upon its thrice weekly entertainments, to say nothing of the market reports it broadcasts daily at hourly intervals and upon which the farmers within a 100-mile radius of Omaha (daylight range) have come to depend. Reports to the Grain Exchange station show this to be a fact.

### ONE FAN WHO IS SATISFIED

MINNEAPOLIS, Minn., April 20.  
EMLYN H. JONES, of Minneapolis, according to his friends, is the only tube set owner in the United States who is so satisfied with his first set that he refuses to change a wire on it.

Mr. Jones built a three-tube three-circuit tuner more than two years ago from a Henry M. Neely hookup, which then were published daily in the Minneapolis Journal.

The set is intact today, brings in distant stations at loud speaker volume and was the only one of fifteen sets at a radio party that didn't "cut up" in company.

"Other fans can experiment if they want to," says Mr. Jones, "but while they are doing that, I'm getting concerts."

### STATEMENT OF OWNERSHIP, MANAGEMENT, CIRCULATION, ETC.

Required by the Act of Congress of August 24, 1912.

### RADIO IN THE HOME

Published monthly at Philadelphia, Penna.  
FOR APRIL 1, 1924.

State of Pennsylvania )  
County of Philadelphia, ) ss:

Before me, a Notary Public in and for the State and county aforesaid, personally appeared G. W. Kraft, who, having been duly sworn according to law, depose and say that he is the Secretary of the RADIO IN THE HOME and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, entitled "An Act to Regulate Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:  
Publisher—Henry M. Neely Publishing Company, 608 Chestnut Street, Philadelphia, Pa.  
Editor—Henry M. Neely, Delaware, N. J.  
Managing Editor—Henry M. Neely, Delaware, N. J.  
Business Manager—W. L. Dudley, Red Bank, N. J.

2. That the owner is: (if the publication is owned by an individual his name and address, or if owned by more than one individual the name and address of each, and if by a corporation the name of the corporation and the names and addresses of the stockholders owning or holding one per cent or more of the total amount of stock should be given.)  
Henry M. Neely Publishing Company, 608 Chestnut Street, Philadelphia, Pa.; Henry M. Neely, Delaware, N. J.; G. W. Kraft, 2000 Larchwood Ave., Philadelphia, Pa.; Norman Neely, Delaware, N. J.; John C. Martin, Wynote, Pa.; Mrs. F. N. Supplee, Philadelphia, Pa.

3. That the known bondholders, mortgagees, and other security holders owning or holding one per cent or more of total amount of bonds, mortgages, or other securities are: (if there are none so state.) None.

4. That the paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona-fide owner; and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is: (This information is required from daily publications only.)  
G. W. KRAFT, Secretary  
Sworn to and subscribed before me this 1st day of April, 1924.

(Seal) CHARLES F. JOHNSON,  
(My commission expires January 7, 1927.)



FADA "ONE SIXTY" NEUTRODYNE RADIO RECEIVER

## Clarity

Radio is most enjoyable when the programs of music and other forms of entertainment are coming in sweet and clear; loud enough to be heard perfectly on the loud speaker, yet faithfully reproducing the voice of the singer or the harmonies of the instruments.

Clarity of tone is a feature that has made hosts of friends for the FADA "One Sixty" radio receiver. No matter where the station tuned in may be located—in the East, or in the West, the clarity of tone produced by the "One Sixty" is remarkably lifelike and pure. And so powerful is this wonderful receiver that the majority of broadcasting stations, both local and distant, can be heard clearly and plainly on a loud speaker.

Quality—in design and workmanship—characterizes the FADA "One Sixty" through and through. Combining as it does the famous Neutrodyne principle with skilled FADA craftsmanship, the "One Sixty" represents a great feat of radio engineering.

In selectivity, volume, distance getting, clarity and fine appearance, the FADA "One Sixty" is unsurpassed. To hear it perform is to be convinced. It will be well worth your while to visit your dealer and see this receiver. Price \$120. This does not include tubes, batteries or phones.

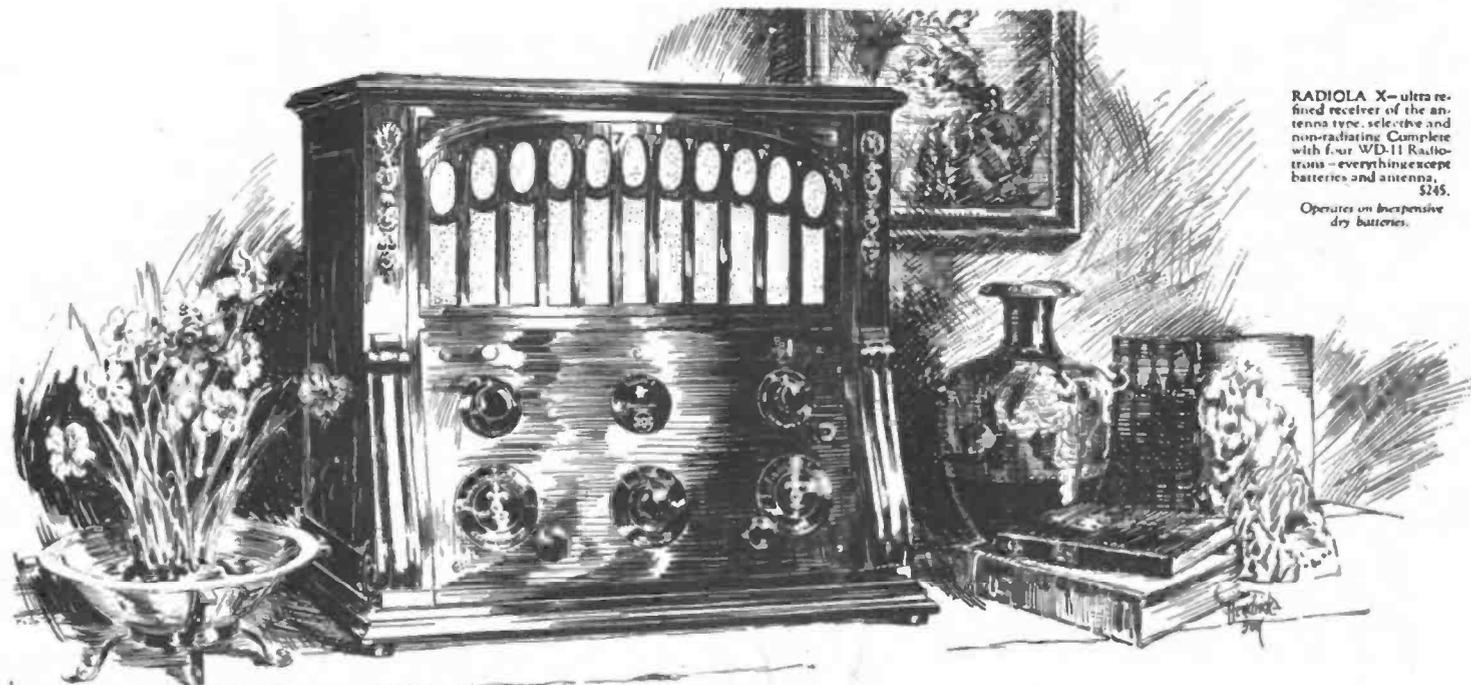
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1581 Jerome Avenue New York City

# FADA Radio



RADIOLA X—ultra refined receiver of the antenna type, selective and non-radiating. Complete with four WD-11 Radiotrons—everything except batteries and antenna. \$245.  
Operates on inexpensive dry batteries.



# New Joys in Radio

3,000,000 Homes listening in, when Presidents speak—when famous artists sing—when the colleges broadcast their lectures, and the theatres broadcast their programs. And with the new Radiolas, with their simplicity, and their tremendous advance in clear reception, hundreds of thousands more homes will soon be tuning in.

distant stations—quickly—easily! Radiola X is the result of new discoveries, developed by world-famed radio engineers. A special new loudspeaker built into the cabinet is one of its outstanding achievements. It is new in essential parts that mean for greater performance—and in little details that mean convenience and simplicity. Most important is the fact that improvement in reception, which usually means greater complexity, here means greater simplicity than ever!

Of the new receivers, one of the most important is the beautifully cabined Radiola X. For music clearer and truer. Selectivity so sharp that no near station can interfere with the programs from far away. Simplicity so perfect that any beginner can get the

Tune in! Turn the knob and pick your program out of hundreds—all clear—loud—and real, with a Radiola X.

RADIOLA REGENOFLEX, a modified Radiola X, in mahogany cabinet, with external loudspeaker. With four WD-11 Radiotrons and Radiola Loudspeaker but less batteries and antenna. \$206.  
Same as above, but without Radiotrons and Loudspeaker. \$150.  
Operates on inexpensive dry batteries.



There are many Radiolas at many prices. Send for the free booklet that describes them all.

*"There's a Radiola for every purse"*

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