March, 1924

RADIO in the Home

Conducted by
HENRY M. NEELY

In this Issue:

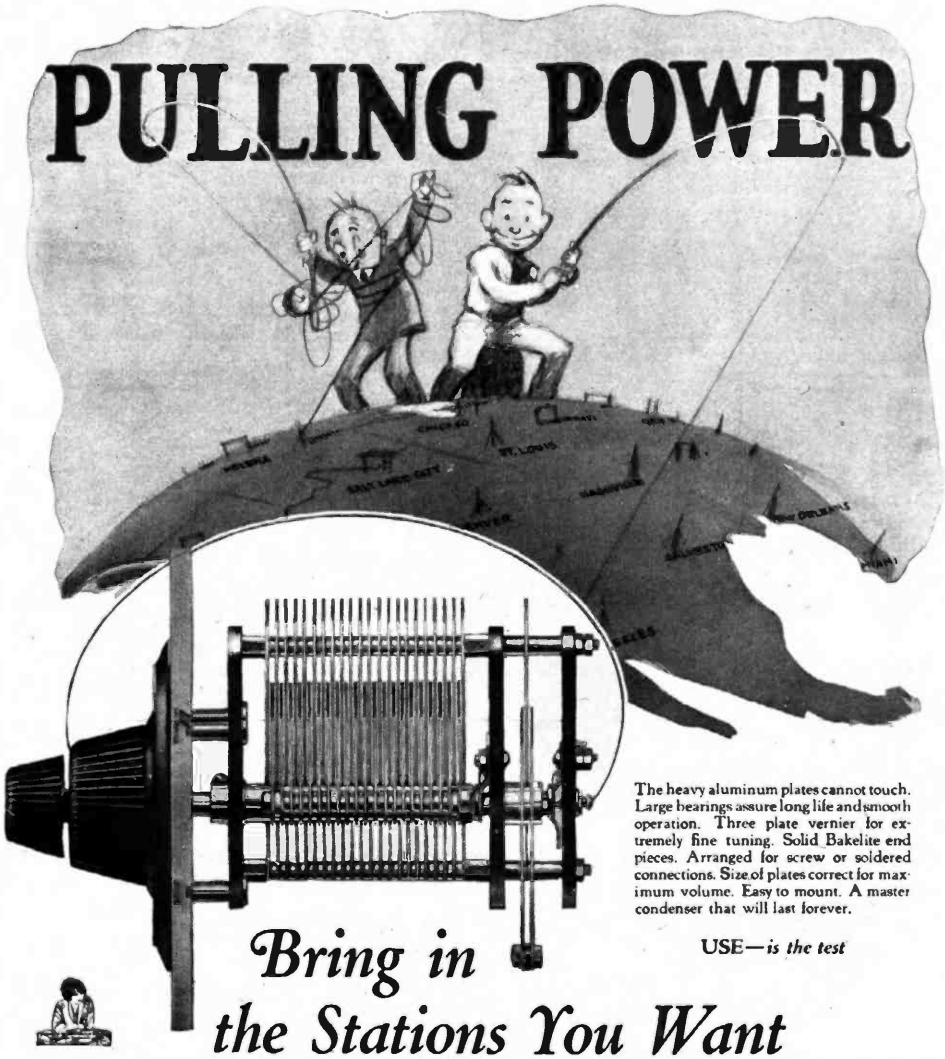
Twenty Cents

The Modern "Children's Hour."
How marvelously has radio illustrated those words of Longfellow—

Between the dusk and the daylight,
When the night is beginning to lower,
Comes a pause in the day's occupation
That is known as the Children's Hour.

(The set is a Fada One-Sixty with Tinymous Talker)

PULLING POWER



The heavy aluminum plates cannot touch. Large bearings assure long life and smooth operation. Three plate vernier for extremely fine tuning. Solid Bakelite end pieces. Arranged for screw or soldered connections. Size of plates correct for maximum volume. Easy to mount. A master condenser that will last forever.

USE—*is the test*

Bring in the Stations You Want

THE decremeter type plates of the Kellogg variable condensers furnish the widest tuning range possible, as the increase or decrease in capacity is constant; dials calibrated in wave lengths can be used. This gives the fine tuning necessary where the greatest selectivity is desired.

In constructing a selective set the variable condensers play an important part in the degree of its selectivity. That is why we recommend using Kellogg.

Select Kellogg radio equipment and know you have the best. If your dealer does not handle Kellogg, communicate direct with us.

KELLOGG SWITCHBOARD & SUPPLY CO.

1066 West Adams Street, Chicago

The SIGNAL FIRE of TODAY

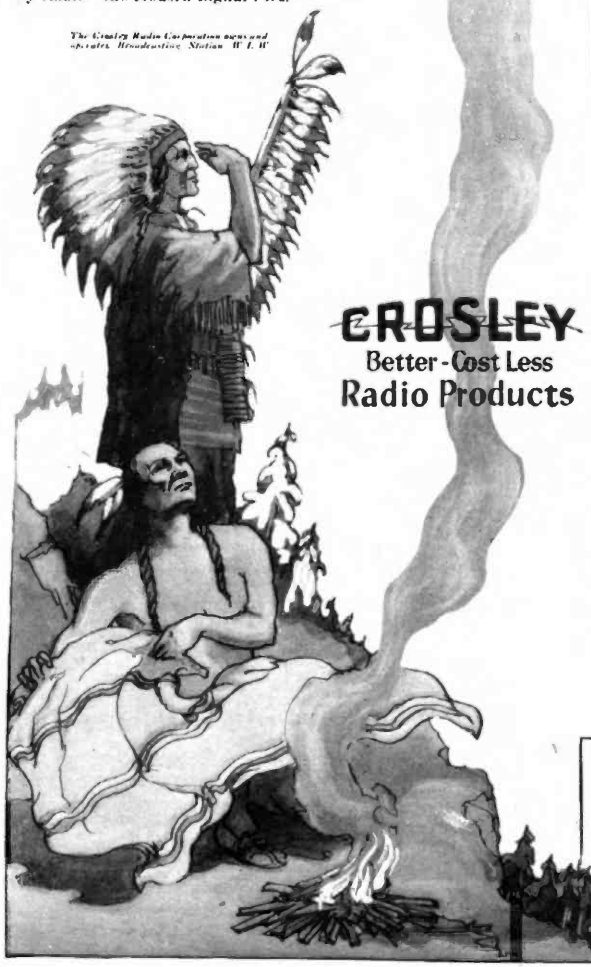
PIONEERS of the old west were amazed to see how quickly the Indians learned of their presence.

The advance of a wagon train was known days ahead. Even a lone trader was known long before he arrived in the Indian camp.

Eventually the pioneers learned that the savages had a highly perfected signal code. From mountain top the signal fire blazed its message at night, or by day sent up its smoke in columns, wreaths, puffs—white smoke, black smoke—it carried a story far and wide.

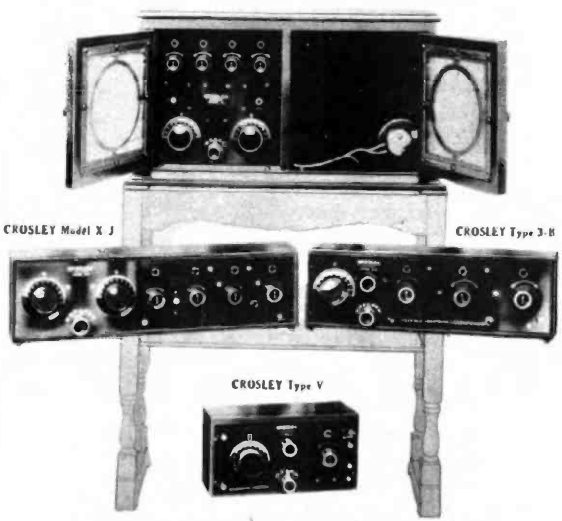
Gone are the signal fires. Scattered are the tribes. Today the Westerner in remotest places receives his message by Radio the Modern Signal Fire.

The Crosley Radio Corporation owns and operates Broadcasting Station W L W



CROSLEY
Better-Cost Less
Radio Products

CROSLEY Model X-L Consolette



A CROSLEY RECEIVER FOR EVERYONE

CROSLEY TYPE V PRICE $16.00

A one tube regenerative set, licensed under the Armstrong U. S. Patent No. 1,113,149. Actual performances of this little receiver have proven a revelation to the radio world. The McMillan expedition has consistently been clearly brought in with this instrument as well as Honolulu and other far distant points.

CROSLEY TYPE 3-B PRICE $42.00

This 3 tube regenerative receiver licensed under Armstrong U. S. Patent No. 1,113,149 combines the Crosley Type V and the Crosley two stage amplifier. In the hands of amateurs and professionals alike it has consistently out-performed sets costing a great deal more. A person hearing a broadcasting station may turn off the set by throwing switch and come back later without re-tuning.

CROSLEY MODEL X-J PRICE $55.00

A four tube radio frequency set combining one stage of Tuned Radio Frequency Amplification, a Detector and two stages of Audio Frequency Amplifications. At bringing in distant stations we believe no instrument can equal it. Local interference is easily and quickly tuned out. We unhesitatingly claim that the Crosley Model X J is the best receiver ever offered to the public.

CROSLEY MODEL X-L Consolette PRICE $120.00

A duplicate of the Model X-J except for the arrangement and mounting into a beautiful mahogany cabinet with the addition of a built in loud speaker. Space is provided in the cabinet for housing the necessary batteries. A special mahogany stand as illustrated in outline for the Model X-L may be had for $25 extra.

This instrument provides an exquisite piece of furniture for any home together with all the pleasures of a long distance radio receiver.

Crosley Instruments Are Sold By Best Dealers Everywhere

Write for Complete Catalog which fully describes the Crosley line of regenerative and radio frequency receivers and parts.

THE CROSLEY RADIO CORPORATION

POWEL CROSLEY JR., President

Formerly

The Precision Equipment Company and Crosley Manufacturing Company

360 ALFRED STREET CINCINNATI, OHIO

—The Largest Manufacturer of Radio Receivers in the World—

MAIL THIS COUPON TODAY

The Crosley Radio Corporation,
360 Alfred St., Cincinnati, O.

Gentlemen:—Please mail me free of charge your complete catalog of Crosley instruments and parts.

Name.....

Address.....

Editorially Speaking

By HENRY M. NEELY

EVERY month it is necessary for us in this organization to discuss the affairs of the previous month in the radio field and to decide what is the most important aspect of radio to be taken up in these editorials.

This month there has been a great deal of important activity. In the estimation of the dealers, the announcement of the Radio Corporation of America, setting forth their entire new line of receivers at prices considerably lower than they have ever had before, seems to top all other events in importance. We had about decided that that was the thing to comment on editorially this month when something else turned up that most dealers and perhaps most fans will think is only of minor importance, but that, to me, seems to be the most significant thing that has yet been done in radio.

I refer to the creation of the Radio Music Fund in New York.

From the very start of broadcasting, those who have been on the inside have been asking themselves and each other, "What is to be the future of this service? Who is going to pay the tremendous cost involved in constantly raising the standards of the programs?"

Now, in saying that the creation of the Radio Music Fund is the most important event in a long time, I do not mean necessarily that this one fund is going to solve all of the problems immediately. But I do look at it in this way:

The theory that the majority of the fans would be glad to pay a certain amount of money every year for the purpose of providing programs has always been a beautiful one, but it has, after all, been nothing more than a theory. There has been no method of testing it.

If there could have been devised a method of testing it and if it had proved to be true, then the problem of the future of broadcasting and the difficulties of meeting the demand for constantly higher standards would have been solved.

But no one can take a mere theory and say definitely what will or will not come out of it in the future.

The creation of this Radio Music Fund is the first opportunity for a practical test of this theory. The fund at present is confined to New York and the broadcasting will be done by station WEAF. That makes it more or less local, but at least it puts the test in the hands of two of the very highest types of organization.

The fund in its financial management will be under the auspices of men whose names are so high in the financial world that they cannot possibly be accused of any ulterior motives. The actual booking of the artists will be in the hands of Arthur Judson, a man who stands at the very front rank of musical managers in this country. I am particularly glad that Mr. Judson has been chosen because my acquaintance with him goes back to the time when he first became connected with the offices of the Philadelphia Orchestra and I was a musical critic on a Philadelphia newspaper. I have watched his progress with a great deal of interest and a great deal of admiration, and I am glad of this opportunity to come out and say in print that I do not think that the Fund could have chosen a better man for the purpose.

So far as the radio side of the experiment is concerned, station WEAF needs no championship from anybody. It is its own best champion, and anybody wishing to dispute its supremacy in the field has picked out a mighty hard job for himself.

The announcement of the creation of the Fund and the plan upon which it is formed has been made several times recently from station WEAF, so that the radio public in the eastern section of the country is now fully acquainted with it. Its success or failure depends entirely upon the listeners-in from this point on.

Here we are going to have an opportunity to see whether the radio public really does appreciate the service that it is getting daily and nightly at no cost to itself and we are to have an opportunity of seeing whether it really does want improved programs and whether it is willing to bear its share of the cost.

I am particularly glad that there has been no attempt to turn this scheme into a law, as was done in England. Over there, every set was licensed and was forced to pay a tax and a certain part of this tax went to defray the expense of broadcasting. Now, the moment you call a contribution a tax and make it obligatory by law you arouse in the breast of the average man a traditional opposition to anything in the form of a forced levy. But when you ask him to do a thing voluntarily for his own good, you will appeal to his "gang" instinct, and he is likely to come across in great shape.

The spread of this Fund idea is entirely a matter of publicity and popular education. With the proper methods of publicity, I feel sure that it can be made a great success, and I only want to point out to the readers of this magazine the fact that a little generosity toward this movement at this time will mean a tremendously valuable increase in their own enjoyment of radio in the future.

Suppose there will be a great many people who will not contribute to the Fund, but who still derive benefits from it? Why should you worry about them? In every movement in this world there are always the slackers and the pikers, but that does not prevent those of us who have higher ideals from making the sacrifices that are required of us in order to see that we and our own kind progress.

I believe that the radio listeners-in should spread the idea that a radio set which does does not contain (Continued on Page 35)

Don't Be a "Gimme"

ARE you a Gimme?

Are you the kind of man who goes into a store and says, "Gimme a condenser—gimme a coupler—gimme a loud speaker"—are you?

Or do you ask for a definite brand, a certain make, a standard trade-mark—and take no substitute?

It is the Gimmes in radio who are responsible for flooding the market with inefficient apparatus, for the spread of the gyp store, for the cheap and tawdy stuff that masquerades as radio and blares blatantly in the highways to disgust and alienate the man or woman of good taste who ought to be radio's most ardent and most valuable supporters.

Don't be a Gimme.

Don't go in and ask for any old kind of a condenser, for just a coupler and let it go at that, for a loud speaker with the accent on the "loud," but with no pride of birth or antecedents.

You wouldn't go out and buy just an automobile, would you? No, you'd ask for a Studebaker or a Rolls-Royce or a Packard or whatever make you had been convinced was the one suited to your needs. And if the salesman didn't have that brand, you'd go somewhere else.

You'd do that because the makers of the car you wanted had built up a reputation that sold you on it. They did that by careful organization with a staff of men whose names and reputations were an asset, by careful and consistent production methods, by a jealous guarding of their good repute, by persistent refusal to compromise their honest dealings and their integrity of purpose.

*And having achieved that as a foundation, they financed themselves adequately and then went out and advertised—**advertised—ADVERTISED**—until you were thoroughly sold on them.*

Any one with ready money can advertise. That alone doesn't carry much of a reputation.

But advertising brings prominence and prominence brings competition and competition brings jealousies and they breed ready resort to innuendo and attack by unscrupulous rivals.

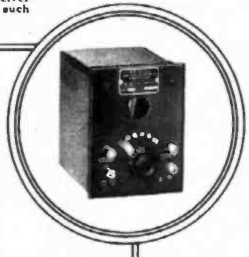
The firm which can advertise largely over a period of years and still ride above the jealousies of rivals is the firm which has proved the solidity of its foundations and the dependability of its superstructure. That is the firm whose goods you should ask for—and you should take no substitute.

Don't be a Gimme.

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 One-Stage Power Amplifier.

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.

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
Baby Audiophone . . .	12.50

THE BRISTOL COMPANY : WATERBURY, CONN.

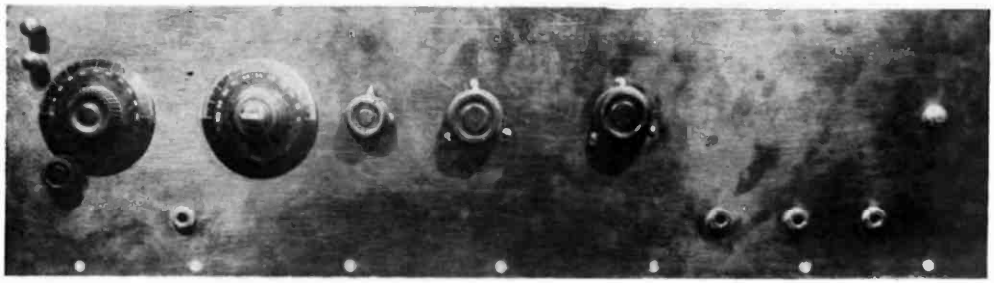
Branch Offices:

Boston, New York, Philadelphia, Pittsburgh, Chicago, Detroit, St. Louis, San Francisco

The Bristol Junior Audiophone

The Bristol Senior Audiophone

RADIO IN THE HOME



SUPER~HETERODYNE

By HENRY M. NEELY

SEVERAL months ago I published an article by Birchall Hammer, giving in a general way the results which he had had with his super-heterodyne set. I stated at that time if there seemed to be enough interest I would experiment with this famous circuit myself out at Station 3XP and would publish a complete article giving the hook-up and full information.

There was a most undoubted demand for such an article. I kept my promise and did the experimenting, but I must confess that of all of the circuits I tried, not one of them gave me the quality of tone which I consider an absolute essential to a radio set in these days of almost perfect reception. Of course I got distance. That always goes with a correctly constructed super-heterodyne circuit. But distance means nothing whatever to me if it brings in mushy and distorted signals, and that is what I got with all of the supers that I tried.

I have on my test table now one of the standard sets for this circuit—a huge and ungainly contraption about four feet long and full of glittering and beautiful dials and controls, and yet I would not exchange for it any of the circuits which we have built at 3XP and which have been described in this magazine. I am talking now about quality of signals.

Then one day not long ago I stopped in a store on my way to the office and the proprietor took me up to his second floor, and, under promise of temporary secrecy, showed me a new circuit for the super-heterodyne set with some new transformers and other pieces of apparatus which had been especially developed for him. I played with this set and the very first signal I received changed my opinion of the possibilities of the super-heterodyne. The quality was the quality which I had been striving for in my own experiments and had failed to get.

I at once asked this man to let me have the name and address of the designer of his apparatus and of the circuit and he got us in touch with each other. The article herewith and the pictures and diagrams are the result. Here at last is a super-heterodyne which I can recommend to my readers. It gives not only all of the distance for which the super-heterodyne is famous, but it gives quality which is satisfactory to a man who has a really musical ear.

This story, written by Mr. Morgan, describes the set in question. In addition to this, I am printing another article by a man who telephoned me one day and told me he wanted to hook up a super-heterodyne and asked my advice as to what he should get. I at once told him about the storekeeper in whose place I had seen this set and advised him to investigate it. I heard nothing further from Mr. Clarke until about two weeks later he telephoned me and told me that he had bought all of the stuff for the set, had hooked it up, had not had to change a single wire and had had a wonderful night's entertainment the very first evening he tried it, and so I have had Mr. Clarke write me a few things about his experiences with this particular hookup.

It seems to me that this combination gives about all phases of viewpoints for this circuit. I give my impression merely as a radio fan who demands quality as well as distance in his set; Mr. Morgan gives the description from the viewpoint of the technician and radio scientist, and Mr. Clarke gives the viewpoint of a man who never tackled anything in radio so difficult as the super-heterodyne and who marveled not only at the comparative ease with which he could build it but the immediate success he had with it.

And so at last I am printing the super-heterodyne here, confident that this particular circuit is the one which will best meet the needs of the readers of *Radio in the Home*. I'm sorry you have had to wait so long, but the other hookups I tried would not have satisfied you.

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By JOSEPH MORGAN
(Designer of This Circuit)

THE magic name of "super-heterodyne" is on the lips of every radio fan. The feats accomplished by this circuit are well known.

Using a small inside loop, music and speech from distant stations can be brought in with greater intensity than most other sets (regardless of the circuit used) bring them in on a long outdoor aerial. Using a fifty-turn honeycomb coil for a loop

the writer has repeatedly brought in WEAF, eighty miles away.

The selectivity of the super-heterodyne is so great as to be almost unbelievable. For instance, with the receiver located in Philadelphia, when WDAR is broadcasting on 395 meters, it is easy to tune this station out entirely, bringing in WHAS (Louisville, Ky.), which broadcasts on 400 meters. And when I say tuned out, I mean tuned out so completely that not a trace of the local station can be heard on the phones or loud-speaker.

For simplicity of operation there is nothing easier than this super-heterodyne. There are only two tuning adjustments. Moreover, these two adjustments are not critical even though they are very sharp. For a given station the dial readings are always the same. There is a decided advantage since the operator can always get exactly the station wanted by setting the two dials at the marks found for this station previously. The tuning of this set is actually easier than that of a single-circuit regenerative receiver using only one tube.

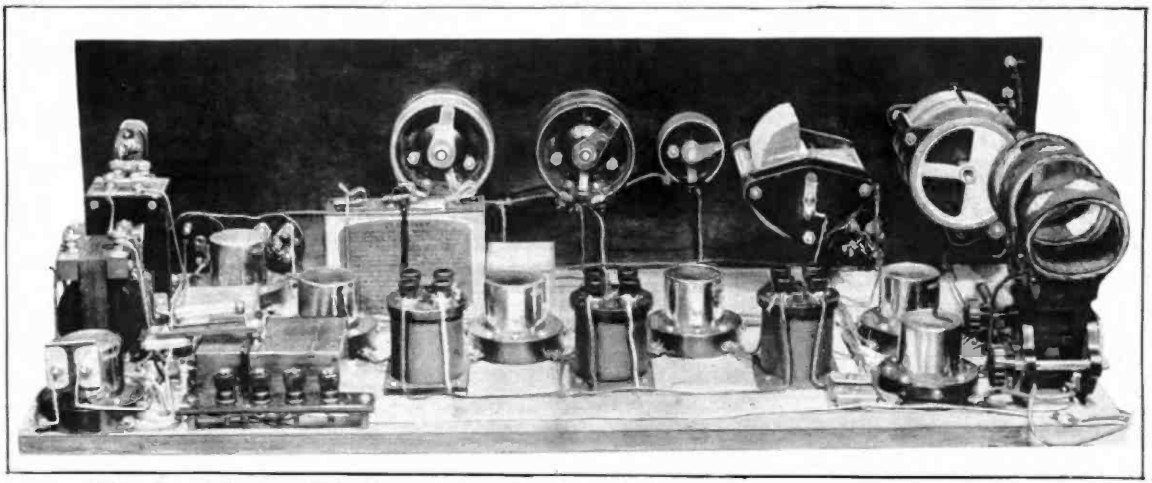
able with this circuit will be made here, since no set, however sensitive, will give good results if placed in a poor location or used under adverse weather conditions.

But this claim is unreservedly made: Whatever any other circuit will do at a given time and a given place, the super-heterodyne is almost certain to do better. The writer has on numerous occasions received stations on the Pacific Coast with loud-speaker intensity while the local stations were broadcasting in Philadelphia.

There is given here a list of exactly the parts used in the construction of the writer's set. While it is not absolutely essential that the same make of parts be used for each thing, there is so much variation between different makes of the same instrument that it is distinctly advisable to use exactly the same parts as were used in the set herein described if the builder wishes to take no unnecessary chances.

Special care must be taken in the selection of variable condensers, heterodyne transformers and the "output selector." The variable condensers must have low

1 De Forest three-coil mounting (geared), type LC-100.
1 25-turn De Forest duo lateral coil.
2 35-turn De Forest duo lateral coil.
3 M. & H. 6000-meter "Superformers."
1 M. & H. 6000-meter "Precision Selector."
2 Federal No. 65 audio frequency transformers.
1 80 ampere-hour 6-volt Exide battery.
2 45-volt Eveready B batteries.
1 Pair Penn Headset phones.
1 Loud-speaker.
1 Cutler-Hammer A battery switch.
3 Anti-capacity double-circuit jacks.
1 Anti-capacity single-circuit jack.
2 Weston phone plugs.
2 4½-volt Eveready C batteries.
2 1 megohm grid leaks (variable preferred).
2 3-inch dials.
1 Radio Corporation loop.
2 2 m. f. Dubilier fixed condensers.
2 0.00025 Dubilier fixed condensers.
1 0.005 m. f. Dubilier fixed condenser.
1 0.002 m. f. Dubilier fixed condenser.



This view of the Super-Heterodyne set shows the placing of the various instruments on the back of the panel

This super-heterodyne never squeals or howls and is entirely free from body-capacity effects. It has a very pure tone and is exceptionally free from distortions. Furthermore, it amplifies equally all wave-lengths throughout its range. In the particular super-heterodyne built by the writer provision has been made to change the entire wave-length range of the set merely by plugging in different honey-comb coils in the grid circuit of the oscillator.

In the past several things have prevented the widespread use of this circuit by broadcast listeners. First, the lack of reliable information as to the methods of constructing, adjusting and operating the circuit. Second, the fact that reliable parts necessary to build the set were not on the market. Third, the super-heterodyne was so complicated to construct, adjust and operate that the average broadcast listener could not build or use it.

These difficulties have been entirely removed, and the writer is prepared to state that any radio fan who is capable of constructing and operating an ordinary one-tube receiver will have no difficulty with the super-heterodyne herein described.

No specific claims as to distance obtain-

losses, and it is a distinct advantage to use only geared condensers since settings can be exactly duplicated with ease.

The heterodyne transformers and output selector used were designed for 6000 meters and are extremely efficient at this wave length. The author is certain that much of the success of this set is due to the use of these particular transformers.

The 6000-meter transformers and the precision selector used in this set were designed by Charles N. Weyl, Moore School of Electrical Engineering, University of Pennsylvania.

Parts for Super-Heterodyne

7"x26" panel, bakelite or hard rubber.
8 UV201A or C301A vacuum tubes.
8 General Radio sockets, type 156.
1 General Radio 0.0005 m. f. geared condenser, type 247H.
1 U. S. Tool Co. 0.001 m. f. vernier condenser, type CV124.
1 General Radio 7-ohm rheostat, type 214A.
1 General Radio 30-ohm rheostat, type 301.
1 General Radio potentiometer, 400 ohm, type 214A.
1 0.0005 m. f. Dubilier fixed condenser.
6 Eby Binding posts.
1 Pound of No. 18 double cotton-covered wire for connections.
(Set may be wired with bus wire if preferred.)

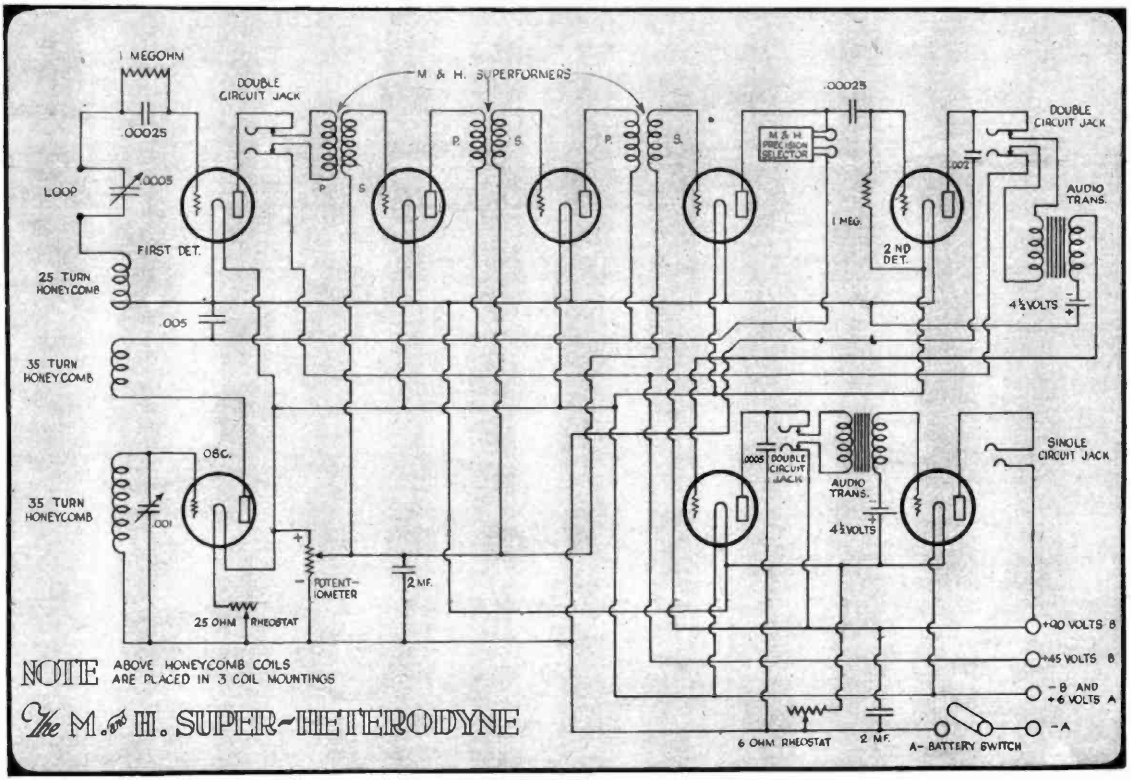
Parts for Special Filter

2 12,000-ohm Durham resistances.
1 100-millihenry choke coil (Durham).
1 0.005 m. f. Dubilier fixed condenser.
1 0.001 m. f. (approximately) Dubilier fixed condenser.

The special filter given in the list of parts, while not included in the original set or the photographs shown of this set, was found to improve the tone of the set materially and to permit two stages of audio frequency to be used with full, clear volume.

Due to the great power of the super-heterodyne much trouble has been experienced in the past when using two stages of audio frequency since the last stage of audio frequency has a tendency to be overloaded. The writer found that this special filter entirely corrected this trouble.

A separate diagram, Figure 5, shows how this filter may be inserted between the second detector tube and the first stage of



audio frequency. The construction of the set is plainly seen in the accompanying figures. Figure 1 shows the panel layout. The panel is 7"x26". On the upper left-hand end are two binding posts for the loop. The left-hand dial is the loop condenser, the dial to the right of this is the oscillator condenser, the little knob to the right of this dial is the oscillator rheostat.

Next comes the potentiometer, and next the rheostat which controls all the filaments except that of the oscillator. It is not necessary to have individual control.

On the extreme right-hand side is the A-battery switch. The jack on the left-hand side between the two condenser dials is used to test the first detector and the oscillator, or when it is desired to use the circuit as a single-tube receiver. The other jacks are the usual detector, first-stage audio and second-stage audio jacks.

The layout of the rear of the panel is clearly shown in Figures 2 and 3. While it is possible to place the instruments closer together and thus use a smaller baseboard, it is not recommended this be done if the best results are to be obtained from the set. It is strongly urged that the layout shown in Figures 2 and 3 be followed when building this set. These figures are virtually self-explanatory; however, several important items will be mentioned here.

All wiring was done with No. 18 double cotton-covered solid copper wire, and with the exception of the plate and grid wires of the tubes, all wires were bunched as close together as possible. This is an aid rather than a detriment to the set, as it helps to keep the amplifier tubes from oscillating. This wire, by the way, is what is known as ordinary "bell wire" or "annunciator wire" and is sold in any hardware store. Wherever possible, wires going to three or more terminals are looped around these in order to avoid soldered joints. Wherever soldered joints are found necessary, the joints must be carefully made, using a noncorrosive soldering flux and as little of that as possible. Virtually all wiring is run along the baseboard to keep it out of harm's way and to make all instruments accessible. The tube sockets are used as follows (see Figure 3): The socket at the back of the baseboard on the right-hand side of the figure is for the oscillator tube. Immediately in front of this is the first detector tube socket.

Going from right to left in Figure 3, the next three sockets are for the radio frequency amplifier tubes. At the back of the baseboard on the extreme left-hand end of the figure is the socket for the second detector tube, and the socket in front of this (in line with the first detector and the three radio frequency amplifier tubes) is for the first audio frequency amplifier tube. The socket on the left-hand side of the figure nearest the panel is for the second audio frequency amplifier tube.

Only one C battery is shown in Figure 3. However, it is better to use two as shown in the wiring diagram. The box directly in front of the four battery binding posts contains the "precision selector" upon which depends much of the success of this set.

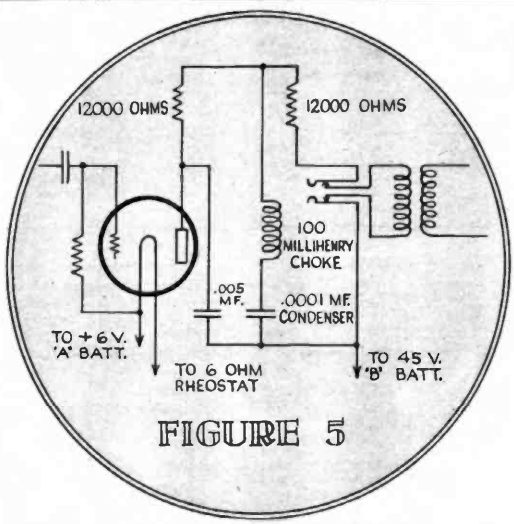
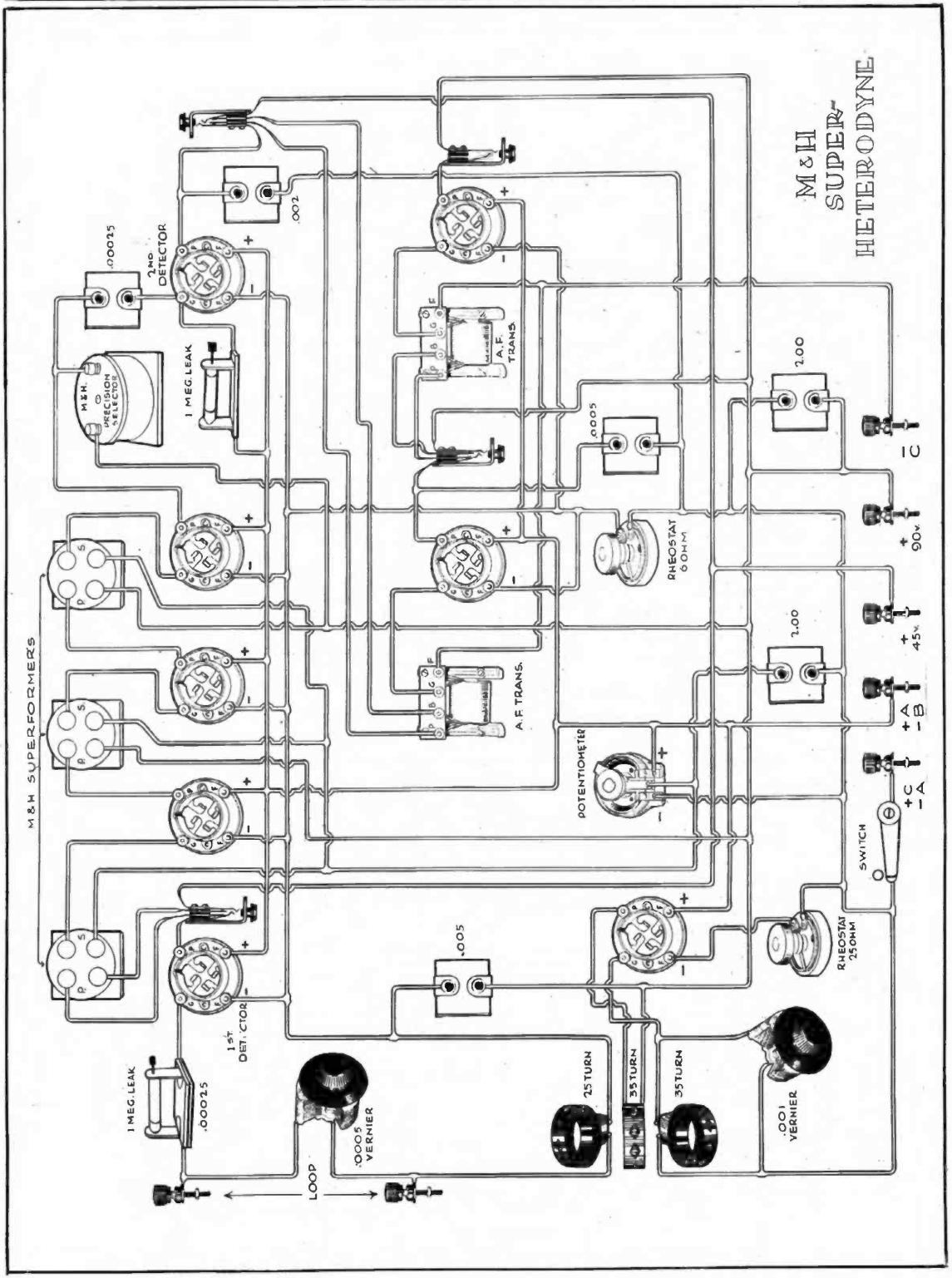


FIGURE 5

Showing how special filter may be inserted between second detector and first audio transformer


M&H SUPER-HETERODYNE
M&H SUPERFORMERS
2ND DETECTOR
1ST DETECTOR
1 MEG. LEAK
.00025
.002
.005
.0005 VERNIER
.001 VERNIER
LOOP
25 TURN
35 TURN
35 TURN
A.F. TRANS.
A.F. TRANS.
POTENTIOMETER
RHEOSTAT 60 OHM
RHEOSTAT 250 OHM
SWITCH
2.00
2.00
+C
-A
+A
-B
+45v
+90v

The three "superformers" are shown behind the radio frequency tube sockets. To the right of the C battery is shown one of the 2 m. f. by-pass condensers, the other being placed between the third radio frequency tube and the first audio tube. The two audio frequency transformers are clearly shown on the extreme left-hand side. On the "superformers" terminal No. 1 goes to plate, No. 2 to B, No. 3 to potentiometer, No. 4 to grid.

After the set is assembled, connect the loop and the batteries. Insert the phone plug in the jack between the first detector and the first "superformer." This is using the set exactly as if it were a nonregenerative single circuit on a loop.

Test the action of the first detector by tuning in a local broadcasting station, using the condenser across the loop. Be sure the oscillator tube rheostat is in the "off" position when making this test.

When you have assured yourself that the first detector is working properly, place the oscillator tube in its socket and bring the filament to normal brightness. Bring all honeycomb coils together.

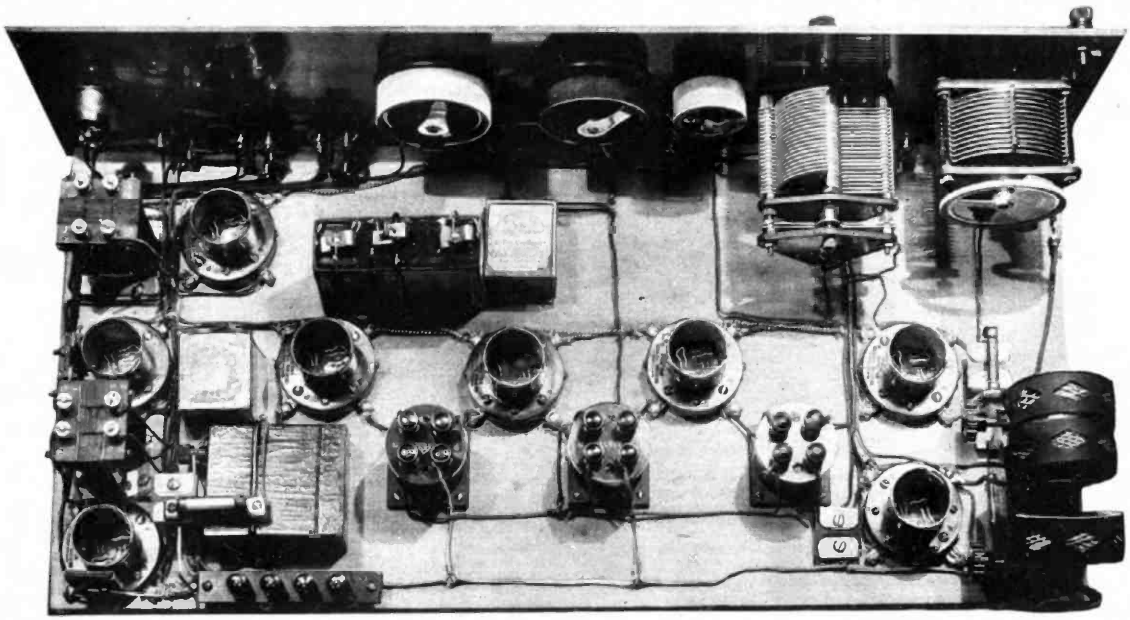
Now tune in the local broadcasting station, using the loop condenser. Next rotate the oscillator condenser until the signal becomes amplified and a squeal can be heard when the oscillator condenser is moved a little to either side of the point of loudest signal. If no squeal is heard, reverse the leads of the honeycomb coil in the plate circuit of the oscillator.

Next without changing the setting of either condenser place the phone plug in the jack between the second detector and the first audio transformer. Turn the potentiometer to the positive (+) side. Leaving the loop condenser entirely alone, slowly rotate the oscillator condenser until the signal is again heard. Rotate the potentiometer toward the negative side (—) until the signal becomes mushy or a squeal is heard in the phones. The potentiometer should then be moved slightly backward toward the positive side until this squeal disappears. This is the point of maximum amplification without distortion and should be left untouched, as it is independent of signal wave length.

Next adjust the coupling of the 25-turn honeycomb coil with the 35-turn grid coil. It will usually be found that loose coupling will give the best results. Low filament current in the oscillator is advantageous. However, care must be taken not to make this current too small or the oscillation will stop and the set will cease functioning.

After this part of the set has been tested insert the telephone plug, first in the first audio jack and then in the second audio jack to see that the audio frequency stages are working properly. On stations up to several hundred miles it will usually be impossible to keep the phones on your head when using the second stage, on account of the enormous volume.

After the set is once adjusted there are only two tuning adjustments for each station. These are the loop and oscillator condensers. For a given loop the two dials will always read the same numbers for a given station.



The layout of all of the apparatus in the Super-Heterodyne set is clearly shown by this photo, looking straight down on the baseboard

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By E. M. CLARKE

ABOUT three weeks ago I called Mr. Neely on the phone and told him I was about to build a super-heterodyne. "God help you!" was his reply. He then told me of the new "super" which had just been designed, and advised me to look it up. This I did, with the result that before dinner that evening I arrived home loaded with the necessary parts and diagram of the hookup. Maybe "God helped me," I don't know, but the "super" is now a reality.

In constructing this set I departed from all radio rules to keep all wires from touching, and did the exact opposite. I took all wires down to the baseboard and bunched them together. This seems to produce a condensing or by-passing effect that helps reception materially. Exception was made of the plate and grid leads, of course, and these were kept entirely apart and as short as possible. By-pass condensers and a specially designed "selector" were used which take the place of two variable condensers and greatly simplify control.

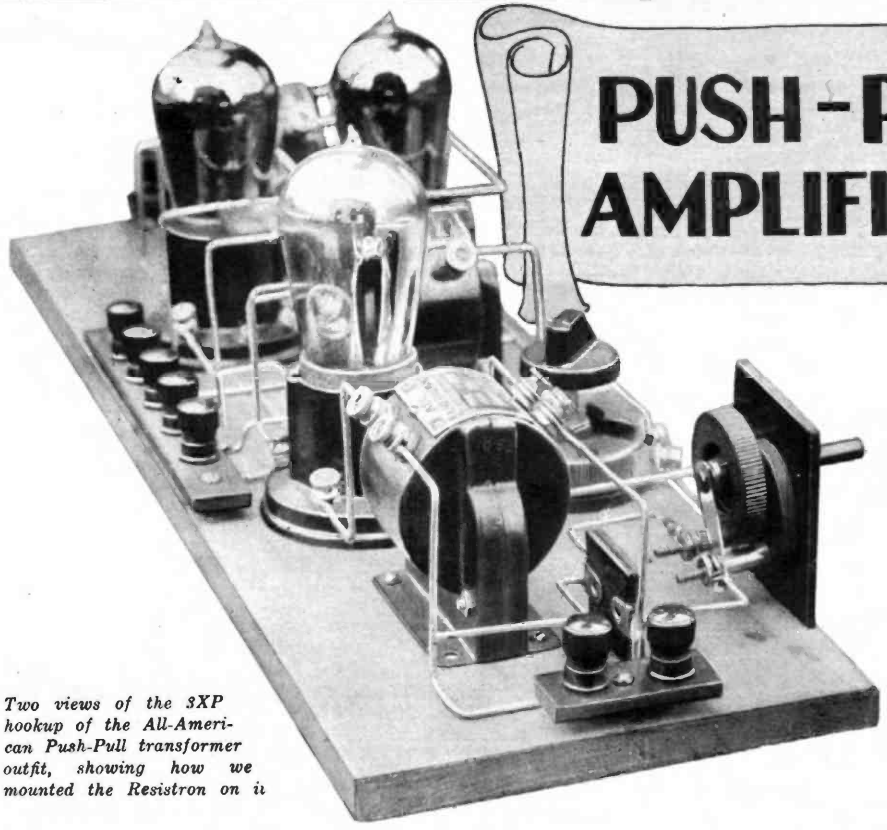
The results have been truly remarkable. The tone is full and natural, without the noises and distortion usually found with high-power sets. Volume is so great that I was forced to place a variable grid leak across the secondary of the second audio transformer to tone it down. Using only one stage of audio, the volume is equal to any set using two stages that I have ever heard, and music can be heard all over the house when I plug in on the detector alone and use no amplification.

Distance seems to make no difference to the "super," for WDAF, PWX and KFKX come in with about equal volume with WEAF, WGY and KDKA and other nearby stations.

Tuning is very simple, there being only two control dials, and once a station has been located, you can always find it at the same dial readings. There are just two points where a station can be heard, and nowhere else. These two points are caused by the heterodyning of the signals to 50,000 cycles. You get a signal at 50,000 above and also at 50,000 below its true frequency, but nowhere else. With some stations I find reception better at the higher point and others at the lower beat.

I have no trouble to get past local stations and reach out into the distance. To illustrate its selectivity, I have heard PWX, when both WDAR and WOR were on, with no interference from either station, although separated by (Continued on Page 34)

PUSH-PULL AMPLIFIERS



Two views of the 3XP hookup of the All-American Push-Pull transformer outfit, showing how we mounted the Resistron on it

THIS is certainly the day of push-pull amplification. Ever since the more technical journals published the details of the principles of this push-pull system there has been an insistent demand among fans for apparatus that would meet the requirements of the system, and it was not long before several manufacturers put on the market transformers with one winding tapped in the middle as called for in the push-pull circuits.

It has long been recognized that six out of ten fans want all of the volume that they can possibly get out of their sets. I am personally not much in sympathy with this desire, because to me music and speech are spoiled when they come from the loud speaker with more volume than they would naturally have if the singers or the speakers were in the position that the loud speaker occupies in the room. The moment the volume is greater than this, I become conscious of an air of artificialty about the whole performance and that leads to the impression that there is distortion in the reproduction of the sound. It is extremely unpleasant to me to hear signals built up beyond this natural point of strength.

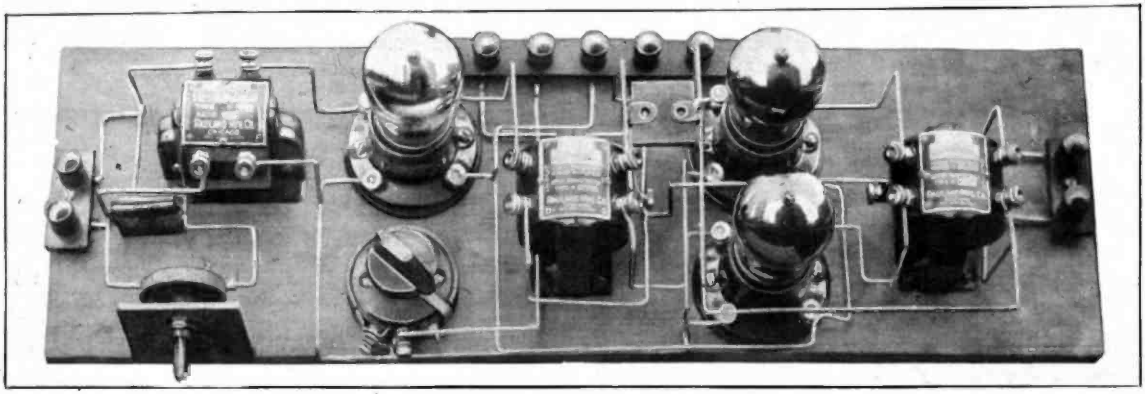
Still, extra amplification is undoubtedly needed on weak signals coming from a distance and here some system has long been desirable to avoid the distortion that undoubtedly takes place when too many of the ordinary type transformers are added in cascade.

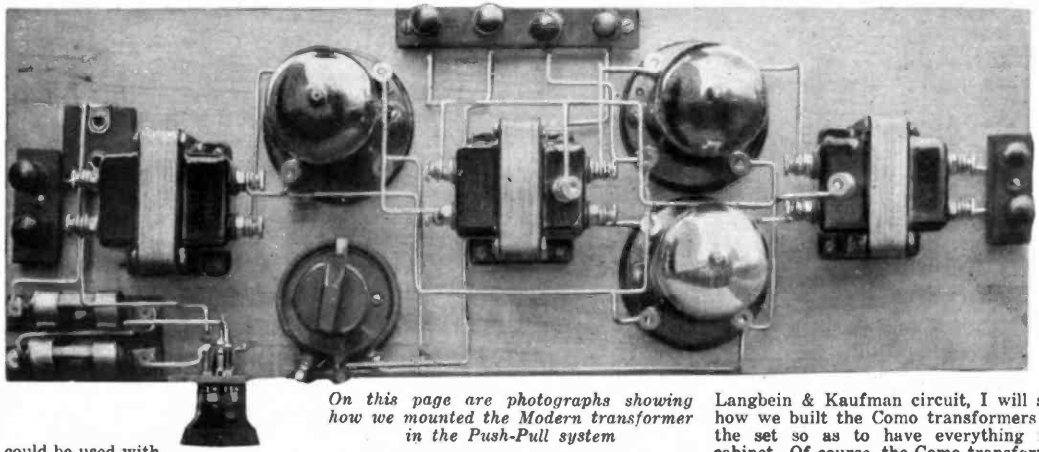
Under the old conditions two stages of amplification were about all that could be used with any degree of satisfaction with the quality of signals produced. And yet there were a great many cases where two steps were not sufficient to build up weak signals to satisfactory volume.

It is here that the push-pull system undoubtedly comes in and becomes of very great value. With a push-pull pair as the third step of audio frequency amplification the volume is very much built up, but the strength that is added is not added at the expense of the purity of the sound.

During the last month I have picked up four types of transformers now being widely put upon the market for the purpose of supplying this demand for a moderate priced push-pull system. These transformers are the All-American, the Modern, the Como and the Rubicon.

We have given all of them a very thorough test out at Station 3XP, and we have been very much pleased with the results that were achieved. The feature that struck me most forcibly with all four of the transformers was that the push-pull



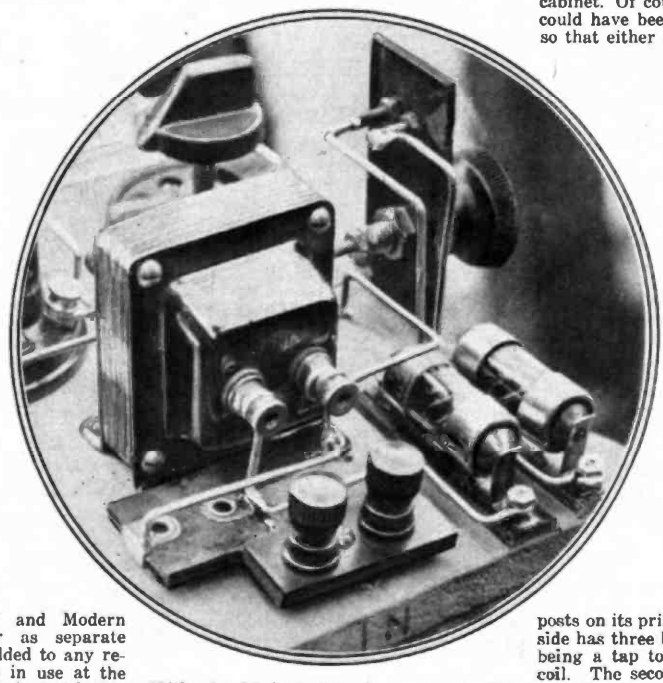


On this page are photographs showing how we mounted the Modern transformer in the Push-Pull system

system could be used with either UV199 tubes or with the 201A or 301A tubes with perfectly satisfactory volume.

Of course, the standard units which come for push-pull power horns use the regular 5-watt power tubes and there is no question but that these deliver the greatest amount of power of all, and for those who can afford such outfits there can be no question of their superiority when used with horns that are especially designed to handle the large output which they give. The average horn, however, is not especially designed for power amplifiers and will not stand the immense amount of volume produced with the standard units, and so for the ordinary horn these units dealt with here are better.

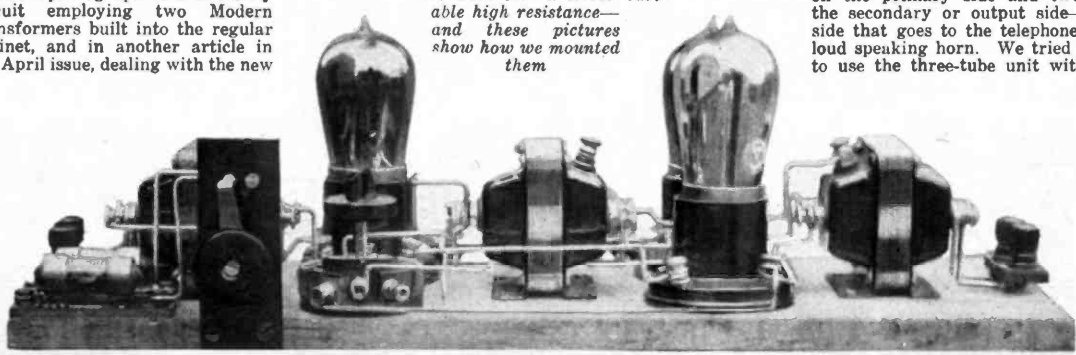
We have built and are showing in this issue two different unit arrangements for this system. With this article I am showing the All-American and Modern transformers put together as separate units so that they can be added to any receiving set which you have in use at the present time. I am also showing with this article a photograph of a Cockaday circuit employing two Modern transformers built into the regular cabinet, and in another article in the April issue, dealing with the new Langbein & Kaufman circuit, I will show how we built the Como transformers into the set so as to have everything in a cabinet. Of course, the Como transformers could have been made a separate unit too, so that either system may be used for any one of the four makes of transformers.



With the Modern transformers we used two Turn-Its—a clever variable high resistance—and these pictures show how we mounted them

It will be noticed that the arrangements shown with this article use three tubes each, but it is really only two stages of amplification. The first stage is a straight audio frequency stage and any of the ordinary low ratio audio frequency transformers may be used with it. The second part of the layout consists of two push-pull transformers and two tubes, but these two tubes are used in what we call parallel and both are in the same stage of amplification. These push-pull transformers it will also be noticed are different from the ordinary in that on one side of each there are three binding posts instead of two.

In all push-pull systems of this kind the first push - pull transformer has only two binding posts on its primary side, but the secondary side has three binding posts, the center one being a tap to the middle winding of the coil. The second push-pull transformer is just the reverse, with three binding posts on the primary side and two on the secondary or output side—the side that goes to the telephones or loud speaking horn. We tried first to use the three-tube unit without

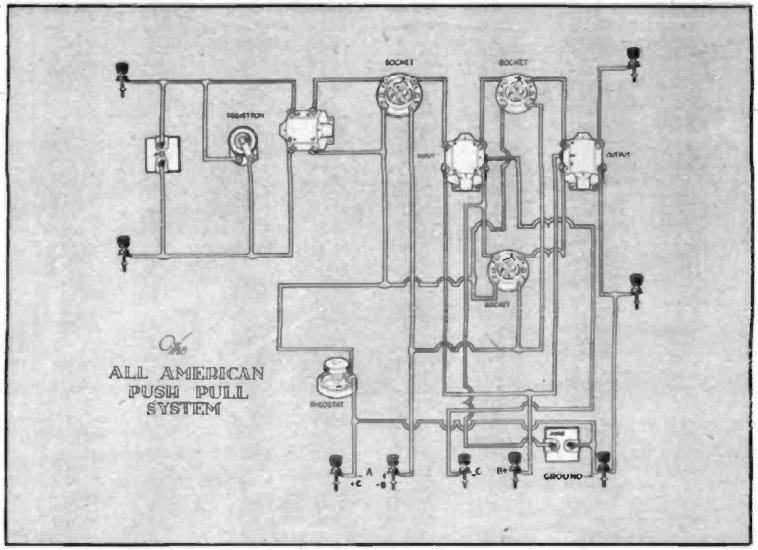


any resistance or condenser across the primary of the first stage, but we found that the quality of signals was very much better controlled by hooking up a .002 mfd fixed condenser across the two primary binding posts of the first transformer and also hooking across the same two binding posts a variable high resistance. There are three very excellent resistances of this kind on the market, and I am showing all three here in combination with the various transformers. You must understand that it is not necessary to use any particular kind of resistance with any particular kind of transformer. You can use the make of transformer that pleases you best and with it you can use any one of these three types of high frequency resistance.

With the Modern push-pull transformer system I am showing two Turn-It resistances connected in such a way that a switch blade passing over two contact points will put either one or both of them into the circuit. This gives a very wide range of control. With the All-American system I am showing the Resistron leak and with the transformers in the Cockaday circuit I am showing three of the Durham variable leaks also so arranged that one, two or three of them can be switched into the circuit in the same way that we have done with the Turn-Its.

For the man who now has two stages of audio frequency amplification and is getting very bad noises along with his signals, I should say that this push-pull system is the best remedy. Such a condition as he is facing usually arises from the fact that he is using transformers of too high a ratio in his present set. In order to get maximum volume, fans everywhere have been demanding audio frequency transformers with a ratio of ten-to-one, and I want to say right here that mighty few transformers of this ratio have been produced that will give signals that are at all satisfactory to my own cranky ears so far as the quality is concerned.

In all such cases I would recommend that the high ratio transformer be taken out of the set and that a low ratio transformer be substituted for it. Then I would recommend that one of these three-tube push-pull systems be employed with a telephone plug leading to the two binding posts on the beginning or input side of the system.



The ALL AMERICAN PUSH PULL SYSTEM

With this kind of an outfit built separately, the telephone plug can be pushed into the detector in the set and signals which are coming in with fair strength will be amplified to maximum by means of the push-pull system and the quality will be better than would be the case with two steps of ordinary audio frequency amplification. In the case of weak signals, the signals should be allowed to pass through the detector and through the first stage of audio frequency amplification in the set—provided the fan has substituted a low ratio transformer in that stage, and then the plug of the push-pull system can be plugged into the jack leading from the first stage of audio frequency amplification in the set. This really is three stages of audio frequency amplification—the one stage in the set, the first stage of straight audio frequency on the separate unit and the push-pull stage on the unit.

Ordinarily, of course, this third stage would cause very bad distortion, but here is where the push-pull system comes in handy because it amplifies the signals but minimizes the distortion.

Such a scheme as this enables the fan to build up as far as we are now able to do the weak signals that come from a distant station and, while there will undoubtedly be noises amplified with them, it will give the best results possible to obtain in the present stage of radio science.

The hooking up of these units is simplicity itself, and I think there will be no difficulty if you will consult the diagrams and the photographs with this article. I am not giving here the ordinary schematic diagrams, because the picture diagrams are so extremely simple that there cannot be the slightest difficulty in making proper connections.

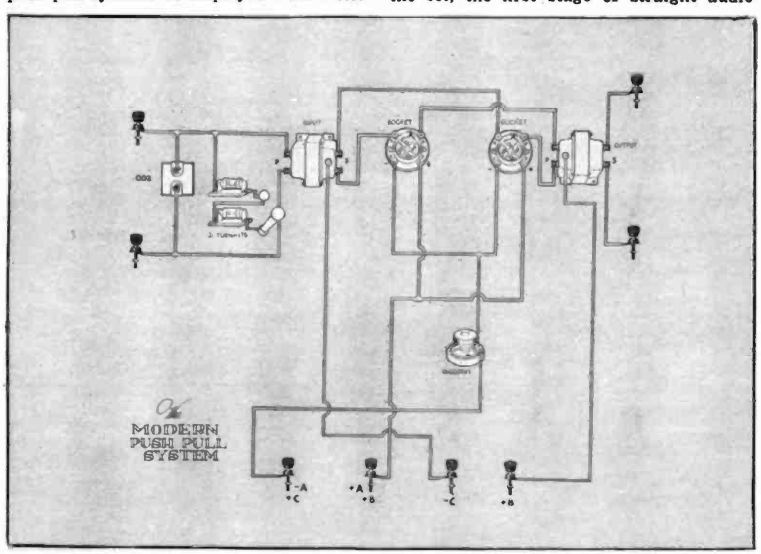
It will be noticed that the push-pull stage of amplification requires a C battery and I have found that about nine volts is best for the A tubes and about four to six volts for the UV199 or C299.

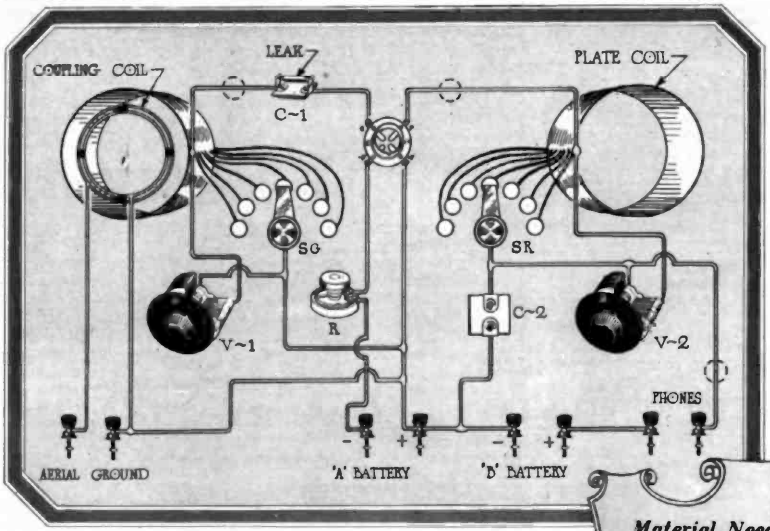
For the B battery, the A tubes will stand as high as 120 volts, but I have found that the 199 or 299 tubes seem to amplify best at about sixty volts in this push-pull system. Naturally this depends upon the individual tube that you happen to get, as it is becoming very widely recognized that it is impossible to turn out tubes that are uniform in their performance.

With this article, as I say, I am showing only the Modern and the All-American transformers. We have tried the other two and found them equally satisfactory, but unfortunately the photographs showing them were crowded out of this issue. The Como transformers will, as noted, probably appear in next month's issue and I hope to show the Rubicon shortly after that.

It will be easily understood, of course, that push-pull transformers must be bought in pairs. The first of this pair, or the "input" transformer, has the three taps on the secondary, while the "output" or last transformer has the three taps on the primary.

It will be noticed that the units shown here have a different (Continued on Page 33)





Listen-in on *the* Short Waves

By BRAINARD FOOTE

THE increased use of short wave lengths is forecast by the remarkable success with which KDKA has been broadcasting on 100 meters for several months past. The Department of Commerce has issued a number of licenses for experimental broadcasting of one kind or another on short wave lengths, and the amateurs have recently found that the wave lengths near 100 meters made possible reliable Transatlantic communication.

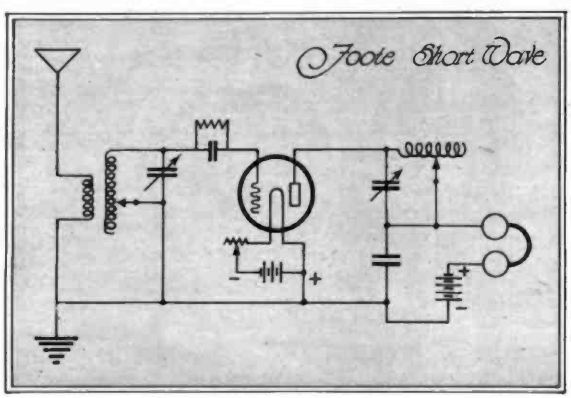
As set forth in my article in last month's issue, the short waves offer practically limitless latitude for the installation and harmonious operation of dozens and even hundreds of transmitting stations, all using the "air" at the same time.

The present demand for the use of broadcasting apparatus can only be solved by an extensive adaptation of short waves to transmitting equipment, and this will necessitate the construction of special receiving sets for the short waves (higher frequencies) inasmuch as it is almost impossible to design an efficient receiver for both the present band and the short waves without a multitude of complicated switching and dead-end contrivances.

Honeycomb coils which may be interchanged could be put to use to furnish different coils for the two wave bands, but the variable condensers, which are satisfactory for long waves, would be out of the question for 100 meters.

Variable condensers of the 17 and 23-plate sizes are too large for convenient use on wave lengths below 200 meters because of the fact that a slight change of capacity serves to make such a great change in wave length as completely to tune a station in and out. This would be so rapid that it would be almost impossible to notice the "squeal" of the broadcaster's carrier wave as it was passed by on the dials.

Therefore the condensers for short wave equipment must have a small capacity and any material alteration in wave length secured by a system of taps rather closely located on the inductance coil. The extra plate style of vernier control should not be used because of the fact that it renders the accurate notation of the dial setting for a certain station impossible. Hence, while a vernier is most helpful, the style of vernier adapted should preferably be one of the "rubber-tired" variety where the gear effect is obtained by pressing the rubber rim of the vernier against the larger rim of the tuning dial or with some other such "micrometer" adjustment.



Material Needed for Foote Short-Wave Set

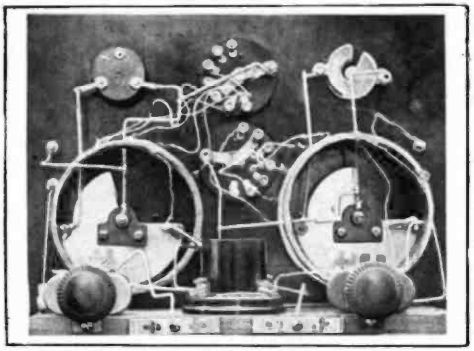
2 cardboard tubes, 4-inch diameter and 2-inch length.
2 nine or eleven plate variable condensers (V-1 and V-2).
1 panel, 7 by 10 inches.
14 switch points and 4 stop points
½ lb. No. 20 double-covered wire.
5 lengths bus bar.
2 switch levers (S-G and S-R).
1 tube socket.
1 rheostat (R)
8 binding posts.
1 grid leak and grid condenser (C-1).
1 .001 phone condenser (C-2).
A and B batteries suited to tube purchased.
1 detector tube.
Telephone headset.

A great many forms of circuit are suitable for short wave reception, but the one chosen must, of course, be regenerative if there is to be no radio frequency amplification employed. I suggest the tuned plate receiver as being a reliable form of tuner and one in which regeneration adjustment exercises practically no effect upon the tuning of the secondary. I might have used a single circuit tuner, but after some experimentation I decided that 100-meter reception called for a pretty tiny aerial and hence the volume would be rather in proportion to its dimensions.

The so-called "untuned" or "aperiodic" primary was then tried out, and it worked so very well that it was adopted for the outfit. The regular broadcast listener's aerial may be used with this scheme and the volume obtained is apparently a good deal better than with a smaller aerial where the antenna circuit is also tuned to 100 meters for KDKA's broadcasts.

Several desirable features for the broadcast listener who is anxious to "step out" into other fields of listening-in were kept in mind when I constructed the set and tested the coils for correct proportions. These were as follows:

1. A circuit which will bring in KDKA



on 100 meters successfully, good volume.

2. A circuit tuning down to about 80 meters in case other broadcasting should be commenced below 100 meters.

3. A circuit covering the entire range from 80 to 330 meters so that amateur phone and telegraphic signals may be enjoyed.

4. A selective and easily controlled circuit *which functions with any tube.*

While the listener-in is going ahead with a small set for receiving KDKA on 100 meters, he may as well take a few minutes of extra time and increase the range of the receiver enough so that he can listen in on amateur phone stations as well as those operated commercially. "The Air Is Full of Things We Shouldn't Miss," says one advertiser, and the broadcast devotee will be surprised when he tunes the receiver to 200 meters or less and "gets in on" the conversation of the amateur. He may hear a good many "All right, old man, your tone is fine business now," and "What do you make my wave length now, old man," and the like, and he should remember that just such experimentation accomplished merely for the sake of making one set better than another is what has established broadcasting as it now exists.

The pictorial and schematic diagrams show the connections. The bill of materials is given in a "box" herewith.

The WD11 or WD12 tube operates very well, as does the UV199, and therefore it is not necessary to have a storage battery for the set. With any tube except the UV200, the B battery should be a 45-volt unit, and for the WD tubes the A battery is a single dry cell. For the 199, two cells are used, connected in series. The rheostat is about 6 ohms in resistance for the WD tubes, but anywhere between 15 and 30 ohms for the 199.

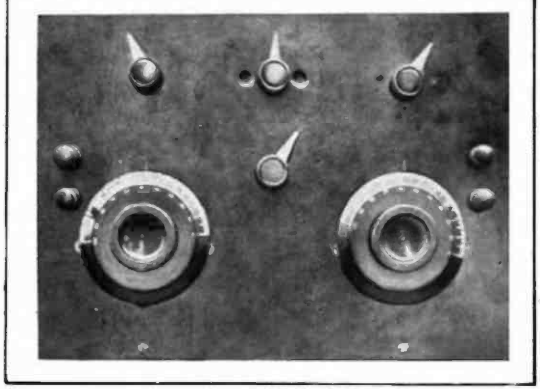
On this page will be found pictures of this set as Mr. Neely built it at Station 3XP when I sent him the preliminary diagrams. It will be noticed that he has not followed my advice about the verniers for the condensers, but has used Marco and Chelten Midget condensers, but his results have proved them to be perfectly satisfactory.

The tuning equipment shows the secondary coil and its associated switching arrangements and variable condensers (Mr. Neely wound the untuned primary directly over the secondary, which did not prove so satisfactory) and the plate circuit coil, switch and condensers. All of this apparatus (except the Midget condensers) is shown in the accompanying pictorial hookup, where their connection to the tube and other binding posts are indicated. The illustrations serve to show how the tuning part of the circuit is made up and the diagram gives the actual connections. Note that the variable condensers are placed inside of the coils to economize on space. This does not detract from the efficiency at all, however.

The constructional part of the set resolves itself into three units: the antenna coupling coil, the secondary coil and taps and the plate coils and taps.

1. Coupling coil. This is made by winding five turns of No. 20 wire around a cylinder about three and one-half inches in diameter and holding the turns in shape by a few narrow strips of bicycle tape as shown in the diagram. The coil is thus self-supporting.

2. Secondary coil. Wind thirty-five

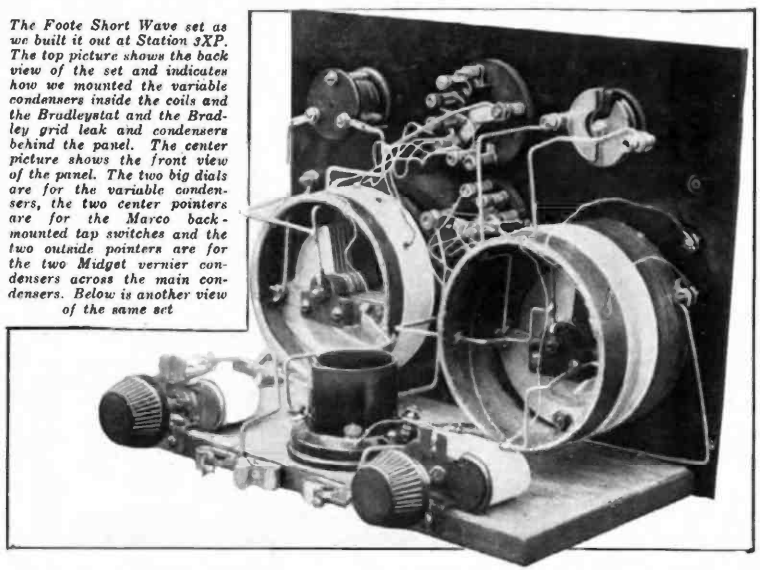


turns of No. 20 wire on one of the tubes, and make a tap at the following turns: 5th, 10th, 15th, 20th, 25th and 30th. The taps may be 3-inch lengths of the same wire scraped for an eighth of an inch at one end, lightly touched with soldering flux and tinned with the soldering iron. A similar spot on the proper turn of the coil is laid bare, touched with a speck of soldering paste, tinned and then the tap and wire held together while the soldering iron is applied to cause the "tinned" parts to flow together. The joint shouldn't pull off easily. A thin strip of mica may be bent in half and laid under the tap to prevent accidental contact with either adjacent turn on the coil.

3. Plate coil. On account of the greater capacity between plate and filament than between grid and filament, this coil requires fewer turns than the secondary. Thirty turns are used, with taps at the 4th, 8th, 13th, 18th, 23rd and 26th. The last turn of each coil is, of course, connected to the last switch point for each.

It is quite convenient to construct the tuning unit in accordance with the photographs given on this page, and to arrange the other parts, such as aerial and ground posts, socket, battery connections, rheostat, etc., on a board in the customary "board mounting" style. This provides one with a double tuning system which will find use in later circuit developments and with different detectors and amplifiers. The dotted circles in the picture diagrams show where the four binding posts "come in" in the actual wiring. These binding posts may be placed at the top of the panel to facilitate connection to the detector circuit, and keeps the connecting wires away from the influence of hand capacity.

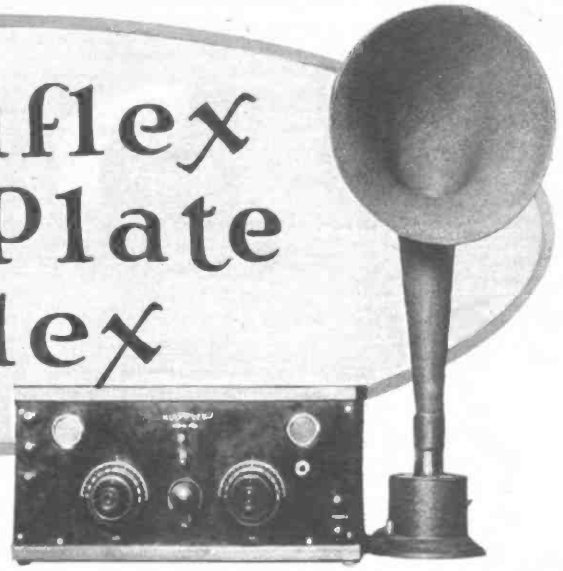
The taps are soldered to the switch points so that the maximum number of turns is included in each coil when the switches are turned to the right. The bus-bar used for making the connections is bent at right angles for turns, and kept as far away from other bus bar connectors as is consistent with short leads. All extra soldering flux should be carefully wiped off after the joints are soldered, and the joints should be bright and clean. This prevents later corro- (Continued on Page 40)



The Foote Short Wave set as we built it out at Station 3XP. The top picture shows the back view of the set and indicates how we mounted the variable condensers inside the coils and the Bradleystat and the Bradley grid leak and condensers behind the panel. The center picture shows the front view of the panel. The two big dials are for the variable condensers, the two center pointers are for the Marco back-mounted tap switches and the two outside pointers are for the two Midget vernier condensers across the main condensers. Below is another view of the same set

Multiflex Tuned Plate Reflex

By EDW. A. SCHLUETER
and STUART ROGERS



The Multiflex Circuit makes a very neat and symmetrical panel when mounted as the authors have done it

THE great San Joaquin Valley—in California—famous throughout the world for its fruits, oranges, figs and raisins, is truly the land of glorious sunshine.

This wonderful valley is set between two great mountain ranges, the towering snow-capped peaks of the Sierra Nevadas bounding it on the east, the Coast Range Mountains on its western boundary. It is about one hundred and fifty miles wide and about two hundred and fifty miles long, so situated between these two mountain ranges that it is protected from the storms of the Pacific Ocean, giving it a climate perhaps unsurpassed anywhere in the world—truly the "Garden of the Sun." This glorious sunshine is the reason for the wonderful fruits and raisins produced here, but the excessive dry heat and reradiation of heat waves plays havoc with radio reception.

We had long been experimenting with different circuits, in an endeavor to overcome static interference with some success, but not entirely to our satisfaction, and we were working upon the idea of reflexing our tuned plate circuit.

One evening in the early part of June, 1923, after an unusually hot day, we sat in our shop discussing this idea. We decided to try it out and went to work building a set embodying our reflexing idea. It was nearly midnight when we finished our job, and owing to the late hour we thought that we would have to wait until the following night to see whether or not our idea was any good. However, we tuned in.

At first we heard no indication of signals. We made a few adjustments, reset the crystal and tried again.

We heard very faint strains of music, showing us that our idea would at least work. After a few seconds we brought the station in clearly, hearing a very wonderful concert. Who was it? To our knowledge there was no station in California supposed to be on the air at this hour of the night. Yes, it was, however. KFI was broadcasting a concert played by the orchestra of the Ambassador Hotel in Los Angeles—the first concert given by this wonderful orchestra.

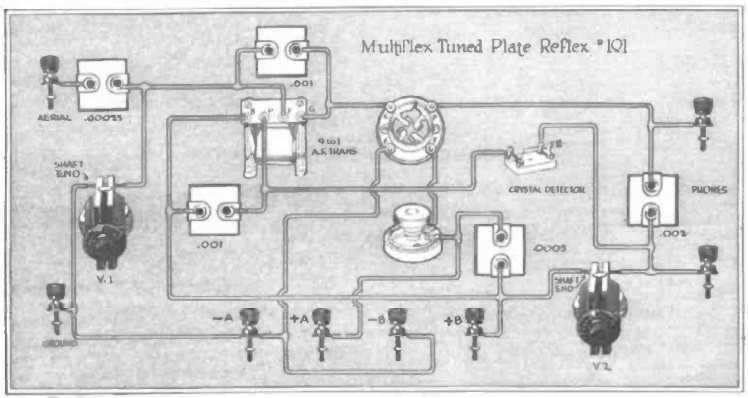
The station which broadcast this concert is only 225 miles away, and the fact that we heard it was not, of course, a remarkable reception; but it made us enthusiastic about our circuit and we were satisfied that we now could build a radio receiving set that would work in the San Joaquin Valley in mid-summer.

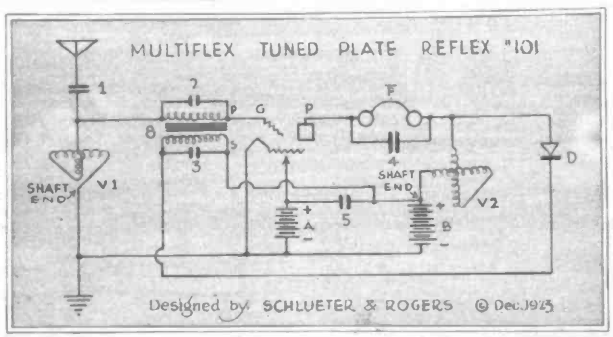
The following evening we achieved a marked improvement in our circuit, and during the latter part of July we had two test sets working in which we used only one tube and a power amplifier, with which we gave some very extraordinary demonstrations.

Our log sheet of August 25th, 1923, using 199 tubes, reads as follows:

V1—40 rotor, 40 stator, No. 28 D. S. C., using .00025 for antenna condenser.

V2—40 rotor, No. 26 wide D. S. C., 40 stator, No. 28 wire D. S. C. Wave length 275 to 525 meters. Tunes very sharp on





Above is the picture diagram of the Multiflex Circuit and to the right is the usual schematic diagram which is preferred by most of the advanced readers

antenna variometer—DX very sharp. Using Federal 3 to 1 transformer, logged the following stations between 7 and 8 P. M.: KFI, KWG, KLX, KGG and KZN. Volume and modulation good—very noisy—weather about 100 degrees. We continued our tests all through the summer and made a number of discoveries which we employ in our present Multiflex circuit.

The circuit in general gives excellent results on one, two and three tubes.

Those who desire to use this circuit will get best results by following instructions and directions carefully. Be sure to use the transformer ratio. This is very important if you are to obtain the maximum results from your set. Condenser capacities should be the same as marked. Changing them changes the working of the set.

The Multiflex No. 103 drawing is designed for UV201-A or C301-A tubes. If you desire to use UV199, WD11 or 12, leave out the 300-ohm potentiometer and connect the ground to the negative A battery. This will also do away with the .002 mfd. condenser which is called for on the potentiometer.

We advise, however, that if you use UV199 tubes, not to make over a two-tube job. For more than that, use UV201-A or C301-A. The crystal detector used, and the one we found most satisfactory in our experimental work, was a B-Metal Crystal. This one held up under the severest tests we gave it.

The advantage of using a variometer instead of the ordinary radio frequency transformer is that tuned radio frequency is more efficient than untuned. In the Multiflex circuit the position of the crystal changes the capacity of the radio frequency tuning unit. A fixed inductance loaded with high capacity that some crystal settings produce would have to be very small to cover the changes in resonance required of a broadcast circuit. This condition of over-capacity and under-inductance again lowers the efficiency and leaves us with the variometer, with which very remarkable results have been obtained.

Another advantage of this type of circuit is its selectivity, the tuning being much sharper than the ordinary radio frequency circuit using a transformer. To make the tube oscillate, set the crystal to a very loose but sensitive position. Adjust both inductances to resonance of wave. This adjustment gives the tube a chance to do a various number of things, thus: Radio frequency amplification, partial rectification, radio frequency feed back and regeneration.

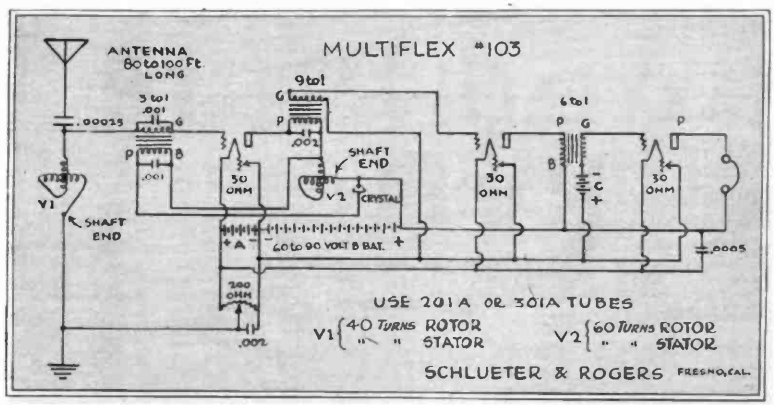
This adjustment is excellent for C. W. reception. To use as non-oscillating, set crystal to a more firm but sensitive position. Adjust as before until signals are heard, and then detune radio frequency unit until oscillation stops. This will give modulated C. W. or phone reception clearly, along with distance.

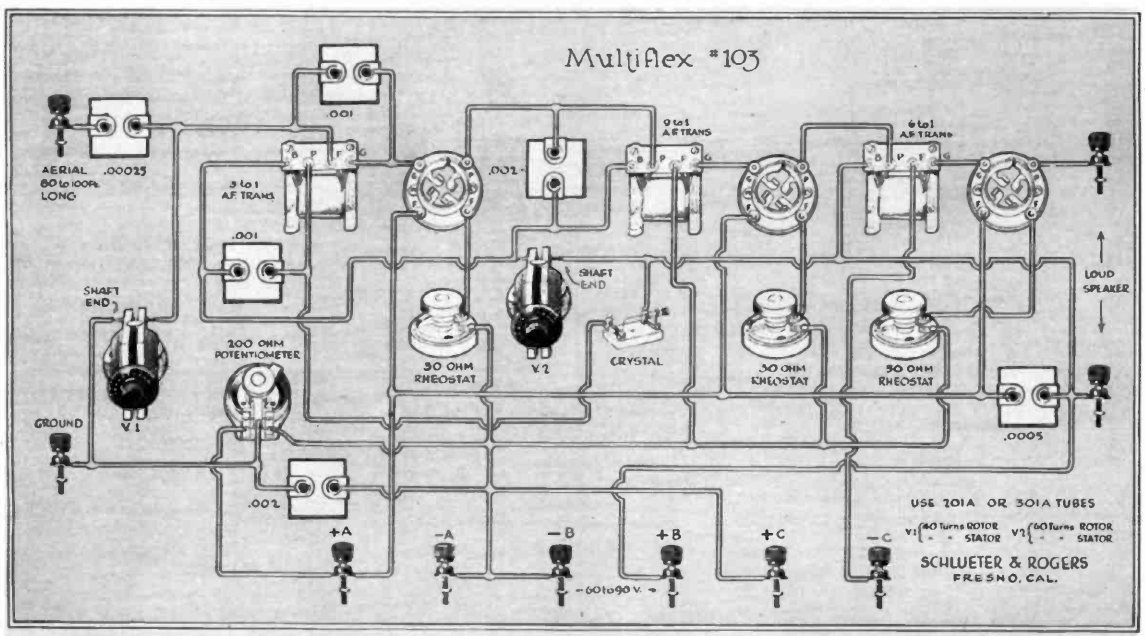
Figure No. 1 shows the one-tube and crystal connection, while Figure No. 2 shows the crystal connection for using two or three tubes.

In winding the variometer to be used in the Multiflex circuit, it is best to space-wind the variometer No. 1 forty turns on the rotor and forty on the stator. We used different windings on the variometer No. 2, or plate variometer—fifty rotor and fifty stator, space-wound. In "space-winding" you wind the wire and a piece of string simultaneously so that the turns of wire are separated by the thickness of the string.

Instructions for connecting a Multiflex Tuned Plate Reflex No. 101 circuit—UV199 or WD12, are as follows:

Condenser No. 1 .00025 Micadon.





Condenser No. 2 and 3 .001 Micadon.
Condenser No. 4 .002 Micadon.
Condenser No. 5 .0005 Micadon.
Variometer No. V-1—special wound 80 turns—40 on rotor and 40 on stator.
Variometer No. V-2—special wound 100 turns.
Crystal Detector—D, use B-Metal crystal or equal.

When using a UV199 or WD12 tube, use the proper rheostat or filament control. Use B battery current from 65 to 90 volts. Transformer No. 8; for best results use a 9 to 1 ratio. Smaller ratio transformers can also be used.

The parts required are as follows: Two 3-inch dials, two variometers, special wound; one Na-Ald 199 socket, or WD11 or 12; one 9 to 1 transformer, six rubber binding posts, one rheostat, five Micadon condensers, one crystal, six feet spaghetti insulation and wire for wiring set, one 7x10x⅛-inch panel, one UV-199 tube, or WD12, one No. 1027 flashlight battery or dry cell, three 22½-volt B batteries, one pair phones, 100 feet wire for antenna.

If this circuit is carefully made according to our instructions we guarantee that it will give results that will amaze you. We have been working it here in the San Joaquin Valley for months, obtaining remarkable reception where few circuits work with entire success.

* * *

Mistake in Our First Multiflex Diagram

Several readers have pointed out to us the fact that the "picture" diagram of the Multiflex circuit given on page 19 of the December issue contained an unfortunate mistake, though the "schematic" diagram on page 17 was correct.

In the diagram on page 19 the wire leading from the right-hand side of the crystal detector to the variometer should go over to the side of the variometer next to the telephone binding post instead of to the side nearest the crystal.

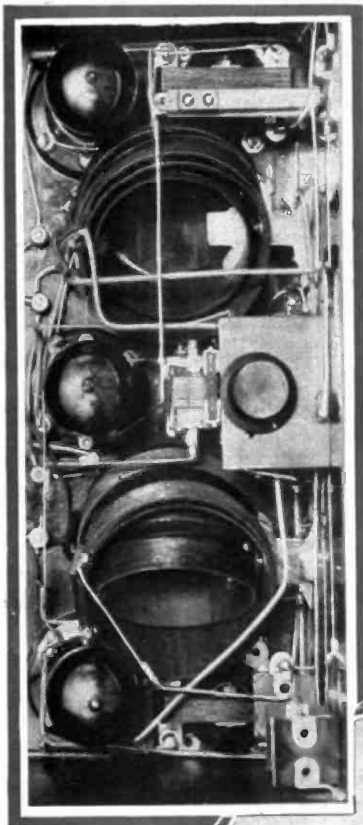
This letter makes everything clear with a corrected diagram on Page 28.

New York, Feb. 1, 1924.

My dear Mr. Neely.

I do not know whether your attention has been called to the following already, but inasmuch as the correct information leads to quite satisfactory results, thought it worth while to write you.

In the December issue of *Radio in the Home* you gave a description and some diagrams of the Multiflex Circuit. There was a picture diagram on page 19 which has some errors in it and the circuit if hooked up as therein indicated would give perhaps very poor results, with the amplifier tube acting as a sort of detector, and the crystal detector being entirely out of the circuit. Of course, reference to the schematic diagram would reveal the difficulties which would be encountered using the other idea, but it is quite possible that some earnest enthusiast might overlook the correct diagram and wonder why he is not getting results.



The top picture shows a view of the three-tube Multiflex looking straight down into the box. The other diagrams are of the first two in the article printed herewith.

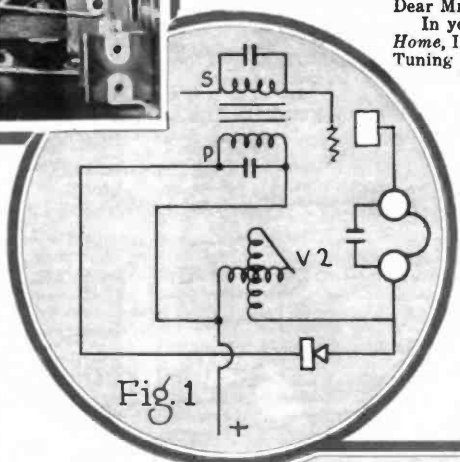


Fig. 1

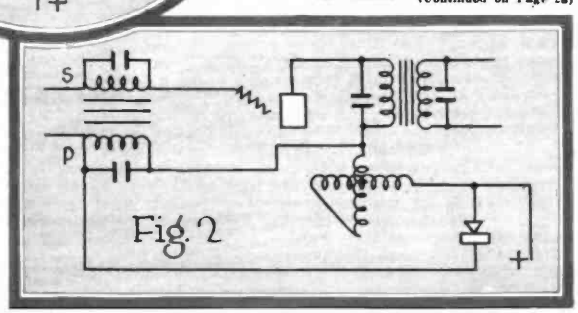


Fig. 2

I have built this circuit and have been quite satisfied with it. I might mention in this connection that the Radio Corporation of America specifically recommends that when using the 201A as an amplifier the rheostat be in the negative A side of the circuit, and that the grid return from the audio amplifier be led to the rheostat before reaching the tube. While I doubt if there is a great deal of difference if this is not observed, still there are those who adhere religiously to such recommendations and it is also possible that this question has arisen in some one's mind.

If this has been brought to your attentino, it is possible that the question of bypassing the radio frequency current through the rheostat was mentioned.

In my outfit I have been using a Bradleystat (which, as you know, is a carbon resistance unit) and I have had it in the negative A side, as recommended by the Radio Corporation of America, and I presume that radio frequency currents are not hampered by such resistance, for my set works very well indeed.

While I admit that my technical knowledge along these lines is quite limited, I thought what I have learned might be the means of helping some one else in distress, and if this be so, I shall, of course, be pleased.

In closing I might call your attention to another small discrepancy—in the photo on page 18 you indicate the transformer as having a 9-1 ratio, while in the text on the same page you say 5-1. I believe Amertrans have a 9-1 ratio, but thought perhaps you might wish to make a correction in a later issue.

I certainly do believe this set is a very good one and recommend a trial to all those who wish a compact, selective and satisfactory outfit. With two stages of audio added one can fill a whole house with clear signals. Yours very truly,

ERWIN MAIER, JR.

* * *

ABOUT THE "RILEY" CIRCUIT

1133 Princess Ave., Camden, N. J.

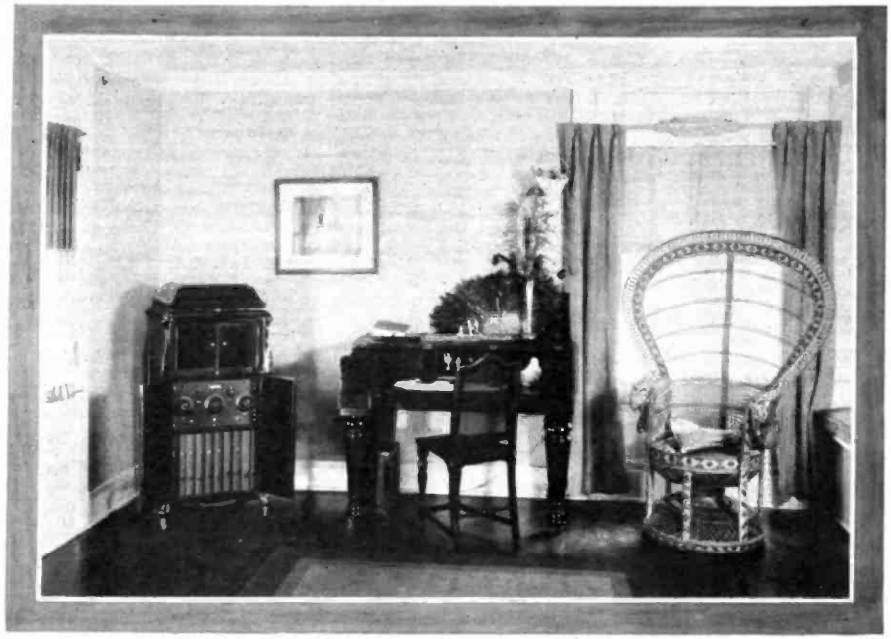
Dear Mr. Neely:

In your February issue of *Radio in the Home*, I read the article entitled "A Circuit Tuning With Condensers" and wish to inform you that it is an exact duplicate of the one published by myself in the March 25th and April 1st issues of the Philadelphia Inquirer.

Mr. Riley evidently did not realize that this was the case or else he had not heard of it before.

I shall tell you in a few words how and why I think it is the sharpest single-circuit tuner ever tried by me, in my eight years of experimenting with vacuum tubes and their circuits.

I have tried many double circuit tuners and I have been able to cut circles around some of them. (Continued on Page 28)



Radio in the Home of Mr. Frank Paxton, Pres. of Paxton Lumber Co., Kansas City, Mo. The set is a Garod "Neutrodyne" installed in a Victrola cabinet. Photo courtesy of Sterling Radio Co., Kansas City, Mo.

Lesson Six

THE RADIO KINDERGARTEN

WE HAVE dwelt at considerable length in these lessons on such subjects as inductance and capacity, resistance and voltage and amperage, and it may be that some of the pupils of the Radio Kindergarten are wondering why I lay so much stress upon these things.

The answer is very simple; fundamentally it is the combination of just these things which make radio as we know it. The radio engineer can take just these phases of a circuit and can design the kind of apparatus that is necessary to do whatever it is that he desires it to do.

We have already defined these electrical terms in picture form. That is, I have already told the pupils to picture inductance as coils of some kind and capacity as condensers of some kind. I have told you that the voltage of a current is the energy or punch behind it and that the amperage is the amount or quantity or the intensity of the current that is being pushed along by this voltage. I have also explained that resistance is anything in the circuit which opposes the flow of the electricity.

Now in this lesson I simply want to tell you in a general way how radio engineers use these various things in such a way that they can figure out on paper almost all of the apparatus required for their radio set.

In order to do this, there are, of course, a great many mathematical formulae which are totally beyond the abilities of you and me, but we can easily understand the simpler ones, and in this lesson I am going to take up only those in order that you may see the methods of the radio engineer rather than delve too deeply into the intricacies which he faces every day.

Right here let me say that every radio student, whether he be in the kindergarten class or not, should have in his library some good book on radio giving the various definitions and formulae and the tables from which certain facts may be easily derived. Such books as this are rather forbidding looking to the novice because of the mathematics in them, and they are certainly not designed for steady reading by any novice, but then neither is the dictionary nor the encyclopedia designed for this purpose. Yet every good library has a good dictionary and a good encyclopedia for general reference in order to settle disputed points or to clear up some uncertainties in the mind of the owner.

Just so the radio student should have such a book, not necessarily for steady reading, but for handy reference in order to clear up the various points that are bound to come up from time to time in conversation or in the ordinary reading of radio magazines and newspapers.

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 members of this class 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 overcoat 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 into its pages and find information there which is of value to me at all times.

Let us take, then, that handbook to illustrate the point that I have been making now. Back on page 500 of my copy there is a chapter which is headed "Wave Lengths, Frequency and Oscillation Constant." This is followed on page 502 by a number of pages of very forbidding looking tables, and yet these tables become as clear as day to those who take the trouble to understand how to use them.

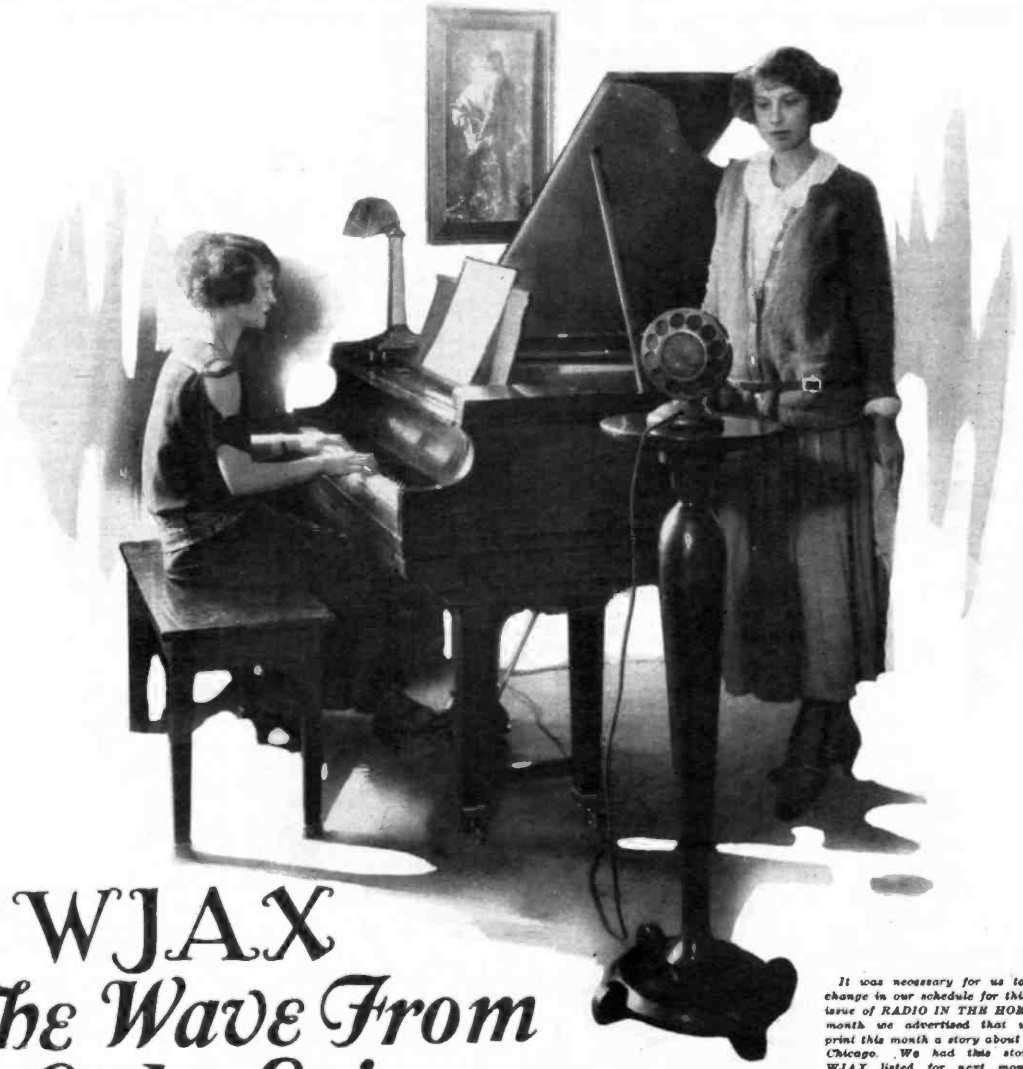
We have already discussed wave length. We have also discussed what is called frequency—that is, the number of waves per second which will pass any given point by signals of a certain wave length.

It is, therefore, very easy so far as these two factors are concerned to understand this sentence from the handbook—"The relation between the wave length in meters, the frequency in cycles per second and the oscillation constant (LC) of circuit is given in the accompanying table."

We know already what is meant by frequency and wave length. Now let us see what is meant by "oscillation constant" and then let us examine that perculiar expression which is given (LC). The next sentence in the handbook says, "The oscillation constant (LC) represents the product of inductance in microhenrys and capacity in microfarads for a circuit of a given wave length or frequency."

Now we know that inductance means coils and capacity means condensers. We have learned that the unit of measurement which is used for inductance or coils is the henry, but that a henry is so big as to be useless in the computation of radio apparatus, and so we take the one-millionth part of a henry, which is called microhenry.

Condensers are measured in a unit called the farad, but the (Continued on Page 29)



WJAX
The Wave From Lake Erie

It was necessary for us to make a change in our schedule for this month's issue of RADIO IN THE HOME. Last month we advertised that we would print this month a story about WJAX of Chicago. We had this story about WJAX listed for next month. The photographs to accompany the story of the Chicago station were lost in transit and we had to make the shift, substituting this month this story about the Cleveland station.

H. M. N.

WJAX, the broadcasting station of The Union Trust Company, Cleveland, Ohio, is unique among radio stations of the country in that its primary purpose is a business or commercial one rather than the mere furnishing of entertainment.

The main purpose of the operation of WJAX is the furnishing of a financial service to bankers, farmers, wholesalers, retailers and other business men within a radius of about 500 miles of Cleveland.

In rural sections particularly, the farmers, bankers and business men have had little opportunity to obtain the very latest quotations upon the commodities which they buy and sell. They have been dependent, to a large extent, upon newspapers published daily or weekly, and at the time the papers were received the quotations in them were already "stale."

Nowadays, any one who is interested can pick up daily quotations upon an enormous range of products, commodities or securities by simply listening-in on WJAX.

Quotations are broadcast four times daily. The standard schedule, in detail, is given below:

9:00 A. M.—Bond Gossip
9:15 A. M.—Stand By
9:17 A. M.—Financial News and Grain Markets (yesterday's close)
9:30 A. M.—Stand By
9:32 A. M.—Bond Gossip
9:45 A. M.—Sign Off

10:00 A. M.—Iron, Steel, Coal, Coke and Petroleum Bulletins
10:05 A. M.—Current News Bulletins
10:15 A. M.—Stand By
10:17 A. M.—Foreign Exchange
10:19 A. M.—Live Stock—Cleveland and Pittsburg Markets (Opening)
10:22 A. M.—Chicago Grain (Opening)
10:23 A. M.—Marketgrams and Agriograms
10:28 A. M.—U. S. Liberty Bonds (Opening)
10:30 A. M.—Stand By
10:32 A. M.—Bond Quotations (Opening N. Y Exchange)
10:37 A. M.—N. Y. Stock Exchange Quotations (by request)
10:41 A. M.—U. S. Liberty Bonds
10:42 A. M.—U. S. Weather Forecast
10:45 A. M.—Sign Off

2:00 P. M.—Stock Quotations (by request)
2:04 P. M.—Chicago Grain Market (1:00 P. M.)
2:05 P. M.—Current News Bulletins
2:10 P. M.—N. Y. Stock Exchange Quotations (by request)

2:15 P. M.—Stand By
2:17 P. M.—Butter, Eggs & Poultry (Cleveland Market)
2:19 P. M.—Foreign Exchange
2:20 P. M.—U. S. Liberty Bonds
2:22 P. M.—Financial News Bulletins
2:30 P. M.—Stand By
2:32 P. M.—U. S. Weather forecast
2:35 P. M.—Bond Quotations (as of 2 P. M.) N. Y. Market
2:45 P. M.—Sign Off
3:00 P. M.—Homegrown Fruits and Vegetables
3:15 P. M.—Stand By
3:17 P. M.—Butter, Eggs & poultry (Cleveland Market)

Top picture is a view of the studio of Station WJAX

Center shows Ambassador Myron T. Herrick and J. R. Nutt, president of the Union Trust Co.

Right—"Tris" Speaker, of the Cleveland Ball Club. Left—Elmer G. Johnson, "The Wave From Lake Erie," WJAX

3:20 P. M.—Live Stock—Cleveland and Pittsburgh Markets (Closing)
3:22 P. M.—Hay and Grain (Cleveland Market)
3:25 P. M.—Toledo and Chicago Grain (Close)
3:27 P. M.—Flour and Feed Market
3:30 P. M.—Stand By
3:32 P. M.—Foreign Exchange at 3:15
3:33 P. M.—Crude Rubber Quotations
3:35 P. M.—N. Y. Bond, Cleveland Stock Exchange and N. Y. Stock Exchange Quotations (Close)
3:40 P. M.—U. S. Weather Forecast
3:43 P. M.—U. S. Liberty Bonds
3:45 P. M.—Sign Off

This program may be of little significance to the man in the city, but it has practically revolutionized the business methods of hundreds of farmers, dealers, stock raisers and the like.

In many small towns today the daily prices of eggs, cattle, wheat and the like are being set by WJAX. Local bankers receive produce quotations and post them in their lobbies, where they are available to all of their customers. Many storekeepers are also doing this as a service to patrons. The people who appreciate this broadcasting most, however, are the farmers who live on the dirt roads away from the towns and they are thereby enabled to know how much to charge for their produce when they take it to market.

This, naturally, explains the bank's purpose in operating a broadcasting station. WJAX has a very direct bearing upon the conduct of business throughout the field served by the Union Trust Company. And anything which can be of aid to business in general is bound to be reflected in banking operations.

In its evening broadcasting, however, WJAX enters an entirely different field—the field of pure entertainment. Two evenings a week—Tuesday and Thursday—the Union Trust

Company broadcasts musical programs, the content of the programs varying all the way from ordinary jazz to the symphony concerts performed by the Cleveland Orchestra.

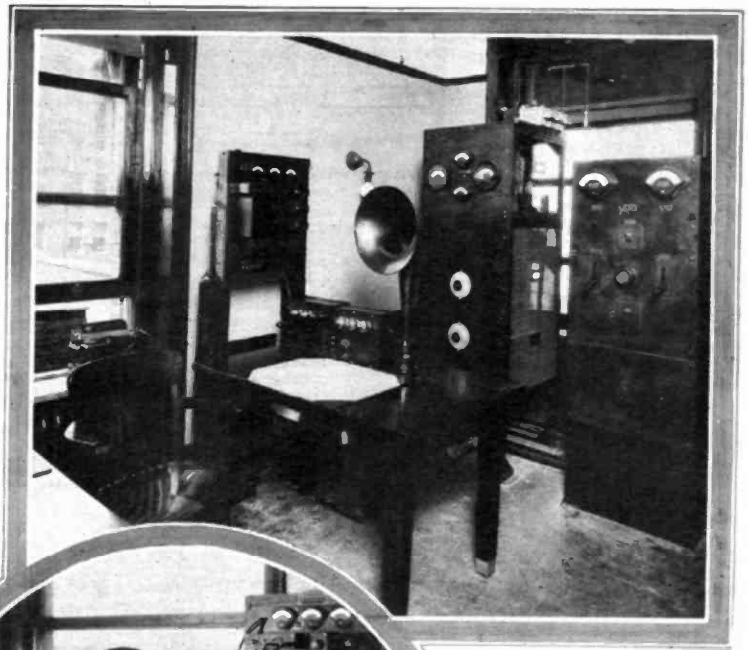
In fact, WJAX has attracted a great deal of attention in the radio world by its use of remote control, whereby it has succeeded in broadcasting programs from many different points in Cleveland. Besides symphony orchestra concerts, which were given at Masonic Hall, there have also been broadcast the organ of the Cleveland Public Hall, where the coming G. O. P. convention is to be held, the orchestras of the Hotel Cleveland and Hotel Winton and the boys' choir of Trinity Cathedral.

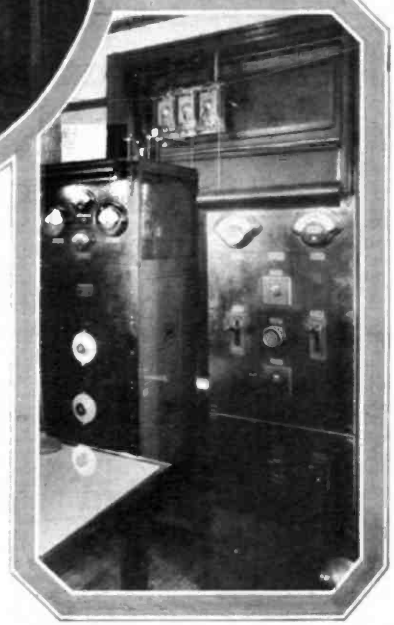
A great many people have been under the impression that when a concert is broadcast from some point away from the studio, it is necessary to install complete broadcasting equipment at the place where the concert is being given. Of course, that is not the case.

No matter from what points WJAX has broadcast concerts, the transmitter, generator and all other standard equipment have been undisturbed and have been operating within the studio. The concert has been carried to the station by telephone wires installed by the local telephone company.

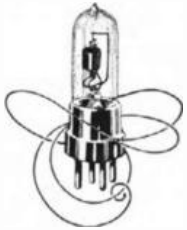
This involves the use of a private line direct from the place of the concert to three pairs of conductors—one pair for regular telephone equipment in order that the operator at the station and the operator at the remote control panel may have physical means of communication. The remaining two pairs of conductors are then given a special test and all line noises and all cross talk is eliminated. Two pairs of conductors are installed so that in case one pair should develop trouble, broadcasting could be continued over the other pair. After the lines have been made ready, special input equipment including an amplifier and microphone are installed at the place where the concert is to be given and connected to one pair of conductors. The lines are then con-

(Continued on Page 28)

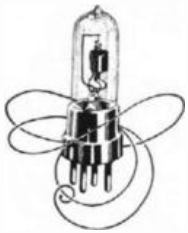




Top—the apparatus room of Station WJAX and in the center is J. M. Thornburn, chief operator. To the left are towers on the Union Trust Building and at the right is a glimpse of some of the apparatus



The Inverse Duplex and Dry Cell Tubes



By DAVID GRIMES

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

IT SEEMS almost impossible to make all of our "picture" diagrams check up correctly, no matter how careful we are with them. We continue to give these picture diagrams for the benefit of novices who are unable to follow the usual schematic or symbol hookups, but we say for the benefit of all who can follow these symbol hookups that they are always the safest to use in hooking up a set because it is from these our picture diagrams are made up and that is where the mistakes sometimes creep in.

In our article on the Grimes two-control circuit as we built it at Station 3XP with two Fada neutroformers—the article that was printed in the January issue—the schematic diagram given on page 7 was correct, but there were two unfortunate errors in the picture diagram given on page 9.

If you will turn to that picture diagram on page 9 and make the correction now, it will avoid the danger of some one picking up your magazine at any time in the future and trying to hook up a set from that diagram.

Just under and to the right of the first neutroformer you will see a fixed condenser under which are the figures .0025. The right-hand connection of that condenser is shown going out directly to the right and connecting to the nearest wire on that side. This is wrong. You should mark out that connection entirely. The right-hand side of that fixed condenser should have a wire running directly down to connect to the wire which goes on down to the F binding post on the audio frequency transformer in the lower left-hand corner of the picture.

The wire going from the ground binding post over to the plus A binding post is also wrong. That wire should be marked out.

In the place of that wire, run a wire from the ground binding post up and to the right to connect to the bend of the wire which connects to the minus filament binding post on the first tube socket.

We are republishing this diagram correctly on page (32) of this issue and the set will function as shown there.

H. M. N.

AS A natural result of the two articles published on my inverse duplex system in the January and December issues of *Radio in the Home*, there have been many questions pouring in regarding certain troubles which have been experienced. These questions in the main fall into definite groups on parts of the articles perhaps not entirely clear. It is rather difficult to obtain the other person's viewpoint when one is writing about a subject more or less familiar to oneself: Many things which appear self explanatory to the writer are the most vague to the reader. So it is by means of the questions written in that I am able to tell just where I have failed to do justice to the subject.

Of course, the letters have been so numerous that I have not been able to answer them all, but I hope to do this in time. One of the objects of this article, then, is to answer many of these letters in such a way as to put the readers straight, while they are meanwhile patiently awaiting a direct reply from me. By such an article I am able to answer the greatest number of questions for the greatest number of readers in the shortest possible time—the fairest proposition for all concerned.

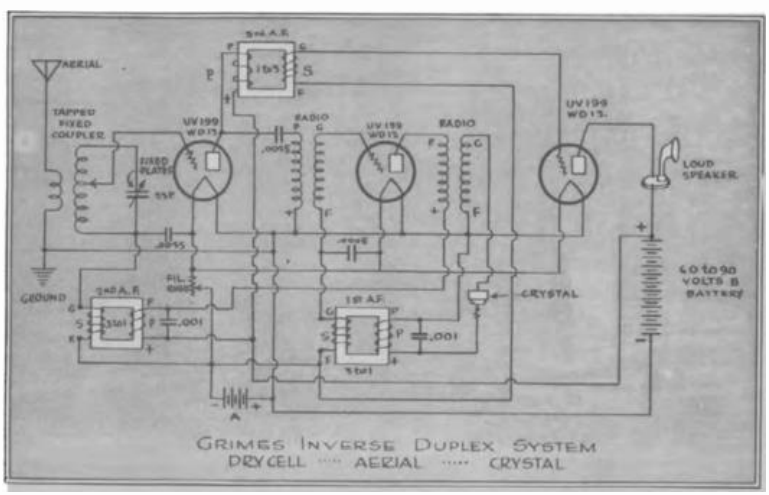
Now I realize that most proud possessors of a 'roll your own" set have told every neighbor within reach about their wonderful hookup. I know—I do myself. And these individuals wouldn't have it known for the world that there was even a thing to question in it. Yes, I've been there myself. You know, I think we can talk these mutually confidential things over just between ourselves this way! Well, I am not going to give you away; so every question will be answered without reference to who asked it, and you can go on blowing just as hard as ever for all of me!

The first general question which arose from many sources on the December article was the possibility of dry cell operation. It's the same old story of trying to get something for nothing. I appreciate, however, that many experimenters live in localities where it is impossible to recharge storage batteries. It is for the benefit of this class that this question is taken up in detail. Otherwise, the answer would merely be "Yes, we have no results."

The employment of dry cell tubes in multitube circuits results absolutely in a decrease in reception. In one-tube sets, they work out very well and save the cost of a storage battery that often amounts to more than the cost of the set. In the more powerful sets employing two or more tubes, they haven't the energy to produce the goods. If the dry cell tubes were "just as good" as the larger tubes, why aren't they used in power amplifying systems and why don't the broadcasting stations install them for transmission instead of the large expensive tubes measuring about a foot high and almost half as much in diameter? The answer is obvious. The energy which a tube is capable of delivering is roughly proportional to its size.

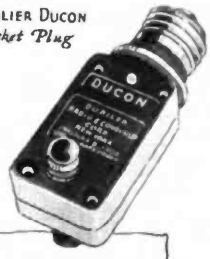
With that question clear in our minds we can now proceed to an intelligent discussion of the subject. Dry cell tubes in the more powerful circuits will give some results. Two of them will give more than one tube and three more than two, etc. And after all, some results are better than no results and no results it would be if an experimenter couldn't recharge his storage battery. So dry cell tubes will deliver a radio entertainment where otherwise it would not be possible to enjoy one. Certain precautions must be taken and too much must not be expected from them. It is useless for the ordinary fan to expect good loop reception on loud speaker over considerable distances on dry cell tubes. A few such sets have been successfully built by using five or more tubes, which immediately makes the whole thing expensive because of frequent battery renewals. Any set using more than four

(Continued on Page 36)



So practical—so convenient

DUBILIER DUCON
Socket Plug



The Dubilier Ducon is the standard socket-plug.

It takes the place of the cumbrous, unsightly antenna.

Simply screw the Ducon in any lamp-socket and connect it with the radio set. Not only are the broadcasting stations heard clearly, but tuning is sharper.

DUBILIER MICADON
The Standard Fixed Condenser

DUBILIER VARIADON
Variable Mica Condenser

DUBILIER DURATRAN
Radio Frequency Transformer

Dubilier Condenser and Radio Corp.
46-48 West Fourth Street **New York**

DUBILIER *Devices*

Goodreau Answers Questions About His Famous Circuit

By W. FRANCIS GOODREAU

SINCE the publication in the January issue of the article, "An Ideal Circuit for the Ducon Plug," I have been swamped with letters from interested radio fans from all over the country. This has pleased me very much, and I am glad to know that this little circuit has appealed to you so strongly.

Many of you have received personal replies to the questions asked in your letters; the rest I could not answer because I could not spare the time to do so. However, your editor said I might answer all your questions in this article, and so I hope you will pardon me for not writing each of you a personal letter.

The most important question, judging from the letters received, seems to be, "Can this set be used with more tubes?" Yes, this set can be used with one or more tubes, provided that these additional tubes are used for audio and not radio amplification. I have had little success in combining radio frequency amplification with this circuit, and so would not advise its use. No special audio unit is needed with this circuit, any standard unit will do, and for best results you should make sure that there is a phone condenser across the primary of the first transformer. This should be a Dubilier Micadon and the capacity should be .001 or .002 mf. Used with one or two additional tubes, the Goodreau Circuit will give very good volume on a loud speaker. The Goodreau Circuit using one tube will not give good results on a loud speaker unless one or two audio units are added.

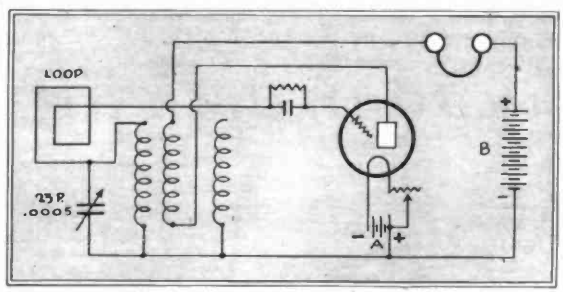
Any standard tube may be used in this circuit. As stated in the article in the January issue, the UV 200 tube is the best to use as a detector. UV 201 A, UV 199, WD 12, WD 11, etc., are also satisfactory, though they do not equal the UV 200. The plate and filament voltages of the tubes are as follows:

TYPE	FILAMENT	PLATE
UV 200	6 volts	Not over 22½ volts
UV 201 A	Not over 6 V.	45 volts
UV 199	Not over 3 V.	45 volts
WD 11—WD 12	Not over 1½ V.	45 volts

I find that this set works best with low plate voltage.

It is impossible to state what the distance range of any set will be, as that depends on many different things. Location of antenna, skill of operator, etc., all affect the range of the set. The Goodreau Circuit on one tube, using antenna or ground alone, will equal any standard set using antenna and ground, provided that this standard set uses the same type of tube, the same antenna, in the same location. It will operate well on antenna or ground alone. I prefer whenever possible to use an antenna or Ducon plug.

Many, in fact most all of you, have asked that I describe my personal receiving set, so I will do so. At present I am using three tubes in my set, a UV 200 as a detector and two UV 201 A tubes as audio amplifiers. The circuit is the one described in the article published in the January issue of this magazine. I am using a Kellogg variometer, vernier condenser, Pacent 30 ohm rheostats, Bestone sockets, all-American audio transformers. A Dubilier micadon phone condenser capacity .002 mf. is across the primary of the first transformer. The ratio of the audio transformers is 5 to 1. The panel I am using is Radion Mahoganite and the size is 7x18x3-16. The binding posts I use are Eby. The



Goodreau circuit as used for loop reception. For best results a two-stage audio amplifier should be added. This should be connected in place of phones. Loop and antenna may be used together for more selective tuning.

dials are the well-known Sommerville 4 in. silver finished dials. I am using 16½ volts on my detector tube and 90 volts on the two amplifiers. I am also using a "C" battery on the grids of both amplifying tubes. This saves the B battery and gives loud, clear signals without distortion. My loud speaker is the well-known Magnavox type R2.

I am using a Ducon plug as my antenna. With an outdoor antenna, it can be of any length up to one hundred feet. I prefer one about seventy-five feet long and about thirty or more feet high.

Many of you have written about there being a difference in the wiring diagram and the wiring in the pictures given. Always follow the wiring diagram when making a new set. The pictures are given for the purpose of showing you how to place the parts for best results, and the wiring should be disregarded. It is almost impossible to trace a complete circuit by following a picture.

Any standard variometer can be made into a split variometer provided you understand how variometers are made and can separate the windings without causing the wire to become loose on the stator or rotor of the va-

(Continued on Page 38)

About the "Riley" Circuit

(Continued From Page 19)

I'll admit that one has to learn how to operate it before maximum results can be obtained. I spent hours and hours balancing coils of different sizes with condensers and vice versa until I came to the following conclusions:

In a vacuum-tube circuit in order to get maximum results the inductances and capacities must be in proportion; i. e., you can't take a large inductance and balance it with a small capacity. Therefore, in designing my inductance, using 23-plate condensers, I found that a 3½-inch tube wound with No. 22 wire will begin to make my circuit act slouchy when less than thirty-five turns are used or more than forty-five. So I am now using forty turns, which covers all waves from 200 meters to 550 meters and thus am able to use a 23-plate over its entire range of capacity. This is one of the secrets of making a set tune sharply. The use of honeycomb coils of twenty-five and fifty turns in the circuit I have proven to be less efficient than a straight winding, so you may make mention of that.

In my little diagram which I submit you will find the stationary and movable plates designated by heavy and light lines respectively. If the set is wired as shown, all body capacity will be done away with. This, as you know, is very important. The use of a potentiometer is optional. I have found that the negative B lead, when connected to the plus A battery, will give very good results.

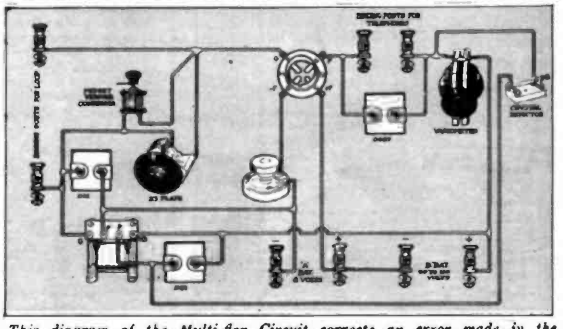
All tuning is done with the coil condenser, the antenna condenser being used as a sort of vernier and at low capacity at all times, at about twenty degrees of the scale. The phone condenser is set at about half capacity before lighting the tube and this will give one a chance to bring the tube to an oscillating point by turning the dial toward zero and stopping it by turning toward maximum.

When the peak of a transmitting wave is gotten this way the volume is surprising, especially on DX.

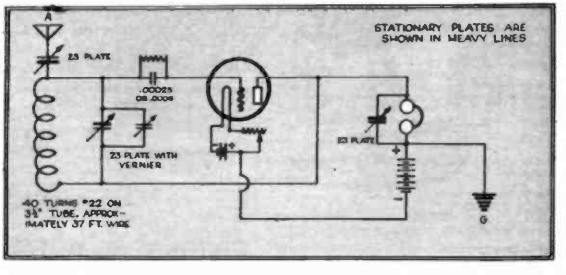
I must emphasize the use of only first-class condensers in this circuit, as a defective one will show up right away. A 23-plate vernier may be used across the coil.

Mr. Neely, you will have to excuse the jumpy way in which this letter is written, but my time is limited and you wanted this letter before next Monday, and so hope it will be clear enough for you to write something about. I shall appreciate your kindness in giving me the credit for having devised the circuit, which seems to be very popular from the number of letters I received.

Respectfully yours,
GORDON KRESSEL.



This diagram of the Multi-flex Circuit corrects an error made in the diagram given in the December number. The hook-up as shown here is right.



This circuit, showing the hook-up tuning with condensers, is the one originated by Mr. Kressel and described in his letter to us.

WJAX—The Wave From Lake Erie

(Continued From Page 23)

nected to the speech amplifier equipment at the stations and tests are conducted both for audibility and quality. The volume is adjusted to a certain level in order to insure perfect handling. If the "gain" is set too low, the broadcast wires will pick up cross talk from adjacent wires in the same cable and inversely if the gain is too high, telephone subscribers will be greatly annoyed in their conversations from signals collected from the broadcast pair.

A volume indicator is installed on the remote control panel and after the correct values have been ascertained through tests, the reading of the indicator is noted and from then on the volume is kept as nearly constant as is possible during the entire concert.

The matter of controlling whatever is being broadcast is practically the same in the transmitting room whether it is remote control or local studio broadcasting. After the signals have passed through the input equipment in the station, the gain can be regulated to the desired level and the volume regulated by watching the modulator plate current on the transmitter. From operating practices, a certain deflection of the needle gives the best results and the operator tries at all times to keep this reading constant.

Although WJAX uses only 500 watts in the antenna, it has been heard in such remote places as Washington, California, Hawaii, Texas, Cuba, Costa Rica, Florida and Maine.

Most radio fans know WJAX as the "Wave From Lake Erie." And the station signal sounds like a real wave, too. Elmer G. Johnson, the announcer (otherwise known as "The Sheik," on account of the many hundreds of letters in feminine handwriting which he receives), is responsible for the invention of the device that gives the imitation of the Wave From Lake Erie. He won't tell how it is done, but it certainly sounds realistic. In fact, several letters have come in from radio fans who thought that the broadcasting was done from the lake shore.

"Jim" Thorburn, the operator of WJAX, simply cannot talk for more than two minutes without getting onto the subject of modulation. It's his hobby.

"The big idea in broadcasting, as I see it," says Thorburn, "is not so much to see how many miles you can reach as it is to see how well and how naturally you can reproduce the concert you are broadcasting."

That is what Thorburn has tried to do and the many thousands of letters received by WJAX testify to his success.

WJAX will shortly move into the new building just being completed by the Union Trust Company, where the station will have a much larger studio and facilities for still better concerts. The new towers have already been erected upon the roof of this largest of Cleveland's skyscrapers.

Radio Kindergarten

(Continued From Page 26)

farad, like the henry, is far too big for ordinary use and so we also take the one-millionth part of that and that is called a microfarad. From this you can see that the prefix "micro" means "one-millionth."

The product of inductance and capacity then simply means the value of the coil multiplied by the value of the condenser. This then leads us to believe that the letters L and C mean inductance and capacity, and that is exactly what they do mean. The letter L in radio or electrical formulae always refers to inductance, and the letter C always refers to capacity.

The whole thing then means that we can figure out the wave length or frequency of any combination of coil and condenser by knowing the inductance and the capacity. This also necessarily means mathematically; that if we know the wave length and the capacity we can figure out the inductance, or in other words if we know any two of these factors we can figure out the third.

It is in these tables that I find the I. C. S. handbook really more suitable for the radio beginner than the Government book that I have spoken of. The Government book gives inductance in what is called "centimeters," and while the expert can very easily change centimeters into microhenrys, it is very much simpler to have the microhenry and the microfarad to deal with and that eliminates one other mathematical process. So these tables that I am speaking about now, which are given in the handbook, are the simplest to use.

Let us now take one or two examples that are given in this handbook on page 501 and see what we can do with these various factors which we have been speaking about.

Example No. 1 says—"What is the frequency of an alternating current whose measured wave length is 1200 meters?"

And then the explanation says, "Opposite the value 1200 meters in the table is the value 250,000, which means that the frequency of the current is 250,000 cycles per second."

In these days of many radio supplements to newspapers and many radio magazines, it is quite common to see stations listed according to the frequency and this is always given as so many "kilocycles." This term sounds forbidding, but as a matter of fact is very simple, because the prefix "kilo" simply means "one thousand." So the frequency of 250,000 cycles per second would be spoken of as a frequency of 250 kilocycles, or 250 KC.

Now let us go into the "oscillation constant," or the LC of a circuit. Here is an example given in the handbook: "What is the natural wave length of a circuit composed of an inductance of 135 microhenrys in series with a condenser of .0003 microfarads capacity?"

The solution is very easy to understand. It is this: "The product of the inductance and capacity values is 135 times .0003 which equals .405, which can be called the oscillation constant (LC). Opposite this value of LC in the tables will be found the value 1200 meters which represents the free wave length of an oscillatory current in this circuit."

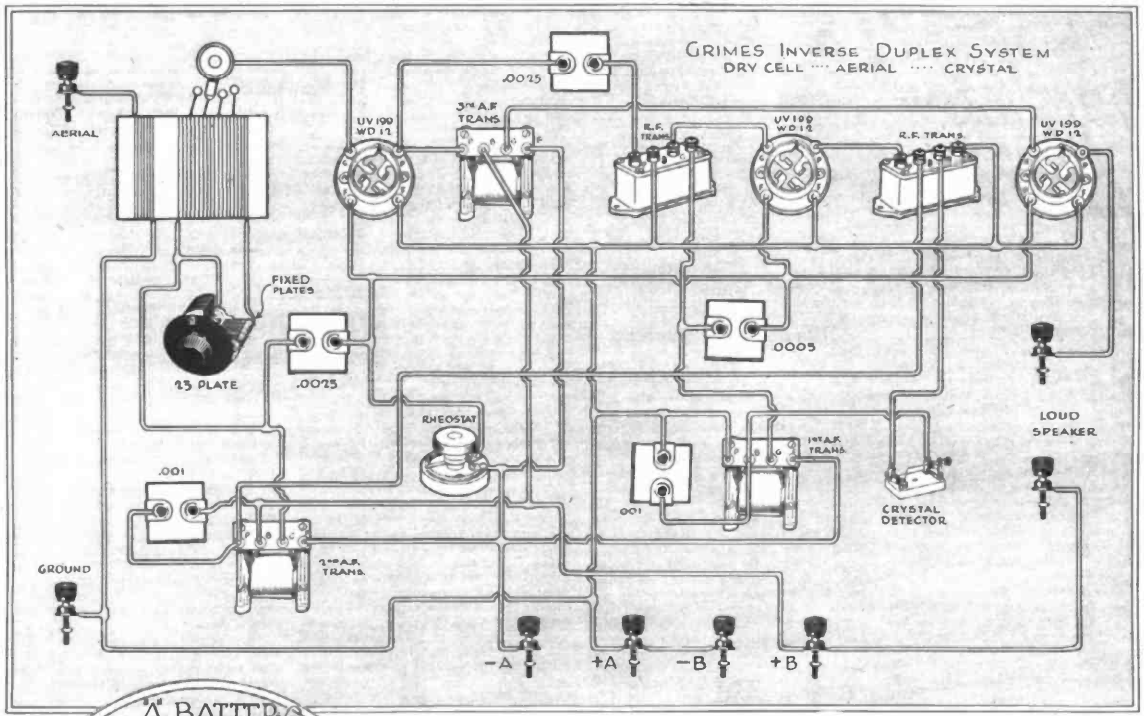
In other words, if we have a coil which is marked 135 microhenrys, and we have a condenser which we know is .0003 microfarads, we know that the two in series will respond to signals of 1200 meters. If we happen to know that we are receiving signals of 1200 meters and know that our condenser is .0003 mfd. we can figure out the inductance by looking at the tables and that would give the value of 135 microhenrys, which would be the value of the coil that we are using to receive those signals. This is stated in another example given in the handbook:

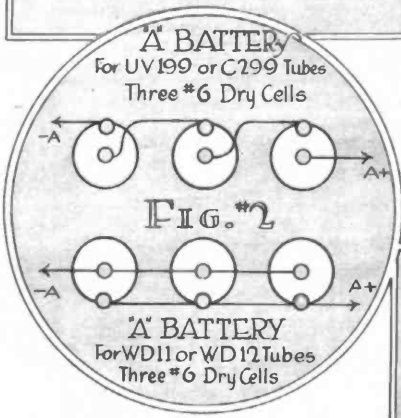
"What value of capacity must be connected in series with an inductance of 25 microhenrys in order to tune the circuit to 200 meters?"

The solution is this: "Find opposite 200 meters in the tables, the LC value .01126 which is the oscillation constant. Divide this value of LC by 25 and the quotient .00045 is the required capacity in microfarads."

Do you see how it is then that the radio engineer uses these values and these formulae?

This principle goes all through the study of radio and a book of this kind will reveal to you far more secrets of the radio engineer's art than I can possibly take up in these short lessons.



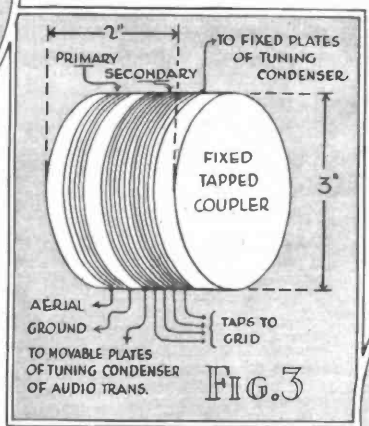


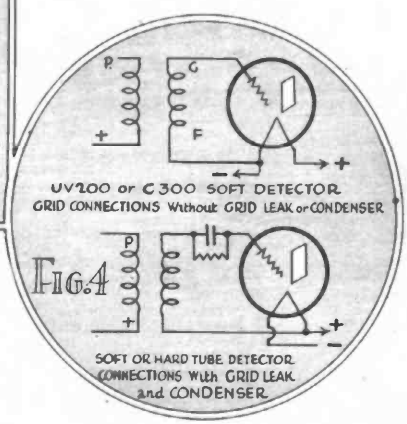
tubes of any type is merely flirting with death as far as the B batteries are concerned. If it happens to be a dry cell set, then the A batteries are also being sorely pressed.

For the benefit, then, of the enforced dry cell users, I am giving the details of a three-tube, crystal detector, aerial operated set. The energy brought in by an aerial is many more times that picked up by a loop and this will help compensate for the loss of amplifications in the tubes. Experimenters so located that electricity is not available are usually in the outlying districts where an aerial installation is not objectionable. Aerial reception therefore fits in well with dry cell installations. Of course, aerial operation is a little more subject to atmospheric noise and telegraphic disturbance, but the set shown in Figure 1 is no more so than the ordinary aerial set. Figure 1 shows the detail wiring diagram of the set in question. Three dry cell tubes are employed such as the UV199 or the WD12. The A battery is the only variation in the circuit to adjust to either one or the other of the above types of tubes. Three of the same kind of tubes should be used, though, if considerable difficulty is to be avoided. A suitable rheostat should be used in order properly to control the tubes in question. All three of the tubes are controlled by the same rheostat, which simplifies the problem.

If 199 type tubes are desired, it will necessitate three No. 6 dry cells connected in series for the A battery. The proper rheostat can then be readily figured by means of Ohm's law. The 199 operates on .06 amperes in the filament. Three tubes would draw .18 amperes. The three dry cells give 4.2 volts, while the tube requires but 3.1 volts. This means the rheostat must offer 1.1 volts drop. From Ohm's law "current equals electrical pressure divided by the resistance," the necessary resistance works out to be 6.1 ohms. This means a ten-ohm rheostat in order to provide a safety margin.

If WD12 or WD11 tubes are to be used, three dry cells will be also used as the A battery, but will be connected in parallel, not in series, as for the 199 type. This difference in hookup is shown in Figure 2. The WD11 and WD12 are alike in their electrical characteristics, only differing in their method of socket mounting. They





require ¼ ampere in the filament at 1.1 volts. The dry cells connected in parallel generate 1.4 volts and therefore the rheostat must dispense with 0.3 volt. Since all three tubes operate through the same rheostat, there will be flowing through it ¾ ampere. By Ohm's law, in this case a rheostat of much less resistance than 10 ohms would be desirable. A commercial 4-ohm one would be quite all right.

The tube question now settled, the next problem to be undertaken is the crystal. This may be of the fixed variety or of the adjustable type. In general, the fixed crystals are not as efficient as the adjustable type. However, this is not always true, as there are adjustable crystals and adjustable crystals! Some are absolutely hopeless while others are excellent. The redeeming feature is that they are relatively inexpensive, and one may try several for best results without going into the hands of the receiver. In any case, always keep an adjustable crystal clean by protecting it from dirt and dust. It will pay to give it an alcohol bath once in a while.

It will be ascertained by counting up the audio transformers that there are three stages of this kind of amplification used. These transformers should preferably be of a low ratio, such as three to one. Different makes of audio transformers work with varying degrees of efficiency in the inverse duplex.

I have yet to find a three-to-one ratio that was an absolute failure. Several of the four-to- one types have given trouble, while many of the five-to-one types have caused no end of difficulty. There is a tendency entirely apart from the duplexing for three stages of audio frequency amplification to howl if high-ratio transformers are used. This howling is particularly noticeable when an adjustable crystal is employed, because, in making adjustments, the cat's whisker is often removed from the crystal, opening the primary circuit of the first audio transformer. It is this opening of the primary of the first audio which sets up the audio howling. Low-ratio audio transformers reduce this tendency to howl when the crystal is removed. Often no howl will occur at all.

This circuit in Figure 1 will be rather broadly tuned on local reception, but those experimenters who will primarily be interested in dry cell operation will be located in the outlying districts where extreme selectivity is not so necessary. The adaptation of the Grimes inverse duplex system shown in the January issue gives a highly selective aerial set for the person located near a large broadcasting station. Future articles will describe this crystal set using tuned radio frequency amplification if there is sufficient demand for it.

The tapped fixed coupler is about the only other piece of equipment which may cause confusion. This can be very easily made in a few minutes with some No. 28 single cotton-covered copper wire and a 2-inch length of 3-inch diameter tubing. The primary consists of eight turns of the wire at one end of the tubing. The secondary consists of about forty-three turns with a tap about every eight turns for controlling the volume. This is shown in Figure 3. It is thought that the rest of this circuit is more or less self-explanatory.

Another point which has raised quite a question among the readers is that concerning the best detector tube. I have run many tests under all kinds of conditions of most all types of tubes and have found none which equaled the UV-200 or C-300 for extreme sensitiveness. When the signals are coming through strongly, then some of the hard tubes using a

grid leak and grid condenser produce apparently as good results. But on loop reception the signals are never very strong except on local reception. The loop intercepts so little energy compared with an aerial that nearly all reception is in the "distance" class. This, then, requires the best possible detector tube, and for that reason the UV-200 has been recommended. The C-300 is also very good, being a soft tube.

If a hard or amplifying tube is desired for a detector tube, one must not expect as good results on the loop. The range of reception will immediately drop. Furthermore, one cannot merely swap a hard tube in the circuit in place of the soft one. It requires a change in the circuit before much of anything will be obtained. This one thing has caused more confusion than anything else. Many have inserted a UV-201A tube or other hard tube in the detector socket of the circuit shown in the December issue and then have wondered why they have not obtained the desired results.

When a soft tube is used as a detector it is not necessary to employ a grid condenser and grid leak in order for it to operate properly. In this case the filament side of the transformer in the grid circuit of the detector tube will connect to the negative filament. This places the potential of the negative filament on the grid. This is the best condition for the soft tube when operating as a detector without a grid condenser and grid leak.

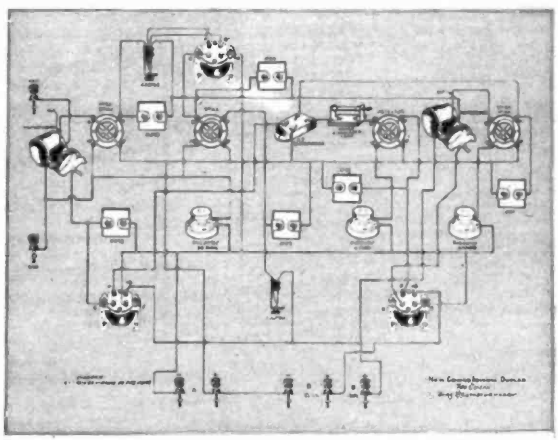
When the hard or amplifying tube is used for detection it is absolutely necessary to install the grid condenser and leak as shown in Figure 4. In this case the grid return to filament will go to the positive side of the filament. The grid will then have on it the potential of the positive side of the filament. This is an important point to remember no matter what circuit or hook-up you are trying. The soft tube will function whether there is or is not a grid condenser or leak, but the grid return to filament must be changed accordingly.

It is too early as yet to say just what the greatest stumbling blocks will be in the January article on using tuned radio with the inverse duplex. The letters are still piling in. Some of them indicate that instability or oscillation is being experienced at the lower wave lengths. This is caused by variations in the various commercial types of fixed radio transformers. The circuit will have to be changed a little to suit the particular transformer you have installed. Oscillation is caused by the tap to the grid of the second radio tube being too high up on the tuned coil. It should be dropped a few turns or until this trouble disappears. This difficulty is easily detected, because an oscillation takes place when the second condenser is nearly all the way out, irrespective of the setting of the first condenser.

When an instability or oscillation occurs with both condensers tuned alike, then the cause may be one of several things. The two tuned radio transformers should be mounted at right angles to each other, unless they can be mounted quite far apart —at least a foot or more. The safe and sure way is to place them at right angles to each other. Then another cure is to reverse the primary terminal connections to the second tuned radio transformer. Finally, after doing these things, try dropping down on the taps on the first tuned radio transformer — the input coil to the first radio tube. This is usually called the fixed coupler, but in reality is a tuned radio transformer.

Lastly you may experience difficulty on local reception due to overloading the tubes. This causes poor quality, and sometimes howling, as the two tuning condensers are brought to similar settings. The remedy for this is to leave one of them slightly out of tune as a volume control, or you may run down your taps on the secondary of the first tuned radio, thus controlling the input radio energy to the grid of the first tube. This will permit setting both condensers at the same dial reading without overloading.

Another way to prevent this overloading on local reception is to boost the plate voltage on the amplifiers up to 150 to 175 and place a negative "C" battery in the grid returns to filaments. This scheme will be taken up in a later article.



This diagram gives the Grimes Circuit correctly and rectifies the error made in our January issue.

Radio Is Introduced to Western Farmers

By H. E. MURDOCK

BOZEMAN, Montana, Feb. 20.

THE radio bug has been buzzing around in this part of the country for some time. It got busy and has bitten a good many who have become fans. There are various notions about radio and radio equipment as to what can be done and what cannot be done under the present stage of development, and it was decided to show what can actually be accomplished in radio receiving under our conditions and to show equipment that is satisfactory for us.

Here at the University of Montana we have annual events during the winter at which many hundreds of the best and most prominent citizens of the State gather for conferences and instruction. This year during the first week in January the Extension Workers and County Agricultural Agents held their convention. The second week was Farmers' Week, and during the third week the boys' Vocational Congress was held.

All people attending these conventions are more or less interested in radio, and I thought it would be a good opportunity to demonstrate to them what we, in this State, can expect of radio. Accordingly it was decided to hold demonstrations for these gatherings. They were designed particularly to exemplify the farmers' side and were labeled "The Use of Radio on the Farm."

The Extension Workers and County Agents are interested in radio because they are leaders in agricultural practices, and must know about those things that go to make farm life more profitable and enjoyable and which tend to lighten the farmers' burdens. Their interest in radio is forging ahead by leaps and bounds and they naturally look to their advisers for information on it. Also the County Agents themselves are interested from a personal standpoint.

To the isolated or snowbound farmer radio will bring news, lectures, concerts, sermons, and so forth and in that way he will keep in touch with the world. In Montana, the State of great distances, with its winter snows and occasional drifting winds, traffic is sometimes difficult. With a supply of fuel for his fires and food for his family and stock and with a radio set, the farmer need no longer be cut off from the rest of the world, even though the roads are drifted shut and the wind is howling over the plains.

Those who visited these demonstrations found out that the air is full of those things that tend to bring information and contentment to the family listening-in on the radio. The annual conventions of practically all the stockmen and farmers' organizations were held during Farmers' Week and our crowd for this week was drawn from their delegates as well as other farmers and their wives.

For these demonstrations the Agricultural Engineering Department put an aerial on the building and installed the necessary permanent equipment for use in receiving broadcast programs. Receivers, loud speakers, amplifiers, batteries, etc., were lent to the department by equipment companies and individuals interested in the work. Many radio equipment and parts companies sent samples of their products for display or use in building up sets, others sending complete receiving sets, etc. We also had a large quantity of literature for distribution. In addition to this, some companies sent their representatives here for the demonstrations. In this way we had on display the latest developments in the receiving end of radio.

The radio program covered two classes of work. Some lectures of a nontechnical nature were given on the use of radio on the farm, questions most commonly asked by prospective buyers and the assembling of a set. In this lecture the function of each part of the set was explained.

One evening we had the president of the college broadcast a lecture from radio KFDO which we picked up as part of the program. Later on the same evening, after having another lecture on aerials and the built-up set, we tuned in on Radio KGO, at Oakland, California, for their initial program. The reception for the entire evening was excellent and everybody left with a feeling of satisfaction and that they had been treated to a first-class concert. Besides the formal concerts which took up practically the entire evening when given, other evenings were devoted to demonstrating any equipment specially called for by any one in attendance.

It is believed that our efforts were very successful in accomplishing the objects aimed at, and that the visitors know more about the possibilities of radio receiving than they did before.

EVERY MAN HIS OWN VARIABLE CONDENSER

MINNEAPOLIS, Feb. 20.

RADIO fans here, although busily engaged in adding additional stages of radio frequency and audio amplification to their receiving sets as a result of the drop of nearly $2 in the retail price of tubes, have found time to chuckle heartily over the experiences, as published in a Minneapolis newspaper, of Paul Carroll, an electrician living at Excelsior, twelve miles west of the twin cities.

Carroll, according to the story, built a one-tube set, expecting to use his bedspring for an aerial and a radiator pipe in his room for a ground. It wouldn't work. Dejectedly he sat on the edge of the bed, headphones over his ears. He heard music. Jubilant, he jumped to his feet. The music stopped.

Now Carroll has evolved a system, somewhat strange, but the real thing, he insists.

When he wants WGY he sits on the bed, with both feet off the floor.

When he puts one foot on the floor he gets WOC; two feet on the floor he gets KDKA; lying on the bed, WJZ.

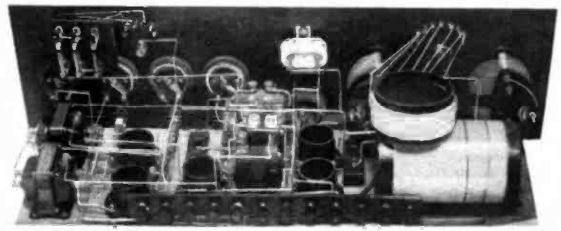
To be technical about it, the human body is substituted for the condenser, Carroll says.

Simple, isn't it?

Push-Pull Amplifiers

(Continued From Page 14)

number of binding posts on the back. The Modern shows four binding posts and the All-American shows five. This fifth binding post of the All-American is a ground connection, as the makers of that transformer recommend that the shell or the core of the transformer be grounded through the



Push-pull amplification included in a complete set. This is the Cockaday four-circuit tuner, built from plans recently published in "Popular Radio." In his original article, however, Mr. Cockaday used Amsco condensers, dials, sockets, etc., with Amertran audio frequency transformers and Como push-pull transformers

fixed condenser shown in the hook-up.

In case there should be any question as to the rheostat shown, let me explain that on both units the rheostat is an ordinary Pacent rheostat mounted flat. This is done by simply letting loose the set screw, pulling out the shaft and reinserting it in the rheostat through the other side and taking up on the set screw so as to make it firm.

Super-Heterodyne

(Continued From Page 11)

only five meters in wave length. I heard California stations on two occasions, loud enough to understand the announcements on the loud-speaker. As it brings in the coast now, in winter, I am certain it will bring in the Mid-West stations next summer.

All I have mentioned here is loud-speaker reception. I only use the

The spread of radio is becoming so rapid that it is rather difficult these days to keep pace with it. Now we have a serious proposition from the Southern Pacific Railway to install sets in their observation and club cars in California. This comes as the result of an experiment tried recently on the Sunset Limited, which was carrying a party of radio men to the Show in Los Angeles. A correspondent of Radio in the Home *writes about this test as follows: "The whole affair was bona fide and the people in the picture I am sending you are of real importance in radio on the Pacific coast. It was through the co-operation of James J. Morris, Associate Editor of the Bureau of News from the Southern Pacific Railway, that a Sleeper Monotrol was installed in the Pullman car Caymic on the Sunset Ltd. The reception was wonderful, and the people in the car who were on their way to the Radio Show in Los Angeles were actually able to dance to music relayed from Havana, Cuba, over the wires of the American Telephone and Telegraph Company and then broadcast. The test was so successful and aroused such general interest that the Southern Pacific Railway is now contemplating installing the Monotrol in all observation and club cars on its system."*

headset to search for very distant stations. I have tried three types of antenna: outdoor, single wire 100 feet long, with a variometer shunted across aerial and ground binding posts; three turns of bell wire around a doorway seven by nine feet; and a plain loop containing about 80 feet of No. 22 D. S. C. wire on a frame 25 inches square and spaced about 5-16 inch apart. The outdoor antenna makes tuning rather broad, but it also makes it necessary to tune only the oscillator tube condenser, for the loop condenser does not function and the variometer remains fixed. The large loop is very satisfactory because it is not directional, but I use only the small loop and get the best results. The edge of a razor is sharp, but it has nothing on the "super" when using the loop; besides, I am not bothered so much by atmospherics and single-circuit squeals, and it will do everything the outdoor antenna will do.

For the ultimate in radio, by all means build a "super," but don't get the idea, from my description, that it is easy to construct. Contrary, it is hard and requires a lot of skill and patience.

I am at the service of any one who may wish to inquire further.

Editorially Speaking

(Continued From Page 4)

a framed certificate that its owner has paid something toward broadcasting is a "bootlegger" set and its owner ought to be ashamed of himself for stealing a part of the enjoyment paid for by others.

The license tag on an automobile means more than that its owner has paid a tax to the State. It means that he has paid his share of the expense of improving roads and installing safeguards and that any enjoyment he derives from his machine is an enjoyment to which he is fully entitled because he has paid his share of the cost.

I believe that it should be exactly the same way with the radio set.

No amateur can work a transmitting set unless he has framed upon his wall a license from the Government showing that he has done certain things to entitle him to that privilege.

Still keeping away from any idea of compulsory payment for broadcasting, I believe that public education would soon swing the listeners-in around to this same attitude. I believe that every receiving set would have near it a framed certificate showing that its owner had voluntarily paid his share of the expense of broadcasting, and I believe that this education could be carried to such an extent that any man who had a set without this certificate could be made thoroughly ashamed of himself and that his numbers would soon go down into insignificant minority.

So send your contribution to the Fund if you live within hearing distance of WEAF. Contributions of $1 or upward will be received and checks should be made payable to Radio Music Fund and sent to Central Union Trust Company, 80 Broadway, New York.

I have sent mine.

Capital Is Increased

President Dietrich, of C. Brandes, Inc., manufacturer of "Matched Tone" radio headsets and the Brandes "Table-Talker," has announced that the capitalization of the company has been increased from $500,000 to $1,000,000. The capitalization was originally $5000, and on March 3, 1923, less than a year ago, was increased to the half-million mark.

Broadcasting Letters

CLUBWOMEN WILL USE BROADCASTING STATIONS

MINNEAPOLIS, Feb. 20.

MINNESOTA clubwomen, following the lead and profiting by the experience of their sisters in the East, plan a more intensive use of radio for broadcasting club programs and information during 1924. Details are to be perfected at annual meetings of several organizations this spring, and the enthusiastic approval of tentative plans is confidently expected by the officers.

While radio as a dependable ally of club work is no longer an experiment in Minnesota, it is only recently that leaders have taken cognisance of the vast possibilities in an intensive utilization of this latest medium of communication. For some time past the Minnesota League of Women Voters has been keeping in touch with its chapters through a series of Tuesday afternoon talks from WLAG, the Minneapolis and St. Paul radiophone central. Reports to headquarters indicate that these talks have reached members in all sections of the State and have done much to unify the action of the chapters with the State organization.

The league expects to extend and broaden this service beginning with next fall, when the new club year begins. Appeals to women voters to go to the polls in the fall elections and "vote right" will be broadcast, according to present plans.

Another organization almost certain to take up broadcasting on a large scale this year in the interest of its extensive legislative program is the Minnesota Federation of Women's Clubs. Officers of the State federation are convinced that radio can be made to serve their needs more efficiently than any other medium they so far have used. Mrs. J. E. Rounds, of St. Paul, president of the State federation, has been quoted as being very much in favor of the plan.

Mrs. Thomas G. Winter, of Minneapolis, president of the General Federation of Women's Clubs, which has a membership of more than 2,400,000 women in the United States, is among the leaders wide awake to the possibilities of radio as an aid to club work. She warns, however, that there must be no propaganda; that what is broadcast must be confined to club work and deal with club aims, if the greatest good is to be accomplished.

Miss Marguerite Wells, of Minneapolis, president of the Minnesota League of Women Voters, is given credit for pioneering in the use of radio for club work in Minnesota, and sentiment in favor of its use has crystallized in the last few months. Articles in *Radio in the Home*, which enjoys a wide circulation in the twin cities and has been stressing the possibilities in the use of radio by women's clubs and other women's organizations, particularly the January issue, which carried a very comprehensive article on the subject by Sidney Lear, also have done much to arouse interest among the clubwomen of Minneapolis and St. Paul. These articles have been quoted at several meetings in the last month.

Mrs. Marx E. Oberndorfer, of Chicago, chairman of the music division of the General Federation of Women's Clubs, who has charge of broadcasting talks on music from WMAQ, has written a Minneapolis friend, as follows:

"It would be impossible for me to send you any of the thousands of letters we have received. But when I tell you I have women tell me personally of following my talks for weeks and that these statements have come from our clubwomen all over the country, from Maine to California, you can see how it is impossible to estimate how far reaching is the influence of radio. One woman in Mississippi told me she lived in a small town on the Gulf of Mexico and heard all but two of my forty lectures on 'Hearing America First'."

Clubwomen in Minneapolis and St. Paul have six broadcasting stations, two of them, WLAG and WBAH, being class "B" stations, at their convenience when their plans are ready for the big offensive.

Twin City broadcasting of the last month has been featured by the repeat programs of the old favorites—the choir of St. Andrew's African Methodist Episcopal Church, a highly trained group of Negro soloists and singers, and the famous Salem Grotto Band of Minneapolis. Requests for the return engagement of these two organizations nearly swamped directors of WLAG. In addition to the regular programs, portions of the 1924 edition of the Knights of Columbus "Casey Revue," playlets illustrating the proper preparation of foodstuffs and lessons in mah jong were broadcast.

The month saw the addition of two broadcasting stations, KFMT and KFDZ, the former installed by Dr. George Young to represent North Minneapolis, and the latter by H. O. Iverson, a well-known organist, Carleton College at Northfield, Minn., also began broadcasting from its new station, KFMX, giving that enterprising college town two stations. The other is WCAL at St. Olaf College.

Electrical engineering students at the University of Minnesota, which institution recently was named by the United States Bureau of Standards to trace down broadcasting stations violating wave length assigned by the Department of the Interior, have begun their work as "police of the air." Thus far no "arrests" have been made.

Amateur broadcasters are in for a peck of trouble if, in the future, they go above the 200-meter wave length and send outside of the hours assigned. Don C. Wallace, secretary of the Twin City Radio Club, is in the midst of an active campaign of "policing the air" locally, which already has resulted in four amateurs losing their spark stations and several others to close down for a week or ten days and "think things over." Some of the amateurs had become rather bold, going up as high as 450 and 500 meters and seriously interfering with the reception from local and outside broadcasting stations.

SYMPHONY ORCHESTRA FEATURES KSD PROGRAMS

ST. LOUIS, Feb. 20.

THE outstanding features of interest to listeners in the St. Louis territory for the last month or two were four concerts of the St. Louis Symphony Orchestra and addresses by Emile Coue, eminent psychologist, and Anton Lang, Christus of the Oberammergau players. All of these were broadcast by Station KSD.

As this station is the only class "B" broadcasting in St. Louis, it is apparent that the interests of listeners center largely on its programs.

The symphony concerts were "picked up" by a microphone in the Odeon and conveyed over land wire to the transmitting room of the station, some three miles away. Likewise, the regular weekly music programs which form a part of the

entertainment in two leading moving picture theatres and "dinner music" from a hotel, are transmitted to the station by the microphones in the respective auditoriums.

Soloists at two of the symphony programs were Ossip Gabrilowitsch and Rudolph Ganz, world renowned pianists. Gabrilowitsch played the Beethoven Symphony No. 8, in F, and Ganz's solo number was the Schumann Concerto in A minor for pianoforte and orchestra. Michel Gusikoff, the third soloist for the month of January, played the Mendelssohn E minor Violin Concerto with orchestra accompaniment. The fourth concert was an all-Russian program with no soloist.

M. Coue's address was not given in the form of a prepared talk, but rather a series of replies to questions asked by the announcer at the station. He refused to make a formal address because of his "poor English," as he expressed it, and asked that he be questioned instead, as he always is by representatives of the newspapers in the cities he visits.

The questions were read from a slip which he handed the announcer and the interview was not so successful as it might have been if the questions had been spontaneous and his replies the same. Nevertheless, the episode was entertaining to those listening in, as was evidenced by numerous telephone calls at the conclusion of M. Coue's visit.

Anton Lang, who was in St. Louis with fellow villagers to exhibit the wood carving and other art work of the Bavarian Alpine people, gave a short address in which he told the history of the Passion Play, and how for the first time in the 300 years since it was first given, there is now danger of its discontinuance on account of the poverty which the Bavarians are enduring as a result of the war.

Several days after this address, a letter was received at Station KSD which contained checks totaling ten dollars from two little girls in another State who had heard his talk and in this way wanted to do their "bit" to help the Bavarian players who were without resources to continue their work.

One Saturday afternoon each month is devoted to a children's program to foster and encourage youthful talent. January 12th was selected as the date for the first one of 1924. It proved very interesting to all who listened in.

Every Monday evening the music program from the Grand Central Theatre is broadcast, while every Saturday night, orchestral music, played as accompaniment to the moving pictures at the Missouri Theatre, is transmitted.

Tuesday evenings are given over to studio programs provided by local talent, and on Wednesday, from 7 to 9 P. M., orchestral music played at the Statler Hotel is put "on the air," followed by a midnight program from 11 P. M. to 1 A. M. consisting entirely of dance numbers.

RADIO IS THRIVING ON PACIFIC COAST

LOS ANGELES, Feb. 1.

THE Los Angeles Board of Education, at its January 28 meeting, appointed a special committee of principals to consider the matter of equipping all school buildings with radio receiving sets and entering the items in the new financial budget. Within the next fifteen months it is expected the schools, libraries, museums, steamship and railroad offices of Southern California will have good receiving sets installed for the

education and entertainment of hundreds of thousands.

• • •

Hollywood's movie colony has gone radio mad. Eddie Brandatatter, popular impresario and business man, has installed three sets in his city and hillside homes. Mr. Brandstatter controls the Hollywood Montmartre and the Roy Ingraham orchestras, which have been heard in concerts from the Los Angeles Examiner studio. The Art Jell Trio, which played at the United States studios during the filming of Constance Talmadge's "The Goldfish," is one of the newer and popular groups of radio entertainers.

• • •

The William Fox studio recently sent a party of five hundred actors up in the deserts of Nevada, nearly a hundred miles north of Reno, on location. The group includes Madge Bellamy, movie star, and John Ford, the director. Their new receiving set was tuned-in for the first time January 27, when Yvonne Farr, radio soprano, of Los Angeles, was heard to sing "Carry Me Back to Old Virginia." Sleeping in wooden shacks and tents, the Hollywood actors are nevertheless kept in close touch with Southern California through the daily news bulletins.

• • •

More than two years ago radio was used as the only means of entertainment for a party of actors on location at San Clemente Island, about twenty-five miles from the mainland off Santa Barbara.

Since that time more studio folk have installed receiving sets than probably any other one class of people. "Musical Mac," otherwise known as Norman McNeil, the accordionist, plays at the studios daily, but every night he can be found entranced at his neutrodyne set.

Ben Turpin, Buster Keaton, Harold Lloyd and all the other stars and near-stars have also gone radio mad.

• • •

California covers such a geographical area that radio meets with many situations. In the deserts of the State radio has brought cheer and comfort to hundreds of miners, prospectors and health seekers.

In the mountain fastnesses thousands of rangers, hunters and travelers have brightened the long winter nights through radio entertainment. In the houseboats which traverse the length of the State hundreds of families depend on radio for news and entertainment of the outside world.

• • •

The Second National Radio Exposion will have been held in the Biltmore Hotel by the time this is printed. Its dates are February 5-10. The Examiner studio will broadcast evenings and present the artists in person to the throngs of visitors to the exposition. The portable input panel will be installed by the Southern California Telephone Company with connecting lines to the radio central station, KFI. The very latest developments in radioland will be in evidence at the exposition, and a detailed description will appear in the next issue of this magazine.

• • •

KFI, owned and operated by Earle C. Anthony, Inc., Packard distributors for California, has installed remote control stations for the Los Angeles Examiner radio studio, the Los Angeles Herald radio room, and the Ambassador Hotel for Abe Lyman's dance orchestra and Rosenfelt's concert orchestra.

KFI also has a portable input panel, which is moved to the Hollywood Bowl for the musical festivals, to the Los Angeles Coliseum for the football games, and to other locations.

Goodreau Answers Questions About His Famous Circuit

(Continued From Page 26)

riometer. I advise the purchase of the Kellogg variometer if you do not think it safe to try to split the variometer you may have on hand. If you cannot secure the Kellogg variometer I suggest that you write direct to the Kellogg people for one and mention to them the fact that you wish to use it in the Goodreau Circuit as published in *Radio in the Home*. This also applies to any other part you are unable to secure from your local dealer.

Because of the fact that this set uses no radio frequency amplification it will not cover long distances on a loop. Used with a UV 200 tube as a detector and two UV 201 A tubes as audio amplifiers, it will operate a loud speaker on local stations and will receive up to about six hundred miles on head phones. The circuit will have to be changed a little for use with a loop. Disconnect one wire from the grid condenser on the side away from the socket and to this connect one side of the loop, the other side of the loop is now connected to the wire you removed from the grid condenser. See the diagram with this article.

Of the hundreds who have written to me regarding this set, only two complained of body capacity. I do not have any trouble from this source with my set because it is operated correctly. If you have trouble from body capacity decrease the amount of filament energy by turning down your detector rheostat.

Those who have built this set report good results with one or two exceptions. If you built this set and you are sure it is hooked up O. K. do not blame the set if you do not hear a thousand miles the first hour you operate it. While this set is very simple, you must learn to tune it as you would any other set, and when you have learned the fine art of tuning this receiver you will be more than pleased with the results.

This receiver was designed for broadcast reception only and the wave length range is not great enough to be used for the reception of commercial signals. Its range when used with an outdoor antenna about one hundred feet long will not be over 650 meters. This will enable you to receive ship stations, but that is all.

The greatest distance I have received on this set, using two stages of audio amplification on a good outdoor antenna, was station WBAP, located at Fort Worth, Texas, which is over two thousand miles from my home in Providence, R. I. This was received on the head phones, not on the loud speaker. I use Western Electric phones, Type 509W.

On the loud speaker I have received many stations as far West as Chicago. Some of these are KDKA, WGR, WSAI, WWJ, WTAM, KYW, WJAZ, WDAP. All of these stations could be heard all over an average sized room. Chicago stations come in very loud in Providence and so does KDKA. This station very often sounds like a local one because it comes in so well.

Now you do not have to use the parts that were given in the article in the January issue of this magazine, but those given will give very good results, and if you wish to purchase all the parts for this set, I strongly advise that you use the parts listed. If you already have a good vernier variable condenser of .0005 mf. and wish to use it, you may do so and obtain good results, but it must be a real high-class condenser. A poor condenser will spoil the best receiving set made.

I have used all of the receiving tubes made by the Radio Corporation of Amercia in this set and find the results to be very good when using the dry-cell tubes. When used as a portable set I prefer UV199 tubes, but when used as a receiver in the home I prefer the UV200, and next to that the WD12. This tube is one I value next to the UV200 because a great deal of my long-distance reception has been accomplished while using this tube. Judging from letters received, suggestions regarding tuning seem to be in great demand, so perhaps a few hints will help you to secure the best results with this set. If, when you are tuning in a station and turn down the rheostat in order to clear the signal, you find that it clears with a snap, this means that you are using too much plate voltage. Keep the plate voltage as low as possible on the detector tube. If you are using audio amplification, the voltage on the amplifier can be whatever amount the maker states is the proper voltage to use on the tubes. When tuning in a distant station I operate my set in the following manner: First, I turn on the rheostat almost all the way, turn variometer dial until sharp "click" is heard, then rotate condenser dial very slowly about ten degrees. If no whistles are heard I advance variometer dial again until "click" is heard, then I advance condenser dial again about ten degrees more. I do this until I hear a whistle, or until I have covered the tuner dial. If I do hear a whistle at any point on the dial I adjust both dials until the whistle is loudest, then I decrease the amount of filament energy by turning down the rheostat slowly. This usually makes the whistle still louder and when I get it as loud as possible I turn back the variometer dial very slowly, which usually clears the whistle and brings in the station.

Perhaps a few extracts from some of the letters received will interest you. A lawyer in Maryland writes, "I hooked up the set described in an article in *"Radio In The Home"* for January, and inside of one hour had heard the following stations, KDKA, WHAZ, WSB, and the Northern Electric Co. station at Montreal, Canada. This was done while using a ground connection only."

A Texas man writes, "Finished hooking up your set as described in the magazine *"Radio In The Home"* at 11 P. M. last evening, and at 11.10 P. M. was listening to WSAI in Cincinnati, Ohio. During the next hour or so had heard KSD, St. Louis. Mo. (for the first time), etc. I consider this a remarkable little set."

So it goes; satisfied radio fans all over the country are getting good results, and hearing stations they have never heard before. Many are using the same parts used in former sets and seem quite surprised that they can increase the range by merely changing a few wires.

And now let me say to all of you who have written to me, that I am very glad that you like this set, and I thank you one and all for writing. To those who have written regarding other circuits, and on matters not connected with this particular circuit, I wish to say that I am sorry I am unable to cover the things you wish in this article, but if you write to the Editor of this magazine, telling him what you desire to see in *"Radio In The Home"* I am quite sure he will be willing to secure for you the information desired.

Listen in on the Short Waves

(Continued From Page 16)

sion by the acids in the flux. The dials for the variable condensers should be set carefully opposite a scratch on the panel to read 100 when their rotor plates are fully enmeshed in the fixed plates. The suggestions given for avoiding hand capacity in my other article should be followed in connecting up the coils and condensers. The "aperiodic" primary is held in place by the bus bar.

Let us first try 200-meter reception. Set switch S-G on the fifth from the left and S-R at the fourth. V-1 is then varied slowly between 40 and 60 on its dial, while V-2 is moved somewhere between 0 and 30. It will be found that there is always a definite relation between the two condenser settings at which regeneration begins. This is indicated by the usual "rushing" or "swishing" sound with which regeneration is accompanied in any receiver.

Should condenser V-2 be set to too high a scale reading, or should there be too many taps included, a loud "squak" will result, and this is a common occurrence with most regenerative receivers where too much feedback is used. The remedy is to use fewer turns and less capacity in the plate circuit. Amateur signals, both telephone and telegraphic, will come in with the settings indicated, or thereabouts.

To receive KDKA on 326 meters set V-1 at nearly maximum and S-G at the seventh tap to the right. Then set S-R at the sixth tap and V-2 at about 50, more or less, until KDKA's carrier wave is picked up. V-2's scale reading is then decreased until regeneration just ceases and the voice or music comes in. Endeavor to remember the volume and the clearness with which KDKA comes in on 326 meters and then go about getting KDKA on 100.

First set S-G on tap No. 3. Set S-R on tap No. 2. Set V-2 at about 15 and vary V-1 between 0 and 30 slowly, very slowly, until the carrier wave again comes through. Usually you will be agreeably surprised to notice an improvement in volume on 100 meters, although the tuning is remarkably sharp and critical. V-2 should be reduced in capacity until the regeneration just stops and V-1 again adjusted for best volume.

There actually seems to be a difference in quality on the shorter wave although it is hard to describe. "Music over water" may perhaps give the idea. At any rate, the "air" is quiet 'way down on 100 meters and you can listen to KDKA as long as you like without hearing any other station "butting in." Once the tuning knack is mastered there are other stunts equally entertaining.

Try tuning around both above and below KDKA for other stations and sure enough others will be heard, though weak. These are almost all what are known as "harmonics," and represent the "octaves" of radio frequency just as several harmonics are present when a musical pitch is struck by the voice or piano. It is easy to calculate the wave length being tuned in and then to note down the dial and tap combination for the secondary (not necessary for the plate). For instance, if WFI comes through at grid tap No. 5 and grid dial No. 45, you may know that you are then tuned to exactly one-half of WFI's normal wave length, 396 meters, or 197½ meters. WGY sometimes comes through at 190 meters and WBZ at 168½.

What Fans Are Buying Everywhere

NEUTRODYNE IS BATTLING WITH SUPER-HETERODYNE

NEW YORK, Feb. 22.

CONSIDERABLE interest has centered in the recent incorporation of a master company to control the affairs of the neutrodyne licensees; otherwise known as "licensed through the Independent Radio Manufacturers, Inc.," which owns the Hazeltine patents.

During the past season the neutrodyne circuit has won unusual popularity and the members of the group are considered to be in an unusually strong position. Individual concerns, however, are now being sued by the Radio Corporation for infringement of various patents. Among these the Radio Corporation is suing Frank A. D. Andrea, Inc., a neutrodyne licensee, claiming that the Rice patent antedates the Hazeltine patent and alleging other infringements. Naturally the various members in the neutrodyne association find it mutually profitable to pool their interests and to act in common on any lawsuits brought against the individual members.

Nevertheless, there is at present a strong tendency on the part of the public to turn its interests from tuned radio frequency to the super-heterodyne. Some say that the Radio Corporation has been severely hit by the neutrodyne movement and the fact that it has announced its policy of manufacturing super-heterodynes ahead of actual deliveries has been construed as a strategic move to hold down the demand for neutrodynes.

There are only three licensees which are supposed to be permitted to manufacture super-heterodyne receivers: Westinghouse Electric and Manufacturing Company, present owner of the patent with cross licenses to General Electric Company, Radio Corporation of America, American Telephone and Telegraph Company), A. H. Grebe & Co., and Adams-Morgan Company.

On the other hand, the dealers who have found it somewhat difficult to hold prices firm in the face of the recent shifts in demand have embarked in manufacturing or aiding their customers to manufacture their own neutrodyne and super-heterodyne sets in a considerable volume.

There are a number of companies which now manufacture super-heterodyne transformers and parts and these companies report very heavy demand for their apparatus. Among these the Radio Receptor Company, Acme Apparatus Company, General Radio Company and Hardy Manufacturing Company, are reported to be hard pressed for deliveries although production schedules are hardly announced.

The set market has been very peculiar this year owing to the heavy pressure put on the strictly radio dealers by large phonograph and department stores which have been selling sets on time payments. This trend had long been expected but it is a costly method of selling and has required considerable capital to carry out. Dealers not selling on time have therefore been obliged to discount their prices or give extra service. This has somewhat demoralized the market.

Again the dealers are being pressed to advertise in several new radio sections. The Evening World has started a tabloid section and the Evening Journal has been putting out a special full page radio department each evening. Now the Herald has come to the front with a Sunday section that has already been felt by the Sunday Times, which is promising to start a supplement in a month or two. The acquisition of the Evening Mail by Mr. Munsey and his consolidation of that paper with the Telegram, has helped the Mail to keep up its pace as the first radio tabloid put out. The Sun, however, holds the largest volume of advertising. Just how all these sections can expect adequate support is difficult to understand in the face of the hardships many dealers have to endure.

On the other hand, Manhattan Electric, Davega, Haynes-Griffen, Gimbels, Macy's and other concerns continue to use fairly large space in the morning papers.

What may be considered the most deadly rival of the radio section this year has been the weather. With hardly one day in thirty bad enough to call wintry, the dealers have failed to find a very heavy buying "push" in the ranks of the public. With so many dealers and so much competition in price the limited buying that has come has not been considered satisfactory. It is generally conceded that if the winter does not materialize with at least two or three weeks of real bad weather to keep people at home several evenings in a row, the trade will miss out on a real winter buying boom. This coupled with the general business depression which has been felt among all mercantile lines has set a pace for the trade which is rather discouraging.

The picture, however, can be brightened with the realization that the game is no longer outside of the law; that is, banks do recognize radio as a trade and the possibility of securing commercial loans are good where the dealers have cultivated their credit connections and held down their overhead. Credits generally remain strict. Those concerns which rely upon heavy advertising to secure volume trade on a small margin are generally withdrawing either to better locations or to other business lines. The number of failures is remarkably small, despite conditions, and the wholesalers are regarding the situation as normal all along the line. Credit conditions are greatly improved today over what they were a year ago.

SALESMAN FINDS RADIO TRADE METHODS WRONG

BUFFALO, N. Y., Feb. 8, 1924.

Mr. Henry M. Neely,
Philadelphia, Pa.

Dear Sir: I have just finished reading your publication for February and it sure has some fine articles in it.

I am greatly taken up in your editorial, as I have been confronted with the same question as you were regarding "What You Get Out of Radio."

I am a traveling man, selling heating apparatus and am away from my home a great deal. I carry with me a sample crystal set of my own get-up. Whole thing, phones (regulation) and all go into a tin candy box eight inches in diameter and two and one-half inches deep. Set itself is exactly the size of the little handbook put out by the International Correspondence School of Scranton—3½x5x1".

As I am writing this I have the headphones on and am listening to a concert given by City Mission at Hotel

Statler. I am half mile away—ground, faucet in bathroom—antenna is the brass bed.

An hour ago I heard an address by Mr. Carl Sherman, Attorney General New York State, on "Stock Frauds." This address alone might be worth untold dollars as he certainly exposed some dealings going on.

At home, Horseheads, N. Y., my wife is kept in on account of a baby, she actually wouldn't consent to have an outfit installed. I worked like a nailer and finally two years ago installed a one-tube outfit. Results, she wanted something better—today we have a Fada installed in a nice desk in our dining room and believe me or not when the elements are against the radio she's furious.

Benefits: I wouldn't be without a radio for any amount of money.

If I am that way—what is it worth to the farmer off on the hills.

Men must be secured to really sell this: The whole trouble today is *not* in the people but in the manufacturer. Their sales policy is all wrong.

I have been in the selling game for twenty years and know something about the consumer as well as the dealer.

There is hardly a town or city that I visit that I don't drop into a radio shop. You know what I find? Simply this: The high-grade line is being handled by the low-grade (don't care kind) dealer, in other words the 10-cent store is getting the business and in many instances killing it.

Now, understand, I have no axe to grind, as I am disinterested only as to the FUTURE of radio. I'll venture to say that the average man buying his parts from these cheaper places pays double the price he would if he bought of a good reliable concern with *clerks who know* the game. Here is where the shoe pinches.

Do you know where you get the best service today? It is not in the larger city, it is in the town of 12,000 to 15,000 people or less.

These boys have made and are making a study of it and are passing their found dope on, results excellent business.

I was in Rochester this week and I inquired for a well-known reflex agency, big adv., etc. Where do you suppose I found it? On a side street in a garage, no display, and if it had, no one would see it because the windows were so dirty. Thought I was in the wrong place but took a chance. A fellow came up, and I said, "You handle ——— line?" Answers, "What do you want?" After digging over in an old chest he pulled out what I was after. I took a peep in the chest and I'll bet dollars to doughnuts that there was $500 worth of this particular line in there. I tried to talk radio but he was too busy.

This is getting lengthy but it does get a fellow's goat. I have that crystal on this set and not using it as a reflex and it sure is a winner. Why don't he use it? Would I tell him? Guess not.

For heaven's sake, Neely, give the radio dealers a write up. Tell them to get busy. Go after business.

How do I sell furnaces in the summer? I do—for winter. Why not use sense? There were very few nights we didn't get WGY at home all summer. Nothing to it.

Go to it. Yours very truly,
L. N. THOMAS,
105 Sayre Street, Horseheads, N. Y.

P. S.—If you would like I'll send you a photo of *my* crystal set and hookup. It's different!

(Sure, I'd like it; so would my readers. Ship it along and I'll publish it. —H. M. N.)

CLEVELAND DOES NOT FEAR ANY SLUMP THIS SUMMER

CLEVELAND, O., Feb. 20.

RADIO dealers of the Fifth City are busy; very busy. The counters are crowded wherever radio goods are sold, whether it be at the "dime stores" or the shops dealing exclusively in radio supplies. Cleveland is a good radio town; the three livewire local broadcasting stations—WJAX, WHK and WTAM—take their turn each evening of the week except Monday, and the nearby and powerful stations of Detroit and Pittsburgh are received as easily as any of the local stations.

R. G. Sidnell, of the M. & M. Company, believes the trend of the public is toward factory-made sets. This is explained by the growing complexity of the later circuits requiring more skill and better workmanship than possessed by the average radio enthusiast. It is easy enough to throw a "Copp" together, but a 5-tube neutrodyne is another story. But knocked-down neutrodyne sets are extremely popular; the Freed-Eisemann and Work-rite kits selling well.

Of reflex circuits the Acme seems to enoy the greater popularity with those who wire their own. The factory-made Freed-Eisemann 5-tube neutrodyne is the best seller of assembled sets. Mr. Sidnell looks for continued good business for another three months.

H. L. Lesser, of the Lesser Company, has three Cleveland stores and specializes in parts, though this company does a very satisfactory business in assembled sets. Mr. Lesser finds the factory-built Freed-Eisemann 5-tube neutrodyne is extremely popular, the greatest trouble being in securing deliveries of these sets. The Crosley and National Airphone sets are good sellers among the more reasonably priced outfits. Among the reflex circuits, the Erla outfit seems most popular with those who prefer to build their own radio sets, and the Power set, made in Cleveland, is the most popular of the factory-built reflex circuits. The demand for parts is centered in those for radio frequency hookups.

The tube situation, while not acute, often causes annoyance by reason of slow deliveries. The sale of phonograph attachments has fallen off, though for a while the demand was active. It would appear that the average radio bug finds it "too much trouble" to move his set to the family Victrola or vice versa, and in consequence the loud-speaker unit is favored over the less expensive attachment.

Neutrodyne sets and parts lead all others in the opinion of J. F. Kitchen, of the Electric Supply Company which handles a number of the leading sets. The recent price cut on tubes stimulated the sale of tubes and parts in general. The trade outlook appears good for another three months or until the Demon Static gets in his disagreeable work. The static season does not appear to be the bugbear that it was formerly; not in Cleveland, at least, for the radio fan can be well entertained at home by the local stations and it is worth while to attempt devising a method of elimination. Just now the general sale of parts and assembled sets is very satisfactory.

The Electric Fixture and Supply Company, through I. Wolff, reports a continued demand for parts, mostly for neutrodyne and radio frequency sets. Of assembled sets, the Freed-Eisemann 5-tube neutrodyne appears a favorite and the Tuska set employing two stages of radio frequency is also a good seller. The 5-tube Atwater-Kent assembled set is also popular. Mr. Wolff has his share of worry about slow tube deliveries, but every dealer is in the same fix.

C. J. Carter, of the Carter Manufacturing Company, reports a very satisfactory volume of trade for February. This company makes the "Carco" line of tuners exclusively, and does not deal in assembled sets. The month of December was particularly satisfactory; trade fell off to some extent in January, but has more than recovered itself and the present month bids fair to outdo the December business.

The Cleveland newspapers are enthusiastic supporters of radio from its many angles and have offered some very satisfactory hookups to their readers within the past few months. A recent circuit embodying a stage of tuned radio frequency, detector, and two stages of audio amplification met with a very hearty response from the public and drew attention to the use of neutroformers in place of the more expensive radio frequency transformer. The circuit is very efficient. A compact and portable regenerative set described a few months ago stimulated an immediate demand for parts and proved to be very satisfactory.

A number of dealers appear rather anxious to observe the public's reception of the latest offering of the Radio Corporation, the super-heterodyne. There is a very limited demand for parts required to build sets of the super-heterodyne type, the majority of amateurs being daunted by the expensive array of tubes and radio frequency transformers, not to mention the refinement of workmanship required in constructing a set of this type.

The Work Rite Mfg. Co., through V. H. Meyer, expressed extreme satisfaction with the present situation and state that while they had intended to slacken production through the summer months, the volume of orders will permit of no such program. This company manufactures parts, assembled neutrodyne sets, and neutrodyne kits, and reports a most surpris-

ing volume of business for all their items, with, of course, neutrodyne sets and parts leading. It seems to be a 50-50 proposition on assembled sets and parts. The Work Rite Company has established a very satisfactory export trade, Norway and Sweden being good customers on the European Continent and all countries of South America, and New Zealand and Australia being represented on their order books. France would be an extremely good customer were it not for adverse exchange rates. The export trade demand is largely for assembled sets. Mr. Meyer unhesitatingly credits the American radio magazines with the foreign demand, as the company has made no special effort to seek export trade and is barely able to care for domestic orders.

Warren R. Cox, the genial manager of the Radiovox Company, says his only trouble is in getting his orders filled at the factory. The Radiovox Company is the Northern Ohio distributor for products of the Radio Corporation, and Mr. Cox reports a very active interest in the super-heterodyne and other new Radiola models. The shipping rooms of the Radiovox Company present a busy scene these days and there is no indication of the trade slackening up for several months.

The Willard Storage Battery Company reports the January sales of radio battery equipment as exceeding all previous months. This company manufactures storage cells for both "A" and "B" battery purposes, and a very simple electrolytic rectifier for charging cell groups.

NEUTRODYNES LEADING IN ST. LOUIS MARKET

ST. LOUIS, Feb. 20.

A SURVEY of the St. Louis radio market for the last month shows that the greatest demand has been for complete sets and loud speakers, with a healthy demand for high grade parts running a very close second.

Apparently, the novelty period of experimentation with new and "improved" circuits which characterized the beginning of "broadcast listening" is rapidly passing, and the radio public at large is not asking what kind of circuit is the best, but what will it do? It is demanding results, with little regard for the number of tubes involved, or the expense incurred.

The neutrodyne type of receiver is by far the most popular in this city and the outlying territory. Dealers who have salesmen soliciting country trade are unable to supply the demand. "It supplies just what the farmer has needed and has been waiting for," said one salesman, "and it delivers the goods."

Every dealer in St. Louis and every wholesale distributor acclaims this circuit to be taking the radio world by storm. Little sales talk is required, as the sets are now selling on their reputation. It was found that a number of retail dealers had only sample sets in their stores, with none in stock. The demand is exceeding the supply.

Next in popularity, from the sales standpoint, are high-grade parts for assembling multi-tube receivers employing tuned radio frequency, reflex and heterodyne circuits. The latter is not as popular in this city as in the East, probably due to lack of publicity and explanatory data, but it is gaining in popularity.

The necessary parts for assembling tried and proved circuits are greatly in demand, but in some cases, are only available in small and limited quantities—a condition which works a hardship on the merchant and hinders the radio business as a whole. While advertising in the leading radio journals continues, the dealer can only make vague and indefinite promises as to delivery.

It is an interesting point to note, that only the best and highest grade of parts and accessories are in demand. "If a customer is shown an instrument which sells for three dollars and another of superior workmanship which lists at five dollars, there is no hesitancy on his part. He will take the higher-priced article every time," said one dealer. "They all want the best we can supply."

The month's sales apparently were not affected by the sale of a $277,000 stock of Kennedy regenerative receivers by a local department store. The type, which originally sold for $145, was offered at $59.50, while the $235 set sold for $98.50. Hundreds were disposed of in St. Louis and the surrounding territory. Mail orders were received from twenty-five States. There has been a shortage of A tubes (C301-A, UV201-A) during the entire month. It is doubtful whether the recent cut in price precipitated this scarcity, for it is the general opinion of dealers that the number of tubes required in a given set has little influence on the sale if the receiver will give the results desired.

CROSLEY MAKES REDUCTION IN PRICES OF ALL MODELS

CINCINNATI, Feb. 20.

FOLLOWING the merger of his two companies, Crosley has now come out with an announcement of a reduction in prices for his whole line. His notice to dealers follows:

"Since we first started making radio apparatus it has been our fixed policy to offer to the public the best possible receivers at the lowest possible cost. Heretofore constantly added improvements have forced us to maintain steady prices, but greatly increased production now allows us to lower the price of the entire line and still maintain our constant research for improvements.

"As an example of the results of this research, we now offer a new two-tube receiver consisting of Armstrong regenerative detector and one stage of audio frequency amplification, giving loud speaker volume on local stations at all times and on distant stations under fair receiving conditions. This instrument, known as the Crosley Model 51, sells at $18.50. It has been thoroughly tested in our laboratories and its satisfactory performances have surprised us.

"Note the following price reductions on these Crosley receiving sets:

"Crosley type V, single tube Armstrong regenerative receiver, the same instrument used by Leonard Weeks in Minot, N. D., in his established communication with the McMillan expedition at the North Pole, formerly $20, now reduced to $16.

"The Crosley two-stage audio frequency amplifier to match the Crosley type V, formerly $20, now $18.

"The Crosley Model VI, two-tube receiver incorporating radio frequency amplification and detector, formerly $30, now $24.

"The Crosley type 3-B, a three-tube Armstrong regenerative receiver, consisting of detector and two stages of audio frequency amplification, in a solid mahogany cabinet, formerly $50, now $42.

"The Crosley Model X-J, a four-tube receiver, consisting of one stage of radio frequency amplification, detector and two stages of audio frequency amplification, formerly $65, now $55.

"The Crosley type 3-C, a three-tube Armstrong regenerative consolette model with built-in loud speaker, formerly $125, now $110.

"The Crosley Model X-L, a four-

tube set consisting of one stage of radio frequency amplification, detector and two stages of audio, formerly $140, now $120.

HARKNESS SET POPULAR AROUND LOS ANGELES

LOS ANGELES, Feb. 2.

THE circuits which are proving tremendously popular in Southern California at this time include the Harkness reflex, the neutrodyne and the super-heterodyne.

The Harkness appears to be the most popular in the single-tube form as it is easily the most reasonable to build and it seems capable of bringing in stations within a four hundred mile radius on a loud speaker with fair volume.

Around Los Angeles there is considerable difficulty experienced in tuning in for long distance stations without local interference from the two powerful stations, KFI and KHJ. Because of this there is a considerable demand from people in the Pacific Southwest who can afford to spend from $250 to $400 for a radio receiving set—one that will bring in distant stations without local interference.

The neutrodyne and super-heterodyne are apparently filling this demand. The neutrodynes in use here are of the Fada and Freed-Eisemann types. The Fada Manufacturing Company is sending out parts with which any one with a little mechanical ability can assemble his own five-tube neutrodyne.

The users of these sets are having excellent results with a seventy-five foot aerial about thirty feet high and water pipe grounds.

The super-heterodyne, although a particularly fine type of short wave receiver, is not proving to be especially popular in the West—at least not so popular as the types of apparatus before mentioned. This is chiefly because of its cost, also in view of the rather large current consumption and because of the difficulty in securing the proper parts with which to build it. Due to the sharpness of tuning in this type of set, however, it is confidently expected to grow somewhat more popular in the immediate future.

Although the Harkness, the neutrodyne and the super-heterodyne have been mentioned it should not be assumed that they are the only sets out here.

The demand for the regenerative type of receiver is large and many are sold in the Southwest including the Grebe, Kennedy, Zenith, Cutting and Washington, and Radiola lines.

The man who is not a dyed-in-the-wool "radio-phan," but who nevertheless likes radio for popular entertainment purposes, is nowadays in the market for the type of set that comes complete with self-contained batteries, loud speaker and all accessories. There are hundreds of people out here who enjoy the local entertainment and home talent to the utmost, but who, up to this time at least, are not particularly interested in bringing in out of town stations.

PHILADELPHIA BUSINESS SLOWED BY R. C. A. LETTER

PHILADELPHIA, Feb. 20.

FROM the viewpoint of the manufacturer of radio parts, the outstanding feature in the radio market, not only in Philadelphia, but apparently over the entire eastern end of the country, was the partial paralysis of jobber and dealer business by the recent letter of the Radio Corporation, announcing the new models and discontinuance of the former models.

One manufacturer, in discussing the announcement, said:

"This, of course, has had its principal effect on the dealer and jobber markets—the consumer in most cases not being in on the big news. In some cases, however, where the dealer has not had the sets which his customer wished, he would preserve the sale by telling his customer to "wait a week or so" and the new models would be out. We are afraid that the customer will hear many "not yets" before he finally does receive his new set if it is a Radio Corporation new model, for these are not scheduled for good production until April.

"In our own line, we expected the month of February to be the 'big' month. Every radio year has had one. Of course, it isn't just a month—usually this period of greatest demand lasts from five to nine weeks.

"Well, we (and we know others in the same fix) were all set for this big demand when telegrams started coming in canceling regular shipments. On one trip, the telegraph boy delivered five telegrams from Harrisburg, Pittsburgh, Easton, Buffalo and Boston. Our own Philadelphia jobbers called us by telephone with instructions to cut all regular deliveries in half.

"In further talks we have had with these jobbers, we find them just 'cautious,' to use their expression. They feel generally that after the new sets have been seen by retailers and the public generally, business will get back into full swing again and make up for lost time, or put it in another way, for postponed sales.

"However, it is unfortunate that this Radio Corporation announcement comes just when it does, for it has almost killed the big radio month. There is only one explanation for the Radio Corporation announcement at this time, when full deliveries cannot be made until the end of what is nominally the radio season, and that is that the Radio Corporation, in putting out the new models now, wishes to give an impetus to the radio season which will carry radio interest well up into the early summer months.

"In addition—and this is probably the real big reason—the Radio Corporation, in showing models now, believe that orders for fall delivery will be placed far enough in advance to keep their factory and full organization running all during the summer.

"Anyway, we all know that for the present at least, the market for good radio appliances is 'shot.' Of course, the cut-rate houses are doing the usual amount of business in parts, with Harkness parts, coils, condensers and transformers apparently leading all sales. This business apparently has not been affected to any degree by the Radio Corporation announcement. It is doubtful if it will be either, so long as unassembled parts for a Harkness single-tube are selling for $12.50, two-tube $19 and three-tube $26—without tubes or batteries. Erla, another good seller in Philadelphia houses, is selling for $24.50 complete—without tube, unassembled.

"The Radio Corporation announcement, featuring for one, the $35 two-tube set, has not apparently touched this low-price market.

The general opinion among Philadelphia jobbers seemed to show that optimism is the keynote in the local radio industry.

There is no cause for worry among the manufacturers, distributors and dealers who conduct their enterprises

on a common-sense legitimate basis. In fact, trade conditions are now far better than have been anticipated following the great business previous to and during the Christmas holidays.

The impression had been created that the sales of parts and sets would decrease with the beginning of the new year. However, such is not the case, according to a distributor in this city, who has made a close survey of "things as they are."

An important and encouraging factor found in the survey is that the demand for the neutrodyne receiver is still great. One jobber even goes so far as to term 1924 a "Neutrodyne Year" in Philadelphia.

Local optimism was reflected by one of the biggest jobbers who, in spite of the Radio Corporation of America announcement, said:

"Present indications are that there will be no slow down in the radio business for a while. The industry has not yet attained its high-water mark in both production and sales. Today business is just as good as it was in November, with the demand far greater than the supply.

"This has caused the manufacturer to fall behind in his production. The jobber is continuing to place large contracts with the manufacturer, and the dealer, who has felt the pulse of the public by selling parts and sets manufactured by established enterprises, has been rewarded with an increase in sales. The storekeeper has realized, as well as the manufacturer, that by producing and selling fine merchandise it acts as its own advertising."

Here is an instance which showed the trend of thought among manufacturers recently. A reputable builder of sets, anticipating a spring slump because of the holiday sales, communicated with all his distributors, requesting that prizes be offered to their salesmen to expedite sales. But the jobbers did not take this suggestion seriously because the present good trade conditions did not warrant the necessity of an inducement to spur their salesmen on.

CINCINNATI REPORTS HIGH-TIDE BUSINESS

CINCINNATI, Feb. 20.

WITH an estimated increase of from 100 to 200 per cent in radio interest on the part of the fans in Cincinnati since the beginning of the winter months came a demand for radio sets and equipment which found local dealers in many lines unprepared for the rush of orders with which they have been flooded. Although jobbers and retailers expected a busier holiday season than they had ever before experienced, they had not expected the large after-Christmas business which followed.

Most lines of the better-known manufacturers are finding a ready sale. Probably the most popular of all during the last month has been the five-tube Atwater Kent 56-50 model. The Radio Corporation's Radiola IV and Radiola V also proved popular with buyers, while Radiola Junior seems to meet with favor with the more modest buyers.

Neutrodyne, always in demand with Cincinnati radio fans, is holding its own and ranks with the leaders in point of sales volume.

According to dealers, these sets are the leaders in the Cincinnati market and the dealers' opinion is backed by a survey among fans in this vicinity. Jobbers and retailers handling the Crosley line, a manufactured-in-Cincinnati product, report that all models of that company are in good demand.

Grebe and Kennedy regenerative sets are proving popular and come in

for a large share of the demand in and around Cincinnati. The sets mentioned above, together with the De Forest, absorb the greater part of the demand in this market, although the unusually active market for radio sets furnished a good distribution point for many other types.

Cincinnati's four manufacturers of radio sets and equipment all report increased production to meet demand for their products.

The Crosley Manufacturing Company has been running at full capacity of their plant for several months and members of the sales organization of this company estimate its output and distribution at approximately 1000 sets a day. To meet the increased demand for its various models the Crosley company will move into larger quarters which are being prepared and which are expected to be ready for occupancy by June 1. The new factory will be capable of turning out 5000 sets a day, according to Powel Crosley, president of the company.

Cleartone Radio Company and the Mid-West Radio Company, Cincinnati manufacturers, both report increased demand and capacity output.

Consensus of opinion among retailers, wholesalers, jobbers and manufacturers in Cincinnati indicates that radio interest in the Queen City has reached its peak during the last two months and a thorough survey reveals the fact that the radio business has apparently suffered only an approximate decrease of twenty-five per cent since a record-breaking holiday season.

The general dislike for the radiating regenerative receiver, particularly those of the single-circuit type, among fans owning other types of sets, has in some measure, discouraged the building of this kind of set.

R. C. A. ANNOUNCEMENT WORRIES NEW ENGLAND

BOSTON, Feb. 20.

CONDITIONS throughout New England in the radio industry are probably better than they ever have been, with prospects of still greater business.

One discouraging factor that may cause a decrease in business is the bringing on the market by the Radio Corporation of its new nonradiating receiving sets, which has been announced in New York City.

Publicity already given these new sets has tended to throw a wet blanket over the New England business, and many people intending to purchase new sets are holding off with the intention of buying one of these new four-tube nonradiating receivers with tubes and earphones for $65.

Up to the present time, however, business in regenerative receiving sets has been booming. There has been a growing demand for the Greene set. This hookup design of Lloyd C. Greene, radio editor of the Boston Globe, has held supremacy in the local market.

There is still great demand for the parts which go in making up this receiver, and according to the Boston jobbers and retailers business in parts for the Greene receiving set leads all others.

The four-tube Acme is said to hold second place in sales here. This Acme reflex circuit is also a local receiver manufactured by the Acme Apparatus Company of Cambridge. Hundreds of these four-tube Acmes have been built during the last month by fans throughout New England and there is a continued demand for the equipment.

Among the higher-priced receiving sets, the Freed-Eisemann neutrodyne leads the way. Many more of these sets could be sold throughout New England if the dealers and jobbers were able to get deliveries on the apparatus.

New England jobbers are looking with disfavor on the Radio Corporation. The announcement of its latest receiving sets coming on the market is causing considerable grumbling by some dealers.

The makers of many of the popular regenerative sets see their sales curtailed if not stopped altogether, and at least forcing lower prices for all kinds of receiving sets.

The attitude of many jobbers toward the Radio Corporation was not any too friendly previous to this announcement, as many of them throughout New England lost heavily on the decrease in tubes put into effect by the Radio Corporation of America recently.

One large Boston jobbing house was caught with $20,000 worth of these high-priced tubes on its hands when the announcement of a reduction from $6.50 to $5.00 was made by the Radio Corporation. This business house took a loss of $8000 alone on Radio Corporation tubes, and naturally does not feel any too pleasant over the transaction.

There is a reluctance among some jobbers and dealers to sell tubes. Several times since the forced reduction in prices dealers have reported to customers that they hadn't any tubes, when it was known that they had tubes in their stores.

There has been some talk during the last week of local New England jobbers organizing and refusing to sell the high priced tubes which they have on hand for the low price of $5.00, as ordered by the Radio Corporation, but so far as can be learned no definite action has been taken, although many jobbers express themselves as wanting to do some such thing.

NEW SELLING METHODS BOOM CHICAGO TRADE

CHICAGO, Feb. 20.

RADIO merchandising in Chicago and vicinity at the present time is more than satisfactory from the jobbers' and retail dealers' viewpoint. The radio public is educated this year in the mysteries of broadcast reception and therefore fewer explanations and illustrations are necessary to sell apparatus, which has naturally resulted in a great increase in volume of trade over a year ago. This increase is particularly noticeable in the outlying districts. The neighborhood radio store is becoming a permanent institution, there being many of them in every part of the suburbs.

BCL's are showing a marked tendency toward buying factory made sets. This applies especially to those who do not wish to go to the trouble of making their own.

As a result of this several concerns have sprung up which make a specialty of selling and installing complete set assemblies. By buying sets through these organizations all difficulties of installation are overcome as they erect the antenna and completely install the set, after which they furnish one man for an evening to teach the purchaser how to operate his set.

Several prominent wholesale firms, who have retail stores, have been having surprising success selling such sets as the Atwater Kent Radiodyne and DeForest Reflex to the public on time payments. Their terms are as low as ten per cent down and five per cent a week, which enables a person of moderate means to buy an outfit without straining his pocketbook.

FADA "ONE SIXTY" NEUTRODYNE RADIO RECEIVER

Selectivity

The FADA "One Sixty" radio receiver is known to thousands as the greatest triumph in radio engineering down to this very moment. It meets all requirements for simplicity of control, selectivity, volume, clarity and ability to bring in distant stations.

Its selectivity appeals to everyone—and to the women folks in particular. You can tune out local stations, even when several are broadcasting, and bring in distant programs. Or, you can tune in any local station you wish and not be bothered with interference from the others.

After any station is picked up with maximum intensity, notations can be made of the dial settings, and if one desires to listen to the same station again it is only necessary to reset the dials in the same positions as recorded.

The FADA "One Sixty" is a four-tube Neutrodyne radio receiver. Our engineers have found by exhaustive experiments that the FADA "One Sixty" with four tubes will produce results at least equal to those of any five-tube set. This means economy in tube and battery costs.

In appearance the FADA "One Sixty" is an attractive piece of furniture. Installed in the home, its chaste, handsome cabinet harmonizes with any interior. It is a quality product throughout. Made with all the care and skilled workmanship that have made FADA products noted, the "One Sixty" is a radio receiver that anyone may be proud to own.

Price, exclusive of tubes, batteries and phones, $120—at all dealers.

F. A. D. ANDREA, INC., 1581 Jerome Avenue, New York City

FADA *Radio*

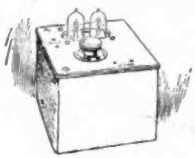
There's a Radiola for every purse

New *and* Remarkable Radio Achievements *in the new* Radiolas

Radiola III, an improved two tube receiver of antenna type, sensitive and selective. *Complete* with two WD-11 Radiotrons and headphones (everything except batteries and antenna) $35.

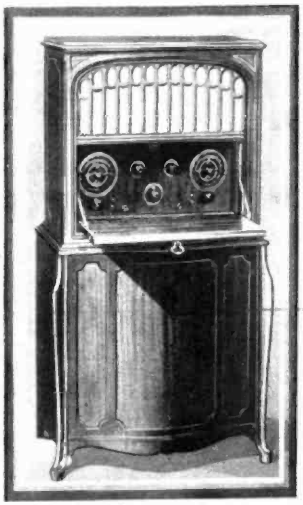
Radiola III Amplifier

Two tube balanced amplifier for Radiola III, including two Radiotrons WD-11 . $30.

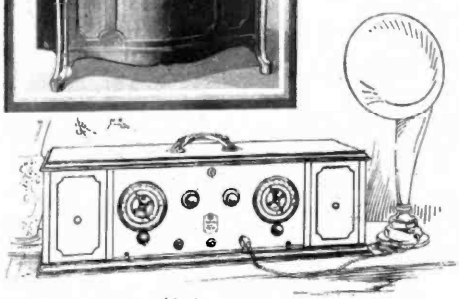


(above)

Radiola III-a, which is Radiola III and its balanced amplifier complete in one cabinet; including four WD-11 Radiotrons, headphones, and Radiola Loudspeaker (either type FH or UZ 1320.) Everything except antenna and batteries . . . $100.



Radiola Super-VIII —an improved Super-Heterodyne. Selective and non-radiating. With *no antenna*, and no ground connection, it receives far distant stations, even while local ones are operating. Loudspeaker built in. *Complete* with six UV-199 Radiotrons—everything except batteries. $425.



(above)

Radiola Super-Heterodyne (second harmonic) same as Super VIII but semi-portable in mahogany finished cabinet, with separate Radiola Loudspeaker of either type, FH or UZ 1320. With six UV 199 Radiotrons, but without batteries . . . . . $286.

Same as above, but without Radiotrons or Loudspeaker, $220.

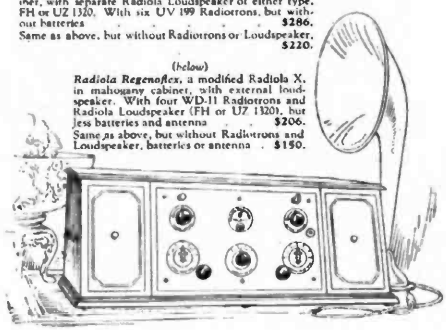
(above)

Radiola X—ultra refined receiver of the antenna type, selective and non-radiating. Remarkable for distance reception and perfect reproduction. Built-in new type loudspeaker. Complete with four WD-11 Radiotrons—everything except batteries and antenna, $245.

(below)

Radiola Regenoflex, a modified Radiola X, in mahogany cabinet, with external loudspeaker. With four WD-11 Radiotrons and Radiola Loudspeaker (FH or UZ 1320), but less batteries and antenna . . $206.

Same as above, but without Radiotrons and Loudspeaker, batteries or antenna . $150.



$35	$206
65	220
100	245
150	286
$425	

This symbol of quality RCA is your protection

It is impossible to give here full description of these revolutionary new sets. Send this coupon for an illustrated booklet that tells the story completely, with detailed description of every set. Then see your nearest dealer.

RADIO CORPORATION OF AMERICA
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Radiola

REG. U. S. PAT. OFF.

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 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 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 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:

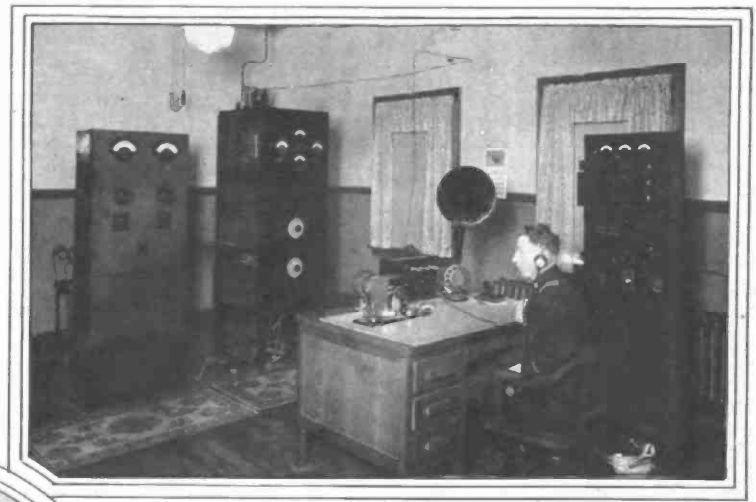
"This is Radio Station WCBD, Zion, Illinois. We specially invite the tourists in this section to visit this radio station when passing through Zion. As you drive through the city on Sheridan road, you will see the towers and radio station a half mile to the west. Officers of the church are in attendance 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 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.

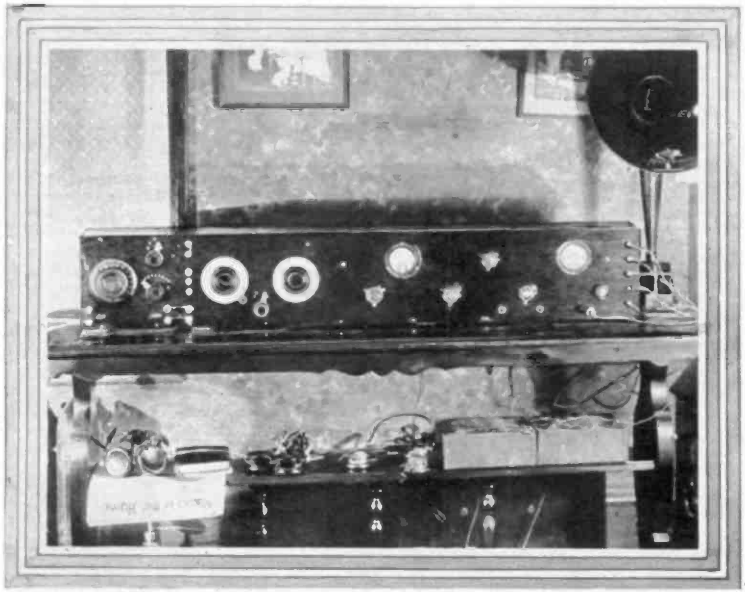
Broadcasting Station WCBD was erected by Mr. Voliva for the primary purpose of spreading the Gospel in speech and song. The service and programs broadcast by this station have resulted in a most satisfactory class of correspondence received from every stratum of our population, each mail bringing many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



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



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

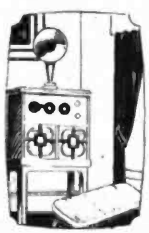
By FRANK C. PARKER, M. D.

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.

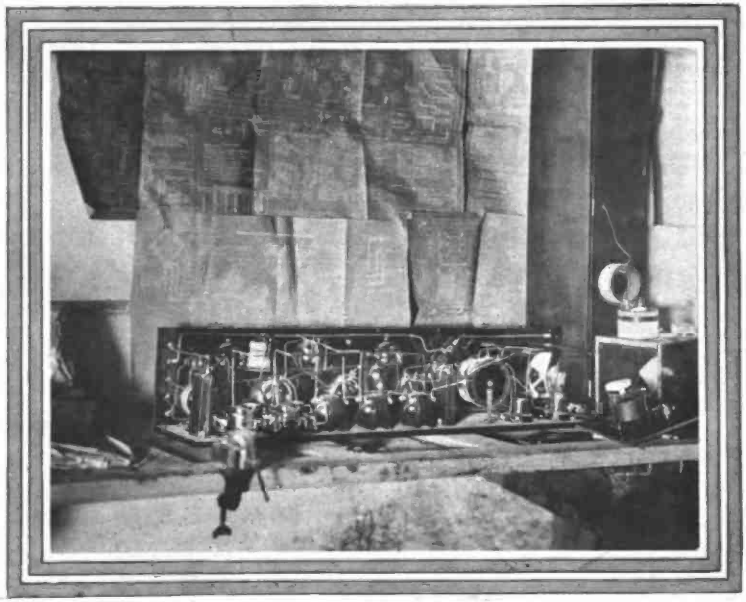
Eight lamps, preferably C301A or UV-201A, are necessary. Other lamps may be employed.

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 slippped by. For instance, the two coils "L" and "Ll" 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.

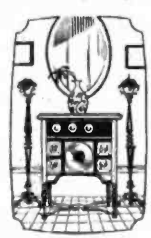
We had heard of four of these superheterodynes having been constructed without success and we wondered whether or not it might not have been just this little slip which has had something to do with the failure to perform.

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 enthuse. The various pieces of appa-

(Continued on Page 30)