March, 1925

RADIO IN THE HOME

Conducted by HENRY M. NEELY

In This Issue:

GRIMES Talks About Tubes

Music Master Success

—Its True Significance

Model VI, 14" wood bell.. $30

Model VII, 21" wood bell.. $35

Connect Music Master in place of headphones. No batteries, no adjustments. Prices of all models slightly higher in Canada.

Music Master

Resonant Wood Insures Natural Tone Quality

THE advent of Music Master sounded the death knell of the mere "loud speaker." For it transformed the radio receiving set into a musical instrument—a triumph of re-creative art.

Two years ago Music Master's full voiced volume and characteristic tone qualities heralded the New Era of Radio Art. It made possible the re-creation of supreme Music, Song and Speech, in the wonderful stellar program now the feature of American nation-wide broadcasting.

Music Master does more than reproduce—it interprets, it re-creates—it transforms mere radio receiving into artistic enjoyment. Inadequately imitated but never equaled. Music Master remains the supreme *musical instrument of radio*—and there IS no substitute.

MUSIC MASTER—The Ultimate of Artistic Radio Re-Creation

Music Master's precision instrument is the seme of scientific perfection. Music Master's tone chamber of heavy cast aluminum is a marvelous mold of sound without distortion. Music Master's amplifying bell of resonant wood gives to every sound its full, vibrant quality and natural and lifelike characteristics.

Music Master's manufacturers hold that every purchase of their product carries with it an implicit pledge of unreserved and unconditional protection. Back of your dealer's full and unfailing service stands the Music Master Corporation to guarantee its products direct to any one, anywhere, at anytime.

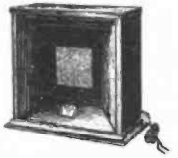
Model VIII, Mahogany Cabinet with "full-floating" wood bell..... $35

Music Master Corporation

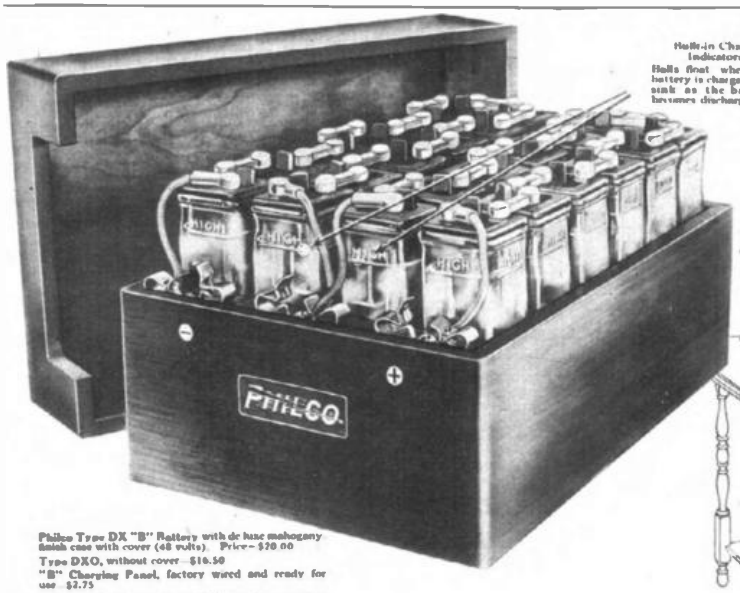
Makers and Distributors of High-Grade Radio Apparatus

Tenth and Cherry Streets

Chicago PHILADELPHIA Pittsburgh



Model V, Metal Cabinet, Mahogany finish, wood bell. $18



Built-in Charge Indicators
Balls float when the battery is charged, and sink as the battery becomes discharged.

Philco Type DX "B" Battery with de luxe mahogany finish case with cover (48 volts). Price—$20.00
Type DXO, without cover—$16.50
"B" Charging Panel, factory wired and ready for use—$2.75
Philco Single Charger for all "B" batteries and UD44 "A" batteries. Noiseless. Price—$8.75
Philco Double Charger for all "B" batteries and UD86 "A" batteries. Noiseless. Price—$15.00
Charger prices include plugs and receptacles

Philco "B" Batteries on Charge

To connect the batteries to your set, throw over switches on Charging Panel (1) and pull out plug (2) from the built-in receptacle of the Philco Noiseless Charger.

Recharge in your living room
without changing a wire

Philco Pressed Glass Case "A" Batteries
Spray-proof. Stay dry and clean always. Built-in Charge Indicators.
Type UD86 for storage battery tubes—$16.00
Type UD44, "a dry cell replacement" enabling you to get better results out of dry cell tubes. Occupies less space than three dry cells and may be installed permanently in the radio cabinet. Price—$8.00

Philco Mahogany-Case "A" Batteries
Types RAR and RW for storage battery tubes. In beautiful Adam brown mahogany finish cases harmonizing with your radio cabinet. Price—$14.50 up.
Philco Charge Tester—permanently mounted in filler cap—avoids fussing with a hydrometer—$1.00 extra.

YOU need storage "B" batteries because clear and distant radio reception depends on steady, non-drooping voltage and strong, hum-free current. Philco has made "B" storage batteries easy, convenient and economical to operate.

To Recharge—just throw the Charging Panel switches and insert the plug in the Philco NOISELESS Charger. Cost—five to ten cents. You don't move the batteries nor disconnect a wire. You avoid all danger of getting positive and negative mixed and burning out tubes.

Clean, Dry and Beautiful. The tightly sealed glass cells are assembled in Adam-brown mahogany-finish cases, harmonizing with radio cabinets and furniture.

Built-in Charge Indicator. Tells you at a glance how much charge is in the battery at any time. Does away with the old-fashioned hydrometer.

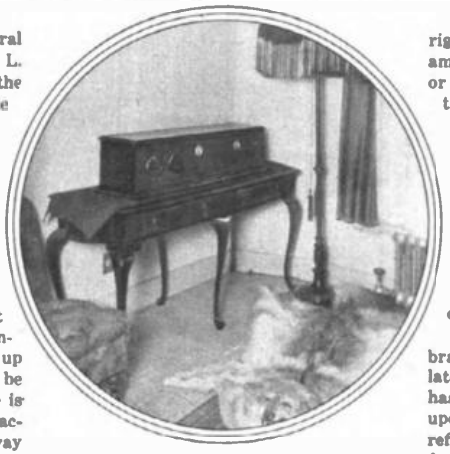
Philco makes storage "A" batteries of similar convenience and economy. Also high-powered starting batteries for your automobile. Your Philco is sure to be new and fresh because, of course, Philco Batteries are shipped Drynamic (dry charged).

See your nearest Philco Service Station. Radio or Music Dealer.

Philadelphia Storage Battery Company, *Philadelphia*

MOTOR CAR OWNERS—avoid the danger and humiliations of battery failure by installing high powered, long-life Philco Diamond-Grid Batteries. With Philco Retainers, they are GUARANTEED FOR TWO YEARS. Philco made automobile batteries range in exchange price from $14.95 up.

PHILCO DIAMOND GRID BATTERIES



Radio in the Home of Charles R. Leutz, Forrest Hills, L. I., N. Y.
The radio set is a model C-7 Super-Heterodyne

EDITORIALLY SPEAKING

By HENRY M. NEELY

IN THE course of his activity as general manager of this magazine, Mr. W. L. Dudley visits virtually every section of the country where there is any considerable amount of radio business being done. He calls upon manufacturers, dealers, wholesalers and retailers and gets from them their slant upon the radio trade as a whole.

Is the Hook-up Craze Dying Out?

Mr. Dudley has found that the last three or four months have produced a very remarkable change in sentiment among manufacturers of apparatus intended primarily for fans who hook up their own sets. It would probably not be putting it too strongly to say that there is an absolute panic among these manufacturers. Their business has slumped away to a startlingly small percentage of what it has been and they report that all of the interest nowadays seems to be in complete sets, not in parts. They explain this on the theory that it is impossible for radio magazines and newspapers to find enough new circuits to keep up the interest among the fans. Consequently, they say, the fans are not buying parts but are turning to the complete sets instead.

I think there can be no question as to the truth of this viewpoint so far as it concerns cities and the larger towns. But to say that the interest in hook-ups and apparatus is dead is to betray an ignorance of the situation as it exists throughout the country.

I have a very clear picture of the situation in my own mind and, while it may not be a true picture, there may at the same time be enough truth in it to be of some value to the more progressive manufacturers of parts and also to the fans who read this magazine.

I am quite convinced that the parts market, as far as concerns the large cities and the bigger towns, is almost saturated at the present time. It is in these large centers of population that radio first took hold. Fans who live in such places started buying apparatus two or three years ago and, in their unbridled enthusiasm, bought everything right and left without any thought of the amount of money that they were spending or the mass of apparatus of various kinds they were piling up on the shelves of their closets or in their workrooms.

Today, those fans are so thoroughly supplied with variable condensers of all sizes, with coils of all kinds, with sockets, rheostats, and all of the other standard parts which go to make up the average receiving set, that seven out of ten of them could almost start a small retail store with what they have on hand at the present time.

It is true that there have been very few brand-new circuits of much significance lately. What designers have been doing has been to develop refinements founded upon the fundamental good circuits. These refinements are being tried by the average fan. The manufacturer of parts, however, is not in a position to get the reaction from this. Why? Simply because the fan does not have to go out and buy anything new; all he has to do to try the new circuit is to go to his shelves and take down the necessary parts and hook them up in his set.

It just happens, besides editing this magazine, I also conduct the radio department of the *Country Gentleman*. That latter position brings me an average of something like four hundred letters a week—these letters being almost entirely from the sparsely populated districts some distance away from cities or large towns.

Radio is just entering these places. Before starting its radio department, the *Country Gentleman* conducted an investigation and found that, of the more than six million farms in this country, *only about two and one-half per cent had radio receiving sets.* Here is a tremendous potential market absolutely untouched. The farm is the obvious place for a radio set to be almost invaluable. Yet ninety-seven and one-half per cent of the farms of the United States do not yet know radio.

The letters that I receive from the readers of the *Country Gentleman* prove beyond any question that the hook-up craze is not at all dead. It is

(Continued on Page 32)

The Question of Tubes

By H. M. N.

I AM particularly glad that Mr. Grimes has chosen tubes as the subject of his article for this month. In a recent issue, I stated editorially that we were not giving hook-ups for the 199 tube because we did not consider this tube a success. These remarks of mine have been very badly misconstrued.

Many readers have written in to tell of the great success they are having with these little tubes in regenerative and audio frequency circuits. There can be no dispute about the number of sets of this type which are giving perfect satisfaction with the UV-199. But modern fans demand circuits requiring radio frequency amplification and it is in such circuits as this that the UV-199 so frequently fails to perform.

Mr. Grimes, in his article in this issue, very clearly points out the fact that a tube may be an excellent detector or audio frequency amplifier but absolutely fail to give satisfaction in radio frequency amplification circuits. This will clear up the point that I had in view in my editorial.

Other readers have felt that there was, behind my editorial, an antagonistic feeling toward the Radio Corporation of America. This is absolutely not the case.

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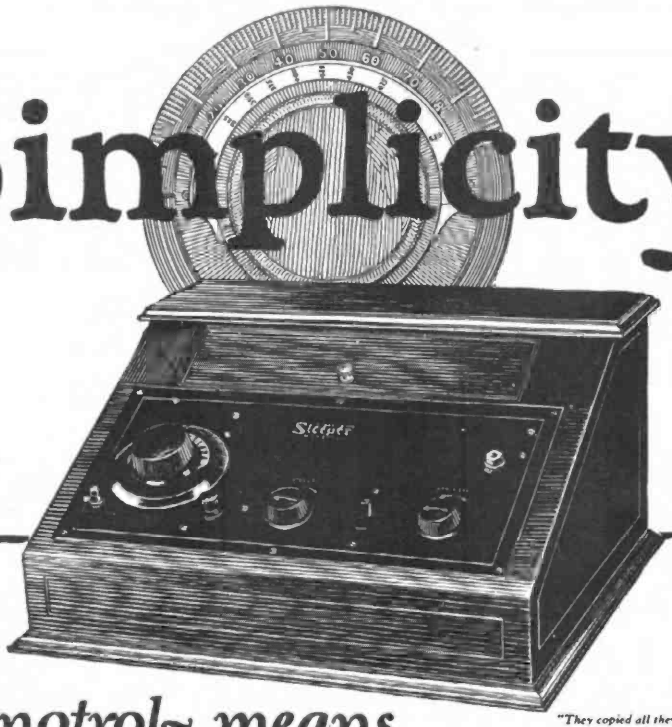
Simplicity



Monotrol~ means One Control

"They copied all they could follow,
But they couldn't copy my mind.
And I left 'em sweating and stealing
A year and a half behind."
—KIPLING

SIMPLICITY of control and operation is a quality easily claimed but hard to achieve. While recognizing that a certain portion of Radio purchasers want complication—want a series of delicate adjustments that make reception a thing of individual skill—want to spend hours "fishing" for stations—Sleeper engineers believe that a far greater number want to be able to log all stations on a single dial—tuning so simple that a blind man can get the same results as an expert.

The Sleeper Monotrol is built for this latter class. It has but one Tuning Dial calibrated in wave lengths as well as the usual numbers.

All that is necessary to tune in with a Sleeper is—look up the wave length of a station—turn the one dial to that wave length—sharpen the tone with the Resonator—and that's all.

Sleeper Monotrols are best sold through demonstration. Any Sleeper dealer is glad to demonstrate a Sleeper your way.

Time payments if you prefer. A free copy of the interesting book—"How to Choose a Radio Set"—is yours upon request.

SLEEPER RADIO CORPORATION, 500 Washington Ave., Long Island City, N. Y.

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Sleeper

MONOTROL

REG. U. S. PAT. OFF.

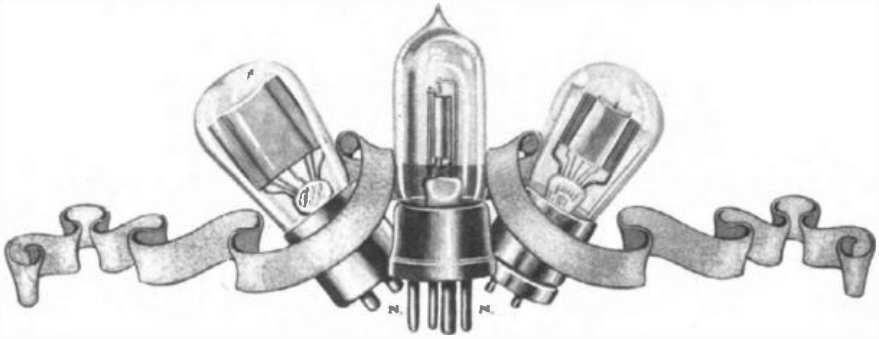
The Sleeper Monotrol without accessories is priced at $130.

It's Compact

RADIO IN THE HOME

Grimes-Flewelling-Harkness

Associate Editors, Writing for No Other Magazine



Let's Talk About Tubes

By DAVID GRIMES

Associate Editor of "Radio in the Home"

THERE are tubes and then, again, there are tubes! Perhaps this is the reason that most of us are continually whining, "Yes, we have no tubes!"

Undoubtedly the greatest source of variation today in the radio business is *tubes*. We used to lay everything to location and remark with despair, "It is radio." This is all very well with sources of trouble over which we have no control. It is bad if we are going to use it ignorantly as an escape valve for every grievance.

We will frankly admit right now that we are considerably "het-up" on this whole tube situation. In fact, right this instant the boiling point is almost upon us. This article is being used as an escape valve; so if you will kindly cover your faces, while the steam blows off, we will proceed to blow up.

Powee-ee-ee!

There now, let's talk about it as intelligently as possible under the circumstances. Something's all wrong and we are certain about that. We usually are certain that everything is all wrong. In this case, there is no question about it at all because facts speak for themselves! Haven't we done and gone blown up?

A fairly thorough study partially condemns and partially upholds the manufacturers of tubes. Both they and the public—that's we—have quite a few things to learn. The manufacturers have been absorbing information here and there, and some of the dear public have "bought and paid for" some data in the form of, well—just tubes. Quite a bit of this will now be given to you collectively as only in this way can the art progress. We are going to lay all of our cards on the table—deuces as they are. Our hand is strong on the very number of them.

"Let there be light and there was light" no longer appeals to the modern radio fan at all. What interests him is whether or not sounds wander from his loud speaker and unfortunately the brilliancy of a vacuum tube is absolutely no test of its amplifying efficiency. The present type of vacuum tube does not emit much light and often much less music. And therein lies one of our main sources of difficulty. Would that we could count the letters stating, "My tubes lighted all right, but results were nothing."

This matter warrants every serious thought because it is so generally experienced and is not easy to correct. The larger

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HENRY M. NEELY.....President and Editor
G. W. KRAFT.....Secretary and Treasurer
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W. FRANCIS GOODREAU }

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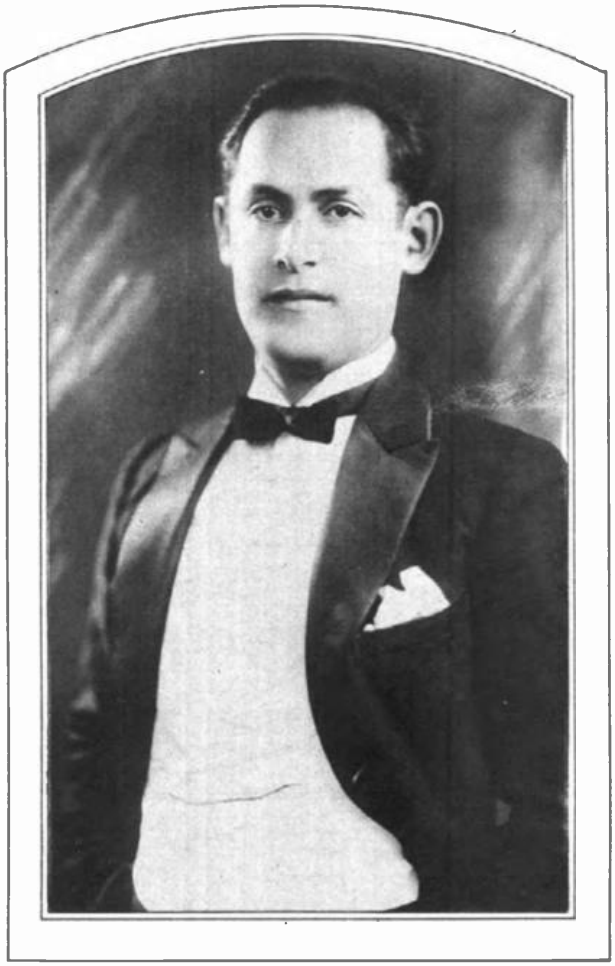

Harry Horlick, violinist, and leader of the well-known A. & P. Gypsy String Ensemble heard every Monday evening through WEAF

The "Red Front Stores" on "Quality Street"

By GOLDA M. GOLDMAN

IF YOU were asked to state promptly and briefly just what "Chain Grocery stores" mean to you, what would you say?

"Cheap prices?"

"Poor goods?"

"Rapid service?"

"Standard goods at low prices?"

Ten or fifteen years ago there would have been no question in your mind.

You would undoubtedly recall unpleasant experiences with half-frozen potatoes, palmed-off canned goods which were substituted for the brands you asked for, eggs of doubtful freshness. You would have added, according to your income, that you found it advisable to do all your grocery marketing at the expensive and exclusive shops, or that you patronized one of the good old-fashioned independent grocers entirely. Dollars and dollars were thus added to your household budget, but you knew that you could serve with confidence the goods you had bought.

But you will remember that you once shrank with identical horror from the motion pictures, from popular fiction, from eating in any restaurants except those of the Churchill or Sherry standards. Now you patronize the movies, keep abreast of the best-sellers and eat dinner downtown regularly in the attractive, less-expensive places before going to the theatre.

And so today you do not find a chill playing tag up and down your spine when asked what you think of the chain grocers. Instead, you reply promptly.

"Wonderful things, these chain stores. The wife does all her buying at the A. and P."

Chain stores started out to reduce the H. C. L.—to sell groceries at prices below those in effect before their advent. The result was that the low prices fostered an apprehension of inferior food in the minds of the public. Customers of the better sort thought lightly of the endeavor and continued to bestow their patronage upon the old time corner grocer or exclusive food shop. Therefore, the chain stores had to be content with a clientele composed of those in moderate circumstances, or those who felt their pocketbooks being pinched.

The companies prospered and the chain stores grew even with this somewhat restricted patronage. It is not characteristic of American business enterprises to be content, however, so A. & P. Stores set to thinking how they could attract the people in more comfortable circumstances to their stores. They knew that they carried in stock a good proportion of the table luxuries commonly served to the "exclusive" set; that the sanitary standards, their store personnel and the freshness of their stocks were everything to be desired. Why should they not get this business?

Could it be that their appeal to people in all walks of life had flaws in it? They had used the self-same mediums that the most exclusive business houses resort to, viz: newspaper advertising, orderly arrangement of merchandise, clean and appealing window displays augmented by direct-mail advertising, house-to-house distributing of printing matter and kindred publicity channels.

Throughout their advertising, however, price appeal was the outstanding feature. To say that 98 per cent of the people of our country are not interested in price appeal would be a wild assertion, as you would naturally conclude that any line of business that was in position to undersell its competitors would have a corner on the market. This is not so; the best type of trade is not that which is attracted by price alone and neither does the house that advertises price exclusively eventually hold its trade. A price customer may be called a "Floater"—they belong to any business just so long as that business maintains a lower price than its competitors. It therefore behooves any company desiring permanently satisfactory results to advertise quality consistently if it desires to build a permanent clientele.

This, then, was the problem faced by the advertising department of the great Atlantic and Pacific Tea Company last year. "The Little Red Front Store" had become a symbol for economy. Could they now make people understand that it is located at the crossroads where Thrift street and Quality street meet?

Handbills and store placards have their uses and their places. They do not suc-

ceed in spelling distinction. A new medium must be found, and the company turned to the newest thing on the market, radio, which was brought to their attention by H. Clinton Smith, of the American Telephone and Telegraph Company. Mr. Smith is steeped in the possibilities of telephone, telegraph and wireless service, as he has been connected with the company for thirty years. Most of his time he has handled the sale of the two first-named services, but when Station WEAF was opened, he found himself switched to selling radio service instead. Now as station account executive for the A. and P. stores, the Alvan Silver Company, the American Bond and Mortgage Company, etc., all of whom buy the facilities of WEAF, he says:

"I was first considered a little 'soft in the head' when I predicted two years ago that all entertainment programs would be eventually paid for, but now any one can see it. Radio broadcasting, this wonderful new avenue in the world of communication, provides a tremendously valuable medium for establishing a strong bond of friendly good will between a seller and the buying public. It creates a human contact with customers that cannot be obtained upon such an enormous scale in any other way."

Once the idea that radio broadcasting provides a tremendous audience was sold to the A. and P. Company, the question of what to put on the air had to be considered. We must remember that buying the facilities of WEAF does not mean that you can give a lecture on the remarkable quality of your goods or anything of the sort. Instead, you are dependent upon an artistic and subtle psychological appeal for your results. The first point to be considered must always be:

"What am I most anxious to impress upon the listeners-in?"

Now, the A. and P. answer to this is summed up in one word, "Quality," so they cast about for some group of entertainers who would be so unusual and high class that there could be no question of their superiority. Then Fate took a hand. One afternoon Harry Horlick and his group of players drifted into WEAF to broadcast on their own behalf. They had been playing in a Russian cafe which had burned down, so they were temporarily out of a home. On that very afternoon some officials of "The Red Front Store" were calling upon Mr. Smith and they were racking their brains for a solution of their feature problem. As they talked the strains of a gypsy melody beautifully played came through the studio loudspeaker.

"What is that?" asked one of the officials, entranced.

"That is Harry Horlick and his Gypsy String Orchestra," replied Mr. Smith.

"They are the men I've been looking for," said the A. and P. man; and they were.

For two seasons now the Gypsy String Orchestra has broadcast every Monday night for an hour, and by the high quality of its performance has demonstrated to the unseen audience the fact that they may trust the standard of the goods on the shelves of the ten thousand stores whose management employs them to play.

On the shelves of these enterprising grocers you will find teas from Ceylon, spices from the Far East, canned fruit from our own California, rice from China, coffee from Brazil—all quarters of the world send their contributions to our table. What more suitable representation for these stores, then, than a band of men from across the seas, playing the haunting airs which stir the blood of all races and lands, with the winds of romance breathing, breathing through them?

Many of the real gypsies come from Southern Russia, from the region around the Black Sea, which accounts for the fact that the half-dozen Russians who compose the orchestra are so imbued with the spirit of this type of music.

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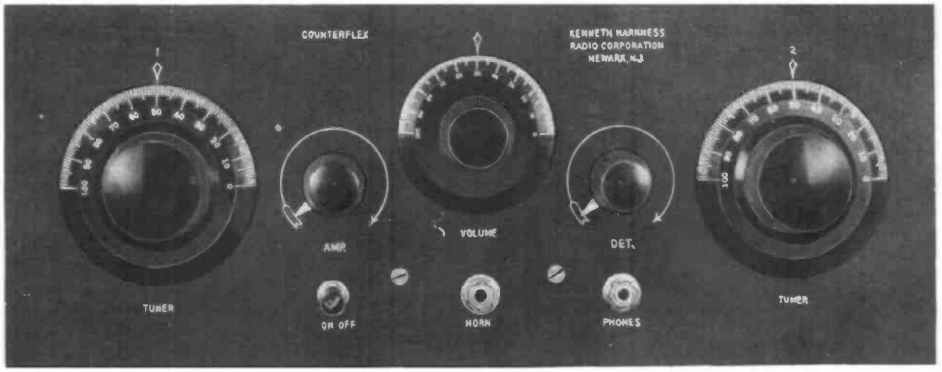
The Gypsies grouped about the microphone ready to play for the lovers of music



How *to* Build *a* "Commercial Counterflex"

By KENNETH HARKNESS
Associate Editor of Radio in the Home

IN RECENT issues of this magazine I have given building instructions for two-tube and three-tube Counterflex receivers. The captions under the illustrations erroneously described these sets as "Commercial" models. These receivers were distinctly and intentionally "amateurish" in their construction, wooden baseboards being used in the customary amateur style.

This month I am going to show you how to build a "Commercial" model of three-tube Counterflex receiver, using exactly the same circuit as the set which I described in the January issue, but designed to meet the requirements of the circuit more efficiently. So far as operating results are concerned, the commercial model is only slightly more efficient than the amateur model, but the commercial receiver has a much more attractive appearance and is very much easier to assemble and wire. I know it doesn't *look* easy to build, but it really is very simple, and I hope to demonstrate very clearly just how easy it is.

Of course, you cannot build this set with any odd parts which you have lying 'round the house; for instance, of all the audio transformers on the market, there are only three makes, to my knowledge, which will fit this set. If you do not own any of these transformers you will have to buy them. Similarly, you need a special triple socket subpanel to make this receiver; but this, and all other parts, can be purchased, and all you have to do is to assemble and wire them in the usual manner. You don't need any special tools—just the usual screwdriver, pliers and soldering iron.

The wiring is particularly easy, because the set was designed with this object expressly in view. It was carefully designed for quantity production in a factory, and, since the bending and soldering of wires is one of the most costly items of production, you will realize it was necessary for me to arrange the parts so that they could be wired together as easily as possible.

The main difference between this receiver and the average home-built set lies in the arrangement of the tube sockets and audio-frequency transformers. Amateur constructors usually mount their tube sock-

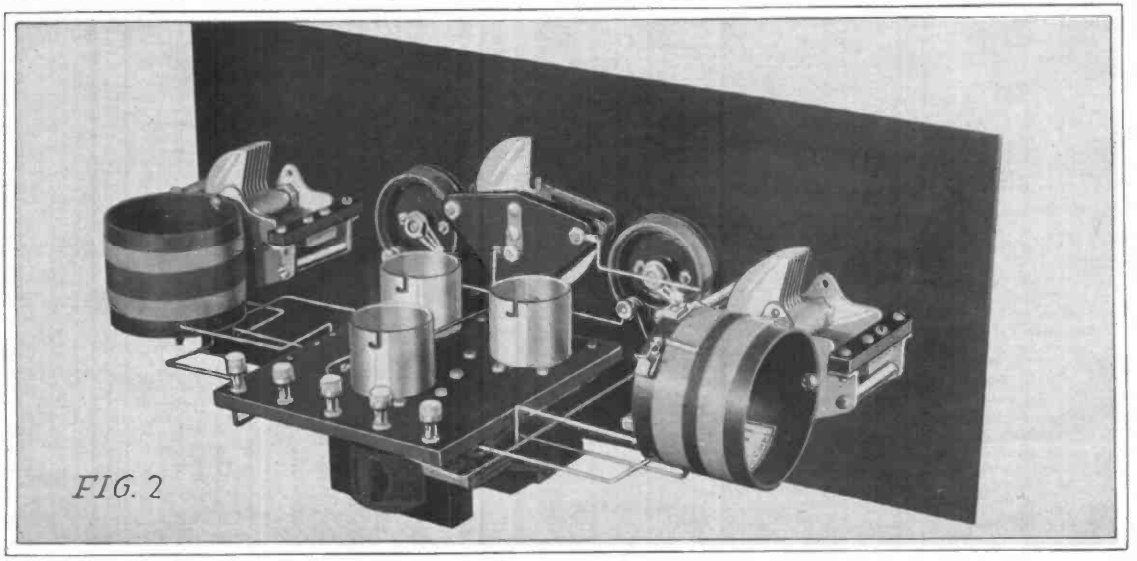
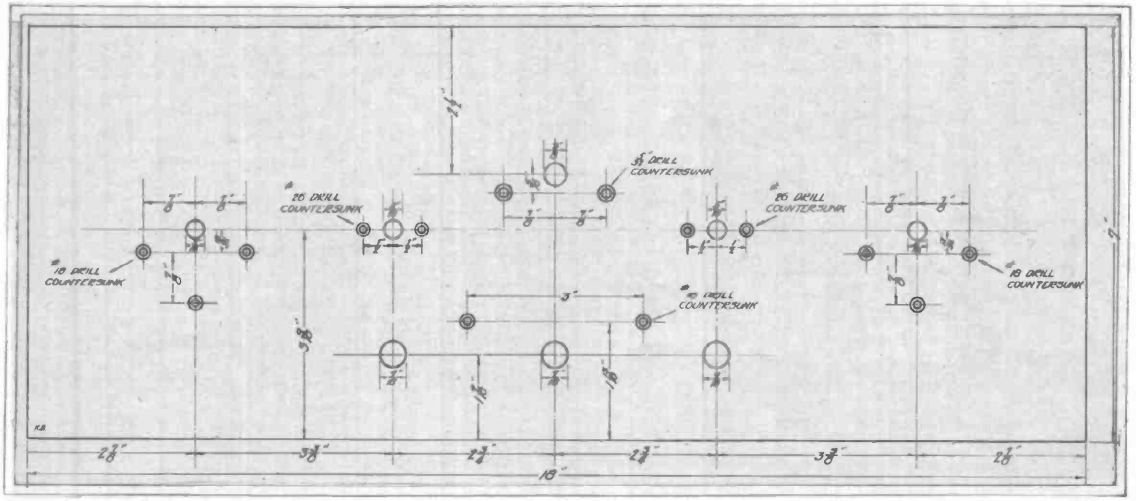


FIG. 2



ets and audio-frequency transformers alongside each other on a wooden baseboard, whereas, in this receiver, a hard-rubber triple-socket "subpanel" is used. The audio-frequency transformers are mounted *underneath* this subpanel and the entire unit is held to the front panel of the receiver with two small brackets. Fig. 8 shows how this simplifies the wiring of the audio-frequency transformers. It would manifestly be impossible to obtain such short, direct wiring if the tube sockets and audio transformers were mounted alongside each other on a baseboard.

I have so many illustrations accompanying this article that I have omitted the schematic wiring diagram of the receiver. The circuit, however, was given in the January issue. I have also explained the functioning of the three-tube Counterflex circuit in previous issues. So I will devote the remainder of my space to a very full and detailed explanation of the construction of this "commercial" model of Counterflex Receiver.

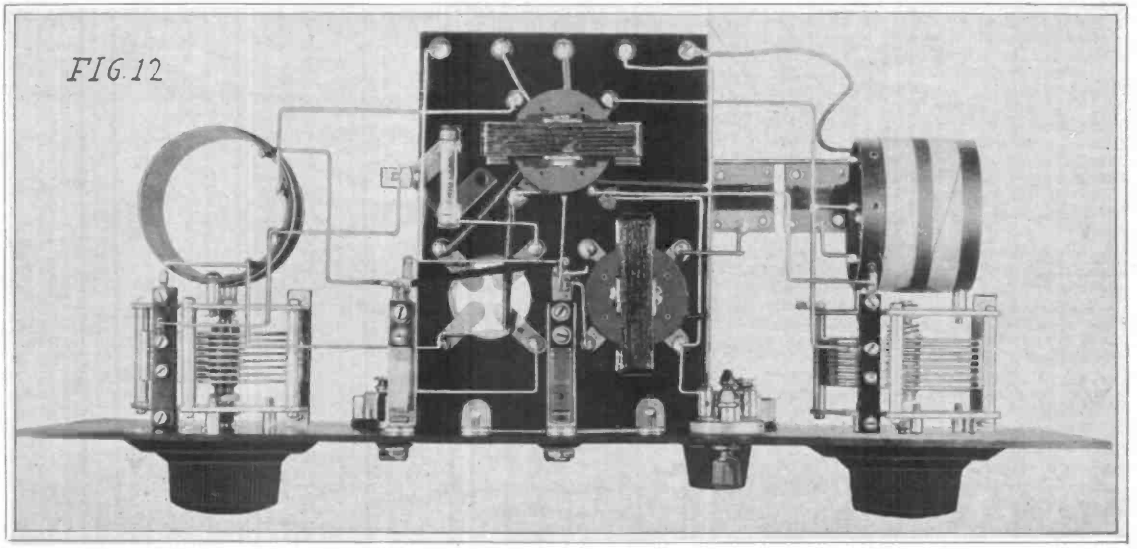
LIST OF PARTS

The following is a complete list of the parts needed to build this receiver:

1 front panel (Radion or Formica), measuring 7 in. x 18 in.
1 Harkness triple socket subpanel with mounting brackets.
1 Harkness or Shamrock counterformer, Type T1.
1 Harkness or Shamrock counterformer, Type T2.
1 Harkness or Shamrock counterdon vernier condenser.
2 Harkness, Shamrock or Kardon audio-frequency transformers.
5 binding posts.
2 20-ohm rheostats.
1 filament battery switch.
1 3-prong telephone jack.
1 4-prong filament control telephone jack.
1 grid condenser (.00025 mfd.).
1 grid leak (1 megohm).
1 fixed condenser .0001 mfd.
1 fixed condenser .00025 mfd.
2 3¾" dials.
1 3" dial.
2 lengths of "spaghetti."
6 length of bus-bar (or Celatsite wire).

The rheostats, jacks, fixed condensers, dials, etc., are all standard parts; any good makes can be used.

The triple-socket subpanel is not so well known as the other parts, being a new product and designed somewhat differently from the usual triple socket. This subpanel was designed especially for the three-tube Counterflex receiver, although it can be used, of course, to build any three-tube set. Holes are already drilled in this panel for the audio-frequency transformers and battery binding posts. Mounting brackets are supplied. It is absolutely necessary to



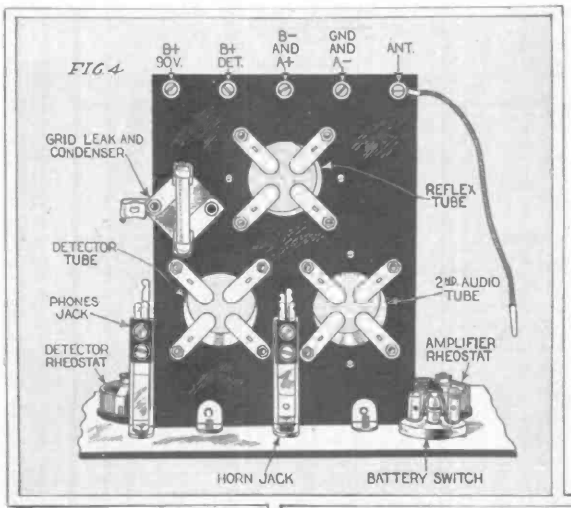


FIG. 4

use one of the three specified makes of audio-frequency transformer, as these are the only kinds which will fit underneath the subpanel. Other makes of transformers are designed only for upright mounting on a baseboard and cannot be used to build this set.

The Counterformer can either be purchased complete or the coils can be wound and mounted on .00025 mfd. variable condensers. The winding specifications of the coils were given in the December, 1924, issue.

The Counterdon is just a vernier condenser given this distinguishing name as it was designed to cover the correct range of capacity needed by the counteracting condenser of the Counterflex circuit. I would like to emphasize that the Counterflex circuit needs a counteracting condenser of a much higher capacity than is afforded by some vernier condensers on the market. The "neutralizing" condensers sold for the neutrodyne circuit are quite unsuitable; their capacity is much too low.

Before assembling and wiring this receiver it is necessary to drill the front panel. For this you need a small hand-drill and a few drills. Fig. 3 shows the exact positions and sizes of the various holes. You can lay out the positions of these holes directly on the panel itself or make a full-size drawing, paste it over your panel and locate the centers of the holes with a center punch.

When building a radio set most amateur constructors assemble all the parts and then wire the completely assembled set. In these pages, however, I am going to show you how to assemble and wire this receiver step by step, clearly illustrating each step as we go along. You can imagine, if you wish, that this receiver is being passed through a standardized factory on a moving belt and that the instructions given below are addressed to the workmen who perform each progressive step until the receiver is completed.

First Step—(See Fig. 4)—Mount the triple socket subpanel, the two rheostats, the battery switch and the two telephone jacks on the front panel, as in Fig. 4. This drawing shows how the parts appear when you look underneath the subpanel. The names of the various parts are also indicated in this drawing. If you have some experience in designing and wiring receivers you will realize that this arrangement of the apparatus permits unusually simple and efficient wiring.

Second Step—(See Fig. 5)—Bend five pieces of wire into the shapes required, as indicated in Fig. 5, remembering to make allowance for the room which the audio transformers will occupy when they are later mounted beneath the tube sockets, as in Fig. 8.

Solder these five wires to the terminals indicated in Fig. 5 so that they join the terminals together as follows:

Wire No. 1—From negative filament contact of reflex socket (1A) to negative filament contact of second audio tube socket (1B), then to one side of the amplifier rheostat (1C).

Wire No. 2—From negative filament contact of detecter tube socket (2A) to one side of detector rheostat (2B).

Wire No. 3—From plate contact spring of second audio tube socket (3A) to third prong of horn jack (3B). By the third prong I mean the third prong from the top, the first prong being the one farthest from the framework of the jack.

Wire No. 4—From fourth prong of horn jack (4A) to third prong of phone jack (4B).

Wire No. 5—From 90-volt B plus binding post (5A) to Wire No. 4 (at point 5B).

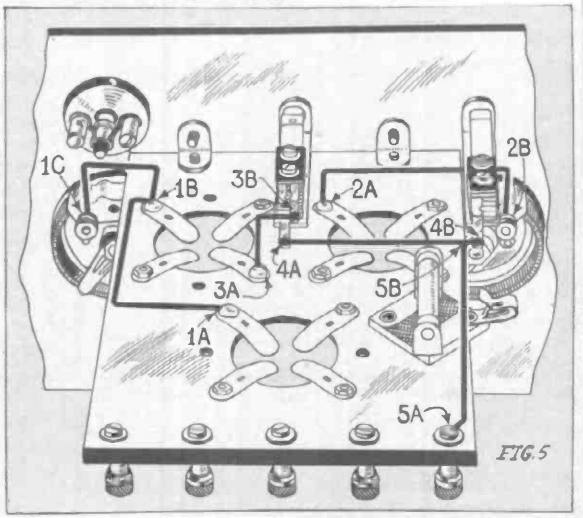


FIG. 5

Third Step—(See Fig. 6)—Bend and solder five more wires as follows:

Wire No. 6—From positive filament contact of second audio tube socket (6A) to second prong of horn jack (6B).

Wire No. 7—From A plus binding post (7A) to first prong of horn jack (7B). This wire passes straight over the reflex tube socket (under the reflex audio transformer when it is mounted in position) and should be partly covered with spaghetti to prevent any possibility of the tube socket contacts shorting on it. Spaghetti, of course, is not required if you use Celatsite wire.

Wire No. 8—From positive filament contact of detector tube socket (3A) to positive filament contact of reflex tube socket (3B),

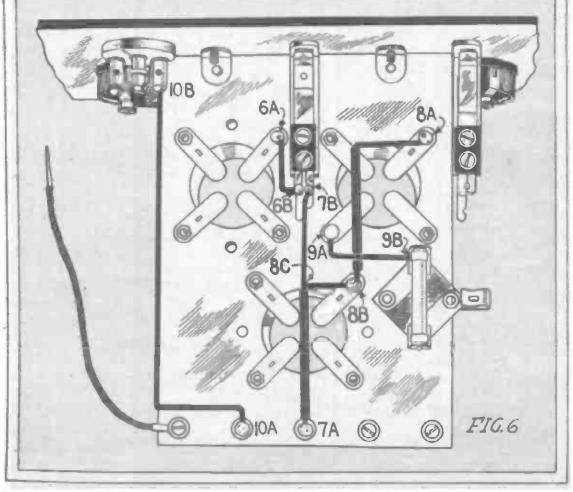


FIG. 6

then to wire No. 7 (at point 8C). Note that the portion of this wire which passes over the detector tube socket must also be covered with spaghetti, if ordinary bus-bar is used.

Wire No. 9—From grid contact of detector tube socket (9A) to one side of the grid condenser (9B). The grid condenser is not attached to the subpanel; it is merely held in place by the wires soldered to it.

Wire No. 10—From A minus binding post (10A) to one side of battery switch (10B).

Fourth Step—(See Fig. 7)—To finish up the wiring of the filament circuit, bend and solder this remaining connection:

Wire No. 11—From open side of detector rheostat (11A) to open side of amplifier rheostat (11B), and then to open side of battery switch (11C). When bending this wire remember to make allowance for the space which the Counterdon will occupy when it is mounted on the front panel. (See Fig. 2).

Fifth Step —(See *Fig. 8)*—Mount the two audio-frequency transformers as shown in Fig 8. Make sure you mount them so that the markings P, B+, G and F, stamped on the metal housing of each transformer, occupy the positions indicated in the drawing. The transformers specified in the list of parts are made in two styles, one with soldering lug or binding-post terminals and the other without terminals. It will be noticed that the type used in building this set has no terminals. Short direct connections are made with the flexible leads of the transformer coils, thereby simplifying the wiring.

Cover the flexible leads of the transformer coils with spaghetti of the required length and solder them as follows:

Connection No. 12—B+ lead of the reflex audio transformer to DET+ binding post (12).

Connection No. 13—Plate (P) lead of the reflex audio transformer to the plate contact of the detector-tube socket (13). Pass this lead underneath the transformer as shown in the drawing.

Connection No. 14—Filament (F) lead of the reflex audio transformer to wire No. 10 (at point 14).

Do not connect the grid (G) lead of the reflex transformer yet. Instructions for this will be given later.

Connection No. 15—Grid (G) lead of second audio transformer to grid contact of second audio tube socket (15).

Connection No. 16—Filament (F) lead of second audio transformer to wire No. 10 (at point 16).

Connection No. 17—Plate (P) lead of second audio transformer to center prong of phone jack (17).

Connection No. 18—B+lead of second audio transformer to the fourth prong of horn jack (18).

Sixth Step — (See Fig. 9)—mount counterformers T1 and T2 on the front panel. In Fig. 9 Counterformer T1 appears on the right and Counterformer T2 on the left. The terminals of the Counterformers are numbered, the numbers appearing on the labels inside the coils. Be careful when wiring to these terminals. It is extremely important that these transformers be correctly connected in the circuit.

Make the following connections:

Wire No. 19—From terminal No. 2 (19A) of Counterformer T1 to wire No. 10 (at point 19B).

Connection No. 20—Solder one side of the .00025 mfd. fixed condenser to wire No. 19 (at point 20).

Wire No. 21—From open side of the .00025 mfd. fixed condenser (21A) to grid contact of second audio tube socket (21B).

Connection No. 22—Solder one side of the .0001 mfd. fixed condenser to wire No. 19 (at point 22).

Wire No. 23—From open side of .0001 mfd. fixed condenser (23A) to Terminal No. 4 of Counterformer T1 (23B).

Wire No. 24—From stationary plates of Counterformer T2 variable condenser (24A) to terminal No. 3 of Counterformer

FIG. 9

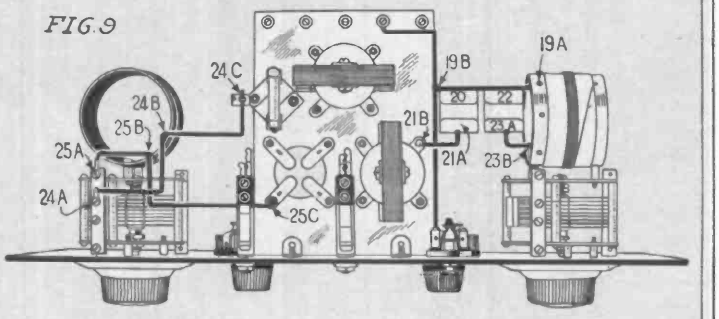


FIG. 8

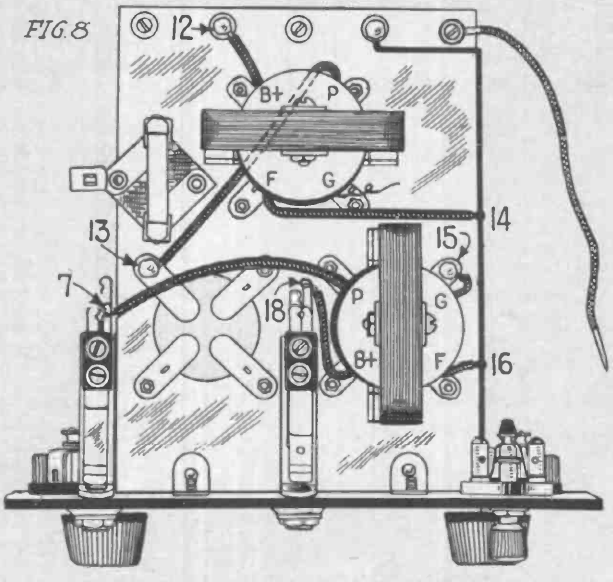
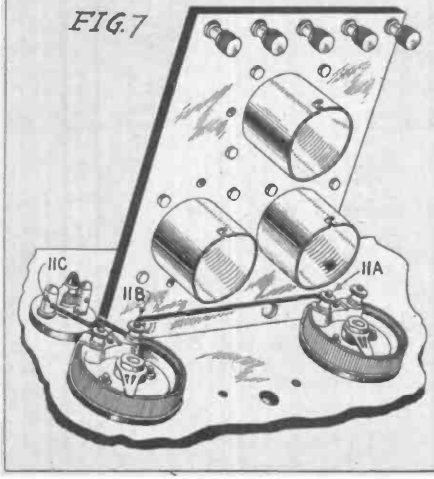
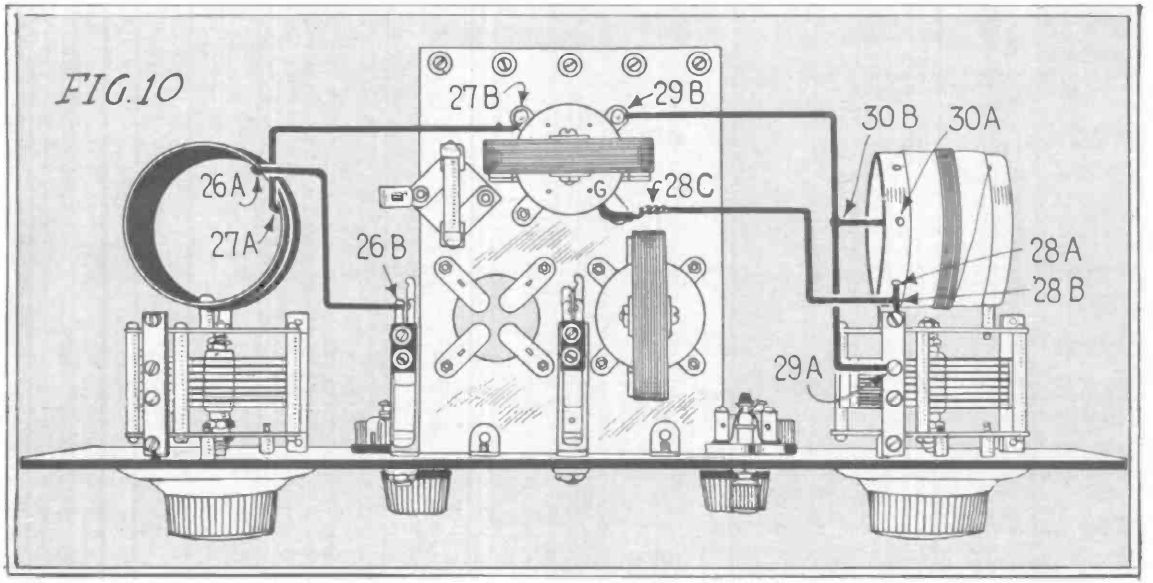


FIG. 7





T2 (24B), then to open end of the grid condenser (24C).

Wire No. 25—From movable plates of Counterformer T2 variable condenser (25A) to terminal No. 4 of Counterformer T2 (25B), then to positive filament contact of detector tube socket (25C).

Seventh Step—*(See Fig. 10)* — Bend and solder the following wires:

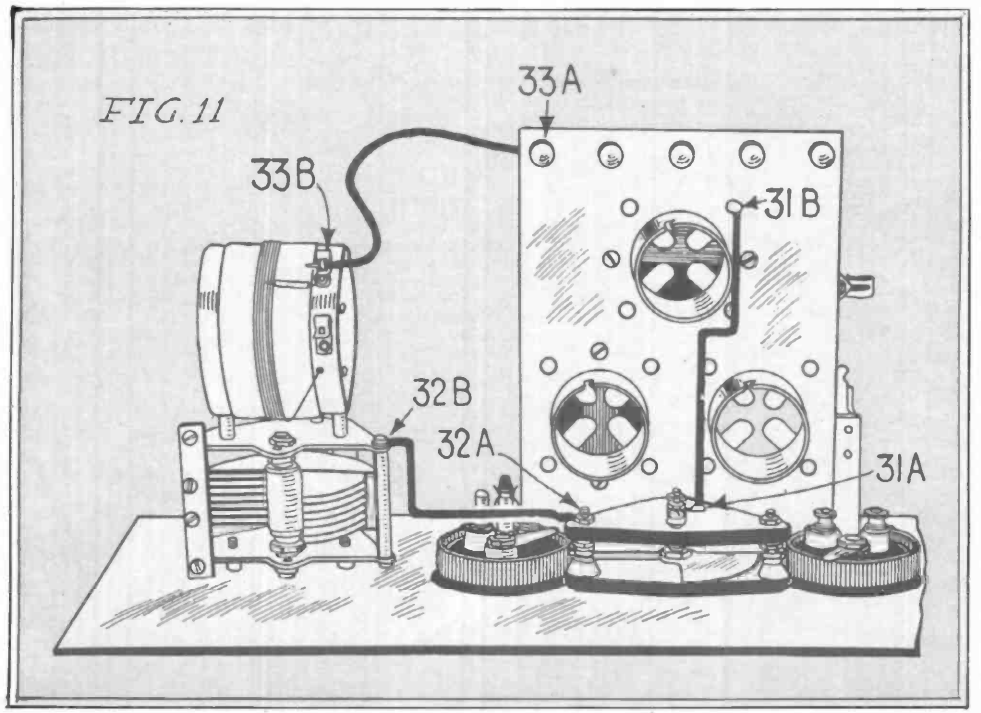
Wire No. 26—From terminal No. 1 of Counterformer T2 (26A) to the first prong of phone jack (26B).

Wire No. 27—From terminal No. 2 of Counterformer T2 (27A) to plate contact of reflex tube socket (27B).

Wire No. 28—From terminal No. 4 of Counterformer T1 (28A) to the rotor plates of Counterformer T1 variable condenser (28B), then to the grid (G) lead of the reflex audio transformer (28C). To make this connection run the bus-bar close up to the reflex audio transformer, wrap the grid lead of the transformer around the bus-bar, and solder.

Wire No. 29—From stationary plates of Counterformer T1 variable condenser (29A) to grid contact spring of reflex tube socket (29B).

Wire No. 30—From terminal No. 3 of Counterformer T1 (30A) to wire No. 29 (at point 30B).



Eighth Step—*(See Fig. 11)* — Mount the Counterdon on the front panel. Then make the last three connections:

Wire No. 31—From the movable plate of the Counterdon (31A) to the movable plate of the reflex tube socket (31B). Note that this lead runs over the top of the subpanel, this being the most direct route.

Wire No. 32—From the stationary plates of the Counterdon (32A) to the movable plates of Counterformer T1 variable condenser (at point 32B).

Wire No. 33—From the antenna binding post (33A) to one of the clips on Counterformer T1 (33B). Make this connection with a flexible wire. Connect to the clip which gives the

(Continued on Page 33)

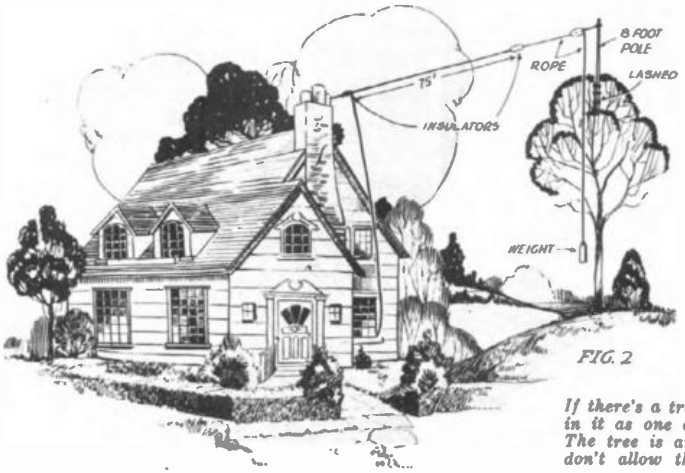


FIG. 2

If there's a tree nearby, put up a pole in it as one of the aerial's supports. The tree is an absorber, however, so don't allow the aerial wire itself to come close to its foliage

100 Per Cent Antenna

By BRAINARD FOOTE

I'D LIKE to say a few words to those of you who have just recently become members of our increasing radio audience. You've purchased, perhaps, a standard commercial receiving set and with it you have plenty of drawings and instructions for connecting the batteries, the loud speaker and the ground and aerial. However, unless you have made a particular study of the installation itself, you are not giving your new receiver a full chance to perform. You are not getting out of the air all that there is in it for you to get. And no matter how extremely sensitive your receiver may be, no matter how selective is its tuning and no matter how well it may work with a small and low aerial wire, you are not getting the utmost out of it until you see to it that your antenna is as nearly perfect as your conditions will permit. Of course, locations vary immensely and it is therefore absolutely impossible to predict just what sort of reception you will have in any given location until you actually try it.

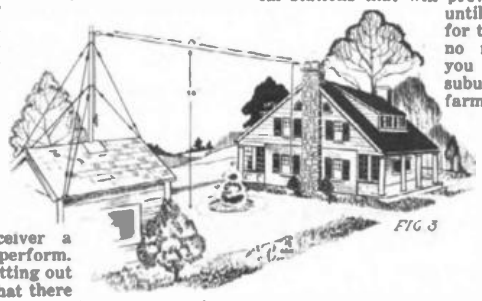


FIG 3

A garage or barn offers good footing for the extra pole. Placed in this way, it can be guyed firmly, even though you use a 20-foot pipe or flagpole

The worst possible receiving conditions occur right in the heart of a large city, in the midst of huge steel buildings. Some very peculiar effects are often noticed, for very frequently some of the buildings themselves, if they're high enough, have "wave lengths" just suited to some station that you wish to receive. If a building, let us say, should have a wave length of 395 meters and is right between you and some local station using that wave length, your reception from that station is likely to be poor on account of the building's absorption. On the other hand, if the building is the other side of you, it may help you to receive that station.

Conditions in suburban towns are practically as good as far out in the country when it comes to long distance work, the only drawback (so some consider it) being the comparative proximity to powerful local stations that will prevent "DX" work until they sign off for the evening. But no matter whether you dwell in city or suburb, village or farm, your receiving conditions may be made as nearly perfect as your location permits, provided your antenna system is planned and erected with an eye to maximum efficiency. To operate most successfully, it is but "horse sense" that the aerial must be given every chance in the world to pick up a maximum of energy from every station within range. And any structure protruding upward from the earth must of necessity be regarded as an obstacle to radio operation, whether it be a water-tank, a tree, a bridge, a barn or other building. Your objective should be an antenna which is so placed as to be at the greatest possible distance from these objectionable obstacles.

This suggestion is in most cases impossible to follow completely and the installation of the aerial becomes a matter of a selective choice among a dozen or so "evils." Structures made of wood, stone, brick, stucco, hollow tile and the like may be regarded as much less in detrimental effects than those of iron and steel. A lower antenna run to a wood building will often function more satisfactorily than a much higher one placed near a steel building, or close to a metal roof. However, a steel tower, smoke-stack or water-tank some distance away makes an ideal support providing about 50 to 150 feet of rope or guy-wire on the other side of an insulator is employed to bridge the gap between

For the suburban home on a small lot. The aerial is confined to the house itself. Make a good job of it and no one will consider it a detriment in point of appearance

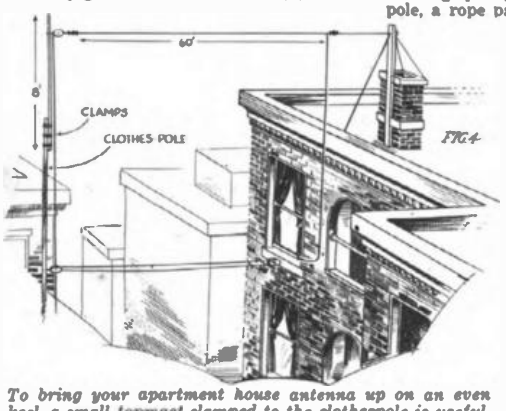
FIG. 1

aerial and supporting point. A highly efficient antenna installation is erected with the following points in mind:

1. Over-all length from tip to ground level not over 150 feet.
2. No close approach to trees or buildings.
3. Horizontal part as high as possible.
4. Lead-in wire away from building.
5. Absence of joints, soldered or otherwise.
6. As few insulators as possible.
7. Ground lead direct to street main.
8. Set placed close to window where lead-in enters.
9. Wire fairly heavy and rigid.
10. Clean connections throughout.
11. Straight, well-secured aerial masts.
12. Not near or parallel to other wires or aerials.

Now it isn't usually possible to put up an aerial excelling perfectly in all these different ways, but at any rate, coming as close as you can to all of them will improve your reception markedly. A very long antenna is not desirable for several reasons. In the first place, the tuning is so broadened that interference from code stations and between broadcasters on different wave lengths is always the result. Then, again, the antenna system will have a "natural wave length" up in the broadcasting band and this will prevent good reception on wave lengths near this natural wave length. Few sets today use a tuned aerial circuit. For example, the neutrodyne and all other forms of tuned radio-frequency circuit have a fixed antenna coil. So does the popular three-circuit tuner. The wave length of the antenna circuit must be less than that of the lowest wave length broadcast station received, or difficulty will be had in getting stations near the lower waves.

In the case of a high apartment house, the effective ground level is raised a great deal, on account of the large amount of piping and wiring in the building. In such situations, a counterpoise usually performs much more satisfactorily than the ordinary ground connections. The counterpoise consists of a wire 75 to 100 feet long, run out horizontally from the window to which the aerial lead comes, not necessarily placed directly underneath the aerial, but at least 40 feet lower than it. If it is necessary to slant the counterpoise downward to increase the distance between aerial and counterpoise, by all means do so. The counterpoise is insulated just as though it were a separate antenna.



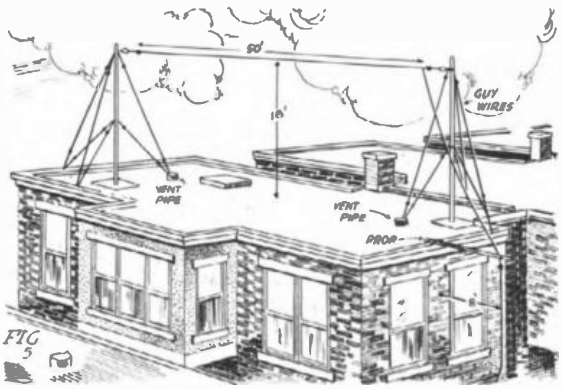
To bring your apartment house antenna up on an even keel, a small topmast clamped to the clothespole is useful, providing the landlord is good natured

Trees and buildings form pretty good antennas in themselves and sap a great deal of energy out of the "air" and away from the aerial. It is not bad practice, however, to use a tree for the support of an antenna, providing the aerial wire ends at least 25 and preferably 40 or 50 feet from the tree. The remaining distance is bridged by a piece of rope or a length of guy wire, with an insulator at the end of the aerial wire. The aerial ought to be higher than the tree, too, so it is a good plan to lash a stout pole to one of the main branches so that the point of support will be as high above the tree as you can make it.

To avoid breakage of the aerial when the tree sways in the wind, a smooth-running pulley may be fastened to the pole, a rope passed through it, and a window sash weight tied to the rope. When the tree sways then, the weight will move up and down, always keeping the aerial tightly stretched and at a fixed distance from the ground.

Poles on the roof of a house or apartment building should be very firmly guyed into position. If the pole is of steel (a length of pipe will do) three guy wires are usually needed at the middle and three at the top. The aerial itself should not be used to support the pole—the poles should be independent and capable of standing by themselves in the strongest wind.

A very fine apartment house aerial can be made by erecting two 18-foot lengths of iron pipe (about 1½ inches in diameter) about 100 feet apart and guying each pole securely to surrounding chimneys, vent pipes and the like. Heavy galvanized iron wire is suitable for the stays. The aerial wire itself should be about 60 feet long, with a lead-in from the end that is nearest your lead-in window. Even though the horizontal portion of the antenna be only about 50 feet in length, it is of distinct advantage to get it high and clear of surrounding objects. The lead-in wire from the aerial to the set should run eight to ten feet out from the building if possible, or if it comes down through an areaway or court, it should be placed right at the center. And it is best in all cases to make the lead-in wire and the aerial wire one and the same piece—the lead-in merely being the aerial wire extended. If it is necessary to buy a longer length than 100 feet to insure that you will have just one length of wire from your antenna binding post out to the end of the aerial, buy the necessary length and thus avoid soldered or twisted joints.



This apartment house aerial is about as perfect as it can be made. Two strong iron pipes form the poles, secured with two sets of guy wires each and a special prop maintains the lead-in away from the building wall

To reduce the chances of leakage during the damp weather, a multiplicity of insulators should be banned. Use only two insulators to suspend the aerial and one, when possible, as an attachment joint for the lead-in wire. This is located right near the lead-in bushing, and takes the strain off the bushing itself. The lead-in wire must not approach the wall of the building until it gets directly opposite the window.

It is a good plan to run the ground lead outside the wall, right down to a cellar window and thence inside to the water main. A length of heavily insulated wire about No. 12 in size is preferred for this lead, or else a piece of the same sort of wire that you use for the aerial, suspended on insulators outside. This type of ground connection is vastly superior to an attachment to the radiator in the room unless you are in an apartment building. In that case, especially if you are high up in the building, the direct connection is apt to be better. It is quite important to have short wires in the room. On this account, locate your set near the entrance bushing and run the aerial wire directly to the antenna binding post. If it is necessary to pass the wire through a hole in the rear of the cabinet, slip a length of spaghetti over it to prevent actual contact with the woodwork. A fairly heavy sort of wire is best for the aerial, either bare or stranded, and at least No. 14 in size. Stranded wire is less apt to break during bending caused by the wind.

To avoid losses at points of contact, the joints should be thoroughly cleaned before the wire is attached. This applies particularly to the ground pipe, which should be scraped and sandpapered down to the shiny metal before the ground clamp is put on. Connections in the set that are included in the antenna circuit (the antenna coupling coil or primary) must be cleaned and tight, too, for the slightest bit of resistance anywhere between the antenna's tip and the water main will lower the signal strength perceptibly.

It is often necessary to put up an aerial near other aerials and (Continued on Page 34)

By
VERA BRADY SHIPMAN

Miss Georgene Faulkner, America's original "Story Lady" (copyrighted), who broadcasts a weekly radio story to children every Wednesday over WMAQ

WMAQ, Chicago, "The Mother of them All"

SIT in your comfortable armchair before the fire, with your slippers and smoking jacket on (yes, there are still some folks who stay at home long enough to wear them), tune in on Saturday evening to WMAQ, Chicago, at about eight-thirty.

Your smoke dreams may help carry you into the far country—for over the radio you may listen to an interesting travelogue—the kind for which you pay several dollars for orchestra chairs each season. Open your rotogravure section of the Saturday Daily News, to the page of radio photologue-pictures of travel, and follow the lecture into Java and Sumatra with E. M. Newman; or another week into China with Mrs. Carter Harrison, to Italy with Miss Clara Laughlin or to King Tut's tomb with Professor Breasted, of the University of Chicago—it comes over the radio every Saturday night and is given in conjunction with the rotogravure section of the paper. The page comprises travel pictures, together with a map of the country discussed and photo of the lecturer. The lecturer comes into the radio studio at eight-thirty, and gives a short descriptive talk regarding this page. This radio photologue is a new and novel radio feature, wholly original and exclusive with WMAQ, Chicago.

Educational, you say! WMAQ is more than that. It is constantly seeking to find hidden gold in some unusual performance or some greatly desired radiocast. Its programs are musically of the first rank, from either a literary or purely entertaining standpoint. You enjoy their programs the more because you never can be quite sure what surprise WMAQ will give you when you tune in.

Musically, WMAQ features nationally known musicians. Mr. and Mrs. Marx E. Oberndorfer, lecture-recitalists, have been regular WMAQ contributors since the founding of the station, with their interesting musical interpretations. They have given analyses of operas and the Chicago Symphony weekly programs, have conducted a Musical Memory contest for children, also a series "Hearing America First," and this year are doing what is known as "Musical Geography." They are devoting two weeks to each country, first with the folk music and later with the well-known composers. These series have been indorsed by the General Federation of Women's Clubs, of which Mrs. Oberndorfer is National Chairman of Music. Mrs. Oberndorfer (formerly Anne Shaw Faulkner), is one of America's foremost authorities in musical appreciation and federated club work along the lines of Americanization in music and folklore.

Every kind of representative music is heard on the Oberndorfer programs. Especially interesting and valuable were last season's "operalogues," which preceded the

WMAQ weekly broadcast of the Chicago Civic Opera. Mr. and Mrs. Oberndorfer have specialized in these and their recital lectures are in demand in every city. Marx Oberndorfer is a well-known pianist and composer and Mrs. Oberndorfer's lectures are supplemented by his illustrative piano playing.

You can imagine how much more interesting the performance of *Thais* by Mary Garden would be after hearing the Oberndorfers' operalogue, or Marshall's *Samson*, or Louise Homer's *Amneris* in "Aida." The Oberndorfers give the operatic themes, the plot, characters and cast and an intimate drawing-room version of the whole opera.

Listeners wrote in their appreciation of the various programs of "Hearing America First" series, with special appreciation of cowboy music of the great West and Southern folklore of the days of Stephen Foster. It gave the American public insight into music of its own people.

A recent radio debut was given as a special courtesy to Mrs. Oberndorfer, when Mrs. Edward MacDowell, widow of Edward MacDowell, America's greatest composer, gave a program of MacDowell music interspersed with the history of the MacDowell colony (at Peterboro, New Hampshire) over WMAQ. Mrs. MacDowell makes her life work the perpetuation of the MacDowell colony, the summer colony in the New Hampshire woods for the creative artist. Proceeds of her recital programs go to the MacDowell fund, and the little woman tours America telling tomorrow's as well as today's musicians of the value of America for Americans.

At Peterboro, the creative artist in the Three Arts can find isolation in one of the many cabin studios scattered over the four hundred acre tract. It was MacDowell's idea to help the artist to create and Mrs. MacDowell gave her first radio performance over WMAQ last season, telling the listeners of the aims and aspirations which are the fulfillment of the Peterboro Idea.

Right — Miss Clara Laughlin, one of the radio photologue lecturers over WMAQ, who also gives a weekly lecture on travel

Left—Mrs. Edward MacDowell, widow of the late Edward MacDowell, the greatest American composer. Mrs. MacDowell lectures on MacDowell music, playing his compositions and sometimes using lantern slides of the famous MacDowell colony, at Peterboro, N. H. Mrs. MacDowell recently made her radio debut over WMAQ as a special courtesy to Mrs. Oberndorfer

Some one once called the Chicago radio stations a large, friendly family—and added that WMAQ was "the mother, God bless her, of them all."

WMAQ began with a newspaper service, in the mind of Walter A. Strong, business manager of the News, who combined the first WMAQ station with an advertising venture on the roof of the Fair store. He engaged the services of Miss Judith C. Waller, born and reared in a Chicago suburb. Miss Waller supplemented her school days with brief European travel, and from that entered the business world as an office executive in New York and Chicago advertising agencies.

Miss Waller has unusual vision. Her ideals for reaching the public, for giving them what they need as well as what they want, have been often in advance of other radio stations.

Sometimes they have called WMAQ programs "highbrow," but you will notice that any announcement in the News of a radio departure from the beaten path of

Left—Miss Judith C. Waller, director of the station. She gives its listeners always something worth while and unusual

club publicity, she was recently appointed radio chairman in the new department of the General Federation.

Nightly orchestra from the La Salle Hotel downstairs, from the Chicago Theatre programs of twin organ and orchestra, afternoon home economics by Mrs. Elizabeth O. Hiller of the Daily News staff, Mrs. Frances Ford's Mothers' Council as well as the Children's Wide Awake programs in conjunction with the newspaper, a home nursing course under Red Cross direction given by Miss Estelle Weltman, Harry Hansen's book reviews and Clara Laughlin's Tuesday travel talks are some of the weekly WMAQ practical features.

The WMAQ players are a recent addition. Under the co-direction of Mrs. Alexandra Carlisle Jenkins, formerly leading woman in the "Fool," who retired last season from the stage when she married J. Elliott Jenkins, a well-known Chicago clubman and radio expert—and William Ziegler Nourse, an experienced actor and coach, the WMAQ players present "play nights" each week of one-act plays or those of greater length, when an act will be given for two or three consecutive weeks. This group is as well rehearsed as a regular theatrical company and their productions have received favorable comment. Mrs. Jenkins also conducts a weekly course in English diction which is popular, her own English pronunciation giving rise to a German woman's hasty phone inquiry regarding "so much propaganda being given for the English." There is one feature of which WMAQ is proud and which has made itself famous in child circles and children's educational work. It is the Wednesday evening story broadcast by Miss Georgene Faulkner, probably the best known and beloved children's story teller in America today, the original "Story Lady" (copyrighted) of books, Chautauqua, talking machine records and radio fame.

Miss Faulkner is a Chicago woman, an instructor in the fashionable Faulkner private school, and her stories interest all ages. You enjoy her stories of Lincoln's boyhood, or her

(Continued on Page 38)

songs and instrumentation has flooded the mails with response from listeners who approve and want more. Miss Waller's personal tact makes and keeps her friends. Her busy desk at the News office is often a clearing house for friendly suggestions.

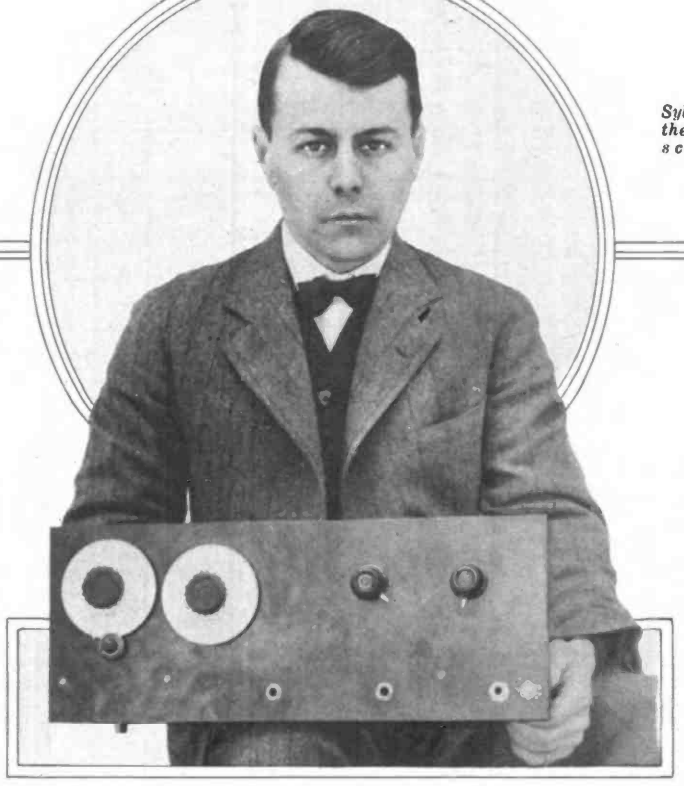
A recent wire connection to the University of Chicago brings deans and professors of this great institution in weekly talks, of from twenty to thirty minutes, on all subjects connected with the universities. Particular care is given to keep the talks nontechnical or at least understandable to the average radio listener.

As former President Judson of the University of Chicago once said that to meet the ken of the people you must meet the intelligence of a sixteen-year-old, WMAQ is striving to meet a like demand. Northwestern University professors are weekly before the WMAQ studio microphone as well.

Football games, World Series, sports of all kinds in the public eye, bring WMAQ in the vanguard with remote control radiocast directly from the ball grounds and stadiums; also weekly luncheon talks from the Association of Commerce, Illinois Manufacturers' Association, Y. M. C. A. Forum speakers, Illinois Federation of Women's Clubs (afternoon broadcast with clubwomen all over the State listening in). In appreciation of Miss Waller's helpful activities in federated

Alexandra Carlisle Jenkins (Mrs. Elliott Jenkins) and William Nourse, who are co-directors of the WMAQ players, who present a play or an act of a play each week

(Mrs. Jenkins, Phot by Shideler)



Sylvan Harris with the DX-Getter described in this article

A DX Getter—Easy to Build

By SYLVAN HARRIS
Engineer, Duraplate Company

WHEN a radio fan is asked to draw a circuit of a regenerative receiver, invariably he will show either a tickler coil arrangement in series with the phones and B battery, or a variometer in the plate circuit. There are many other variations of the regenerative type of receiver besides these two circuits and the results which may be obtained with some of these may often exceed those obtainable with the usual circuits. The subject of this article is an adaptation of the Hartley circuit to receiving broadcast signals.

The well-known circuit diagram of the Hartley circuit is shown in Fig. 1.

A single coil is shown connected to the grid at one end and to the plate at the other end through the source of voltage which may be a battery or a generator. A variable condenser is connected around this coil, the coil and condenser forming a tuned circuit.

This circuit is subject to many variations, depending on the use to which it is to be put. In some cases, where short waves are desired, the condenser may be connected across either that part of the coil between the grid and filament or that part which is between the plate and filament. The connection to the filament is made near the center of the coil for most efficient operation of the outfit as a generator of radio frequency current.

In this circuit a by-pass condenser is required around the source of voltage, as shown in Fig. 1. The reason for this is that the oscillation circuit is energized by the high-frequency voltage across the points A and B of the coil. If the impedence of the generator is very high, this potential difference will be small and consequently the energy transferred from that part of the coil in the plate circuit to that part which is in the grid circuit will be small.

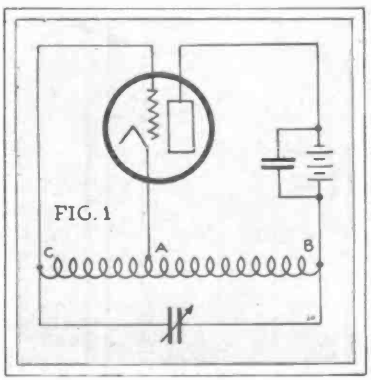


FIG. 1

Advantage of this fact is taken in this circuit to be described here. A condenser is inserted between the plate of the tube and the point B of the coil, so that it can be made sufficiently small, and consequently have its impedence raised to such a value that the oscillation will cease. Furthermore, it is not necessary to have the source of voltage connected in series with the coil and plate.

Fig. 2 shows an arrangement embodying this idea. This allows only the high frequency oscillations to flow through the coil which otherwise would have to carry both the alternating and D. C. components of the plate current. If necessary, a high-frequency choke coil should be connected in series with the generator, as shown at L, Fig. 2, to prevent the high frequency oscillations from entering the generator.

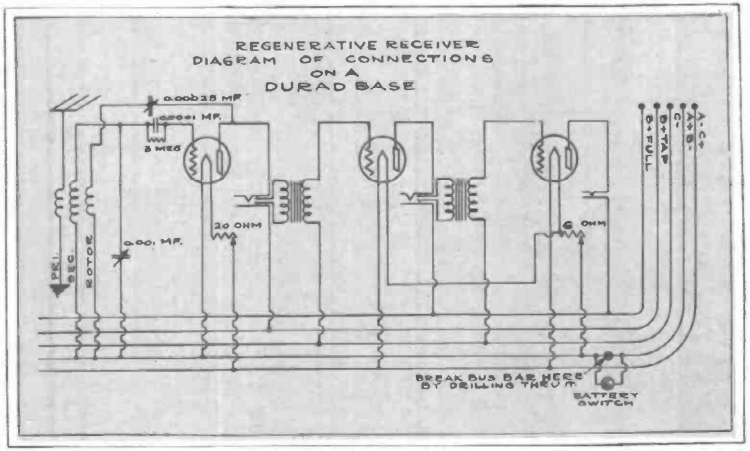
The circuit diagram of the regenerative detector, based upon this Hartley circuit, is shown in Fig. 3. The condenser, C-2, is a small condenser, as explained above, connected in series with the coil and plate to control the regeneration, or conditions for oscillation.

When the capacity of this condenser is small, its reactance is high and little energy flows through the coil. If the regeneration is low, the circuit cannot oscillate. When the capacity is increased, more and more energy is allowed to flow to the coil, increasing the feed back into the grid circuit, until a point is reached at which oscillations are set up.

Another coil is coupled to this one to act as a primary connected to the antenna and ground. To facilitate adjustment of the circuit the magnetic coupling between

the two parts of the main coil is made adjustable. In other words, the part A B is mounted so as to rotate within the part C A.

The success to be obtained with this circuit, as with any other radio receiver, depends upon the proper design of the tuning circuits more than anything else. In other words, low-loss construction should be employed throughout.



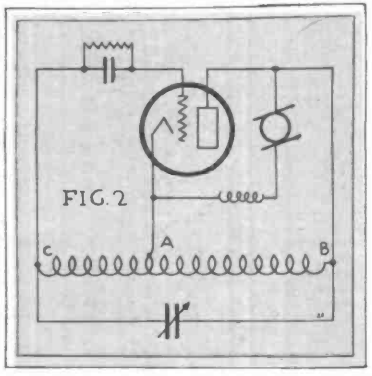
This schematic diagram shows the wiring of the set using the Durad baseboard. The connections can easily be followed if youprefer to use the ordinary wooden base

In the construction of this set the writer wishes to emphasize the value of low-loss coils and of low-loss wiring and to show that the other losses which may be present in tuned circuits are negligibly small as compared with these losses. Ordinary apparatus that is on the market and which is not classed as "low-loss" was used. The condensers had molded bakelite end plates and the coil was wound with ordinary bell wire and enameled wire on bakelite tubing.

The part C A of the coil was wound on a 3½" bakelite tube with ordinary bell wire, using 35 turns. On top of this winding the primary winding was placed, beginning at one end of the coil. This winding was also of bell wire and consisted of ten turns.

The movable part of the coil (the part A B) was wound with twenty turns of enameled wire, No. 20, on a bakelite tube just small enough to rotate within the larger tube. This was mounted by ordinary machine bolts so that it could be turned. No provision is made for mounting a dial on this, as, once it is adjusted it need not be touched again. This coil is mounted at that end of the large tube opposite the primary winding.

Although plenty of insulating material was used in the construction of this tuner, it is really a very low resistance tuning unit. The heavy insulation on the wire results in considerable spacing which reduces the skin effect in the coil considerably. Furthermore, it will be noted that a 0.001 microfarad condenser is used in tuning this coil. This results in a much smaller coil than would be necessary if a 0.0005 microfarad condenser were used. The smaller coil means a considerable drop in the resistance which more than counterbalances the lowering of the inductive voltage which this coil places on the grid of the tube.



The remainder of the circuit is the same as that of any ordinary audio-frequency amplifier which has been described many times before.

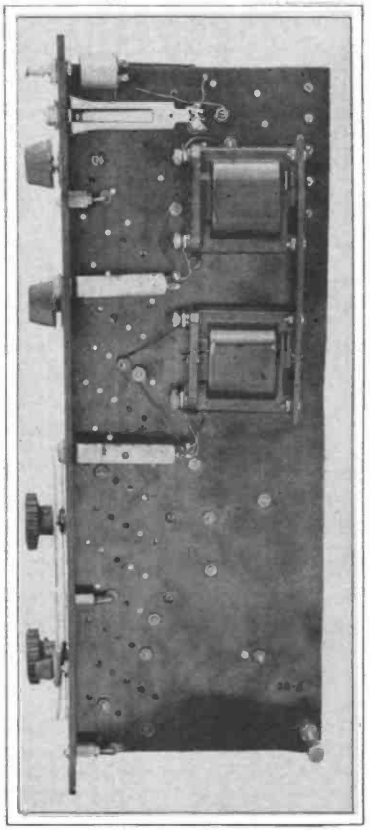
Another innovation in this set is the method of wiring used which eliminates all questionable soldered joints and loops in the wiring which may contribute inductance and capacity to the circuits, thereby adding considerable resistance or losses.

The base on which the apparatus is mounted is raised above the bottom of the panel. The reason for this is to get all the binding posts in the set near together. This is not possible with all the apparatus, as, for instance, the tuning coil and the condenser, as these are large pieces of apparatus and must of necessity require considerable wire to make the connections.

The transformers and jacks are mounted alongside each other under the base. This makes the connections of the transformer primary to the middle prongs of the jacks very short. Furthermore, the jacks are mounted as nearly as possible underneath the tube sockets. This makes the connections from grid to transformer also very short. In the photographs, it is to be noticed there are five main feeders running the length of the base. These are the feeders from all the batteries, viz., the A, B and C batteries, and are arranged in accordance with the wiring diagram. These are sunk into the base, so that the tube sockets may be placed directly over them if desired. Obviously, the connections from the filament terminals of the sockets to these main feeders may be made very direct, as may also the transformer returns to the C feeder.

The rheostats are mounted on the panel as close to the base as possible, so that the connections to these feeders may also be made very short. Where several tubes are to be controlled by one rheostat, as in this case, where the two amplifier tubes are controlled by the rheostat on the end opposite from the coil, the feeder from the A battery is broken and the rheostat shunted around the break. The same method is used in installing the battery switch.

The method of mounting the transformers is shown in another photograph of the bottom of the set. On account of being limited by the height of the panel, and not wishing to have the tubes project over the top, it was necessary to mount the transformers with the short dimension vertical. This has a twofold advantage, for it brings

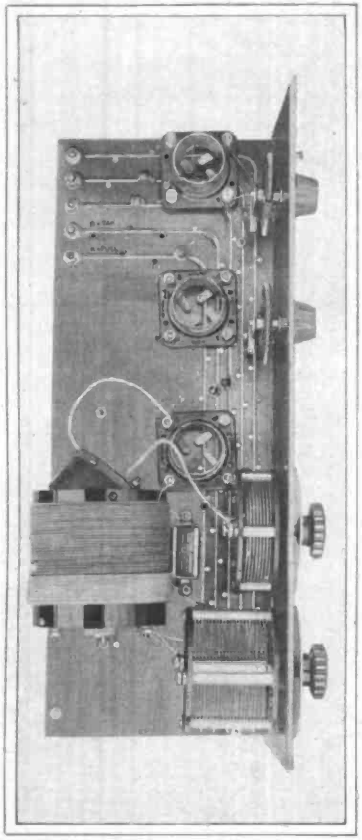


This method of mounting jacks and audio-frequency transformers under the sub-panel gives you the shortest possible leads

the input and output sides of the transformers next to the jacks to which they are to be connected. This eliminates crossing of wires and more inductive loops.

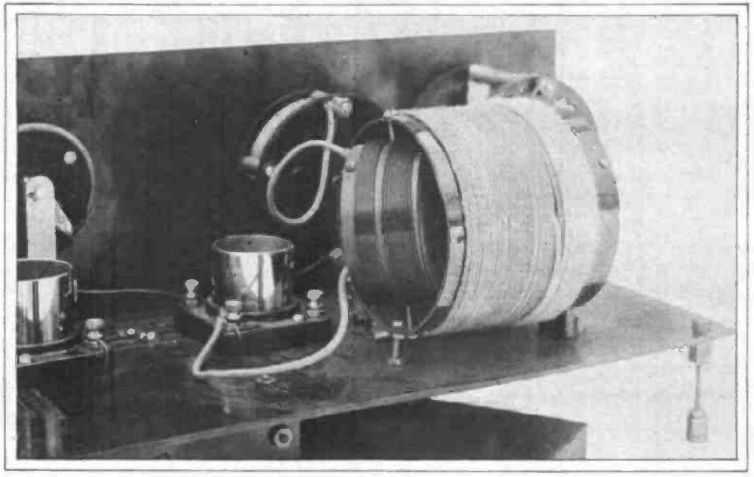
In all radio circuits there are a great many connections which go to common wires. Referring to the wiring diagram, it will be seen that there are eighteen connections to the various common wires or feeders. It is obvious that the wiring of the set is greatly simplified by these main battery feeders, for the connections that go from the instruments to these common wires can be made directly and very short by simply connecting them to the proper feeder.

The main battery feeders are sunk into the baseboard a little below the surface. This can be done by the radio fan by simply grooving the base board and forcing the bus bar into the grooves. Connections to these bus bars are made by means of bolts and nuts through holes placed next to the soft copper washer which has been bent down on one side so as to press into the groove. (See photos.)



Showing how all the instruments are mounted. This view was taken looking straight down into the set. It gives an excellent idea of the construction of the Durad base

If the fan is too busy to go to all this trouble, it may interest him to know that there is on the market a base board of a new insulating material in which the bus bars are molded into the material, as is shown in the accompanying photos. The necessary lug washers and bolts are furnished with the base, together with attachments for fastening the panel to the base. Holes are already drilled alongside the bus bars at intervals so that in assembling the apparatus together into a set connections to the bus bars may be made at the most convenient points. This commercial base board is known as *Durad* and is shown in the photographs.



This picture shows clearly how the coil is wound with ordinary bell wire and how the rotor is mounted with ordinary machine bolts. Easy, isn't it?

As to the results which have been obtained with this outfit, the following list includes some of the stations that have been received. These stations were received between the hours of 10 and 12, on January 8th, by William Johnson, of Frankford, Pa. The static at the time was considerable: WIP, Philadelphia; WEAF, New York; WFI, Philadelphia; WBZ, Springfield; WWAD, Philadelphia; CNRM, Montreal; KDKA, Pittsburgh; WBGS, New York; WEBH, Chicago; WSAI, Cincinnati; WGY, Schenectady; KFKX, Hastings, Neb.; WMAK, Lockport, N. Y.; WOC, Davenport; KYW, Chicago.

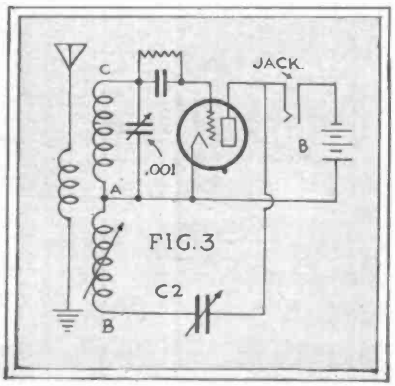
The tuning of the set is extremely sharp and, as can be expected, a vernier control must be used on the .001 condenser. The volume obtained on this set when using only two of the tubes was too great for comfort on the local stations. Satisfactory volume on local reception could often be obtained using only one tube. The reason for this is that the low-loss design of the circuit permits closer approach to the critical point, or the point of oscillation.

This close approach to the critical point is evidenced by the fact that the circuit does not "spill over" into oscillations suddenly, as is the case with nearly all regenerators. As the regeneration-control condenser is increased, the amplification increases continuously, gradually working into the condition for oscillation. The approach is so close that both the incoming signals and the squeal can be heard at the same time when the tuning is made very close.

The adjustment of the movable part of the coil is made as follows: The set is tuned for the longest wave length it is desired to receive, with the movable coil at right angles to the main coil. This is the condition for least amplification or feedback. The movable coil is then turned until the set just begins to squeal. It need not be touched thereafter, and it will be found that the critical adjustment can be obtained over the whole range of broadcasting wave lengths simply by manipulating the regeneration-control condenser (C-2).

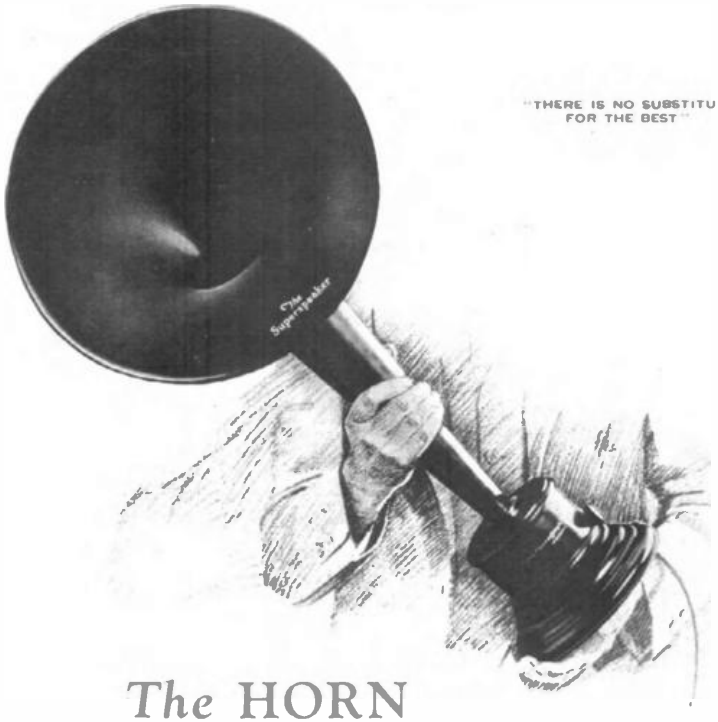
The list of materials required to build this outfit follows:

1 3½-inch bakelite tube.
1 2¾-inch bakelite tube.
¼ lb. bell wire.
1 .001 vernier condenser.
1 .00025 condenser.



1 Durham (new type) grid leak resistance, 3 megohms.
1 Grid condenser, .0001 microfarad.
2 Double circuit jack.
1 Single circuit jack.
3 Tube sockets.
1 20-ohm rheostat.
1 6-ohm rheostat.
2 A. F. transformers.
1 Durad-base and accessories.
1 7x18 Panel.
1 Filament switch.
3 UV-201A Radiotrons.

(Continued on Page 32)



The HORN *with the* "WHY"

When you first hear Radio through the Jewett Superspeaker, you marvel at the amazing accuracy and volume of the reproduction.

Yet there is no mystery in Superspeaker performance; it is based on laws you yourself can easily understand.

One could never jam the massed harmony of a full brass band through the eye of a needle. So the Superspeaker horn is ample in size for the work it must do.

Also sound, as you know, moves in a direct line. The Superspeaker throat is therefore straight as an organ pipe, avoiding the bugling effect due to the crooks or curves. And its inner surface is smooth and glossy, never tripping or confusing the waves of music or voice.

But most important of all is The Superspeaker's absolute immunity to harmonic vibration. It adds no notes of its own to the round, natural message with which it fills your room. So it "violins" only to a violin—"trombones" only to a trombone—rings only to a real bell. Non-metallic materials, in tapered and laminated construction, are the secret here.

Finally, to reflect its message into your home theater, The Superspeaker provides a sounding board shaped like a shell—the model used for generations by acoustical engineers.

Just listen to The Superspeaker! Compare its performance with that of any other loud speaker in the world. The difference will amaze you.

No extra batteries—Exclusive air-gap adjustment to modify results from nearby stations, and increase strength of those from far away—A true musical instrument, built and guaranteed by the million-dollar company whose name it bears Sweep the ether with a Superspeaker!

JEWETT RADIO & PHONOGRAPH COMPANY
5682 TWELFTH STREET, DETROIT, MICHIGAN

JEWETT Quality Products

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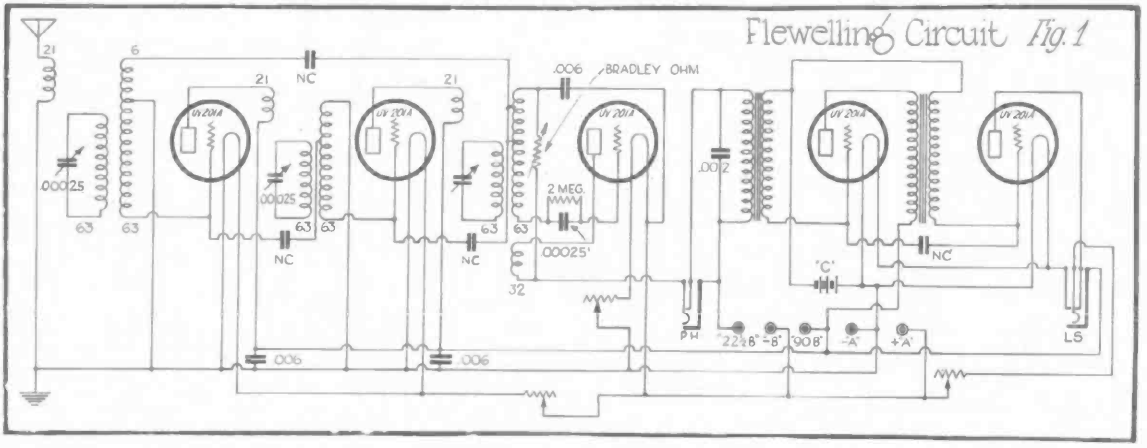


Neutralized radio frequency with super-regenerative detector and two stages 3½ to 1 audio frequency.

Radio-frequency transformers:

Primary: 21 turns No. 30 D. S. C. Bank Wound, 3 turns high, 7 turns wide.
Secondary: 66 turns No. 22 D. C. C.
Tertiary: 66 turns No. 22 D. C. C.
Tickler: 32 turns No. 26 D. C. C.

Radio Frequency *and the* Flewelling Circuit

By E. T. FLEWELLING

Associate Editor of Radio in the Home

BEFORE the days of the vacuum tube the radio world did not have an excessive amount of knowledge concerning the use of regeneration, as applied to radio reception.

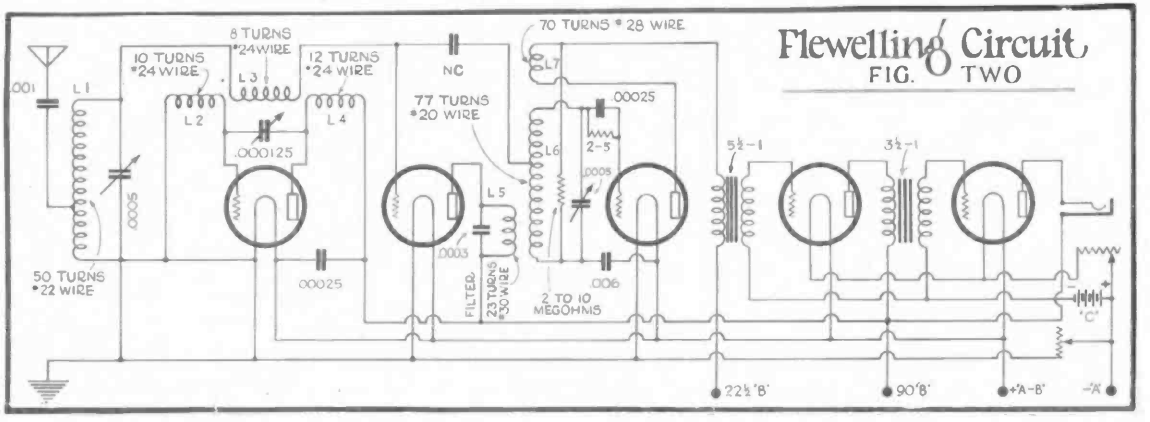
Not an exceptionally brilliant statement, I'll admit, but it leads very well to my next one, which is in effect the following: that it sometimes seems in the present day that even the best radio engineers have not yet entirely solved the problems presented when regeneration is used. Only last night I heard a very prominent engineer, a man who is an authority on the subject, practically admit that he did not have the subject under his thumb, so to speak. I very greatly admired the position that this man took, for the reason that he was not afraid to admit that he did not know, and because I felt that there is a very great need for further education along this line. The subject of regeneration, you will remember, was touched upon in my previous articles because I felt it might help my readers to estimate what they might expect from the Flewelling Circuit.

Suppose that we carry the subject a bit further, with the idea in mind of preparing ourselves a bit for the reason for this article—that of adding radio-frequency amplification to the Flewelling Circuit.

In articles of about two years ago I laid great stress upon using the shortest possible connections in wiring a radio receiver. I also asked my readers to build their sets with only the best obtainable parts. So far as I am aware, these articles were the forerunners of the present-day low-loss mania. I am asked today, quite often, "Flewelling, does this low-loss craze mean anything?"

Suppose we do a little brain work. Consider the incoming radio signal. Think of the power or strength of a common fly. I forget the figures, but as I remember, *a common fly has about* (Continued on Page 36)

1st Tube Oscillator.
2nd Tube Wave Changer.
3rd Tube Regenerator Detector.
2 Tuning Controls with one-stage neutralized Radio Frequency.



$100 a Month Increase

I am averaging anywhere from $75 to $150 a month more than I was making before enrolling with you. I would not consider $10,000 too much for the course.

(signed) A. N. Lang, Greensburg, Pa.

$3500 First Year

No sooner had I received my discharge (as a buck private) than I opened a radio shop of my own. I earned over $3,500 in 1 year. I wouldn't have missed the N. R. I. course for a million dollars

John P. Zinno, Corona, L. I.

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Before I enrolled with you I was making $15 a week on a farm. Now I earn from $2,040 to $4,420 a year. And the work is a hundred times easier than before. Since graduating a little over a year ago, I have earned almost $4,000 and I believe the course will be worth at least $100,000 to me.

(signed) Geo. A. Adams, Tamaqua, Pa.

Doubles Income

I can very easily make double the amount of money now than before I enrolled with you. Your course has benefited me approximately $3,000 over and above what I would have earned had I not taken it. T. Winder, Grand Junction, Col.

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Here is work that is fascinating, new and easy—an industry which is growing more rapidly than any other in the world today—an industry that offers you the chance of a lifetime to "get in on the ground floor" and make big money. Right now, thousands of trained men are needed in all branches of the business. Radio operators, radio engineers, salesmen, mechanics and Radio executives are scarce and receive wonderful pay. Are you going to shut your eyes to this golden opportunity when there is a quick, easy way to get one of these splendid positions?

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This page contains only a few of the thousands of letters we receive from successful graduates. Hardly a week goes by without our receiving urgent calls for our graduates.

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This is the time to go into radio. Big opportunities are now open in every branch of the work, and salaries were never so high. The thing to do is to begin studying at once, in whatever time you can spare, so that you will be able to qualify for the position you want when the time comes. Only an hour or so every evening will quickly prepare you for radio—a profession you cannot fail to find fascinating and pleasant. Don't handicap yourself; start at once and advance with the others.

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I am interested in radio as a profession. You may send me, free and without obligation, your interesting book, "Rich Rewards in Radio," all information about your spare time, home-study plan and about your free employment service. Also the details of your Special Offer.

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City ..... State.....

For The Advanced Student

Installment II—Oscillation and Regeneration

By BENJ. OLNEY
Engineer of the Stromberg-Carlson Company

The above phenomena are here discussed because they are influenced by the characteristics of the transformers. Oscillation and regeneration, as indicated by howling and distortion in amplifiers, can take place only when there is coupling between the input and output circuits. This coupling, which may be either inductive or capacitative, must be in such a sense that the voltage fed back is in phase with the input voltage if the system is to oscillate or regenerate. Inductive coupling is practically negligible between transformers with well-designed magnetic circuits. Thus, most of the feed-back commonly met with in audio amplifiers is due to stray capacities between parts of the wiring and apparatus, becoming effective only when more than one stage of amplification is employed.

Experiment has shown that trouble-some feed-back in two-stage amplifiers, as ordinarily connected in radio sets, takes place principally between the final plate circuit and the grid circuit of the first audio tube.

Transformers having excellent amplification characteristics because of their high mutual inductance, and employing the methods of connection hitherto considered standard, somewhat contribute to this trouble be-

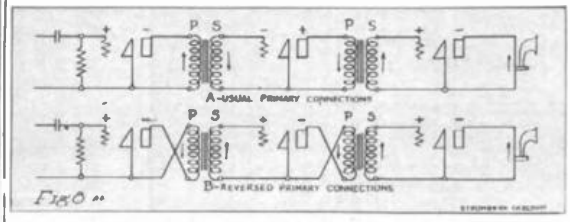

Fig. 8A—Amplifier With Usual Transformer Connections
Fig. 8B—Amplifier With Reversed Primary Connections

cause their high inductance requires but a small stray capacity to form a combination which will oscillate at an audible frequency.

A method of connecting the windings of such transformers has been devised, however, which renders amplifiers employing them exceedingly stable and allows full advantage to be taken of their superior amplification characteristics.

In Fig. 8-A is shown the schematic

Build the 3-tube Counterflex with this complete Harkness Kit

Harkness 3-tube Counterflex Kit **$39.50**

This kit contains all the parts to build the commercial model of the new simplified 3-tube Harkness Counterflex Receiver as illustrated at the top of this page. Cabinet not included.

Harkness 2-tube Reflex Kit **$35.00**

This kit contains all the parts to build the famous 2-tube Harkness Reflex Receiver. This is the set which put efficient radio reception within the reach of all. The receiver is "self-neutralized," does not whistle or squeal and cannot cause interference to others. It has only two operating controls. Complete building instructions enclosed with each kit.

Three-tube Harkness counterflex kit complete, in Canada, forty-eight dollars. Two-tube Harkness reflex kit complete, in Canada, forty-two fifty

The instantaneous and increasing popularity of the new Harkness Counterflex circuit is a good indication of its merits. Harkness fans all agree that it is the best yet—and the number of Harkness fans is increasing daily. Now Mr. Harkness has added the finishing touches to the 3-tube Counterflex circuit, simplified it a little, and made it just about the most worthwhile 3-tube circuit ever devised. This new, simplified 3-tube Counterflex receiver is very easy to build, especially if you use the complete set of parts contained in the genuine Harkness Counterflex Kit, illustrated on the left. The parts in this kit were designed by Mr. Harkness himself and are manufactured under his direct supervision. They are specially prepared to simplify the work of construction. The 7"x18" bakelite front panel is completely drilled and engraved. The three tube socket shells are securely fastened to a separate panel which mounts behind the front panel and beneath which are mounted the audio-frequency transformers. In fact, the parts in this kit are so arranged that, with only a screwdriver, you can put the set together in just a few moments. An instruction booklet, supplied with each kit, shows you how to assemble and wire the receiver. The illustrations in this booklet clearly depict each progressive step in the assembly and wiring, so that you can't possibly make a mistake.

Try this new Harkness circuit. The kit is not expensive and is really quite a bargain when you consider the quality of the parts and the efficiency of the receiver you can build with them. Any other receiver with the volume, selectivity and receiving range of the Harkness Counterflex would cost you two or three times as much.

Ask your dealer for the genuine Harkness Counterflex Kit and look for Mr. Harkness' signature on the label. Avoid cheap imitations. If your dealer does not stock genuine Harkness products, send your order directly to us, giving your dealer's name and address.

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Address .....

diagram of a detector and two stages of transformer-coupled amplification. The arrangement of windings is that which has been usual in interstage transformers, viz, both windings applied to the core in the same direction, the plate being connected to the outside end of the primary and the grid to the outside end of the secondary winding.

With this arrangement, assuming an alternating voltage across the detector grid-filament circuit, at an instant, say, when the detector grid is positive the polarities of the voltages and the directions of current in the other parts of the amplifier circuit will be as shown in the diagram; the plate circuit loads being such that voltage and current in the plate circuits are substantially 180° out of phase. (*)

It should be noted that the final plate voltage is in phase with the first audio grid voltage, which is the condition favorable to regeneration and oscillation. This is true especially in view of the comparatively large capacity area presented by the loud speaker and its cord, and by the first transformer casing, which is in close proximity to the first grid circuit via the outside layer of the secondary winding. The final plate is also in phase with the detector plate, but, in most radio receiving sets, the detector is fairly well shielded and troublesome coupling is seldom experienced here.

Now, referring to Fig. 8-B, we have the same arrangement as in Fig. 8-A, except that the connections of the transformer primaries have been reversed. An examination of the phase relations shows that the final plate and the first audio grid are now in opposite phase, and, consequently, the voltage fed back tends to oppose oscillation. The phase relations existing between the last stage of audio and the detector have not been changed by reversal of the primaries.

(*) "The Thermionic Vacuum Tube," H. J. Van der Bijl, Chap. VII, Sec. 59.

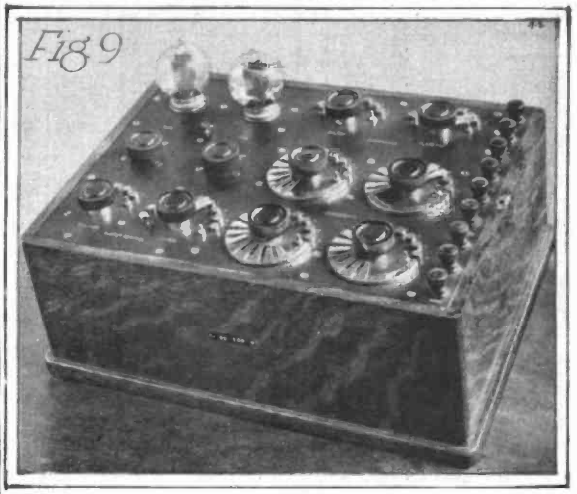


Fig. 9—Audio-frequency oscillator for furnishing input frequencies for transformer tests

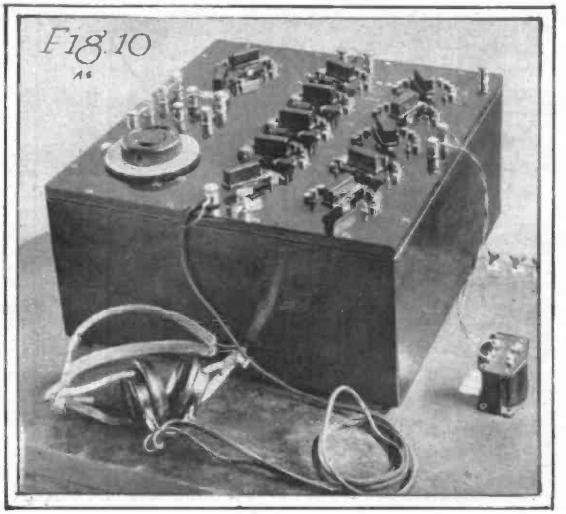


Fig. 10—Impedance bridge for measuring transformer constants

The plate of the first audio tube has been brought into phase with the final plate, but the amount of amplification given by one stage appears in practice to be insufficient to cause oscillation due to feed-back over this path.

It will be noted by those familiar with the neutrodyne principle that if the stray capacities between adjacent grids are of the proper magnitude, any coupling due to the grid-plate capacity of the tubes will be neutralized. Experiment, however, appears to indicate that most of the troublesome coupling occurs, as previously mentioned, between the final plate and the first audio grid circuits.

In practice, this reversal of the primary connections has been found very effective in the stabilization of amplifiers, even in cases where the wiring arrangement was such as to introduce comparatively large effective capacities between output and input circuits, and transformers are now available in which this reversal is incorporated when connected according to the usual terminal designations.

Laboratory and Factory Tests

The experimental study of audio-frequency intertube transformers has required the construction of special laboratory apparatus and the development of circuits and methods of measurement capable of dealing with the minute voltages, high impedances and wide frequency range involved. Special problems of a rather difficult nature were successfully met in the application of laboratory methods to the rapid testing under operating conditions of finished transformers in factory production.

For most laboratory measurements of these transformers it is necessary to have a source of AC testing voltage, capable of generating frequencies over a wide audio range. The requirements are such that great steadiness, both of frequency and voltage, must be maintained; the frequency must be independent of changes of load and be capable of fine adjustment, and the instrument preferably so constructed as to retain its frequency calibration over long periods of time.

A vacuum tube oscillator, satisfying these requirements, is shown in Fig. 9. One of the tubes acts as an oscillator and the other as an amplifier. Frequency is controlled by varying the capacity of a subdivided mica condenser by means of the four fan switches, and by varying the inductance in the oscillating circuit controlled by the two tap switches, shown at the right of the tubes. The two rotary switches at the lower left on the panel control the output by means of a potentiometer arrangement and a variable ratio transformer, the latter adapting the oscillator to work at maximum output into loads of widely varying impedance.

Another instrument, essential to the accurate measurement of transformer constants, is the impedance bridge shown in Fig. 10. It is used in connection with the oscillator, just described, for the measurement of inductance, capacity and effective resistance over a wide range, and is particularly suited, by reason of special high-resistance, nonreactive ratio arms and suitable shielding, to the measurement of very high inductances at audio frequencies. The inductance standards, consisting of a tapped inductor in series with a dial-controlled, continuously variable inductor, are self-contained and provision is also made for the use of external standards of either inductance or capacity. Other uses of this bridge are the investigation of the magnetic quality of transformer core material at audio frequencies and, with the aid of a standard condenser, the frequency calibration of the oscillator previously described.

Measurement of the voltage amplification of transformers must be carried out under representative working conditions to be of value. This requires that the transformer secondary work into the grid filament impedance of a suitable vacuum tube, and that the primary voltage be applied either through the plate-filament circuit of another vacuum tube or in series with a resistance having the same value as the AC plate impedance of a representative tube. The latter arrangement is more commonly used, because it is not only more convenient but eliminates error due to variation in the amplification given by the tube.

The circuit employed by the writer for the laboratory measurement of transformer amplification is shown in its essentials in Fig 11, and a photograph of the set-up is reproduced in Fig. 12. The operation of the circuit will now be described.

Referring to Fig. 11, the source of alternating voltage at the extreme left is a vacuum tube oscillator of the type shown in Fig. 9. The calibrated variable resistances R_1 and R_2 are so connected mechanically that their sum is constant regardless of the position of the handle controlling the movable contacts. Their actual arrangement may be seen in Fig. 12, where R_1 and R_2 are the two upright boxes, having their corresponding switch handles rigidly connected, the switch arms being so set that when one of a connected pair is in the position giving minimum resistance, for instance, the corresponding one is in the position giving maximum resistance.

R_3 is a known, fixed resistance and is connected in series with R_1, R_2 and the oscillator.

Because the sum of R_1, R_2 and R_3 is constant in value, if the voltage of the oscillator be kept constant the voltage E, across R_3 will remain constant regardless of the position of the handles controlling R_1 and R_2.

The thermocouple TC with its associated microammeter serves to measure the current in the circuit in cases where it is necessary or desirable to calculate the voltage E_1. This latter voltage is applied to the primary of the transformer under test in series with R_3, the latter representing the plate impedance of the tube out of which the transformer is supposed to work.

The value of R_3 is small in comparison with that of R_2, plus the input impedance of the transformer, so the connection of the latter two elements does not appreciably affect the division of voltage in the R_1, R_2, R_3 circuit.

The switch K is so arranged that in its lower position the secondary voltage of the transformer is impressed across the grid-filament circuit of the vacuum tube T_2, and in its upper position the voltage due to the IR drop around R_3+R_2 is impressed across the same circuit.

T_1 is a vacuum tube of the type into which the transformer is designed to work, and its associated "C" battery is of such voltage that the grid never takes current.

The output of T_1 is stepped up by another transformer and applied to the input circuit of the tube T_2, which is equipped with a grid leak and grid condenser and is operated as a detector or rectifier.

The arrangement of the output circuit of this tube is that ascribed by Van der Bijl to Dr. J. B. Johnson. It consists of an ordinary Wheatstone bridge network in which the plate-filament resistance of the tube forms one arm of the bridge, its effect being that small variations of potential applied to the grid unbalance the bridge and cause comparatively large deflections of the meter M.

As will be seen later, the deflections of this meter merely serve as an indication of the equality of two voltages successively impressed upon the grid of the last tube; therefore, the circuit resistances and voltages are so chosen that the meter is in effect

"set back," that is, if there were no AC voltage acting on the grid, the meter would tend to deflect to the left of zero, but with the normal voltage it gives about mid-scale deflection. This results in a high degree of sensitivity, the effect being that of using only a few inches of the scale of an imaginary meter having a scale length of several feet, but reading zero with no AC applied to the grid of the tube. Measurements of amplification are made as described in the next paragraph.

The oscillator is adjusted to the frequency at which the measurement is desired with the switch K thrown into the lower position. The voltage E_1, after being amplified, is impressed upon the input of T_2, causing the meter M to assume a certain deflection. Switch K is then thrown up and R_1 and R_2 adjusted until the same deflection is again obtained, K being finally operated back and forth quickly to check the equality of the deflections.

The voltage amplification may then

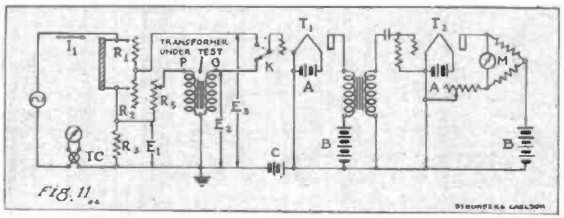


Fig. 11—Circuit for measuring transformer amplification

be calculated from the setting of R_1 and the value of R_2 as follows:

$$E_1 = I_1 R_2$$

also $E_2 = I_1 (R_3 + R_4)$

and when the deflection of M is the same for either position of K,

$$E_1 = E_2 = I_1 (R_3 + R_4)$$

Now, as shown in a preceding section of this article,

$$\text{Voltage amplification} = \frac{E_2}{E_1}$$

Substituting values above,

$$\frac{E_2}{E_1} = \frac{I_1 (R_3 + R_4)}{I_1 R_2} \text{ or,}$$

the currents being the same,

$$\frac{E_2}{E_1} = \frac{R_3 + R_4}{R_2}$$

In practice, it is desirable to make R_2 some convenient value, such as 100 ohms, to facilitate calculation.

The sensitivity of the method is such that the voltage amplification may easily be determined to within one part in 500. Such accuracy may appear to be unnecessary in a measurement of this nature, but is convenient in practice, because it allows the effect of small variations in design factors to be studied.

Factory tests include electrical inspection of windings for opens and short-circuited turns before assembly, insulation break-down tests, and a check of the voltage amplification of the finished transformer under operating conditions.

A test of the windings for short-circuited turns is necessary because of the serious effect of even a small number of the latter upon the voltage amplification of the transformer. A simple device of the induction balance type, shown in Fig. 13, is employed in this test. It consists, essentially, of a primary winding fed from a 1000-cycle source, and over the center portion of which are wound two differentially connected secondary coils wired to an ordinary radio head set, the adjustment being such that under this condition no current flows through the head set. The winding under test is slipped over the primary adjacent to one of the secondary coils, its effective capacity being balanced by that of a similar winding, known to be free from short-circuited turns, permanently located adjacent to the other secondary coil.

If the winding under test be O. K., little or no sound will be heard in the head set, but if it contains short-circuited turns a decided tone will be heard, depending in strength upon the number of turns involved in the short circuit.

The device is sufficiently sensitive to detect a short circuit which will produce any decided loss in amplification as measured by the laboratory method previously described. The windings are also tested for opens during this same operation by short-circuiting their terminals, a loud tone being heard if the winwing is not open.

Insulation breakdown tests between the primary and secondary windings and between windings and the core-case assembly of finished transformers are made by the application across the parts, between which lies the insulation to be tested of 500 volts AC in series with a current indicating device to detect breakdown.

The final factory test of the finished transformer consists in comparing its voltage amplification under operating conditions with that of a standard transformer at three representative frequencies. This testing outfit is shown in Fig. 14. The oscillator which supplies the testing frequencies is not shown in the photograph as it is located some distance away to avoid inductive effects. It will deliver voltages of three frequencies, 200, 1000 and 3000 cycles, and is remotely controlled, through relays, by a three-position key located at the

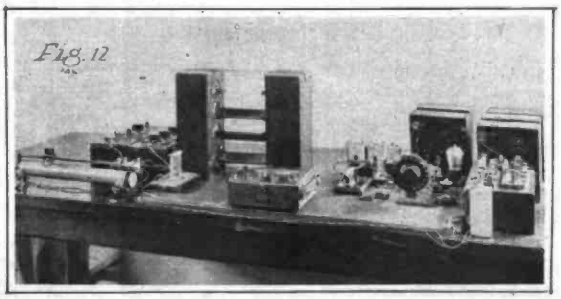


Fig. 12—The actual apparatus shown in the diagram of Fig. 11

lower left of the testing panel. These voltages are applied to the primary of a standard transformer in series with a high resistance imitating the plate impedance of a vacuum tube.

The voltage amplification characteristic of the standard transformer, has previously been carefully determined in the laboratory and represents the limit below which the manufactured product will not be passed.

The secondary voltage of this transformer is amplified, rectified, and caused to unbalance a Wheatstone bridge in the same manner as described in connection with the laboratory test, Fig. 11. This causes the meter located on the baseboard to deflect, this deflection, for convenience, being adjusted to mid-scale.

Then, by means of an electrically operated, quick-acting switch of the anti-capacity type controlled by a push button on the panel, the transformer under test is substituted in the circuit for the standard transformer. The deflection of the meter must now be equal to, or greater than that given by the standard transformer or the transformer under test is rejected. This is repeated on each of the testing frequencies, every transformer being required to pass all three tests.

The rather formidable array of panel consists of "setting-up" adjustments, which are manipulated only at the start of a series of tests. They serve mainly to regulate the input voltages and to adjust the Wheatstone bridge circuit.

The one at the left controls a shunt for the meter, and is so arranged in connection with the filament battery switch that the latter may not be operated unless the meter is short circuited. This protects the meter from damage due to the extreme unbalance of the bridge which exists for an instant after the battery circuit is closed, and during which, as the filament heats, the plate resistance passes from an infinite to a finite value.

In practice, about two minutes is required for making the setting-up adjustments, after which transformers are completely tested at the rate of about 100 per hour. Such testing speed is attained only as a result of careful attention to details in the design of the test set; for example, it was necessary to provide the meter with a damping resistance of rather critical value and to pay attention to the sequence of contact in the change-over switch, and to the location and shielding of the operating magnet of the latter in order to avoid meter "kicks," which would not only be confusing to the operator, but would result in a large loss of time in waiting for these false deflections to subside.

The test will not only detect low amplification, but is so adjusted that a transformer with abnormally high amplification will cause the meter to deflect off-scale. Opens, short-circuited turns, grounds to case, reversal of any of the winding connections, incorrect number or ratio of turns, and poor quality or improperly assembled core material will also cause unstandard indications in this test, the use of which enables a high and uniform quality of finished product to be maintained.

The mathematics of audio-frequency intertube transformer design has been purposely omitted from this article to simplify the descriptions, yet enough detail has been given to emphasize the fact that this part of the broadcast receiver development has kept pace with the radio frequency end.

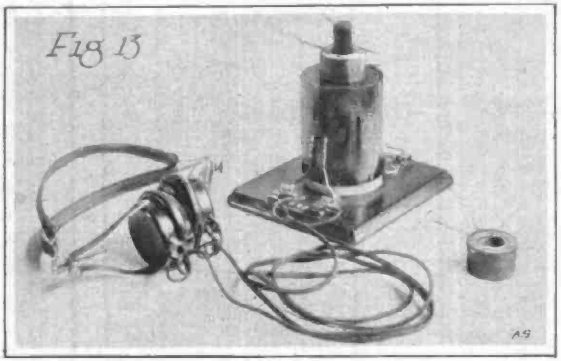


Fig. 13—Instrument which tests for short-circuited windings

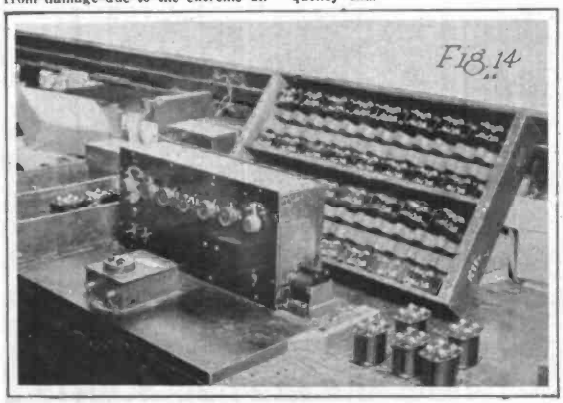
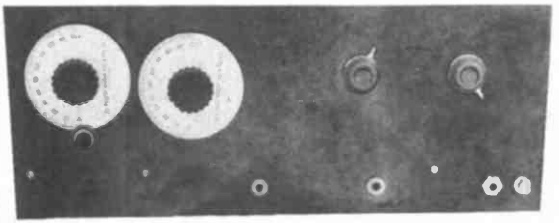


Fig. 14—Apparatus at which the final factory tests of transformers is made

A DX-Getter Easy to Build

(Continued From Page 22)

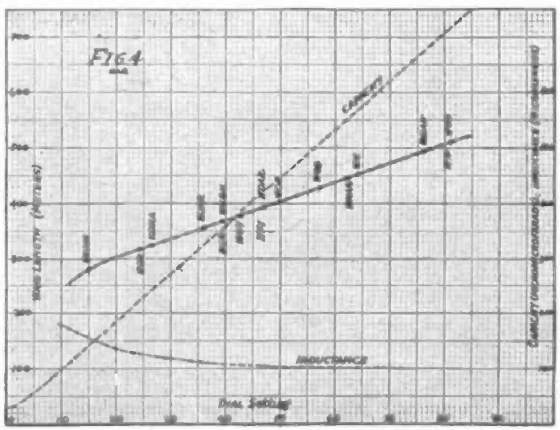
On account of the fixed coupling between the plate and the grid circuits, it will be found that this set can easily be logged. Figure 4 shows a curve plotted giving the wave lengths in relation to the dial setting of the tuning condenser. As a matter of interest, the capacity curve of the particular condenser used for tuning is also shown. From these two curves the inductance of the coil has been calculated and plotted.

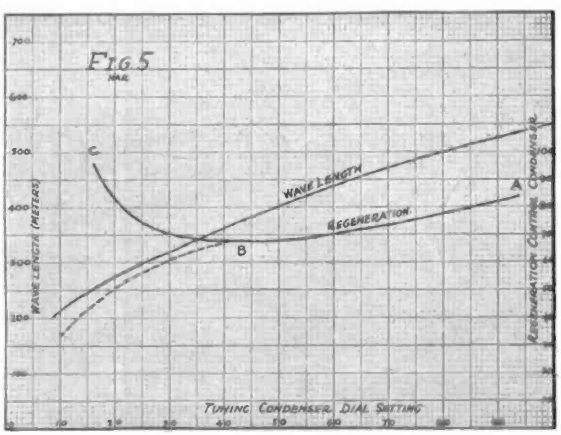


It will be noted that this curve rises as we approach the shorter wave length. Figure 5 shows another such log together with a curve showing the relation between the setting of the tuning condenser and the critical setting of the regeneration-control condenser. This is the point of adjustment at which maximum amplification is obtained. (These curves will probably not fit your receiver. They are simply typical of this circuit and may vary somewhat with each individual set.)

Since this condenser limits the feed-back of energy and the amount of feed-back required is less on the shorter wave lengths, it follows that the setting of the regeneration control condenser, which causes the circuits to oscillate, will gradually

(Continued on Page 46)





How to Build a "Commercial Counterflex"

(Continued From Page 14)

best results with your aerial. Mount the two large dials on the shafts of the variable condensers and the three-inch dial on the shaft of the Counterdon. Attach these dials so that they read "100" when the movable plates of the condensers are completely inclosed within the stationary plates.

And that's all—but you had better run over everything again and check up your wiring to make sure you have made no mistakes before you hook up the batteries and tune in.

Editorially Speaking

(Continued From Page 4)

very much alive—only it is moving gradually farther and farther away from the centers of population.

These people are only now becoming sufficiently interested in radio to make inquiries about it. They are the market next year and the year following. This market will move out from season to season until at least 80 per cent of the six million farms are sold on radio instead of the 2½ per cent that are sold now.

The average farmer of today is in much the position of the fan of three years ago. All circuits are new to the farmer. He has no stock of apparatus. He knows little or nothing about radio, but is beginning to see how fascinating it could be and is starting to study it and make inquiries about hook-ups, parts and completed sets.

If this vast potential market divided itself only fifty-fifty between completed sets and parts, there is no reason on earth why the manufacturers of parts should not be amply satisfied with so tremendous a field. It is up to the manufacturer to go after it and get it. He is done so far as the cities are concerned; he has not yet begun so far as concerns the vast population in the rural districts. It is for this reason that *Radio in the Home* is making no campaign for circulation in the cities, but is going out after this country circulation. We are thoroughly convinced that that is the market of the future, and we are not waiting for an invitation from the market; we are going out and inviting ourselves in. It is a most gratifying fact to me that more than 60 per cent of our whole subscription list consists of readers of just this type—readers who are some distance from cities and some distance from markets and who must depend upon the advertising pages of this magazine to tell them what to get and where to get it.

But there is one thing that the manufacturer of parts has got to realize and he might as well realize it now. That is that the price of all parts is entirely too high to be justified. This, let me explain, to the reader is not the fault of the manufacturer. It is the fault of the unfortunate seasonal aspect of the radio industry and the number of hands through which parts must pass before they reach the consumer.

The manufacturer is compelled under present conditions to give the average distributor 50 per cent plus 10 per cent. The parts then pass through the hands of jobbers and dealers, and the dealer himself must have at least 35 per cent profit on them.

Does this profit seem high to you? It is unfortunately necessary under present conditions.

One of the biggest retail dealers in the United States made a startling statement to me some time ago.

"When I first started in," he said, "I thought that the radio business would be good for eight months in the year and virtually amount to nothing in the summer. Now, however, I am beginning to believe that we are going to have only four good months and eight bad months. If that is the case, you can look for the closing up of at least 75 per cent of strictly radio stores in the country, and I predict that radio material will be handled almost entirely by talking machine dealers, hardware dealers, electrical dealers and other who have another line of goods which will keep profits coming in during the slump period in radio."

If this man is right, it will be essential for the strictly radio dealer to have at least 35 per cent profit during the good months in order to finance himself during the bad months. Otherwise, the strictly radio dealer will be a thing of the past and radio must share the store shelves with material of another line which will move during the summer months and the bad period of radio, and so keep the profits coming in to the dealer.

This consideration of price leads me to another very interesting report from Mr. Dudley and also from my own observation. If the manufacturer of parts thinks that the hook-up craze is dead, I simply invite him to visit the Kresge store in his home city.

Mr. Dudley tells me that he visited several of these stores in order to see how the sale of this magazine was going and that he could not get near the radio counter. Customers were crowding three and four deep in front of the counter, all struggling to get in and buy parts, and Mr. Dudley was forced at last to go to one of the executives of the company before he could get the information he wanted. He could not get close enough to the salespeople to ask any questions.

Here we have a definite proof that there are thousands of radio fans even in the large cities who are still crazy about hook-ups. But they will not pay the high prices which are asked in the general radio stores. They go to Kresges and they keep going there.

There are two things, then, that must be done if the manufacturer of radio parts is to remain in business on a profit-making basis.

First and foremost, he has got to stop his routine of marketing through the regular channels in the large cities. He has got to realize that the hook-up craze, so far as concerns the more highly priced material, is moving out beyond the centers of population into the sparsely settled regions. And, somehow or other, the manufacturer has to arrange his marketing so that he can follow that craze.

Such a merchandising organization as this costs money. The manufacturer who is not amply financed cannot do it. It takes a well organized and a well capitalized company to arrange for such widespread distribution, but there is sufficient profit in it to make it well worth while for those who can arrange it.

I have noticed in my own motor trips around my home that, in every town large enough to boast an automobile dealer, you will almost always see Atwater-Kent material on display in that dealers window. Here is a firm which has realized the importance of following the craze out into the suburbs and the rural districts. And, fortunately for them, their long connection with the automobile industry has given them the merchandising organization and the selling facilities to get their stuff out before the eyes of people who have no chance to see anything else.

I judge from the letters which I get from the two magazines with which I am connected that Crosley Corporation of Cincinnati, is doing very much this same thing. I am astonished at the number of letters coming from unheard of little places

(Continued on Page 37)

A 100 Per Cent Antenna

(Continued From Page 16)

while an unfortunate situation, the best may be made of it by running your own aerial at right angles to the nearest of the others and as far from it as you can. And it won't do a bit of harm if your aerial happens to be higher than the rest.

Power wires elevated on poles are also to be avoided, not only because they often cause humming noises through induction, but on account of the fact that they, too, form absorbing metal structures to be kept at a distance just as you have done in the cases of trees and buildings.

The sketches illustrate some particular cases and give suggestions which you may individually adapt to your own requirements.

In No. 1 we have a frame dwelling of average size but without facilities about the house for fastening the antenna, such as a tree, clothespole or garage. A short, stout mast is erected at front and back of the ridge, extending perhaps 6 or 8 feet above the roof. If of sufficient diameter, these will not require guying, and are supported instead by metal clamps fastened to the edge of the roof as illustrated. To keep the lead-in wire away from the wall, another stick is fastened beneath an upstairs window or under the edge of the roof as a prop.

In No. 2 we find a house with a good high tree at hand. Here the problem is perhaps simpler, although some ingenuity will be called for in fastening the pole in the tree. Plenty of room is allowed between the farther insulator and the tree, however, and a weight is used to keep the aerial tight under all wind conditions.

In No. 3 is a suggestion for a house and a garage. Such locations are usually in the suburbs, where an antenna functions well lower down than would suffice for the city. If there is no room behind the garage for guying, the pole may be placed at its center and guyed in three directions.

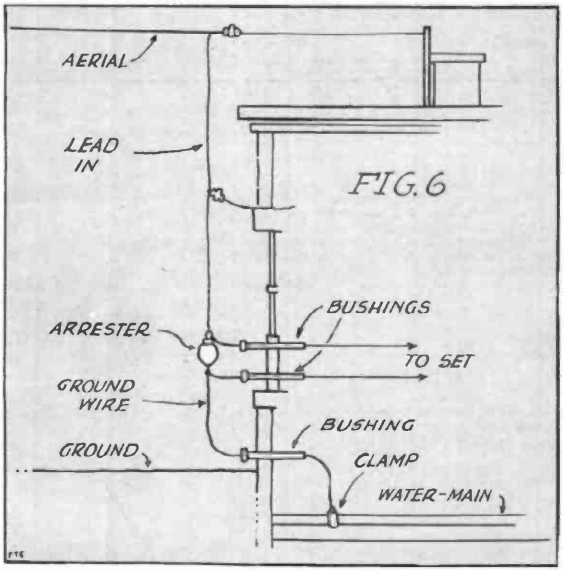
On the city apartment house, where a good clothespole is available, a short "topmast" may be attached as in No. 4. It is well to fasten this extra mast to the pole with a couple of heavy clamps, having nuts and bolts. These can be made for you by a blacksmith at small cost, once you know their size. The topmast might be eight or ten feet long, if it is strong enough to withstand considerable pull from the aerial without bending.

A very fine installation, but unfortunately one which cannot always be obtained, is pictured in No. 5. Here two iron pipes are used as already outlined, guyed secured and the lead wire kept away from the wall by an extra prop at the edge of the roof. Dimensions given are merely suggestions, with all these illustrations.

Regulations by insurance companies differ widely and it is a good plan to ask your insurance broker or the company carrying your insurance for a copy of their latest rules on the subject of radio installations. And no matter whether they seem reasonable to you, be sure and conform to them and then have your installation approved by their inspector. A notation is usually made on your insurance policy thereafter granting you permission for your installation.

Sketch No. 6 outlines in schematic form the most common type of antenna installation that is in conformity with underwriters' regulations. The lightning arrester is specified and the outside type is most conveniently used. It is merely a small air gap, inclosed and protected from the weather with a "petticoat" insulator. It has a spring clip at the top through which the aerial lead wire may be passed without the necessity of cutting or soldering. The lightning ground wire may sometimes be as small as No. 14, though certain localities call for No. 12 or even as large a wire as No. 8. This is best used for the radio ground as well as for the lightning ground, so that two lead-in bushings, spaced a couple of feet apart, are employed. The arrester merely bridges the gap between these two, outside the window. Ground is made to the water main in the cellar, on the street side of the water meter, if there is a meter in use.

When your installation is finished, and you are sure that it is in accordance with underwriters' rules for your neighborhood, you should notify your



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Radio Frequency and the Flewelling Circuit

(Continued From Page 34)

1,000,000 times as much energy in his carcass as an average incoming radio signal. If a fly were compelled to walk over sticky fly paper he most certainly would not get very far because you have placed too much resistance (too many ohms, in radio), in his path.

The analogy is beautiful. Now you have an amount of incoming energy for your radio set equal to about one-millionth of what a feeble little fly has. Can you afford to force it over very much sticky paper? Of course not! Then it is very obvious that low loss does pay.

But—there are a lot of us who feel that it does not answer the problem if we simply use a low-loss condenser and neglect other greater factors such as coils, set layout, and the excessive use of multi-tube circuits.

You ask what has this to do with regeneration? Just this: With the present-day three-element tube, the less resistance you use in the circuit of the tube, the greater the regenerative effect and the tube will oscillate more readily.

One tube can be readily controlled but beyond this our difficulties increase greatly as we add tubes, to such an extent that we must of necessity deliberately introduce a loss, or resistance of some kind, into our circuit in order to control the tubes at all. The writer knows of hardly any multi-tube circuit where this is not done.

Then, you say, if it is possible to do as much with one tube as with five, why use five? Let's see what we can say to that.

The average radio listener has neither the time nor the inclination to juggle one control against another; neither is he at all inclined toward radiating squeals either from his own or other receivers. Oftentimes he can have no outdoor antenna and is not satisfied to hunt continually for stations that he has had before instead of referring to his log sheet. These things he must abide by with the single tube or the single tube with two stages of audio amplification.

But if he uses a multi-tube circuit, he can log his received stations, in general tune his receiver more sharply, need not use an outdoor antenna, etc.

A very large number of requests have been received, asking how to add radio-frequency amplification to the Flewelling Circuit, and I feel that the above justifies these requests. Frankly, I feel that if radio-frequency amplification is added, one defeats the purpose of the Flewelling Circuit, but I know that a great many of those who have done it prefer it to the single-tube circuit.

So now that we have our reason let's start the ball rolling by showing one or two diagrams that Flewelling fans have found to operate successfully, and by asking you folk who have succeeded in adding R.-F. amplification to send in your diagrams.

John G. Shodron, of Fort Atkinson, Wis., sent me a diagram of his circuit which is shown in Fig. 1. This circuit is operated by what we call "trap" tuning. That is, each tube circuit is controlled by a free and independent wave-trap circuit, as you will see upon examining the diagram. The circuit is an exceedingly sharp tuner and a D X getter of the first water, according to Mr. Shodron.

Mr. Shodron, however, submits a second sketch, shown in Fig. 2, which appeals to me much more because it utilizes the most sensitive circuit known, that of the separate heterodyne.

Personally, I feel that the superheterodyne is apt to be a waste of one's money, but that does not apply to a separate heterodyne circuit, such as Mr. Shodron shows. This circuit has been the writer's favorite for some time, and constitutes a time-tried and true circuit of the very highest type. You will get your money's worth out of it, beyond a doubt, and I am pleased to see Mr. Shodron's adaptation of the idea to the Flewelling Circuit. Mr. Shodron has done very much better than coast-to-coast work, and one need have no fear of results if the circuit is built.

Mr. Shodron's trap circuit receiver shown in Fig. 1 does not seem to me to be a very economical or easy receiver to build for the results obtained, and I would not, therefore, recommend that you build it unless you desire to do a little experimenting with the use of trap circuits.

The heterodyne circuit shown in Fig. 2, however, is a more compact and easier set to build, capable of the greatest DX work if properly constructed and adjusted. I know there will be many favorable comments from those who decide to try it.

The circuit layout is very similar to the regular five-tube neutrodyne circuit. In fact, Mr. Shrodron made his from a spare neutrodyne set. Mr. Shodron's diagram calls for two .0005 mf. and one .000125 mf. variable tuning condensers, but the standard 11 plate .00025 mf. condenser can be used very nicely in all three places. All of the coils may be wound with No. 24 DCC wire on cardboard or bakelite three inches in diameter by four inches long; thus the layout calls for three such tubes as in the neutrodyne.

The first coil L1 is wound with fifty turns of No. 24 wire on one of the tubes and mounted, if preferred, directly on the back of its tuning condenser. The second tube contains coils L2, L3 and L4, wound with ⅛ inch space between the coils. They may then be mounted on the back of

the second condenser in the same manner as with L1.

Now the third control, consisting of coils L5, L6 and L7, with the variable condenser, presents a little difficulty. First coils L6 and L7 should preferably be of fifty turns each as in the regular Flewelling circuit, while L5 can be wound directly over coil L6 with but a layer of paper between them for insulating purposes. Coil L7, the tickler coil, must be variable to L6 in order that you may adjust the feedback properly. Here it is best to note that if you have a regular Flewelling circuit you may use it in this circuit without any change by simply coupling coil L5 to the tuning coil of the Flewelling circuit, which is L6.

After such a circuit as this is built you are very apt to find it oscillating so violently as to be beyond control, but herein lies another of the advantages of this circuit because of the following points: The eight turn coil L3 is simply used to couple to the oscillator coils L2 and L4. Also one reason for coil L5 is to couple to our detector circuit L6. If your circuit tends to oscillate too violently, you can easily correct it by removing two or more turns from these coupling coils L3 and L5. The condenser N. C., of the ordinary neutralizing type, is also adjustable to help care for this condition.

All tubes are 201A or hard tubes, and as the tendency toward undue oscillation will be affected by the plate voltage used, this point should be watched and the plate voltage adjusted to the best point.

In operating such a set as this, it will be noted that the incoming signal is first passed through the second tube shown in the diagram, but this tube is coupled to the first tube by the coil L3. Now the first tube acts as a continuous oscillator beating against the incoming signal. Thus we have the typical beat note action of the superheterodyne. The beat note produced by the oscillating tube and the incoming signal is carried through coil L5, picked up by the Flewelling circuit coil L6, rectified and carried into the audio amplifiers. It will be noted in this connection that coil L5 acts as a filter circuit because of the fixed condenser across it, and care should be taken that coil L5 and its condenser tune to the point of best reception. This means that we must be careful about removing turns from this coil to adjust our coupling, changes of coupling preferably being made by coil L3 or condenser N. C.

Those of my readers who have built or operated superheterodynes will find themselves at home with this receiver because the action is very similar.

Editorially Speaking

(Continued From Page 33)

saying that the writers have Crosley sets or else that they are interested in them through some contact.

This is merchandising. It is the only kind of merchandising that will save the situation for the parts manufacturer.

Just so long as new circuits are developed using virtually the same apparatus which the old circuits used, the cities will not show much of an increase in the buying of parts. It is not to be expected. Fans in the city already have all of those parts that they need.

But there is a vast and untouched market simply waiting for the manufacturer who is sufficiently alive and sufficiently financed to go out and get it.

The hook-up craze is not dead. It is one of the livest things in radio. It has simply got tired of living in the cities and has yielded to the lure of suburban and rural life.

WMAQ, Chicago, "The Mother of Them All"

(Continued From Page 19)

Snow White, or her Barbara Frietchie as living persons. She tells the stories for the family, and at the 6:30 dinner hour in the city homes families tune in on Wednesdays to WMAQ for Miss Faulkner. Conversation is ended while she appeals to the best in every heart.

Last summer as Aunt Mary, Miss Faulkner appealed over the radio for funds for the Daily News Children's Fresh Air Fund. A dollar paid the railroad fare and farmers answered the call for free board for a week as well. Her answers ranged from "two bucks to take a couple of kids to Heaven" to a small boy's circus money.

The Lullaby Lady, Mrs. Gene Davenport, comes to WMAQ twice a week with musical programs for the children and "Dad" is a recent evening addition at 6:50. The Daily News soldier radio fund is equipping disabled veterans' hospitals in the five surrounding States, trying to raise $60,000 for 5000 boys for radio sets with loud speakers in the wards. The Speedway Hospital at Maywood, Illinois, is the first, and rapid progress is being made. This great hospital building, the largest hospital of its kind in the world, almost half a mile in length, was the gift of Edward Hines, Chicago lumber king, in memory of his son, who died in the service overseas.

The boys are enjoying the radio sets. Their attentions are being directed into channels of outside listening, while as many as are physically able are doing hand basketry, cloth and bead weaving. One example of direct shell shock cure resulted from a boy's interest in making radio sets. Today he is cured and in business in a nearby suburb.

The greatest artists and experts of the professional world are eager and glad to stand before the WMAQ microphone. There are two people whom Miss Waller was especially proud to put on the air from WMAQ. They are Mary Garden, who sang a group of songs as well as solos in opera broadcast from the Auditorium, and Julia Marlowe, who with her husband, E. H. Sothern, gave a memorable performance of the "Romeo and Juliet" balcony scene over WMAQ in their radio debut.

Mary Garden is a genuine radio

Mr. and Mrs. Marx Oberndorfer, nationally known musicians, who give weekly lecture recitals, with illustrative piano compositions. Mrs. Oberndorfer (Anne Shaw Faulkner), lecturer, is before the microphone. Marx Oberndorfer, pianist and composer, at the piano

A room in the Speedway Hospital at Maywood, a suburb of Chicago. The largest hospital for disabled veterans in the world and a gift from Edward Hines, lumber king, as a memorial to his only son, who was killed in the World War. The rooms in this hospital are being equipped with radio through a fund called "The Soldiers Radio Fund," carried on by the Chicago Daily News

fan. She is thrilled by the invisible audience. She says enthusiastically:

"The real pleasure comes from singing to the man or woman who would not otherwise hear my voice. The man in the lumber camp, the woman in the wee prairie cabin, the folk who live isolated lives, they are the ones to whom my songs are sent.

Robert S. Whitney, announcer, a pianist and composer

They are my appreciative listeners and to them my radio appearance at WMAQ was dedicated."

The WMAQ chief announcer is Robert Whitney, pianist and composer and a member of the Whitney trio which frequently broadcasts. Miss Waller is assisted by Miss Elizabeth Burton, an accomplished musician and announcer, for the afternoon programs.

WMAQ is the real service of the newspaper, combined with a woman's tact and realization of public ideals, as well as demands.

WMAQ is indeed the "Mother of them all." She smooths off the rough places in the day's work and the evening broadcast is a bit of balm to tired listeners.

The "Red Front Stores" on "Quality Street"

(Continued From Page 9)

Perhaps you were fortunate enough to hear Baileff's "Chauve Souris" when it was last here, and you will remember that the most hauntingly beautiful moments of the evening were those in which his marvelous chorus sang the gypsy songs—there is nothing quite like them.

Harry Horlick, the young leader of the group representing the A. and P. Stores, has a life history much in keeping with his work. He was born in Kiev, Russia, and comes from a family of which all the members were musicians. His father was a concert-meister in the large orchestras, and a famous violinist, but as one so often finds, he did not want Harry to be a musician. However, when the boy was only eight he procured a small violin upon which he practiced secretly while his father was away.

An older brother, who was concert-meister in the symphony orchestra at Tiflis, Caucasia, realized the boy's talent when he heard him play, and persuaded the father to allow him to take the youngster back with him to Tiflis. Here he was put under Wilshey, who was a pupil of Joachim, and for six years he worked hard. From there he went to Moscow, where he attended the conservatory and played in the largest symphony orchestra.

Then the World War broke out, his parents left Russia for the United

States, leaving him to enter the Russian army, where he served for two and a half years, absolutely neglecting his violin. He had, however, either the good or bad fortune to be captured by the Bolsheviki, and assigned by them to play in symphonies and opera for the next year and a half. Worried by his inability to get in touch with his parents, he escaped from his captors, working his way back to Tiflis and on to Constantinople. Here, through the American Consul, he succeeded in communicating with his people, and while awaiting for arrangements to be made for him to join them he collected many of the melodies of the East, which from time to time he arranges and plays with his Gypsy String Orchestra.

When funds finally arrived from America he joined his family here, and was shortly after at work in the City Symphony under Foch. Later he played at the "Petroushka," the Russian Club.

You have undoubtedly noted the beautiful tone of Mr. Horlick's violin. It, too has an entertaining little history. The first small instrument which he secretly obtained was laid aside in Moscow, when his brother gave him his full-sized instrument. This was a violin of wonderful tone, but Harry saw one belonging to a friend that caught his eye because of the wonderful graining of the wood. He traded for the better looking article, only to find to his sorrow that he had much the worst of the bargain. He bided his time, and when another boy was smitten as he had been, he traded again, and this time acquired an extra fine Italian violin which he values at several thousands of dollars.

The orchestra, which has always been composed of six pieces, now includes seven, as the latest addition to the WEAF facilities is a two-manual organ which is used to supply musical background and round out the ensemble. The members are all Russians, and were all known by the leader in that country. For instance, George Davidoff, the pianist, was a soloist in Moscow, and the organist, Alexander Bordnowski, comes from Odessa. Both men are composers.

As most gypsy music is Russian, the men are playing those things which are in their blood, which is perhaps why they have been so tremendously popular from the beginning. They play almost entirely the gypsy music, with perhaps one concert selection of a modern composer in an evening. The background is furnished by the introduction and the interpolated remarks of the announcer, this part being worked out as part of the station service. In this way, too, the listeners are quietly informed that they may thank the A. and P. Stores for their pleasant hour. The following program of the evening of December 8 is a typical one.

The Gypsies are always introduced to the strains of the "Two Guitars," and as the first notes are heard, Announcer Carlin begins to talk:

"These bewitching strains of the 'Two Guitars' now come from out of the East to lure you from your homes which are linked with WEAF, New York; WCAE, Pittsburgh, and WJAR, Providence (homes always will respond to the touch of romance), out of these to lure you into a fairyland of dreams. Electric, gas and candle lights now become useless, for, with the Great Atlantic and Pacific Tea Company Gypsies you will wander in dancing sunlight or shimmering moonlight. The company engages the use of the facilities of these stations each week to take you through green valleys, wooded hillsides, on jeweled lakes, over sea and mountains and we ask you, mothers, fathers, sons and daughters, the well and the sick, old and young, to dance, sing or make love in the spirit and as the music leads you.

1. The first selection, 'Suite Orientale,' by the French composer, Popy, takes you far into the East, where the forests are thick and the air is heavy laden with perfumes of luxuriant flower growth and the mystery of the ages. As we journey on we pass through the shaded groves and as we emerge the sun shines but the brighter.'

'Suite Orientale,' 'The Bayaderes,' 'By the Ganges,' 'The Almas,' 'The Patrol.'

2. 'Sorrow' by the German-Russian composer, Ebane, is another phase of life as expressed in music.

3. 'Toreador et Andalouse' by Rubinstein in the next selection that the A & P Gypsies will play. In this piece we emerge from the sorrow into the ring.

4. The A & P Gypsies will play as their next selection a 'Spanish Dance' by the German composer Schmedling.

5. 'Mighty Lak' a Rose' by the American composer Nevin is a song of Southern dialect, symbolic of the purest form of love.

6. 'Orientale' by the Russian composer Cesar Cui.

7. 'Chorus of Boatmen' from 'Prince Igor' by Borodin.

"The time for rude awakening has come. I wonder how many of you have seen the peaceful meadows, the shadowy woods, the ocean billows, have scented the spicy pines or dreamed of loves gone by or that great love to come as the Great Atlantic and Pacific Tea Company Gypsies played. If you have dreamed dreams or had your heart lifted, we hope you will let the Gypsies share your pleasure by sending a little note, or a card which is available at any of the familiar red-front A & P stores. The Gypsies are leaving us now, going back into the peaceful world from which we have them come each week. The dying strains of the 'Two Guitars' will be their adieu to you, and when they have faded away a week will pass. Then at nine next Monday, this same mystic melody will summon you to another hour of dreams."

Now you will admit that even the reading over of such a program creates in you a feeling of good-will toward, and respect for, these particular stores. You want to write them, as did the old lady in Vermont: "If your groceries are of the same

quality as your music then we want to trade with you."

And presto! The A & P Gypsies have helped to show that the red-front store is really on "Quality Street."

Appreciation of this sort comes from people of all type. On the day after their very first program, Mr. Horlick was invited to make records for several companies, and accepted the invitation of the Edison Company.

There was an experiment last winter to see whether this type of music really was appreciated as much as the continuous flow of mail would indicate, so the program was split into half popular and half gypsy music. The reaction on the part of the fans was almost unanimous in requesting them to drop the popular stuff, as that could always be picked up from some station, while their regular program is unique.

So far as the development of good will is concerned, the company has found it practicable to extend its tie-up from three to six stations. It is interesting to note that they find the effect upon the thousands of employes of the company to be quite as valuable a business asset as that on their patrons. They made it possible for their men to obtain sets at a reduced cost so that they could listen-in, and hundreds of letters come from their own managers, etc., displaying great pride in the fact that it is their own organization which is putting on this wonderful concert.

Attractive posters of the band are displayed in the stores, and changed frequently, and a constant topic of friendly discussions between salesman and customer is provided. Applause cards may be obtained in the stores, and in response to each one the company returns a photograph of the band. In some of these districts a mailing list is kept of interested listeners, and special care is taken to have these friendly critics apprised of any special values in the shops in their neighborhoods.

So here again radio has demonstrated its ability to create a most desirable impression by suggesting to an attentive world that the Chain Stores of the A & P Company undoubtedly are on a par with all other superior institutions of trade.

The Question of Tubes

(Continued From Page 4)

To prove it, I do not mind going on record as saying that the UV-201A tube, in my opinion, *is absolutely the very best tube on the market today.*

Furthermore, Mr. Grimes explains in this article why it is that the small tube is likely to be unsatisfactory. He clearly points out that it is not entirely the fault of the manufacturer but the very design of the tube in its extreme delicacy, renders it particularly liable to injury during the course of shipment after it leaves the manufacturer's hands. The larger tube is less liable to be damaged and is therefore much more stable by the time it gets to the consumer.

In addition, it should be understood that both Mr. Grimes and I feel that the manufacturers of tubes are doing a very fine piece of work and are turning out an excellent bit of apparatus considering the limitations of our knowledge of such things and the extreme difficulty in a mechanical sense of getting such apparatus in perfect shape into the hands of the consumer and training him to keep it in such condition.

My advice to use some other tube in place of the UV-199 must be understood to refer absolutely only to the cases where dry cell tubes must be used in radio frequency. It does not apply in any particular to places where storage batteries are available or to use as detector and audio amplifier.

Let's Talk About Tubes

(Continued From Page 7)

manufacturers of tubes are taking precautions by furnishing the various distributors of tubes with testing machines for checking the poor amplifiers. Some designs of these testing machines are so liberal and so favor the manufacturer of the tubes as almost to constitute good jokes if it weren't for the real money involved. On the whole this move is in the right direction and even now, more rigid tests are being installed.

But this doesn't help much if the ultimate customer—that's we—doesn't know how to handle or care for his tubes. Tubes are very delicate mechanisms, both mechanically and electrically, and should be very carefully used both mechanically and electrically. The least little jar or bump may render your tube almost useless, although it may still light wonderfully. Such a bump, we shall soon show, may cause your tube to become very unstable with resulting oscillations. Or, on the other hand, it may reduce your amplification a very noticeable amount. Still again, you may have to throw it away because it has become microphonic—causing humming or "singing." These bumps or jars do not have to be bad ones. Often, the jar caused by a tube falling over on the table from its upright position will mean three cold dollars to you. Never stand your tubes on a table in such a manner.

And the electrical side of the story is just as delicate—if not more so. The entire problem reminds one of that well known song, "Some little bug will get you some day." One would almost be inclined to think that the writer of that song was a radio fan. Maybe he is now and, if so, he will enjoy the new meaning to his creation. It is an ever increasing wonder to us, as we study these things more and more, how any one ever obtains and retains a good tube. We don't like to sound pessimistic, but, in view of the fact that all of the trouble is not with the manufacturer, you cannot be too careful what you yourself do after you have secured a good tube.

For instance, the old type of tubes would operate as long as the filament lighted. It was variously estimated at between three and five thousand hours of burning. If you insisted on burning the filament on the full six volts, you remained in possession of your precious tube about 3000 golden hours. If you were somewhat careful and never turned your rheostat higher than was absolutely necessary for good reception you and your tube kept company almost twice that length of time. Of course, the old tubes murdered your storage batteries by draining them to the tune of four times the consumption of the present design.

Furthermore, one did not need to be too careful concerning his plate voltage on the old ball-room illuminators. If the spirit so moved as to suggest more than the normal ninety volts, no great damage resulted. The length of life was shortened somewhat, but was often more than justified by the increased signal strength. But now—*now!* Well, things have changed since father was a boy! Let's have a look!

The new type tube has been developed and placed on the market. This new type, designated by the letter "A," is an entirely different story. It is a much better tube in many respects but it is also a much different one. In the first place, it doesn't give much light and, of course, can no longer be used for illuminating purposes. Its filament contains thorium, a metal which gives off the necessary electrons at a relatively low temperature. The white heat is no longer needed. The heavy one ampere drain on the storage battery is no longer demanded. But thorium—ah, and that's the trouble—is blamed funny stuff!

In order to make a long story short, the life of the present thoriated filament tube has been variously estimated from five minutes up to almost 1000 hours. So while you are paying less for the present tube and it looks with more favor on your "A" battery, its useful life is not very long. At the end of its period of successful service it is usually burning as brightly as it ever did. The thorium in the filament has simply boiled away. There is a certain definite amount of this substance in each filament—no more, no less—and when it has boiled away you are simply out of pocket and out of luck.

Any excessive current in the filament is very, very bad. The new thorium tubes must always be operated at as low a temperature as is consistent with good signals. If you persist in running your radio set with the rheostats all the way out, you are simply flirting with death so far as your tubes are concerned. This is a most important point to remember.

Then, the question of "B" battery voltage is vital. The normal operating value is ninety volts. Any amount of battery over and above this hastens the boiling of the thorium and shortens the life of the tube way out of proportion to the increased signal strength obtained.

Now we are ready to go into details on the mechanical variations involved—to show why the least jar may spell ruin. We will have to become a little technical, but with curves and lines can make our point clear.

The amplification of a tube depends upon the slope of its grid voltage—plate current characteristic. Such a curve is shown in Figure 1. The curve is obtained by placing various plus and minus voltages on the grid and reading the resulting currents in the plate circuit. It is easy to see that the greater the change in plate current for a given change of energy on the grid, the better amplifier the tube will be. This is indicated by the *steepness* of the curve. If the curve is fairly flat or horizontal, it is a poor amplifier. If the curve is steep or nearly vertical, it is a good amplifier.

Curve A shows a bad amplifier. Curve B shows a good one. Curve C is one that is so good as to be very unstable, tending toward oscillation. So a tube may be either too good or

too bad! Funny paradox, but it's true.

But what makes the curves vary and the tubes differ so in their performances?

That's easy. Several things, but mainly the physical construction of the filament, grid and plate elements. This assumes an ample supply of thorium in the filament. As already brought out, a tube may be good, bad or indifferent, depending on the quantity of thorium in the filament. The factors we are now discussing have nothing to do with this, but, of themselves, cause tubes to be good, bad or indifferent. Let us see how.

Take a look at Figure II and you will see a cross view of the elements of a tube. You will notice that there is a certain space between the filament and the grid and between the grid and the plate. This hasn't meant much to you before, but it means everything in the characteristics of the curves shown in Figure I.

If some slight jar should move the grid nearer the filament than normal, the curve of the tube would become very steep.

So a tube jarred into the position shown in C it. Figure II would have a curve similar to C in Figure I and would be very unstable, tending to oscillate. A tube bumped into the condition shown in A in Figure II would have a characteristic curve like A in Figure I and would be a bad amplifier. We have bumped tubes in the laboratory and have been able to change their characteristics at will. We do not recommend the practice generally, but it can be done.

Now, perhaps, you can understand our pessimism and realize how easy it is to have a poor tube and how hard it is to have a good one. And the tube may have left the manufacturers in good condition. Tubes can be bumped in transportation, you know. Aint it fierce how it is!

Another peculiar difficulty may arise—not pertaining at all to amplification, but, nevertheless, to the question of successful operation of your set. Your tubes may be "microphonic." This disease is caused by loose joints permitting mechanical vibration of the elements of the tubes. Obviously, if the position of the grid with respect to the plate and filament determines the amount of amplification in the tube, then if the grid is somewhat loose and free to vibrate, trouble may be expected. A noise in the room will shake the grid and the grid will impart the same noise into the radio set and it comes right out of the horn. This has, no doubt, been experienced by most of you.

Sometimes the grid of a tube may be so loose that the noise from the loud speaker will shake it, even as it shakes our ear drums, and impart back into the set the same noise. This sort of thing will gradually build up into a hum gradually growing louder and louder.

Some tubes are naturally more microphonic than others. It is almost impossible to build tubes absolutely rigid in their internal construction. Realizing this, the Western Electric Company builds its tubes with small beads of glass on the filament and grid supports so as to dampen or reduce any tendency for them to pick up vibrations. Extensive attempts have been made on most modern receivers to mount all of the tubes on rubber supports. This will only reduce the pick up through the set itself. A specially microphonic tube will be affected by noise in the air. In such cases, the cover of the set should be closed or a piece of cotton stuffed in the loud speaker. Quite often, a relief may be obtained by interchanging the tubes about in their sockets, because a microphonic tube is much more noticeable when located in the first audio stage. A badly microphonic tube may be tolerated in the last audio stage.

The above discussions cover all

types of tubes and naturally apply very specifically to the 199 type. It is much easier to boil the thorium out of the filament by excessive filament current or high "B" battery in this type than in the 201-A variety. It is much easier to jar or bump the elements into detrimental positions and the smaller tubes are much more susceptible to microphonic difficulties. No wonder most 199 tubes are bad and it may not be entirely the manufacturer's fault!

Suppose, at last, you have a really good tube and are really taking very good care of it—what then? We are sad to state, that, like all things earthly, it is bound to come to an end. Hours away though it may be, the moment will eventually arrive when the last electron will flee from the filament and the tube will be forever dead. Tubes don't last forever. As financially hard as it may seem, we must accustom ourselves to it.

We suggest that you have always on hand an extra tube or two. With such spares, the operation of tubes in your set may be continually checked against decrease in amplification or increase in microphonic noise. The time is rapidly approaching when radio sets will be sold with spare tubes even as most automobiles are supplied with spare tires. Just at the present time sets are distributed among the radio public with good and bad tubes. Those having the bad tubes often blame the set. This is gradually forcing the radio set manufacturer to include compensating adjustments for accommodating his receiver to the ordinary variations in tubes and perhaps to include a tube tester to protect his instrument against its operation with bad tubes.

Several sets at the present time have compensating controls for readjusting the instrument for operation on the tubes provided. Such devices consist usually of variable resistances in the plate circuits by means of which the plate current characteristic may be changed—raised or lowered. This forms a convenient external method of regulating the amplification of a tube, permitting corrections to tubes that have been jarred in transit. Experience has shown that these resistances should be noninductive and should run from 400 to several thousand ohms.

Another class of amazing and perplexing troubles is the type of tube that operates nicely as an audio-frequency amplifier, but refuses absolutely to pass radio-frequency currents. There seems to be considerable confusion in the technical profession as to just what causes this. We find, however, many tubes that refuse to operate in the radio stages, but will give good service in the audio stages.

This suggests that tubes should be shifted about in the various sockets for other reasons than microphonic considerations. This has led to the popular misconception that some circuits are critical, demanding so-called picked tubes. When the 'A" type thorium filament first came out many circuits were unjustly criticized because tubes had to be "picked." More experience has, however, shown that the trouble was in the tube—not the circuit.

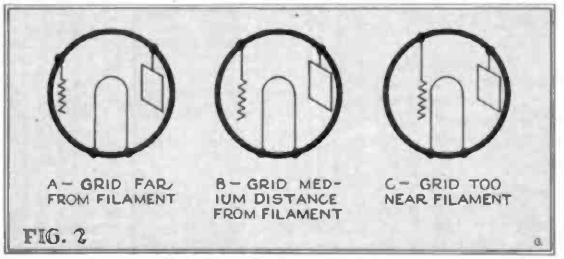


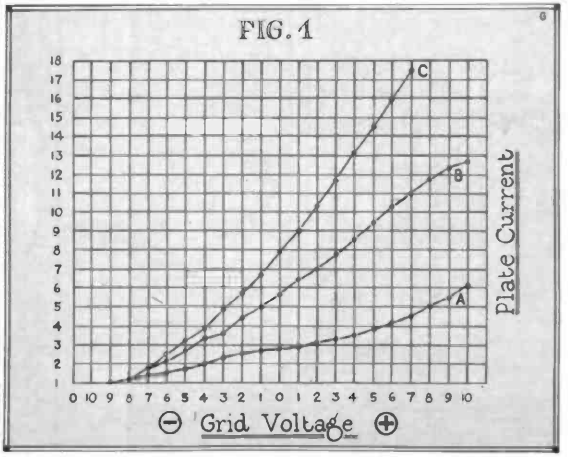
FIG. 2

The length of life of a tube and its determining causes has also been the object of popular discussion for some time. There is, perhaps, more misinformation on this one point than all the other combined and yet it is one of the simplest. Tubes die through three causes:

First—Old age.
Second—Disease.
Third—Accident.

Old age is merely a question of the thorium boiling entirely out of the filament. This depends on the temperature of the filament and the plate voltage. *It has nothing whatever to do with radio signals.*

The tube will last the same number



of burning hours whether or not it is receiving any radio programs, and the tube will last the same number of burning hours whether it is used for double amplification or single. *Reflexing has absolutely no effect on the life of the tube.* In fact, if anything, it increases the life as there is a tendency for the operator to reduce the filament current on account of the extra loud signals reproduced. This very reducing of the filament current will increase the life of the tube.

A diseased tube is one that has an air leak in it or one that has not been properly pumped out. Many manufacturers of bootleg tubes do not seem to realize that the tubes and the metal of the plate and grid must be heated red hot during the pumping action. Otherwise, air will continue to lodge in the metal to ooze out after the tube has been placed in service. Most bootleg tubes are diseased and soon die, although they probably passed excellent tests before leaving the factory.

Of course, death of a tube by accident is too well known among us to be discussed here—that is, if the tube has actually been killed. Sometimes an excessive filament or plate voltage, if but momentarily applied, will apparently kill the tube. However, if pulmotor methods are applied, it may sometimes be brought back to normal and used for many months.

What happens is this: The sudden boiling of the thorium drives off all that existed on the exterior of the filament. Before the thorium on the inside of the filament wire had the pleasure of an early death, the high voltage was removed. Now, if the tube is lighted and the "B" battery removed, a gentle boiling process starts, that gradually works the remaining thorium to the outside of the filament. It is best during this boiling process to reverse the "A" battery so as to work the thorium uniformly out into usefulness. This entire boiling action will sometimes require an hour. It is the old, old story of the pulmotor. It depends on the shock the patient has received, how long, if ever, it takes for complete resuscitation. Consider yourself lucky if you accidently all but murder a tube, and find that you can bring it back at all!

One of our articles several months ago gave a view into future tube developments and that prediction still stands. There will be no need for any further mention here of the tube of the future.

One more point does need explaining. Many radio bolshevists are complaining about the horrible cost of tubes—the terrible profits that everybody but themselves are making. They predict that the price of vacuum tubes will fall to a very low level—that they ought not to cost more than other electric light bulbs.

Of course, all this is based on more misinformation. Most earthly woes are offsprings of misinformation.

Vacuum tubes used in radio sets are not electric light bulbs—much as they look it, they are not. The fact that they give light is only incidental—would that they didn't, they would be more efficient.

A much higher vacuum must be had in the radio tube. The ordinary electric light is not a vacuum bulb at all, by comparison. The grid and plates must be added and you now realize that these are not merely slapped in. They must be accurately located and accurately fixed.

The final fact that will probably forever compel vacuum tubes to sell at higher prices than electric light bulbs is the question of quantity use. No matter how extensive radio will ever become, it is inconceivable that it will ever exceed the illuminating business. Electric light bulbs, then, from the standpoint of quantity production will always undersell the vacuum tube.

A DX-Getter Easy to Build

(Continued From Page 33)

decrease with the wave length. This is shown in that part of the curve in Figure 5 between the points A and B.

Referring to Figure 4, since the inductance of the coil increases at the shorter wave lengths, and still less of the tuning condenser is required to obtain resonance, it follows that still less capacity would be required in the controlling condenser. In other words, it would seem as if the curve A-B in Figure 5 should take the direction indicated by the broken line.

As a matter of fact, the curve turns upward, as at B-C, Figure 5. The reason for this lies in the marked increase in the resistance of the circuit. It is known that the resistance of a condenser, whether it be a low-loss type or not, may rise to ten or twenty times its resistance at full settings at dial settings less than about 25. Besides this, the resistance of the coil increases rapidly at the shorter wave lengths. The resistance of the circuit increases at a much more rapid rate than the inductance of the coil increases, so that to neutralize this extra resistance it is necessary to use considerable more feed-back. It is this that causes the curve to turn upward at the shorter wave lengths.

About This DX-Getter

THE set which Mr. Harris has described in this article is about as good value for the money as any that I have tried. It is very decidedly a regenerative and radiating set, but the best part of it is that it will not function properly when it is so adjusted as to radiate.

I have had this set in use in my home for some time and have been playing with it so as to become thoroughly familiar with it. I find that maximum efficiency is gained when the regeneration control, set at between 90 and 100, requires an adjustment of the rotor which just begins to make the set whistle. The rotor then can be left permanently in that position.

From then on, there is virtually no danger of the operator making the set radiate because as he approaches the radiating point the signals become so distorted and do this so gradually that he stops increasing regeneration because it simply increases distortion. This happens before the set actually begins to radiate.

In other words, this set has its own safety valve to prevent it radiating. This safety valve is the ear of the operator. It brings his regeneration up to the point where it will become unpleasant and then he stops. Fortunately, this point is reached before radiation takes place.

Dollar for dollar I have not seen a set which gives a better value than this one, nor one which is more easily constructed by the absolute beginner in radio. H. M. N.

A 100 Per Cent Antenna

(Continued From Page 34)

agent or insurance company about the matter. An inspector will be sent out to look your work over and his trip usually costs you one dollar. It's worth it, however, and you may be sure then that your aerial is a positive protection to your home during thunderstorms and not a hazard.

Moreover, if you discover that you will be obliged to perform some tree-climbing stunts or promenades along the ridge of your roof, don't take too many chances. Better hire a man who is familiar with such work to do the steeple-jack tricks. Ten dollars spent for such labor is good insurance against a broken limb or perhaps a worse accident and you'll probably have a better job, anyway.

All in all, treat your aerial as a distinct and individual part of your radio outfit, keep it free and clear from other objects, keep the joints clean and tight and surprise yourself with the sort of reception you had always hoped to have but had thought a vain wish rather than an attainable reality.

Counterflex Circuits for Experimenters

(Continued From Page 12)

of the circuit are arranged so that exactly half of this capacity is required to balance the system accurately, it would then be necessary to increase the counteracting capacity to its maximum value, or decrease it to its minimum value, to produce self-oscillation. It may appear, incidentally, that this would be the ideal way to arrange the values of the circuit, but this is not the case. It is better to arrange the values so that nearly *all* the counteracting capacity is required to balance the system accurately. Then self-oscillation can be produced only by *decreasing* the counteracting capacity.

When a Counterflex circuit is arranged in this way self-oscillation usually takes place when less than 10 or 20 per cent of the counteracting capacity is used. Above this approximate value the tube will not oscillate. It will be readily seen that the counteracting capacity of the Counterflex circuit is, in fact, a very useful and easily adjusted audibility control.

And now we will consider some practical Counterflex circuits. In Fig. 3, I show the standard three-tube Counterflex circuit which I have already explained in detail, and for which building instructions have been given. The circuit of Fig. 3, however, is slightly different from the original three-tube circuit. A different method is used for coupling the antenna to the tuned grid circuit of the reflex tube.

In the original Counterflex circuit the antenna was connected to a coil which was inductively coupled to the grid coil L1, the opposite end of the antenna coil being connected to ground. This arrangement was not found to be quite selective enough when the receiver was located near powerful broadcasting stations. Last month, therefore, I suggested another method of coupling the antenna to the grid circuit. I suggested that a small variable capacity (about the same value as the counteracting capacity) be used for this purpose, connecting this coupling condenser directly between the antenna and the grid of the reflex tube. This variable coupling condenser proved to be a very excellent selectivity control.

Since writing last month's article, however, I have experimented further with this idea and I find in the vast majority of cases a variable coupling is not necessary. A fixed value of capacity coupling can be used, provided the coupling is loose enough to give selectivity, even under difficult conditions. If a fixed coupling condenser were connected directly between the antenna and the grid, however, it would have to be a very low value, much lower than any of the fixed condensers readily obtainable on the market. Even if such low capacity fixed condensers were obtainable they would probably not be uniform, and slight differences in capacity would have a large effect upon selectivity.

The same loose coupling effect, however, can be obtained with a comparatively large fixed condenser if it is connected between the antenna and a tap on the grid inductance L1, instead of directly to the grid. Slight variations in the value of the coupling condenser do not then have much effect upon selectivity. I find that very excellent selectivity can be obtained by using the values indicated in Fig. 3, and, more clearly, in Fig. 4.

If you have a standard three-tube Counterflex receiver you can very easily make the changes necessary to improve the selectivity of your set. Just remove the primary winding of Counterformer T1 and tap the center turn of the secondary coil. Then connect a .0001 mfd. fixed condenser between this tap and the antenna, as shown in Fig. 4. If, by any chance, your set then develops a 60-cycle hum or picks up other interference of this nature by induction, you can remedy this condition by connecting an inductance directly between the antenna and ground.

The value of this inductance is not critical. About sixty turns of No. 22 on a three-inch tube will serve, but this coil must be turned at right angles to the grid coil L1 and should be as far away from it as possible.

It will be realized that this method of antenna coupling not only affords excellent selectivity, without complicating the operation of the receiver, but also obviates the necessity of using a transformer to couple the antenna and grid circuits. A single coil, with a center tap, is all that is needed.

When I was working with this, the idea occurred to me that the same thing could be done with the transformer coupling the plate circuit to the second tuned circuit. If so, the construction of the receiver would become very simple indeed, even if the operation was not improved. I decided to try out this idea first with a receiver using a crystal detector instead of a vacuum tube. The idea worked out very satisfactorily. I tried various arrangements and finally decided on the circuit of Fig. 5 as the best. As you can see, it is very simple. Instead of using ordinary transformer coupling between the plate circuit and the L2-C2 circuit, direct magnetic coupling is used, a portion of the coil L2 being common to both circuits. In Fig. 5 the plate circuit is shown with heavy lines so that you can trace it easily.

While I have not made any scientific comparison between this circuit and the original circuit with ordinary transformer coupling, the audibility seems to be every bit as good, if not better. In any case the change is an improvement as the construction of the transformers is greatly simplified. With the original circuit it was necessary to have two different types of transformers (T1 and T2). Although there was nothing very complicated about these transformers a great many home-made sets were inefficient because the coils were not wound right or were incorrectly connected in the circuit. With the cirsuit of Fig. 5 I hardly think it is possible to make a mistake. In the first place, L1 and L2 are exactly alike. Each has the same number of turns and each is tapped in the center. The connections are so simple that it would be almost impossible to make a mistake.

The simplicity of this circuit, however, is not its only advantage. There is another very important feature. When the correct constants are used *the two tuning dials read alike* when the circuit is tuned to any given frequency. That is to say, if a low-wave station tunes at 20 on the first tuning dial, it also tunes at 20 on the second dial. Similarly, if a long-wave station tunes at 85 on the first dial it tunes at 85 on the second dial.

Furthermore, *the dials read alike, no matter what type or length of antenna (with reasonable limits) is used with the circuit.* For example, the dials read alike with an eighty-foot antenna and they also read alike with a 125-foot antenna. The very fact that the dials read alike is alone an important improvement. It is usually very difficult to accomplish this with a reflex circuit. It is accomplished in this case because the tuning constants in the antenna-grid circuits are practically duplicated in the plate detector circuits. Ordinary variations in antenna capacity do not affect this arrangement because of

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It is known as the Erla Circloid. Simply clip the coupon below—and let us tell you the complete technical story.

4 vital improvements

The story of Circloid advantages is a fascinating study—even for those who are not interested in the technical side of radio.

As practically everybody knows, in the ordinary radio set, not only the antenna but the radio-frequency coils themselves act as pick-up devices of broadcasting signal. This is one of the chief causes of what most radio fans call "broad tuning."

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Static disturbance has been reduced to the very minimum. For everybody knows that static has no particular wave length. It invades them all. And because the Circloids have no pick-up qualities, only such static as happens to be present on the exact wave length to which the receiver is tuned can come through. Thus here at last is a radio set that offers new delights in summer-time radio. No other receiver can provide such perfect freedom from annoying interference.

Another Circloid improvement is greater stability — smoothness of operation and ease of control.

The tendency of conventional receivers to squeal and howl uncontrollably is due to excessive feed back between coils and wiring circuits.

With Circloids feed-back of energy is eliminated between coils and confined solely to the wiring circuits where it is subject to complete control. Thus perfect stability is obtained. Oscillation that is sudden and violent in the average receiver, making it necessary to start tuning all over again, is now controllable. Just the slight turn of one control and it is completely controlled.

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And Circloids, because they have no external field, eliminate stray feed back effects and do away completely with this principal source of tonal distortion.

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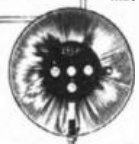

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the loose coupling between the antenna and the L2-C2 circuit.

The selectivity of this circuit is unusually good. The arrangement previously described, and illustrated in Fig. 4, is used. In fact, from every point of view I believe this circuit is exceptionally efficient. I am almost willing to wager there is not another one-tube circuit which possesses all the advantages of this one and I honestly believe it is by far the most efficient one-tube circuit in existence. I shall briefly summarize its advantages:

High Audibility: The audibility of this one-tube circuit is at least equal to that of an ordinary two-tube set with regenerative detector and one stage of audio-frequency amplification.

High Selectivity: The selectivity is remarkably good, especially in view of the fact that the circuit has only

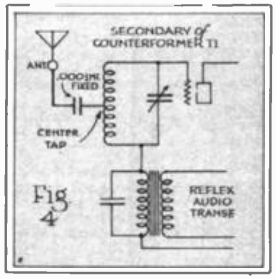

Fig 4

two tuning controls and has very high audibility. Even if a set using this circuit is located within a quarter of a mile of a powerful broadcasting station it is possible to tune in other stations 50 kilocycles away without interference. This, of course, is an extreme case. If the set is four or five miles from the local station it will be able to tune in stations 20 kilocycles or less away without interference. When receiving slightly more distant stations, of course, the set will separate stations 10 kilocycles apart without any trouble.

In other words, this circuit in common with the circuit of Fig. 3, is suitable for use in districts like New York where selectivity is of the utmost importance.

Simplicity of Operation: There are just two tuning controls and, as I said before, the dials of these two controls always read alike when the set is tuned to any given frequency. If desired, the audibility can be controlled with the counteracting capacity or this capacity can be left permanently in a position which prevents the tube from oscillating.

Ease of Construction: The parts used in this circuit are all very simple. The coils L1 and L2 are not critical values. They have only to possess sufficient inductance to enable the tuning condensers to cover the broadcast range of frequencies. With two .00025 mfd. condensers, 60 turns of No. 22 on a three-inch tube will be about right, in each case. Each coil is tapped in the center. I am using low-loss self-supported coils and find them very satisfactory.

Low Cost: This circuit does not cost any more to build than a two-tube set with regenerative detector and one stage of audio-frequency amplification, and yet it uses only one tube and possesses all the other advantages mentioned above.

As you can see, I feel rather enthusiastic about the operation of this circuit, but if you built a three-tube Counterflex with the original circuit, as in Fig. 3, please do not start tearing it down to use the circuit of

Build it Yourself! New 3-Tube Harkness Type Counterflex Circuit

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Including Triple-Socket Sub-Panel and Drilled Panel, With Shamrock Transformers & Parts

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Our radio engineers have specialized on this set for years. We recommend it, and have sold it in every part of the country to radio fans who are enthusiastic about it.

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A tried and proven circuit with a new coil that kills self-oscillations, the drawback of every radio-frequency circuit. Now Jersey to California on loud-speaker several times in week is this set's record.

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Fig. 5; or if you contemplated building a three-tube Counterflex, go right ahead. The Fig. 3 circuit is by no means obsolete.

If any of the modifications given here, or in later articles for the benefit of experimenters, appeal to you, you will find that you can very easily change your set to use these modifications. Next month I will show you how to use the system of Fig. 5 with the three-tube circuit of Fig. 3.

Fig. 6 is the same circuit as Fig. 5. It is included to show experimenters the value of the fixed condensers, the arrangement of the binding posts and telephonic jack and the connections to the audio-frequency transformer.

Fig. 7 shows the same circuit with an extra stage of audio-frequency amplification. This, of course, is the most practical circuit to use. The audibility is increased so that a loud-speaker can be used and good volume obtained.

I shall be very glad to receive reports from readers who experiment with these circuits.

(To be continued next month)

Those Short Waves

(Continued From Page 7)

shorter waves, use multiple reception to obtain better quality, and thus be able to rebroadcast the signal on the regular broadcasting waves. This is now done quite often, in particular by the Westinghouse Company, through their Station KDKA, at Pittsburgh.

Another point in question concerning the use of short-wave transmission is the common belief that the short waves travel as well by day as by night.

Very unfortunately, indeed, this is not so. It has been found that waves in the range of 20 to 30 meters reach out much better by day than by night; exactly opposite to those in the usual broadcast range of from 225 to 600 meters. Again waves of from 30 to 50 or 60 meters are apt to prefer the time from noon to midnight for long distances. There does not seem to be a happy medium that will travel as well by day as by night, although the field around 60 meters sometimes shows a little promise in this direction.

If we consider the field of waves shorter than 15 to 20 meters, we begin to enter the questionable; and for the waves of shorter than one meter in length it can only be said that here lies the Great Unknown with all its mysteries, thrills, and, if there be any, promises.

As to the question when broadcasting will be done on the short waves instead of those in use at present, let me remind you that this can probably only be done through congressional action or some other such action. This it is not likely to happen tomorrow afternoon. Again it is well to remember that there are now millions of dollars invested in broadcasting transmitters that would be useless for short-wave work. Also there is so much to be learned about the use of short waves that there are probably not enough engineering data available to assure success if the change were made to the short waves.

If any such change is made, it will come in the natural course of events after long continued work on the part of radio engineers. Like every other industry and art, radio progresses only in proportion to the time and energy devoted to it. On the other hand, the Westinghouse short-wave transmitter broadcasts regularly and sinultaneously with the regular KDKA transmitter and has been heard in all parts of the world. Regular broadcasting on the short waves is therefore happening at the present time, as you can see.

This brings us to the question often asked as to what can be heard in the short-wave range. It is, of course, not easy to answer this question because of the constantly changing conditions, due to the fact that all of the work that is being done at present is more or less of an experimental nature. One can be assured, however, that no matter where he lives the chances are that he will be able to hear KDKA. The author's station, 9XBG, has also been reported from practically the entire United States, although broadcasting from this station is necessarily of an infrequent nature. Stations in France and England have been heard in the Middle West, so that while there are but few stations broadcasting by means of short waves, their ability to cover greater distances often means the thrill of hearing a foreign station.

To return now for a moment to the question as to the greater distances possible with short-wave transmission. The amateur radio operator with his transmitter has been responsible for the importance that short waves are assuming in the field. Too, he is the one who has been able to point out by actual demonstration the enormous distances that it is possible to attain by their use.

This brings us to another reason for this article when I mention that so far we have been considering the use of short waves for radiophone work. The amateur has done but little phone work in the short-wave field; in fact, is not allowed to by his Government license, and there is a vast difference between the transmission of code and phone. Code, you understand, consists of nothing but dot and dash signals and, roughly speaking, has but one tone. Quality of tone does not count for much; it is the ability to get a signal through regardless, if necessary, of quality.

This rather more simple operation naturally aids the transmitter considerably. On the contrary, radiophone transmission requires the transmission of practically all of the notes or frequencies in the audible range, the full scale of the piano, various musical instruments, etc., and this, it can be seen, is a tremendously more difficult problem, because *quality* transmission becomes paramount in importance and it may be necessary to limit the distance of transmission for the sake of securing quality of reception.

So far in our discussion of the subject we have not been extremely kind to short-wave transmission, but we are also able to show very good reasons why their use may quite likely be universal at some future time.

As I have said, the amateur has shown the possibilities of distance transmission. He has done this so well that many times he has sent signals half around the world with only about as much power in his transmitter as is used to light one's reading lamp—surely a marvelous achievement and one that begins to make us wonder what is to come in short-wave power transmission.

We can also add one or two more advantages to the credit of short waves. One, for instance, the fact that it becomes possible to use extremely small antennae. The brass curtain rod, two or three feet long, above your window, would serve as a very excellent antenna for the transmission or reception of waves in the neighborhood of four or five meters long. *Proportionately then, it should be possible to carry in our pockets, without folding, a perfectly good antenna for waves under one meter in length! Miniature transmitters, receivers and antennae, operating with small power expenditure,*

yet able to communicate around the world, is something for us to dream about.

I have referred throughout this article to waves in terms of their length only because this has been the popular way of thinking of them. It is far better, though, to think of the waves in terms of their *frequency* rather than their length because it in a way means more.

For example, the length of the wave does not help us directly, so far as the much-discussed subject of selectivity is concerned. Selectivity is one of the factors that has determined for us how much radio we can use without destructive interference, and selectivity is primarily dependent upon the frequency of the wave.

To illustrate more clearly, perhaps, what is meant here, consider the wave lengths used in broadcasting—those from 200 to 600 meters long. A 200-meter wave has a frequency of 1,500,000 cycles, that is, it reverses its direction that many times each second. A 600-meter wave has a frequency of 500,000 cycles. Now, in general radio-phone work, with a receiver of the better type, two transmitting stations should be separated by a frequency difference of at least 10,000 cycles in order that they shall not interfere with each other. Between the 600-meter wave of 500,000 cycles and the 200-meter wave of 1,500,000 cycles there is a total difference of 1,000,000 cycles, which means that only 100 stations might operate within this band and be free from interference.

It will be seen from the above that the shorter the wave the greater its frequency. A wave one meter long has a frequency of 300,000,000 cycles per second and a wave of 5 meters length has a frequency of 60,000,000 cycles, a difference of 240,000,000 cycles. Dividing this by our necessary separation figures of 10,000 cycles we find that *we could operate 24,000 stations in this band* without interference. If broadcasting ever is done on the waves under 5 meters in length, it is conceivable that one might have to take about half a day off in order to find the local station unless more general use is made of wave meters.

H. M. N. I am sure would be glad to include in an early issue of *Radio in the Home* an article on how to build a short wave—or, for that matter, a universal range-receiver if my readers desire.

NOTE.—Sure I will. All that our readers have to do is to let us know that they want such an article and the necessary space will be allotted at once. *H. M. N.*

Now Women Demand Their Share of Programs

(Continued From Page 17)

of soap have been put. Use boiling water for all of the dishes except the silverware.

Wash glassware first, then silver, then cups and saucers, plates and serving dishes. As I said before, it is easier to wash the pots and pans during the preparation of the meals.

Glassware will be brighter if not much soap is used, though a little makes it brighter. Using the dish mop, first wash the glasses inside and out, rinse them and place them upside down, slightly tipped, in the drain basket, and then dry them. The silverware may be cleaned satisfactorily and quickly with the mop, and this method keeps the hands out of the water.

Have you a drain basket? It is such a time saver and does away to a large extent with the insanitary dish towel. After washing the dishes, stack them in the racks and scald