

RADIO AGE

Magazine of the Hour

In This Issue

Blueprints of a Single Tube Loop Set and a Capacity Feedback Receiver.

Pickups and Hookups by Readers; Prize "Static-busters."

Radio for the Beginner.

Five New Hookups for the Set Builder.

Eight-Page Section of Studio-Land Features.

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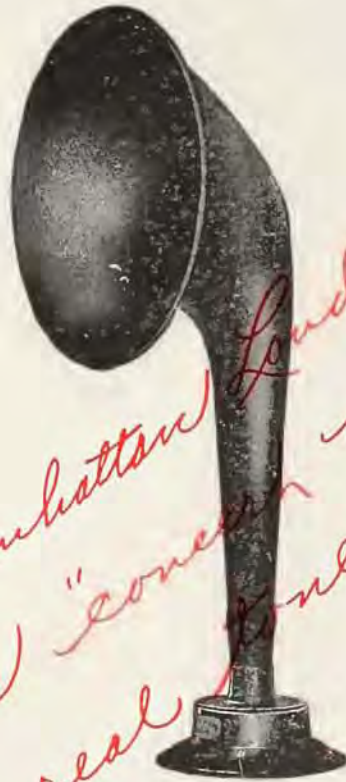
NOVEMBER 1924

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Blueprint Section Every Month

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How I Earn \$100.00 a Week as a Radio Expert

A year ago I was mighty blue and discouraged. It seemed to me that I would never be more than a low-paid bank clerk. Of course I had a small increase in salary every now and then, but I knew that pretty soon I would reach my limit and there would be no further advancement for me. What future had I to look forward to? Where would I be in five years? I became restless and discouraged and began to look around for some other opportunity.

It was then that I discovered that the demand is for *trained* men, that the opportunities are all for men who can do some one thing better than anything else. There were wonderful opportunities for men who were experts or specialists—but I was..... a clerk. How I regretted then that I hadn't prepared myself for some definite career!

I Wanted to Marry

The thing that made me more restless at that time than anything else was the fact that Marian and I were—that is, we wanted to be married. But we both knew that we couldn't possibly get along on my small salary. If only there was something I could do that would bring me a larger salary!

It was just about the time that everyone became so interested in radio. Our whole town became radio-mad, and of course what was happening in our town was happening all over the country—all over the world. I managed to save up enough to buy a receiving set and I was never quite so happy as when I was trying to tune in on stations.

The thing fascinated me. Playing with air waves! Bringing melodies and messages out of the sky! I was never so interested in anything before.

Marian was the first to sense the great opportunity. "Why don't you become a radio expert?" she said. "You like it, and I am sure there must be a big demand for men who understand it.

It's a new field and there's plenty of room for wide-awake men."

"But—but I'm not trained!" The thought excited me. To be a radio expert! To find my future in this fascinating new field! "I don't know anything about it, Marian," I said. "I wish I did, though."

"Well, why don't you find out about it?" she retorted. "You can't learn about radio just by listening in to the concerts. Why don't you take a course?"

But we found out that most courses were expensive or that they would interfere with my other work. We were about discouraged when I discovered that through the National Radio Institute it is possible to become a radio expert by studying right at home in spare time. I told Marian about it and she was elated. "Send off for information, at once—today!" she exclaimed.

Advances Quickly to \$100 a Week

I did, and the following day received an important booklet, "Rich Rewards in Radio" telling all about radio opportunities and how to become an expert in any particular phase of the work.

Here was my opportunity at last!

I began to study in all my spare time. It was the most interesting and absorbing study I had ever made. The secret of the radio revealed to me! Day by day I became more skilled and deft until I was able to take apart receiving sets and put them together again as though I were playing with a toy. It was fun! In a month I was able to take a position as lineman at a bigger salary than I was getting at the bank. This was wonderful experience for me, and I kept right on with my studies. It wasn't long before I qualified for a position as radio engineer at a salary of \$100.00 a week! That is what I am earning now, though I expect to make more soon. It seems to me almost too good to be true, after all those years as

a low-paid clerk in a bank. And Marian, who will soon be my bride, keeps saying, "I told you so!"

As a radio expert I can tell you that there is a tremendous demand for men who can build, sell and install radio sets, who can design, test, repair. Men are needed as engineers and executives, all over the world. The opportunities are limitless, and if you like radio there is no reason why you cannot qualify for one of these positions by studying in your spare time at home as I did.

The National Radio Institute offers an absolutely complete course which prepares you for the Government First Class Commercial License and for the bigger-paying jobs in Radio. The Director, E. R. Haas, will be glad to send you all details of their marvelous new method of practical instruction, including information concerning the Free Employment Service which secures positions for National Radio Institute graduates. Everyone interested should have this information. *It's free*, and this coupon will bring it to you. I advise you to send it off today. Radio is a new and interesting field, and it offers you more money than you probably ever dreamed possible!

Important

Those who mail the coupon *at once* will also receive details of Special Short Time Reduced Rate. Do it now.

National Radio Institute, Dept. 53 LA.
Washington, D. C.

I am interested in radio and would like to find out whether or not I am suited for a radio career. Please send me, without the slightest obligation, your interesting free book called "Rich Rewards in Radio." Also full details concerning your special Short Time offer.

Name.....

Address.....Age.....

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

RADIO AGE

The Magazine of the Hour
Established March, 1922

WITH WHICH IS COMBINED RADIO TOPICS

Volume 3

November, 1924

Number 11

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A Chat With the Editor

IN A recent advertising campaign in which this magazine sought to impress prospective advertisers with the fact that RADIO AGE carried 80 per cent more advertising in October than in the previous month, it was emphasized that "Reader Interest Tells in the Long Run."

"Reader interest" is a term applied to a certain confidence which a publication inspires in the minds of its readers—confidence in its editorial contents and in its advertising columns. This confidence is always accompanied by an actual interest in the subjects discussed and an approval of the manner in which those subjects are presented.

Now we want to tell you why we emphasize "reader interest" in our recent advertising. We based our statement that it wins in the long run on the fact that we have proved it in less than three years of hammering away at one editorial principle which we considered radiologically sound. That policy was and is embraced in the determination to give our readers each month the best technical information and the best technical draughtsmanship in the radio publication field.

Readers who read our articles in the Spring of 1922 are still reading them and writing us their approval.

They have greeted our eight-page blueprint section with surprise and delight. They are enthusiastic followers of our "Pick-ups and Hookups By Readers" department. These letters come from every state, from all Canadian provinces, from England and from countries even more remote. We acknowledge them by direct mail but hereby wish to express our appreciation to all these friends as a group. We also are showing our good will in return by continuing to keep the volume and quality of technical radio up to our old standard.

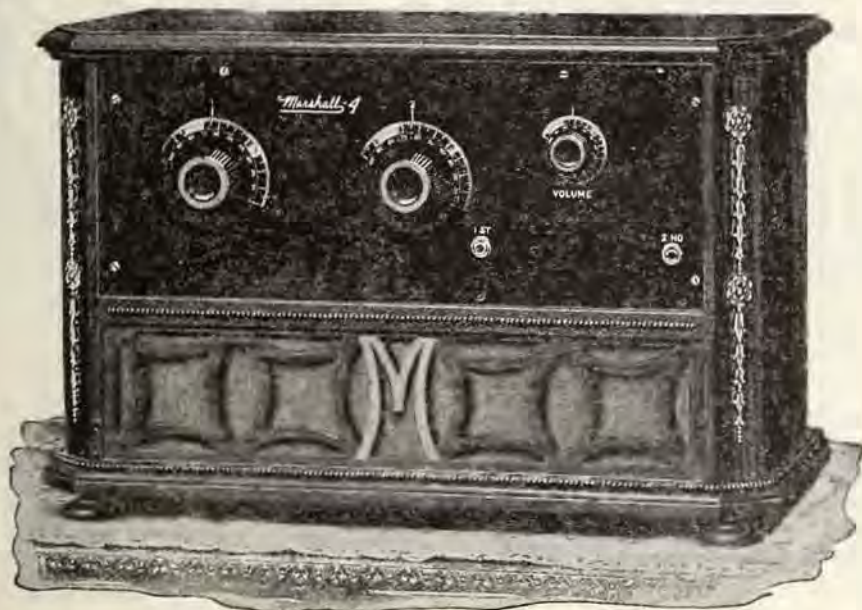
Advertisers have forced us to 80 pages in this issue. Please notice that we have not reduced the number of pages of pictures and information to "make room" for more pages of advertising. On the contrary, we have increased the editorial content considerably.

Frederick Smith

Editor of RADIO AGE.

Marshall The Greatest Advance yet made in RADIO

3-4 and 5 Tube Sets



Receiver and Loud Speaker in Combination Cabinet of Solid mahogany

This Beautiful Marshall 4 Tube Non-Oscillating Receiver Complete with all accessories

only \$5⁰⁰ DOWN

WRITE TODAY for full particulars of this most exceptional offer. Marshall Sets embody the very latest improvements known to radio. The wonderful new principle involved is proving the sensation of the 1924-25 radio season. Zero Coupling—the problem which radio engineers have been working on for years—has at last been solved. As a result, the Marshall has no need for neutralizing condensers or other make-shift methods of avoiding internal oscillations which invariably reduce efficiency. The Marshall Tuned Radio Frequency Receiver brings to radio a new degree of musical quality. Its selectivity will delight the experienced radio operator. Yet it is so easy to tune that the novice will handle it like an expert.

Easy Monthly Payments—2 Weeks Free Trial

This is the remarkable offer we are prepared to make you! Two weeks to prove that the outfit you select is everything we have said for it. If it doesn't make good our claims, back it comes, and your deposit will be cheerfully refunded. But if it fulfills all your expectations, you may pay for it in easy monthly installments. You don't risk a cent when ordering from us. You *must* be satisfied, or we don't do business. Is it any wonder that radio buyers the country over are rushing to take advantage of such an offer? If YOU are interested, figure on getting your order in early, while prompt shipment can be made. Everyone predicts a serious shortage of radio supplies this season. Send for full particulars today.

Beautiful Solid Mahogany Combination

Compare the beautiful Combination Cabinet, pictured above, with the usual radio box and horn. Here the receiver and Loud Speaker are contained in a single handsome cabinet. Or, if you prefer, we also have the Receiver in a separate cabinet of the same design. These cabinets are the work of a master designer—fashioned of solid mahogany. They will harmonize with the furnishings of the finest homes. In spite of the extra value, these Marshall sets are surprisingly low in price. Compare them with others which sell for cash. Then remember you can order a Marshall outfit on two weeks' free trial and pay for it on very easy terms.

Complete Outfits If Desired

In buying from Marshall, you have the choice of a set complete with all accessories, or the set alone. You have choice of dry cell or storage battery outfits. Unless you already own the accessories, you can buy them from us at less-than-market prices, with your set, on easy terms. Your outfit will come all ready to set up and operate within a few minutes,—saving time and trouble—and saving money, too.

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Marshall Blvd. and 19th Street, Dept. 58-98 Chicago

Send Coupon for Special Offer!

If you have any idea of buying a radio set this year, don't let this chance slip by. Our terms and liberal guarantees have set a new pace in the radio business. The low prices we will make you on a 3, 4, or 5 tube Marshall set will surprise you. A letter, postcard, or just coupon will do. But send it today.

We also have a most favorable offer for radio dealers. Write.

Marshall Radio Products, Inc.

Marshall Blvd. and 19th St., Dept. 58-98 Chicago

Please send me your special offer price, terms and full description of Marshall Radio Outfits. Though I may change my mind on receiving your proposition, my preference now is for a:

.....3 Tube4 Tube5 Tube (Please check)

Name

Address

ALL-AMERICAN

now brings you
DISTANCE, VOLUME AND QUALITY
 with **ONE TUBE**

Self-Tuned Radio Frequency Transformers
 —Wound to Suit the Tube



OUT of a year of many experiments and numerous failures to achieve in a practical instrument the theoretical possibilities of broad-tuned Radio Frequency Amplifiers, has come a simple but far-reaching discovery. Radio Frequency Transformers can and must be adapted to the characteristics of the particular vacuum tube whose grid voltage they supply. That truth—with All-American scientific research and All-American precision manufacturing—has made radio history.

SELF-TUNED RADIO FREQUENCY TRANSFORMERS have arrived—and All-American, naturally enough, has brought them. Never before has an instrument been built which will amplify so effectively, over the entire radiocast range, as will the new All-American Types R-199 and R-201A. Together with the new Type R-140 All-American Universal Coupler, they have made possible a new standard of efficiency in Radio Frequency and Reflex receivers.

As an example of this, we offer ALL-AMAX JUNIOR (1 Tube) and ALL-AMAX SENIOR (3 Tube). Both are All-American-coupled throughout, and both exemplify the new standard of performance.

Build an ALL-AMAX—using the complete panel scheme and wiring plan shown in your KEY BOOK—and you will never go back to an ordinary reflex set. Distance and power are yours!

All-Americans—Precision-Made for Reliability
 Sold by all the Better Dealers

Audio Frequency Transformers
 "All-American for Reliability"

- Ratio 3 to 1 R-12, \$4.50
- Ratio 5 to 1 R-21, 4.75
- Ratio 10 to 1 R-13, 4.75

Built by Precision Methods in a Modern Plant, All-American Audios are Unsurpassed at any price for Quality Reproduction and Dependable Service.

Long Wave Transformer

For High Amplification and no distortion of side bands at 4,000 to 20,000 meters (75 to 15 Kilocycles) . . . R-110, \$6.00

Power Transformers

For Tone Quality in a Third Stage, or for Loud Volume with Clearness.
 Input Type R-20, \$6.00
 Output Type R-31, 6.00

An absolutely new kind of book—immensely valuable to both beginner and expert.



ALL-AMAX JUNIOR and SENIOR; also many other good hook-ups.

Sent for 10 cents, coin or stamps.

RAULAND MFG. CO.
 2680 Coyne St.
 CHICAGO
 Pioneers in the Industry



Radio Frequency Transformers
 "Self-Tuned—Suited to the Tube"

Effectively amplifying all Frequencies within the Radiocast Range.
 For "199" Tubes R-199, \$5.00
 For "201A" Tubes R-201A, 5.00

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It gives superior results in beat reception, filtering out a 30 Kilocycle Frequency with high selectivity and no side-band distortion R-120, \$6.00

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(Oscillator Coupler.) A uniform output at 150 to 650 meters . . . R-130, \$5.00

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Sets a new standard of efficiency as an antenna coupler. As a radio frequency transformer in tuned stages it is unsurpassed R-140, \$4.00

ALL-AMERICAN
 TRADE MARK

Largest Selling Transformers in the World

RADIOTORIALS

THE third national radio conference, called by Herbert Hoover, Secretary of Commerce, has passed into history, and the great army of fans undoubtedly are familiar with the steps that are to be taken in the progress of radio during the next year.

A perusal of Secretary Hoover's opening address before the conference leaves no doubt regarding his attitude toward the radio industry as a whole. The complaints of hundreds of small stations during the last few months, to the effect that they were faced with extinction to make way for super stations, seem to be groundless. Mr. Hoover makes it clear that he does not wish to stifle progress in any direction, and that nothing must be done that will interfere with the programs of local stations, on which so many millions of people depend.

Secretary Hoover realizes that efforts are being made by several corporations to install powerful stations with power up to 5,000 watts, which in turn would make it impossible to hear any small station which happened to have the misfortune to broadcast at the same time. From the Secretary's attitude, and from the opinions of the members of the conference who directly represent the radio public, it seems unlikely that permission will be given for the establishment of powerful stations whose operation would tend to monopolize the air eventually.

Mr. Hoover does advocate however, the national interconnection of radio stations. Whether this is to be done by super stations or by inter-connection of local stations, he does not definitely say, leaving that point to the discretion of the conference. But he does assert the need for a sort of associated press of the air, which could be subscribed to by broadcasting stations and depended upon to furnish programs of suitable excellence, as well as arrange events of national importance.

Mr. Hoover is unqualifiedly in favor of interconnection of radio stations. He emphasizes the need of a system of program directing that will take programs out of the amateur class and put them on the high plane that they deserve. But, again, he does not say who should do this. Surely, not the government; surely, not one company, for that would be monopoly. Who, then? Perhaps the conference will decide. Perhaps the conference will form from its own personnel a force of sufficient dependability and ability to furnish nationwide programs.

Mr. Hoover's entire speech assumes that the local station will continue to exist. That is good news for the "DX" hound. But he insists some plan must be worked out whereby this same local, and perhaps small station shall be able to broadcast events of national importance and interest. In so doing he opens the way to propositions of large corporations who would have to handle this huge system of inter-connection. They will be the only ones who can afford to do this, if the Government will not do it. And if a few related corporations take over radio intercon-

nection, the small station probably will lose its individuality. But only the conference will decide that.

Mr. Hoover is right when he says radio will die of its own confusion unless it has stringent rules of conduct to which all elements adhere. He is right when he says radio must be an instrument of service if it is to succeed. All we ask is that it be allowed to serve everyone, and not a *few*: that its destiny be entrusted to those who really love radio—not those who love the money in it.

THE New York broadcasting fraternity is in the throes of a restless discussion over the question of paying broadcast artists. Small stations who have thrived on free entertainers are beginning to furrow their brows with worry over what will happen if they have to buy their performers' services. And members of the Actors' Equity and other professional unions are beginning to see in radio a new commercial field to conquer. Perhaps so. The ether has been peaceful enough because of the absence of selfish squabbles such as characterize the Actors' Equity. Without salaries to worry about, the broadcasters have been able to assume a lofty position and choose entertainment that they believed was the best. The minute they start paying for it if they have to do so, they may pick the cheapest. It is only human nature for individuals seeking to cut expenses to purchase that which is low-priced and which will pass as the real thing. It will happen to the broadcasters, for they have no tangible income from their stations, and paying money for artists is hard unless there is some return. No, New York is needlessly alarmed. Radio entertainment is good enough now. When we want the professionals we'll ask for them.

RADIO'S great tribute was paid at the New York "Radio World's Fair." The large body of fans never realized what a husky youngster their hobby had developed into until they visited that show and crowded their way to the manufacturers' booths. Radio sets and parts heretofore undreamed of were there. The men who brought about this perfection were there, too. But after all is said and done, there were no radical changes. True, radio sets have developed to a great extent. There have been improvements, but none which would confuse the radio fan of a year ago. The sets are more simplified, their beauty enhanced, and their parts more durable, but their principle is not far removed. The outstanding feature of the receivers in the 1924 radio show seems to be excellence rather than radical change. Fans want quality—tone—selectivity. They realize it will be a few years before radio again changes its shell, and in the meanwhile they want sets that will give them what they want to hear when they want it, and with as much natural reproduction of one as is scientifically possible. There are many such sets today. They are the symbol of the continued excellence of quality that has characterized radio manufacturing for the last twelve months.



(Photo C. Drake Studio)



Miss Rosemary Hughes is known to nearly every radio fan in the country because of her consistent performances at scores of stations during the past few months. Miss Hughes has an alluring soprano voice, and her rendering of popular and semi-classical favorites has put her in demand wherever she goes. Because of her success over the radiophone she is said to be considering a liberal vaudeville offer. At the left is Bert Davis, "The Clown of the Air," who can "sing more crazy stories than you ever heard before." He is scheduled to make a nation wide tour of radio stations this Winter, and he is also to be featured on RADIO AGE programs over Chicago stations.

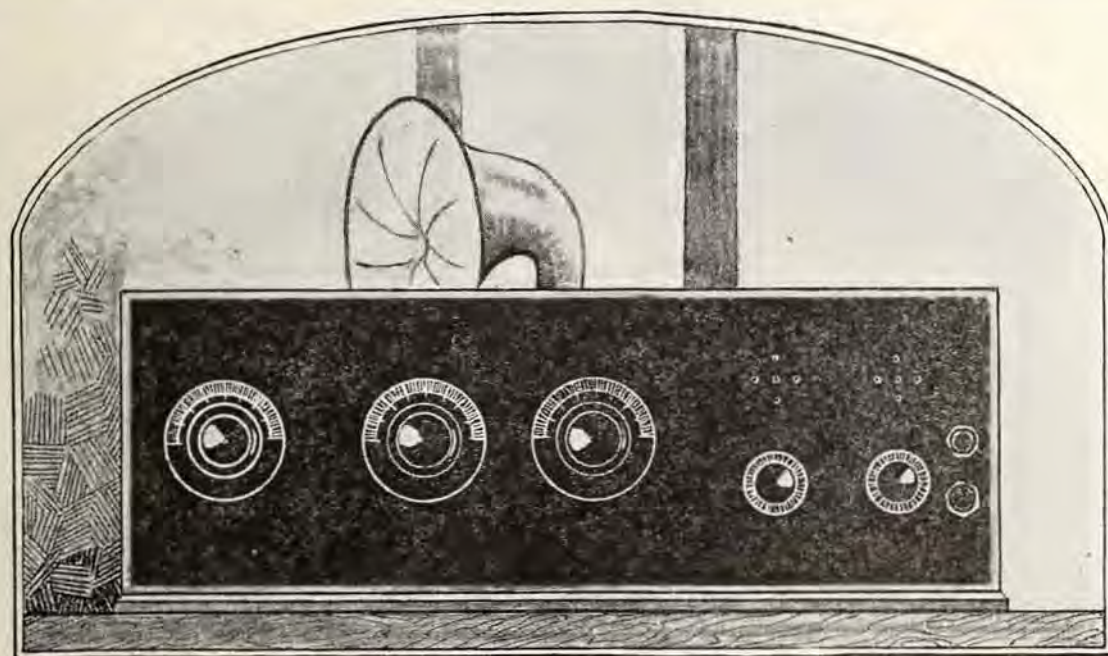
RADIO AGE

The Magazine of the Hour

M. B. Smith
Business Manager

A Monthly Publication
Devoted to Practical
Radio

Frederick A. Smith
Editor



A Three-Tube LOW LOSS Regenerator

A RECEIVER THAT TUNES DX LIKE A SUPER-HET

IT has always been the policy of the members of the technical staff of RADIO AGE to promote the development and interest in the low loss type of receivers, and in nearly every description of receivers in past issues, the reader has probably noticed that this lesson has been particularly stressed. At the risk of becoming tiresome, the writer has drummed this message over and over again, with the natural result that many letters of gratitude and satisfaction have been received from people who benefited by following this low loss policy in constructing their radio sets.

In the March, 1924, issue was printed our first actual description of a real low loss radio receiver, that really deserved the name for its design. Acting in the capacity of official question-answerer of the technical staff of RADIO AGE, the writer has had the privilege of noting the interest and results which this description created, and since March it has been a pleasure to note the increasing demand for more information along the low loss line,

By *FELIX ANDERSON*

If you will refer to that number, you will find several initial lessons or requisites that must be followed in the course of constructing a receiver that is really and truly low loss.

It may be well to refresh the mind of the reader on this subject, since the major points of that article may not have been duly considered at that time. Taking up these requirements, we find that there are at least three factors of tremendous importance which must be observed. Listing them they are as follows:

1. A good secondary circuit, with a low loss coil and an electrically and mechanically near as perfect variable condenser.
2. A properly adjusted grid leak and a good detector tube.
3. A well chosen list of accessory units such as tube sockets, rheostat, and fixed condensers.

THE secondary circuit consists of a coil and condenser in series which form the tuning unit of the receiver, and which must necessarily be good if sharp tuning is desired. The coil must be free of both actual ohmic resistance and high frequency resistance as possible, and must be so constructed that it has the least amount of distributed capacity possible.

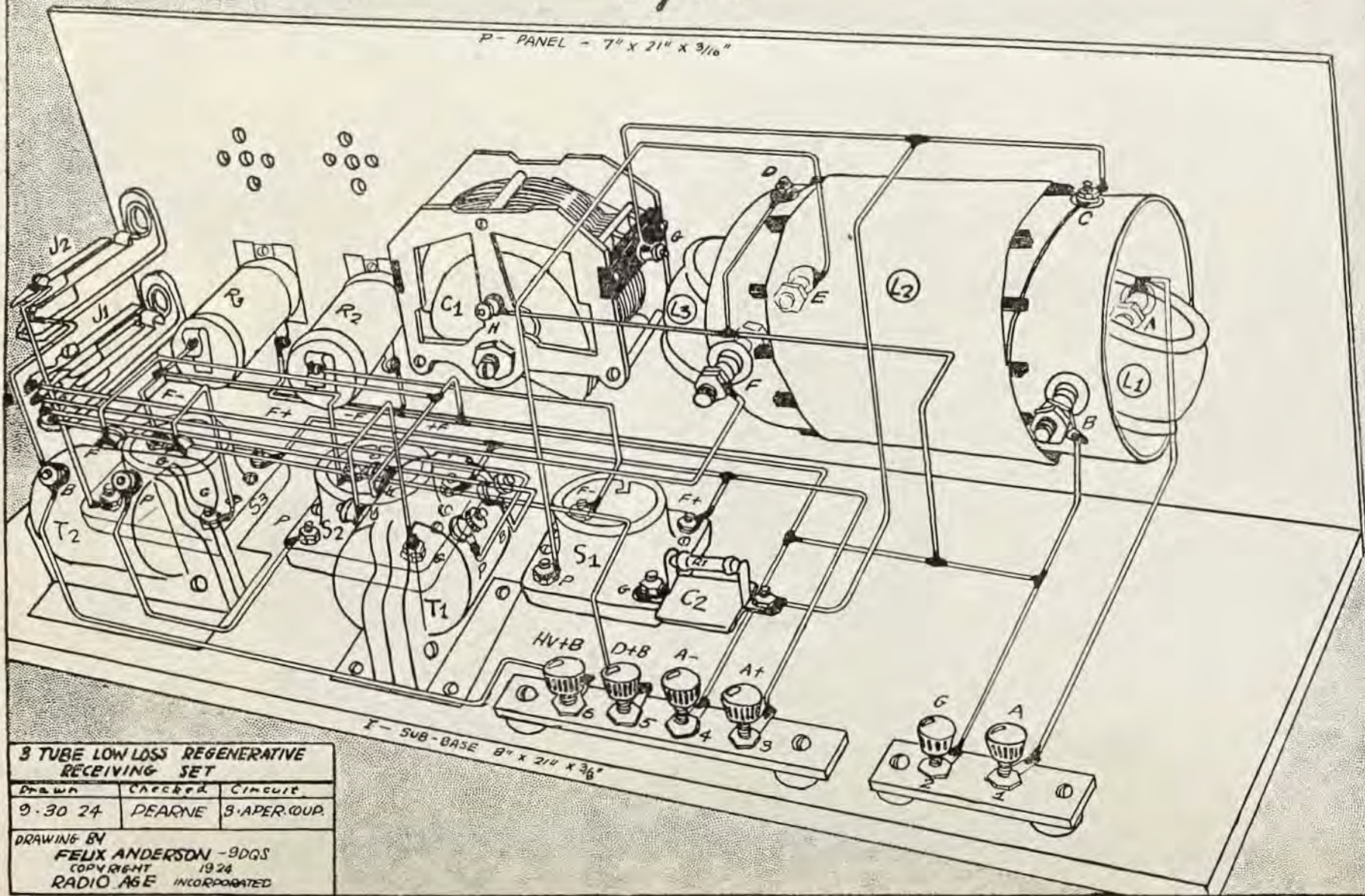
The condenser should be one of the low loss type, having a grounded rotor, and should be sturdily made with regard to both insulation and plate construction so that it may be calibrated in terms of wavelength in conjunction with the coil you are going to use. A condenser poor in a mechanical way will cause wobbling of the plates, and this destroys the accuracy of the logging possibilities of the receiver.

The grid leak is next in importance, as well as the choice of a good detector tube. The tube is, of course, more or less of a gamble, since you cannot tell whether it will detect as well as another tube of the same type, but the grid leak should at least be so constructed that it

THREE TUBE LOW LOSS REGENERATIVE RECEIVER

Figure 2

P - PANEL - 7" x 21" x 3/16"



3 TUBE LOW LOSS REGENERATIVE RECEIVING SET

Drawn	Checked	Circuit
9-30-24	PEARNE	S. APER. COUP.

DRAWING BY
FELIX ANDERSON - 9DQS
 COPYRIGHT 1924
 RADIO AGE INCORPORATED

will be free of noises, and so that it will not change in resistance with the weather. Since the June, 1924, issue covers that subject so thoroughly, I will not discuss this unit at any greater length. Suffice it to say that it is important, and if you lack knowledge on this matter, it would certainly be a wise move, regardless of what kind of a set you operate, to stock yourself with the knowledge of this small but important part of your radio set.

The other accessories such as the tube socket are not so great a problem, since the average tube socket on the market is now usually low loss. However, tar paper and composition sockets should be avoided, as should paper or other make-shift fixed condensers.

In the March, 1924, issue, the writer discussed these features of a receiver from A to Z, and while the subject is still of great interest, it is regretted that space does not permit us to again discuss the relative importance of these units in more detail. If further information is desired in regard to the foregoing, it can be obtained from that number. It is somewhat of a joy to note that the specifications for the condenser and coils of the receiver in that description are just now beginning to appear on the radio market, and by the looks of things, that type of apparatus construction will probably stay with us for a long while.

Three Tubes Instead of One

IN the opinion of the writer, an all-around receiver for the broadcast listener should have tubes and amplification enough to permit the use of a loud speaker. The low loss set of the March issue employed only one tube. So many requests were received for additional circuits showing two more and even four more tubes that it was quite a sur-

prise. The receiver in the following description is ideal in that respect. Further, the ideal broadcast receiver should be easy to tune, and we find that only two actual working hands are necessary in the operation of the receiver to be described. Like a super-heterodyne, we have two dials, the secondary control being the condenser, and the tickler control which corresponds to the oscillator dial on the super-het. With the super-heterodyne, we usually have a potentiometer which requires an occasional touch, and on this low loss set we must make an infrequent adjustment of the antenna coupling to get the best results. The logging operation is the same—two dial readings; viz.: the secondary and the tickler readings being logged, and used.

Constructing the Set

PROBABLY the most important unit of the set is the tuning coupler, which must be made carefully and intelligently if results are to be obtained. Low loss couplers adaptable to the circuit are now on the market, and if the constructor so desires, they may be purchased instead of being home-made. The condenser, of next importance, can be purchased from any supply house, the low loss 23 plate, all plate vernier type, being the type to be obtained. Reference to the advertising pages of RADIO AGE will disclose some of unusual merit.

Tackling the problem of the coupler, we will need two rotors, of either wood or bakelite. Referring to Figure 2, these are the forms upon which L_1 and L_2 are wound. In addition to these rotors, you will need a thin cardboard tube, which has been lightly varnished with a thin coating of spar varnish after having previously been oven dried.

The size of the cardboard tube will depend upon the size of the rotor balls

which you purchase, and since it is easiest to get cardboard tubing of the proper size, to use with the rotors, get the rotors first and then match them with the proper size tube. The matching should be done with the idea in mind of allowing from 1-4 to not more than 3-8 inch coupling space between the rotor ball and the cardboard tube. Bakelite tubing may be used but it is harder to work with.

After the above material has been procured, cut yourself a dozen bakelite strips, from an old panel and plane their edges square. These strips should be just as long as the tube you are using (the tube being about 6 inches long to start with). Glue the strips you have cut, firmly with their edges to the tube, then set the form aside to dry. When the glue has hardened you are ready to wind your secondary coil.

Incidentally, the size of the bakelite strips is not important, so long as the outside diameter of the coil L_2 does not exceed $4\frac{3}{4}$ inches. The entire length of the coil as a whole may be determined after the coil has been wound. If the coil L_2 is $3\frac{1}{2}$ to $3\frac{3}{4}$ inches, outside diameter, 55 turns of wire, space wound should be used. If from $3\frac{3}{4}$ to 4 inches from one side of the winding to the other, only 45 turns are necessary, and if the entire coil diameter is so great as to be over $4\frac{3}{4}$ inches from one side of L_2 to the other, only 40 turns will be necessary. The coil is space wound, to offset distributed capacity. By space winding, it is meant that the wires are not wound closely alongside of each other, the wires being separated from one another by a small air space about three quarters as wide as the diameter of the wire itself. It is because of this method of winding

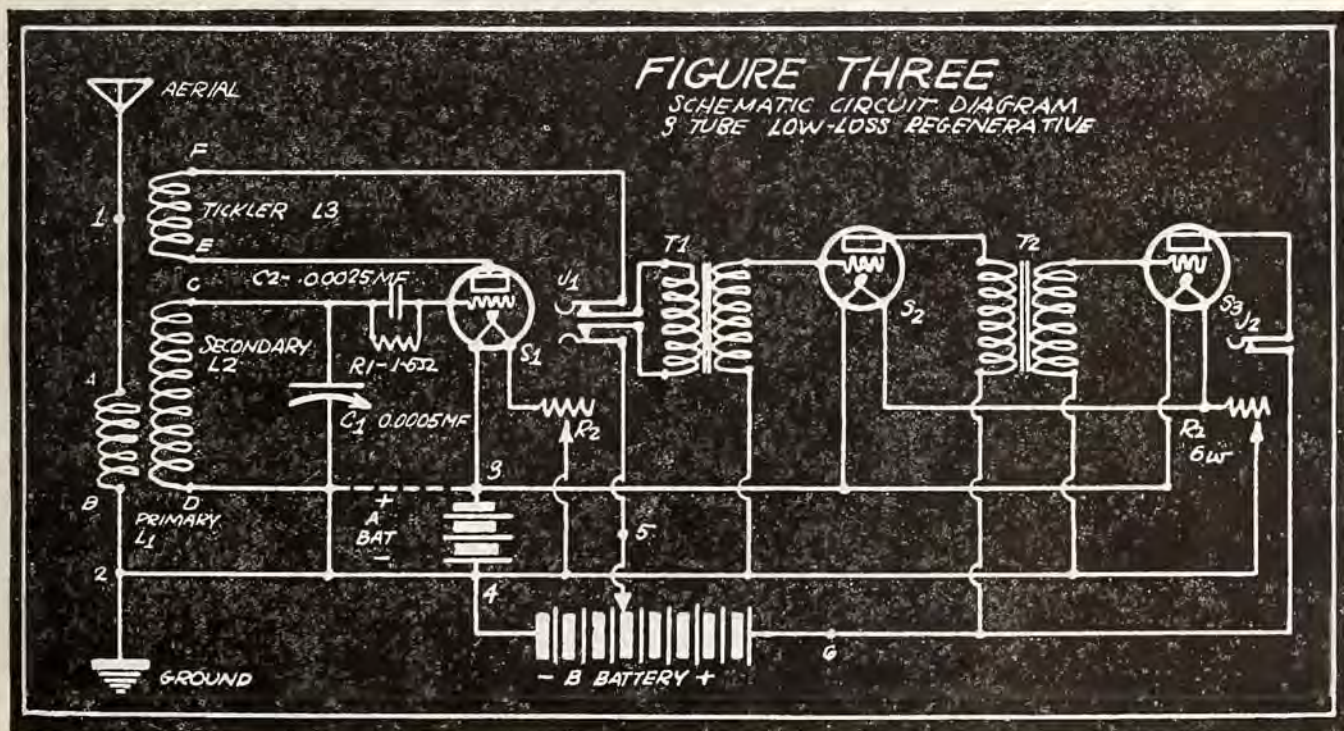


Figure 3. A circuit diagram of the low loss receiver described in the accompanying article by Mr. Anderson. The connections for the ground may be made either positive or negative, as indicated by the dotted line at points 3 and 4.

that the coils will vary in length, as will the actual length of the tuner itself.

After the coil L_2 has been wound the points for the holes of the rotor shafts may be determined. Drill your holes so that they clear the coil L_2 with about a good $\frac{1}{2}$ inch clearance.

BY following the proportions in Figure 4, you can get a general idea of how the coil should look when finished. The entire unit is mounted on the panel with two collars threaded and supplied with screws at both ends—one end for the coil and one for the panel. Figure 2 shows the connections for the coil, as does Figure 3. A and B may be reversed if hand capacity effect is noticed without impairing the effectiveness of the set. C and D are the grid and filament ends of the coil which are connected to the rotary and stationary plates of the 23 plate variable condenser. E and F are the connections of the tickler coil for plate and jack connections.

These may also be reversed, if the set fails to oscillate. The coils themselves should have the following number of turns as determined by a few preliminary experiments: L_1 should be wound with 20 turns of number 18 DCC wire with 9 turns on each side of the shaft. L_2 , should be wound as mentioned just previous, with the same size of wire, and L_3 the tickler, should be wound with 35 turns to start. If your antenna is a long one, coil L_1 should be decreased to about 12 turns. The final number of tickler turns should be determined by setting the coil L_1 at maximum, and then turning condenser C_1 to full setting.

The tickler coil should then be set at maximum (maximum is when all coils are in parallel setting and all windings run in the same direction), and turns should be removed until the set barely oscillates at that setting.

General Notes

The audio frequency transformers should be of good make with a ratio of not over 5 to 1 for maximum clearness. The ratio of these transformers is left to the choice of the constructor, who may desire louder signals over clearness, the choice of which lies in the purchase of either a low or high ratio transformer. High ratios distort and give louder signals but low ratios give cleaner signals with less volume.

A vernier rheostat should be used at R_2 while an ordinary type may be used at R_1 . R_3 controls both audio tubes. The battery connections are made at the rear of the set, as are the antenna and ground, as indicated. No. B- post is shown, since this connection should

be made to the +A of the filament battery.

The set tunes in the same manner as the single circuit regenerative, except it is very much sharper.

It is not a malignant squealer, since the ratio of antenna coupling to the grid coil is very small, and only little energy gets through. The proper ratio of tickler coil also is one reason for its being easily controlled with respect to regeneration, since by employing a correct number of turns on the tickler the set does not spill over so easily.

Figure 1 is a front panel view of the set, which was drawn to scale from the working model.

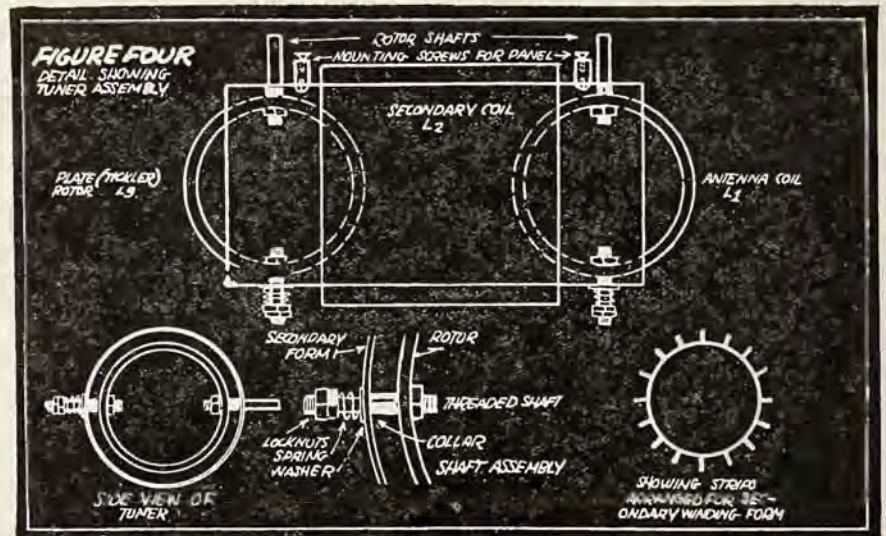


Figure 4. Details of the coupler are shown in the accompanying sketch. The top view shows the complete assembly of the coupler; the bottom left, a side view. The center bottom gives the details of the shaft and tension mounting, while the lower right gives an idea as to how the bakelite strips are fastened radially to the tube.

Low Loss Design for Efficient Reception

THE ambition of the broadcast listener of today is to have a receiving set that will operate a loud speaker and one that will reach out and get the distant stations. However, in the purchase or construction of the receiver he overlooks the value that low loss design has to do with his set.

How many times have you visited a fellow listener's station whose set consisted of a lot of bell wire wound on a Quaker Oats box and more wire strung here and there and leading to every place but what seemed the right place? Then you began to wonder why he was getting better results than you were with your more expensive set. However, your friend, in building his set, has eliminated a good many losses that are so troublesome to an efficient receiver.

The present tendency seems to be to get amplification regardless of tuner efficiency. The loss of 5 per cent in a condenser or a coil cannot be detected by the human ear, but when ten or fifteen per cent is added to this by bad

By KENDALL NORTH

connections or dielectric loss, a noticeable effect may be distinguished on distant stations. This will also apply to local stations.

There are two methods of tuning the secondary of a receiving set. First, by a variable condenser and second by a variometer.

WHEN a set is constructed to tune from 75 meters to 375, the capacity tuned secondary is used. This might be termed employment of a variable condenser and coil.

When a condenser is connected across the secondary coil, the voltage is lowered. Regardless of this, the losses due to the distributed capacity of the variometer or coil are greater than the losses that will be found in a good condenser, and as a result they more than make up for the decrease in voltage caused by the condenser itself.

If you are building a coil with a capacity of 300 meters, wind the coil for 300 meters and not for 600. When you wish to tune the set to 300 meters, you will have what is known as dead end. This is known as the unused part of the coil.

It has been found that an ordinary paper tube, providing it is free from moisture, is far superior to the expensive material found in some expensive sets, such as the heavily varnished tubes that are sold on appearance and not for actual operation.

The secondary plays an important part in the receiving set and it is necessary when purchasing one that you obtain one of low loss. Of all the condensers on the market, there are about six makes that have really low loss. These condensers do not sell for any more than the ordinary so called moulded mud brand. That is the kind that has enough moulding in the back and front to mould a socket for a vacuum tube. You can readily see that here again arises the problem of insulation in an electric field.

How Careful Design Helps in Mastering the 3-CIRCUIT TUNER

WITHOUT any doubt, the simple and reliable one tube receiving set of today is the three-circuit tuner, with its untuned antenna coupling coil, the secondary coil tuned by a variable condenser and the tickler coil for controlling its sensitivity. Yet it is true enough that results are widely different—the very same set acting far differently when used in different situations.

Lack of uniformity in reception is largely a matter of differences in the aerials to which otherwise similar receiving sets are connected. Especially is this inequality likely to occur with the three-circuit tuner, simply because the antenna part of the set is not tunable. There is always a fixed amount of coupling existing between the antenna and the tuned secondary, and whether the aerial be immense in its dimensions or a mere indoor wire strung along the picture molding, the coupling is not variable.

Naturally, a large antenna is going to pick up many times the energy from broadcasting stations that is within the grasp of a little one, and hence the distance and the strength of signals received will be widely different. Therefore the results anyone may expect with his three-circuit receiver depend to no little extent upon the degree of coupling between the aerial and the secondary circuit.

How Much Coupling?

It is quite easy for any listener to judge, merely from the way in which stations are received, whether the coupling in his set is too much, just about right, or not enough. The selectivity is a good criterion. For instance, if WNYC can be heard faintly through broadcasting from WEA, one may be quite sure that there is a little too much energy being transferred from the aerial to the secondary. When this condition exists, signals are received with plenty of "kick," but great difficulty is met in endeavoring to tune in a distant station whose wavelength is not many meters away from a local station.

ON the other hand, if stations within ten or fifteen miles

By *BRAINARD FOOTE*

Degree of Coupling Between Aerial and the Secondary Circuit Fixes Set's Efficiency

do not come in with much volume, and at the same time are exceedingly difficult to tune to the precisely correct "spot" on the dial, it is a certainty that there isn't quite enough coupling or quite enough energy being transferred to the secondary coil to insure really satisfactory reception. In cases where volume is good from all of the locals, and yet there is sufficient selectivity to tune in distant points such as WGY, WIP, WDAR, etc., without too serious interference from neighboring broadcasters, the listener has the coupling just about as it should be.

With a large aerial, say a wire 100 to 150 feet long, including the lead-in, and which is fairly well elevated from trees and buildings, eight to twelve turns on the antenna coupling coil usually provide all the coupling that is necessary. As the aerial becomes smaller,

it is necessary to use a larger primary coil, and with an over-all antenna length of 75 feet or so, fifteen to twenty turns may be employed.

When it comes to indoor aerials, however, it doesn't help much to go over 20 turns for the primary, and the best practice is to include the aerial right in the secondary circuit, so that the aerial as well as the grid coil is resonant to the received wavelength. This takes advantage of every bit of available energy that the aerial can get hold of, and when this is done the distance and the volume that can be obtained with a tiny insignificant looking aerial is surprising.

How to Change Coupling

In Fig. 2 is given the ordinary three-circuit arrangement. When the aerial lead is connected to point No. 1, the most common type of circuit is obtained. The aerial is then coupled to the secondary through a separate primary coil, the most desirable method where the aerial is of good size. However, if the aerial is very small, the amount of energy change-over from the separate primary isn't great enough. In that case, the aerial lead may be connected to point No. 2, which is the center point of the secondary coil. Half of the secondary coil is then acting as a primary winding also, and the antenna circuit is completed through the connecting lead "X," whereby the positive side of the filament is grounded.

AND with a very tiny aerial, fifteen to thirty feet long, perhaps, or with a set of capacitive aerials, which are very successful for indoor work, the aerial lead goes to point No. 3, where the entire secondary is also the primary coil. Maximum coupling is thereby had, and the capacity of the antenna supplements that of the secondary tuning condenser. In this latter case, any alteration in the capacity of the aerial exerts a strong tuning effect upon the set, so that a capacitive aerial or an indoor wire should be erected where persons passing by cannot come closer than two feet to the aerial or the aerial lead.

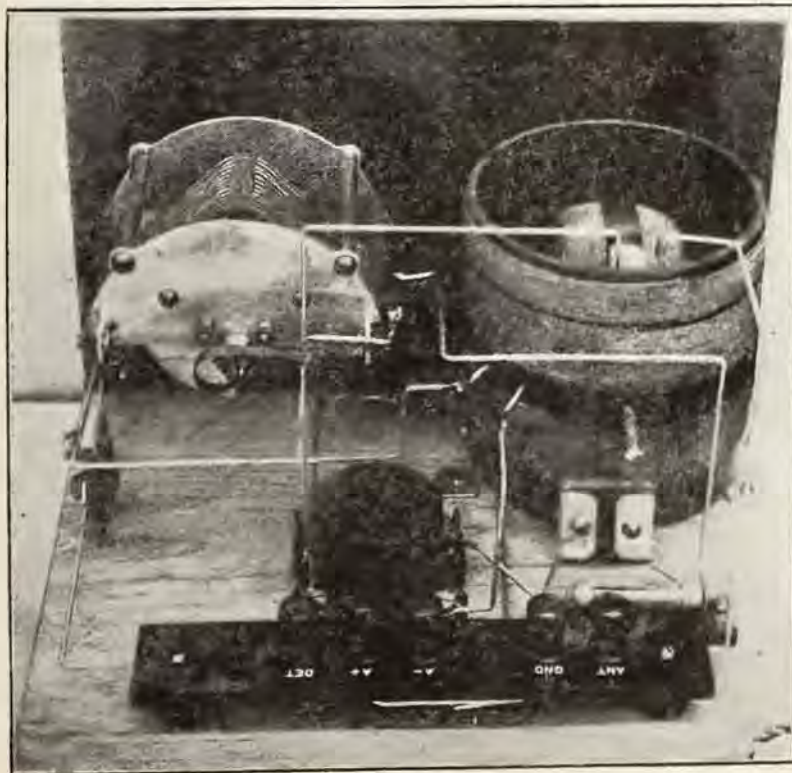


Fig. 1—Home-made, but simple and satisfactory. The secondary coil is split in two, the primary coupling coil located on top, and the tickler coil placed in the middle, inside the tubing.

When the separate small primary coil is employed, the antenna is quite independent, however.

Any listener having trouble in reception with such a three-circuit set would do well to solder three little copper lugs to points 1, 2 and 3 and try connecting the aerial lead to each one with a clip. As a matter of fact, it is of considerable advantage to have a coupling adjustment for any single tube receiver, or with such a receiver used in conjunction with a two stage audio amplifier. While taps and switches are not considered to be especially efficient, points 1, 2 and 3 might be connected to a set of three

switch points for easy selection of the best coupling arrangement, provided the switch points are so placed that the leads from points 2 and 3 are very short.

A distinct advantage in this scheme lies in one's ability to alter the coupling to suit varying conditions. When a local station is wanted with lots of volume, use point 2 or perhaps 3 to get it, so long as there isn't interference from some other station to be encountered. But when a weaker and more distant broadcast program is desired, use less coupling to get rid of the local interference.

In Fig. 3 is shown the front panel view of a typical three-circuit tuner, one for which the coils may be homemade. At the left is the dial for adjustment of regeneration—the tickler control. Next, at the lower center, is the rheostat knob, while at the right may be seen another larger dial for moving the tuning condenser. Binding posts at the right are for the phones, and the small knob beneath the condenser dial is a vernier control for the condenser.

The Coupler

The rear view of the same set is given in Fig. 1. The coupler is made with coils of No. 20 double covered wire wound on a piece of high grade insulating tubing measuring 4 inches long and 4 inches in diameter. The secondary coil is put on in two sections, 46 turns in all, with 23 turns to a section.

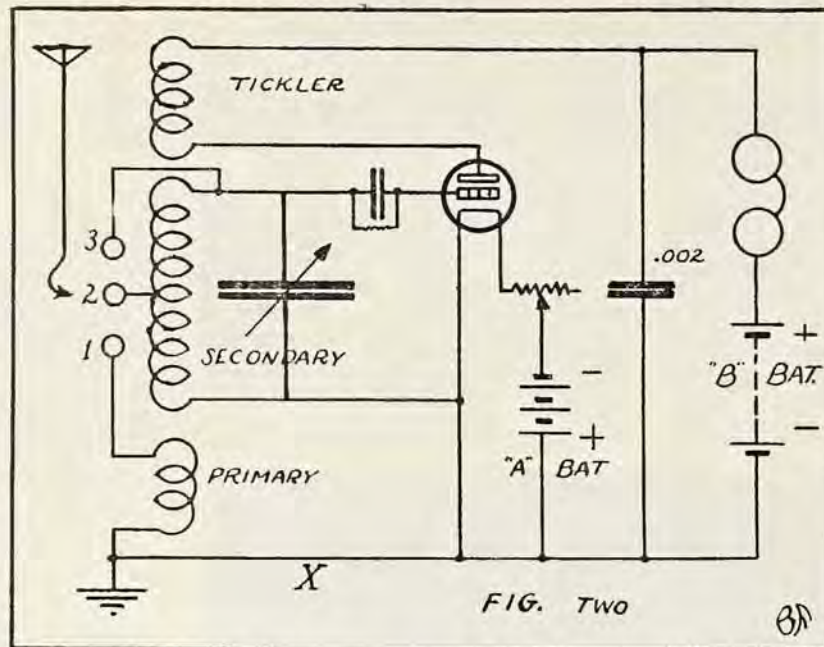


Fig. 2—The popular three-circuit tuner plus coupling adjustments, to adapt the receiver to aerials of varying proportions. Small aerials require more coupling, and vice versa.

A space of about one-half inch is allowed between halves to provide room for the passage of the 1-4 in. shaft, which controls the tickler coil. The halves of the secondary are wound in the same direction, so as to make up a continuous coil of 46 turns when the inner ends are soldered together. Ends of the secondary are held tightly by pushing them through small holes drilled in the tubing. Actual connections to them are made inside.

A 15 turn primary coil is wound at one end of the secondary, with a gap of about one-eighth of an inch. This winding serves for ordinary purposes with the average antenna, but the aerial may be connected as in Fig. 2 if this be found necessary. The tickler coil is wound on a rotor of similar high grade insulating material measuring approximately 3½ inches in diameter

the halves of the secondary coil, are drilled for the shafts, using a ¼ inch drill. A small rat-tail file is then used to slightly enlarge the hole so that it fits snugly but without binding. Fiber washers or short lengths of fiber tubing maintain the rotor ball in the center of the tubing. Flexible wire forms the connections to the ends of the tickler coil, and two brass brackets or angles serve to mount the coupler to a wooden baseboard.

The Assembly

Other parts required are a 7x10 inch panel, 7x10 inch baseboard, socket, rheostat, .002 phone condenser, .0001 or .00025 grid condenser, 2 megohm grid leak, .0005 mfd. variable condenser with vernier attachment, strip of panel material for a binding post panel inside the set, 6 feet of bus bar for connections, necessary dials and 7 binding posts. The

tuning condenser chosen should be of some reliable make, with a minimum of insulating material and having the rotor ball in the center of the tubing. The fixed plates should be shielded by an end plate from hand capacity effects.

Connections are given in Fig. 2. Rosin-core solder should be employed rather than plain solder and acid flux as the latter is too likely to institute corrosion at the joints. The photographs tell well enough where the parts are located, and holes for mounting the rheostat and (Turn to page 75)



Fig. 3—A simple three-circuit set, front view. The rheostat knob is in the center, regeneration and tuning controls at left and right respectively, and phone binding posts at the extreme right.

Overcoming Obstacles in the Construction and Operation of a Super-Het

By ROSCOE BUNDY

WHILE a great many super-heterodyne hookups have been shown in the various radio publications during the past few months, yet there has been very little data published regarding the actual construction from an analytical standpoint. This is undoubtedly the reason for the many failures with the "Het" and is also responsible for the prevailing opinion among certain groups of builders that the eight-tube super-heterodyne offers little more than the five-tube neutrodyne.

To have a simple hookup diagram is not sufficient for the beginner in building a multi-tube receiver. He must also have a knowledge of the remedies to be applied when his circuit goes wrong, and must be told what to do and what not to do in the actual construction.

We had the same conditions when the neutrodyne first appeared upon the scene, and before the true significance of "neutralization" was brought home to the novice. The same group that are now so bitterly assailing the super-heterodyne were the very fellows who were knocking the neutrodyne six months ago. Let it be said that neither the neutrodyne nor the super-heterodyne is a circuit which we can hook up in an evening and then expect to get maximum performance on the first twirl of the dials. Both circuits require careful adjustment and experience in tuning before they develop their full capacity for range and volume. With care and attention to details the super-het can be made to live up to its reputation in every particular.

Precautions to Observe

In the first place, we must not fail to remember that the super-heterodyne is a special form of radio frequency circuit, and that many of the precautions observed with the short wave R. F. receivers must also be observed with the "het." We must insure against feed-backs between the radio stages and use every means to suppress free oscillations in the R. F. tubes. This, however, is a simpler matter with the heterodyne than with the straight radio frequency or reflex circuits.

PRIMARILY the super-heterodyne is intended for use with loop aerials, and if it is desired to operate the circuit on an outdoor flat-top aerial we must observe certain precautions. The very sensitivity of the circuit causes it to pick up much noise and interference with the outdoor aerial unless the set is very loosely coupled. The outdoor aerial is more inclined toward picking up noises than it is signals, and while fainter and more dis-



One must not expect a super-heterodyne to do its best the first time it is operated. Like neutrodynes or other multi-tube sets, several weeks of painstaking adjustment are necessary before maximum efficiency is attained.

tant stations can be picked up by an outdoor flat top from a standpoint, yet the increased interference also imparted to the aerial usually more than overcomes the benefits thus obtained.

For this reason we must provide an extremely loose coupling between the primary and secondary circuits, a coupling that often involves as much as six to eighteen inches between the primary and secondary. The standard vario-coupler is seldom suited for this purpose unless there is sufficient distance between the rotor and stator to insure against the least degree of electrostatic coupling. Selectivity with this circuit is attained only when we can introduce comparatively great losses in the input.

Loop aerials, being strongly directional, afford a means of eliminating undesired stations and noises by simply turning the loop in the direction of the desired signals. In this way, waves lying to either side of the loop plane are greatly weakened and can be more readily tuned out by the normal controls of the set. Actually, the loop is used as the third control of the super-heterodyne and is nearly as effective in tuning as the primary and oscillator condensers. This applies particularly where there is much local interference from nearby broadcasting stations.

For the best results, the loop aerial must have a very low electrical resistance, and this is one reason why great distance is never obtained with the ordinary commercial loops wound with small gauge solid wire. Heavy lamp cord of No. 18 to

No. 16 gauge is the smallest conductor advised, and excellent results are obtained with heavy ignition cable. In such cases, the increased diameter of the stranded conductor gives a greater presented area than a solid wire, and as it is the superficial area rather than the cross-sectional area which rules in high frequency work, the lamp cord or ignition cable gives stronger signals and a much higher degree of selectivity.

To Get More Selectivity

ADDITIONAL selectivity may be had by applying the wave trap idea to the loop; that is, by installing an absorption circuit within the main turns. From six to ten turns of wire are wound just within the outer turns of the main loop, and the ends of this inner coil are connected to the terminals of a 23 plate vernier condenser. By adjusting this condenser we can effectively short circuit any undesired waves, thus reducing the lead on the main tuning units and reducing interference. This adds one more control, it is true, but it frequently becomes necessary under certain conditions.

When an outdoor aerial is used, it is of course necessary to ground the lower end of the primary, and also the (—A) connection. Even with a loop it may also be necessary to ground the (—A) under certain conditions when the loop may be acting both as a loop and as an antenna at the same time. When the set does nothing but squeal without amplifying the incoming signals it is a good plan to

(Turn to next page)

ground the (—A) as an experiment, and the same is true when body capacity is much in evidence or when the set is not properly selective.

Much of the trouble experienced with body capacity or from weakened signals due to feed-backs between stages, can be avoided by grounding the metal shells of the radio frequency transformers, or by connecting the metal casings to the (—A) line, which is much the same thing. This is not an invariable remedy with all transformers, but it is frequently of great assistance.

Shielding the Set

Ordinarily, shielding the interior of a radio receiver is not to be recommended, owing to the losses that may be introduced, but in the super-heterodyne it is frequently necessary to reduce body capacity and to increase the selectivity. Every wire and every coil inside the cabinet acts as a small untuned antenna in picking up stray waves unless shielded by a complete enclosure of grounded metal plates, and where there is much local interference we cannot attain perfect selectivity unless we ground the local waves before they induce uncontrollable currents in the wiring and coils. This means grounded metal shields on the front, back and ends of the cabinet when there are many nearby broadcasting stations.

Grounded metal shields are also often necessary between the oscillator tube and the first radio frequency tube to prevent direct feed-backs between the plates of the tubes. However, it is best to avoid this by changing the arrangement of the tubes where possible, but in certain cases the shield is the only solution. Grounded shields, forming partitions between the various tubes of the radio frequency stages are sometimes of advantage, but in most cases had better be omitted. At this point the shields absorb an unusual amount of energy, and unless body capacity is much in evidence it is better to allow a small feed-back to take place rather than to suffer losses in the stages.

FOR the maximum results with the super-heterodyne we must use storage battery tubes for all stages, the C-301A or the UV-201A being the best for this purpose. Dry cell tubes do not provide much energy, particularly in the audio frequency stages, and while such tubes as the UV-199 or the C-299 may give fairly good results in a circuit designed for them, yet the 0.25 ampere tubes give much the greater amplification. At present it is considered the best practice to dispense with the soft gas filled detector tubes (UV-200 or C-300) owing to the great amount of "A" battery current taken, and also for the reason that the soft detectors must be worked with a positive bias on their grids, thus causing an excessive demand on the "B" battery.

Many heterodyne circuits have fallen down on the job simply for the reason that their owners did not appreciate the fact that all tubes are not uniform, and that certain tubes out of a lot are better oscillators than others. In fact, the lack of uniformity in the characteristics of the tubes has been one of the greatest troubles experienced in the heterodyne circuit. It is only by changing the relative positions of the tubes in the sockets that we can determine which is the best oscillator of the lot and which tubes are the best in the radio stages. There will be found one combination at which the best results are obtained, and in many cases, one particular tube in the oscillator circuit will give twice the volume and range as certain of the other tubes. Before condemning a hookup, try a complete transposition of the tubes.

BEFORE we attain our ideal in the heterodyne we must be able to obtain matched tubes from the dealer or else lay in a sufficient surplus from which to make a choice. Special oscillator tubes should be marketed which have proved by test that they are specially fitted for this service, thus relieving the buyer of the necessity of sorting out tubes and of purchasing more tubes than are actually required. Of course, the five-watt tubes (UV-202) and the

Western Electric amplifiers are wonderful oscillators and audio amplifiers, but they take so much "A" battery and "B" battery current that their use is practically prohibitive in the ordinary set, and we may as well put this idea out of mind at the beginning.

When all eight tubes are of the hard amplifier type (UV-201A) we can use a high plate voltage on all of the tubes. In everyday practice it is the custom to use 45 volts on the plates of the detectors and 90 volts with the amplifiers, radio frequency, and audio frequency tubes alike. This gives excellent results so far as reception is concerned, but leads to an excessive demand for "B" battery current. A better arrangement is to use 45 volts on the plates of the detector and radio frequency amplifiers with 9 volts on the oscillator and audio frequency tubes. The radio frequency amplification is nearly as great at 45 volts as at 90 volts and much less plate current is used. When we have eight tubes in a circuit, the "B" battery problem becomes a very important factor in the operating expense and we must therefore observe every precaution which will reduce the demand on these batteries.

An independent rheostat for each tube is not desirable, although we frequently see this arrangement specified on hookup

(Continued on page 72)



A rear view of a novel neutrodyne receiver constructed by a well known Eastern amateur radio builder, which shows some unusual feats of engineering skill. Note the method of off-setting magnetic coupling between the neutroformers, and the simplified arrangement of the receiver as a whole. The panel is shielded carefully from stray capacity effects, which may be introduced while operating.

The March of Radio in Other Lands

How *John Bull* is

PAYING THE RADIO PIPER

By *FREDERICK SMITH*

ENGLAND is several strides ahead of other European countries in the development of the broadcasting art. The enthusiastic radio fan in London will tell you that the British Isles will soon become leaders of the world in home radio activities. In fact, some Englishmen told me that they believed English broadcasting methods and organization were even now superior to those of the United States.

Yet, there are only sixteen broadcasting stations throughout the British Isles. Some are scarcely started and others are still to establish continuous operation. When we remember that New York City alone has sixteen active and powerful stations, it makes one stop to question the English radio man who talks of the advance made by the magicians of the microphone in the land of John Bull.

When you begin to ask questions, you get interesting information. First, broadcasting in the British Isles is controlled by the British Broadcasting Company. No broadcasting is permitted by independents. This arrangement has been termed a monopoly, but the B. B. C. denies the charge, basing its denial on the argument that any radio manufacturer may become a member of the broadcasting company by taking up a share of its stock at one pound a share. After becoming a company stockholder, the radio manufacturer has the privilege of assisting in the operation and development of the broadcasting system in the British Isles.

THE number of stations operated by the B. B. C. is rigidly restricted by the Postmaster-General. With their love of abbreviations, the English call him the "P. G."

B. B. C. and P. G. work hand in hand. B. B. C. pays P. G. a fee of fifty pounds per annum for each station. The government then undertakes to prevent, so

far as is possible, the sale of foreign-made radio goods in the Isles. That, presumably, helps the manufacturing members of the B. B. C. by giving them almost absolute protection against competition of imported merchandise. Whether such a restriction on the full and free use of radio equipment is a wise program in the long run is a question that time will answer.

A license to the British Broadcasting Company was issued on the 18th of January, 1923. It will be observed that radio in the United States had been in full stride for one year when the license was granted in England.

American radio followers, whether interested in radio as a trade or an art, will find the kernel of the English broadcasting situation in the following provisions of the scheme adopted:

"(a) A Company (called the British Broadcasting Company) to be formed among British manufacturers of wireless apparatus. Any such manufacturer to be entitled to join the Company on subscribing for one or more one pound shares and on paying a deposit of 50 pounds and entering into an agreement in the form approved by the Postmaster-General.

"(b) The Company to establish eight broadcasting stations and to provide a regular service to the reasonable satisfaction of the Postmaster-General. The Company to pay a royalty of 50 pounds per annum in respect of each station.

"(c) The Postoffice to issue broadcast receiving licenses at a fee of 10 shillings (about \$2.25) a year containing a condition that the sets used and certain parts (viz., valves, valve amplifiers, head telephones and loud speakers), must bear a standard mark—'B. B. C.'—Type approved by the Postmaster-General."

"(d) The Post Office to pay the Company a sum equal to one-half the license fees received in respect of broadcast and experimental receiving licenses.

"(e) The sets sold by members of the company, as a condition of bearing the 'B. B. C.' mark, to be British made; to carry a payment to the company in accordance with a tariff approved by the Postmaster-General, and to require the Postmaster-General's approval of the type of set, such approval being confined to securing that the apparatus would not be likely to cause radiation from the receiving aerial. The tariff payments on apparatus, which were required by the Postmaster-General, could, in certain circumstances, be reduced by him after consultation with the Company.

"(f) No advertising or paid matter to be broadcast and only such news as is obtained from news agencies approved by the Postmaster-General.

"(g) The Company not to pay dividends at a higher rate than 7 1-2 per cent per annum.

"(h) An undertaking to be given that requisite capital would be subscribed, that the service would be continued throughout the period of the license, and that any deficit would be met. Six firms undertook these responsibilities and were given the right each to nominate a director, two additional directors being nominated by the remaining firms who might take up shares, and an independent chairman being appointed by the six firms."

Under the foregoing conditions broadcasting and broadcast reception were undertaken. Some changes have been made as to details, but as a whole



C. A. Lewis, shown above in a restful moment, is the "bedtime story man" of England. He is known to thousands of children for his typically British way of telling stories. His popularity, however, does not approach that which is enjoyed by similar entertainers in America.



England is fast realizing the importance of radio in modern education. Special classes have been formed in several public schools, where crystal sets have been introduced for the young pupils. The photograph above shows a group of grade school students being introduced to the intricacies of radio reception at one of the London schools. The radio idea is fast spreading throughout the British Isles, it is said.

the English are working along on the basis outlined.

I PAID two visits to the British Broadcasting Company's main offices in London and the American radio fan will appreciate with what interest I sought to learn how radio was prospering under restrictions which to Americans are little less than amazing.

I found the officials of the B. B. C. cordial, courteous, alert and intensely enthusiastic. When they told me of English radio success and named their sixteen stations I remembered that Americans abroad are often regarded as braggarts; so I refrained from mentioning the fact that in our country we have upwards of 600 broadcasting stations.

But it was not necessary to tell my English friends about our great number of stations. They knew it. They had that very fact in mind when they made the assertion that they thought their broadcasting system was preferable to ours. They preferred their own system for the reason (as they presented it) that the Americans had so many stations there was confusion and trouble. They also referred to the freedom with which Americans were permitted to choose sets of any make or type and they did not appear to approve of this liberty.

Of course, the licensing of receiving sets is necessary in order to make sure that the radio fan is not using an Amer-

ican or other foreign set or equipment. As a matter of fact, the government has seen fit to revoke its rule against use of foreign receivers and apparatus; but this means little, as there is a sort of gentlemen's agreement throughout the British Isles that only British equipment will be used.

Frankly, I was disappointed at not finding some of our excellent radio equipment on sale in cities like London. I believe it would do the cause of English radio a substantial good if the restrictions were broken down and the fans were permitted to make use of whatever material best suited their fancy or their purse.

It seems to me that England is making the mistake that Germany made; that is in trying to make a protected industry of a trade that is universal in all of its main appeals. I am of the opinion that we have in America about all the government assistance we need in promoting the industry here. What is needed in the United States, above all else, is an awakening of Congress to an appreciation of the need for proper financing of the departments which are trying to guide radio to even greater prosperity and popularity than it enjoys today.

OUR broadcasters do not have to join a company in order to get a license to build and operate a station. Our broadcast listeners do not have to pay a license fee in order to operate their receiving sets. This is truly a

land of the free so far as radio is concerned.

There is an international element in radio transmission and reception that makes English radio more attractive and picturesque than our own. Various peoples, speaking various languages, struggle with the English that is broadcast from England and English fans wrestle with the strange tongues that speak to them from the continent.

A letter received by one of the "uncles" of 2LO, the main London station of the British Broadcasting Company, illustrates the point. The letter was written by a little Spanish girl. It was addressed to "Caractacus" whose real name is C. A. Lewis, and who entertains the children with stories by way of radio. The letter follows:

"Dear Uncle Craktykuss—I am staying in Londres con my auntie, and I am eleven yeers of old, but my familia are in Madrid, where I live. I like England, but the sun is not to shine and the cold comes much. I have listened on the wires, and I like you very, very much and the other gentlemen too. Are you pretty? Your voice is. I can nearly spike English well. Have you seen a bull fite. I not have, but wen I am old I will, I send you much kiss. Adois con muchos abrazos, su amiga, Carmencita Lopez y. Fernandez.

A later article in RADIO AGE will tell of broadcasting in Belgium, where there is but one station.

Answering the Demand for A SELECTIVE CIRCUIT

AS THE science of radio progresses, the cry for selectivity in receiving sets becomes louder and louder each day. Bringing in the distant stations is a comparatively easy matter with some of the receiving sets in use today, but try to do it with three or four local stations thundering away and see what the results are.

On a good cold night, with the air clear and the local stations quiet, it is no trick to pick up the distant stations with almost any kind of a good tuning unit, but the crying need of the present is a receiver that will reach out and get them when the locals are all busy and pass through them without interference. Such reception would be ideal and no doubt the time will come in the near future when it will not only be possible, but receivers of this type will be very common.

Looking back to a few short years ago, a fan who was fortunate enough to hear California stations on an exceptionally good night for reception, would hardly dare to mention it to his friends for fear of being laughed at. Today if he does not show these stations on his log, the laugh is on him.

By FRANK D. PEARNE

SO MUCH for the rapid development of this fascinating science to date, but what may we expect in the near future? Distance now being an accomplished fact, the next serious subject is selectivity and the elimination of static interference. Just as distance was annihilated, so will be the interference of undesired stations and static.

There are many sets now on the market which show great selectivity, proving that we are moving in the right direction. Another very important improvement will be a set which is entirely controlled by one dial. Some of the good selective receivers now in use are capable of very sharp tuning, making it possible to get distant stations through considerable interference; but they usually have so many controls that it takes some time to get the proper adjustment. The set shown in the accompanying drawings is of foreign origin, being used quite extensively in Australia. While the desirable points before mentioned have not all been realized, its selective characteristics are such that it rates much higher in this respect than the ordinary

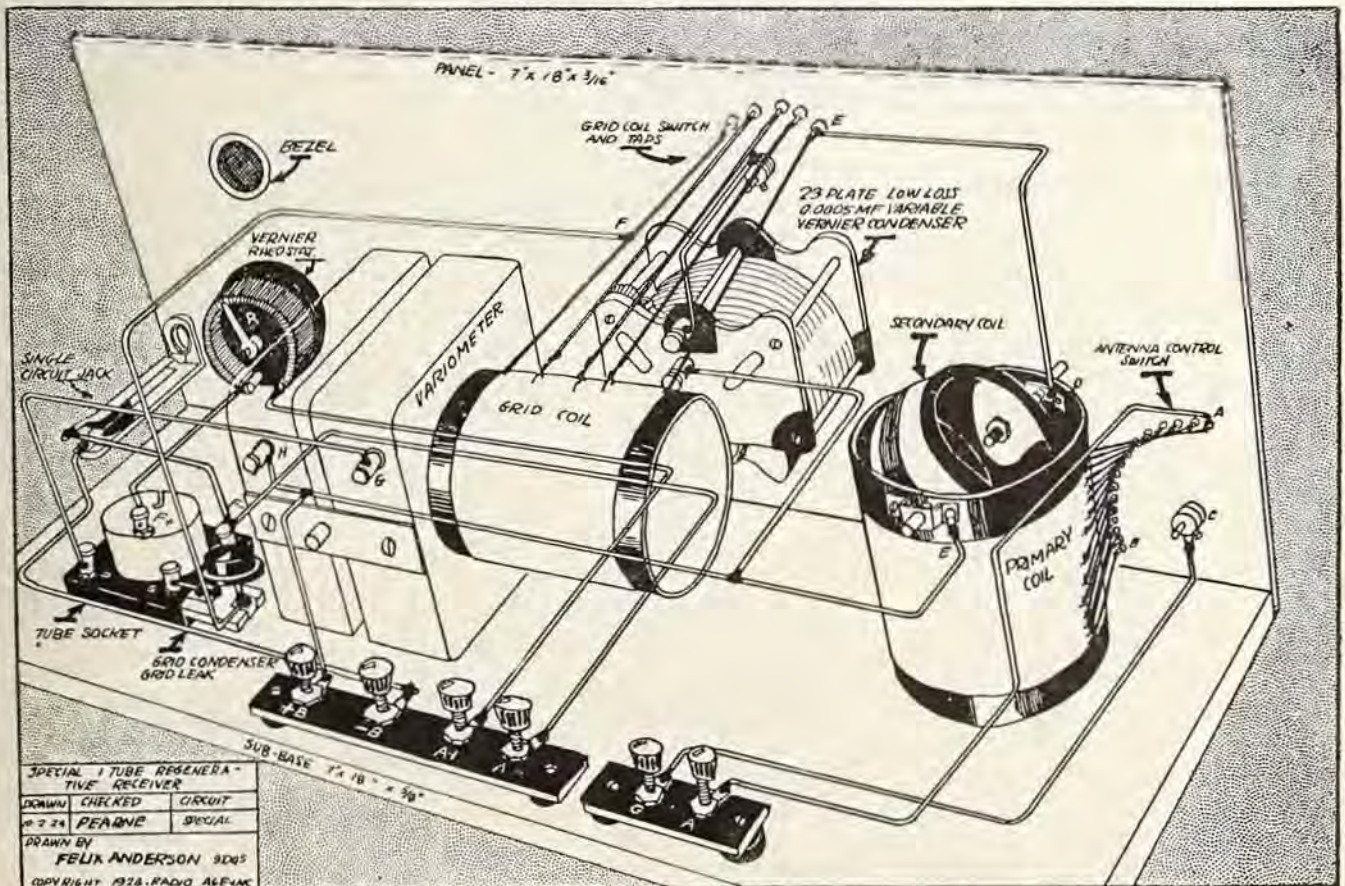
three circuit regenerative set so commonly used in this country. It also has the advantage of greater signal strength.

Construction of Parts

It will be noted that the primary inductance consists of the stator winding of a vario-coupler, with the secondary wound upon its rotor. Very few of the couplers now on the market will be found to have the required number of turns, and for this reason it is suggested that the coupler purchased for this set be one which has a long tube for the primary winding. To make room for the special winding, this tube should be about five inches long, but if one of this length cannot be obtained a shorter one will do. This will mean that the size of the wire specified will have to be reduced so that one hundred turns may be wound on it. This coil to be correct should contain 100 turns of No. 22 double silk insulated copper wire, but if a shorter tube is used it may be wound with the same number of turns of No. 24 wire, although this will increase the resistance somewhat.

In constructing these parts, eliminate all guesswork for efficiency.

(Turn to next page)



An isometric projection of the selective receiver described by Mr. Pearne in the accompanying article. This sketch is schematically diagram'd in Figure 2, and may be used as a wiring plan if Figure 3 puzzles. The variometer is set back slightly so the grid coil will clear the condenser.

OF COURSE, the original winding of the coupler is taken off and at the beginning of the new winding, the starting end of the wire is anchored in the same manner as that which was removed. Taps are brought out at the 5th, 9th, 12th, 15th, 19th, 24th, 28th, 32nd, 47th, 53rd, 58th, 68th, 78th, 88th, and at the final end of the winding which is the 100th turn. These taps are made by twisting a loop in the wire at the proper turn, leaving them about 6 inches long.

These turns should be twisted up tightly against the tube, so that the winding may be drawn up tight enough to hold its position. The final end of the wire is anchored to the tube in the same manner as that of the starting end. One thing to be carefully watched during the winding is to see that in twisting the loops used for taps that the insulation is not impaired so that a short circuit will occur between the base of the tap and the adjacent turn. This is the reason for using double insulated wire.

The great number of taps used, while perhaps a little inconvenient in the construction, will give a very close variation in the antenna adjustment on the short waves, and will also give a good variation on the longer ones. If it is found that a closer adjustment is required for the short waves, it can easily be supplied by connecting a variable condenser between the switch lever and the ground. For giving a better adjustment for the long waves, it can be connected across the two outside terminals of the coil. This may seem like "splitting hairs" to some of the fans, but we must bear in mind the fact that we are building a good set which is to accomplish something more than the ordinary and therefore too much attention cannot be paid to details.

A switch may be arranged to make it possible to switch the connections of the condenser into the ground circuit or across the outside terminals as desired. The rotor ball of the coupler will also have to be rewound, as it will only be a miracle if one having the correct number of turns is found. There should be about 3-4 of an inch winding space on each side of the ball to accommodate the winding. The correct winding should be 25 turns of No. 22 double silk insulated wire on each side. If the winding space is too small for this number of turns, the size of the wire and not the number of turns should be reduced. This can probably be done with No. 24, or No. 26 wire.

ALWAYS remember, however, that the resistance should always be kept as low as possible and the smaller the wire, the higher will be the resistance. In winding the rotor, the two coils must form one continuous winding, and it will

variometer. The set will function no matter which direction the winding takes, but it will work better if the coil and variometer windings are opposed. This should be carefully studied to decide which side of the variometer it is

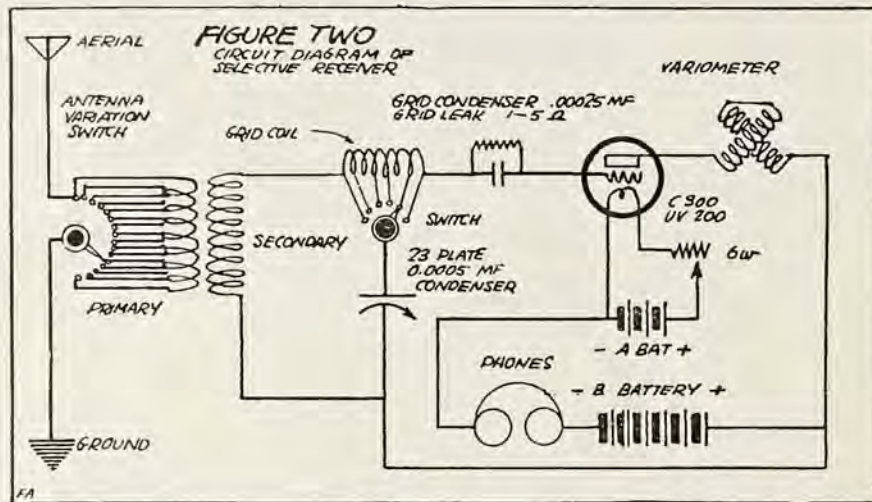


Figure 2. A schematic sketch diagram of the circuit, illustrating the principle of the circuit. Notice the peculiar position of the phones and B battery in the circuit. While a UV 200 or C 300 tube is indicated, any of the standard dry cell tubes may be used with equal results.

be found that the winding will have to be done from the outside edge of the ball, up the sloping sides toward the center. This will mean that in order that the two coils shall furnish a continuous winding in one direction when completed, the winding, because it must be done from the outside toward the center, will be in the opposite direction. The two coils are to be connected together in the center.

If these coils oppose each other, the set will not work, and it is suggested that one investigate the winding of the rotor before the wire is stripped from it.

In selecting the variometer, the ordinary wooden type will best serve the purpose because the extra inductance is to be mounted on one side of it in such a manner that the rotor ball will partially enter it and the coil can be much easier fastened to the wooden type than to any of the standard bakelite variometers.

Select a variometer which is wound with No. 22 wire. Others will work, but we want to keep all windings as close to the original specifications as possible. This special inductance is a coil wound upon a cardboard or bakelite tube 5 inches long and 3 1-2 inches in diameter. A space of 1-2 inch should be allowed on the end of the tube before the winding begins to make allowance for mounting it on the side of the variometer. This coil is also wound with No. 22 double silk insulated wire and contains 70 turns. Taps are brought out every 10th turn, which will give the coil two ends and six taps. Anchor these ends by means of two small holes punched or drilled through the tube, about 1-4 of an inch apart and in line with the winding.

Special attention must be paid to the direction of the winding, as it must be in the opposite direction to that of the

to be mounted on and then calculate the direction of winding accordingly. The actual mounting of the tube to the side of the variometer may be accomplished in several ways, the best being to cut out a ring from a piece of wood one-fourth of an inch thick, the outside diameter being just large enough to fit in the tube and the inside diameter large enough to allow the rotor to pass through it. This ring is glued (not tacked) to the side of the variometer and the tube glued to it.

The use of tacks is bad, because they may pass through the side of the variometer and short-circuit some of the turns. The ring may be easily cut out with a jig saw, or if one does not wish to go to this trouble, the tube may be fastened in place by means of sealing wax; but this is not recommended if one expects to move the set around from place to place. This method of coupling the grid and plate circuits has not been adopted in this country, probably for the reason that it has not been known. But it certainly adds much to the value of the set. The connections of the phone and plate battery circuits are peculiar and one might think at first that something is wrong with the drawing, but they must be followed out to the letter. The phones are to be connected between the negative filament and the negative plate battery terminals. It is suggested that the 23 plate condenser be of the low loss type, as we are working for efficiency and every little prevention against loss will help in the final results.

Following the Circuit

Without the refinements mentioned before, such as the switching arrangement for the extra condenser, the circuit may be traced as follows: from the aerial binding post to the top turn of the variometer stator and through the switch and contacts to the ground. One end of the rotor is connected to one terminal of the inductance which is attached to the variometer and the other end of this inductance is connected through the grid condenser to the grid binding post on the socket. The six taps from this coil are connected to six switch contacts.

The switch lever, which makes contact with these taps, is connected to

(Turn to page 68)

Getting Distortionless Reception

IT IS indeed very interesting to observe how, as the months pass by, the attention of the entire radio public drifts from one thing to another in the matter of radio reception. Not so long ago, I remember a very large proportion of the radio population were satisfied with their little crystal receivers.

Suddenly the bulb came into prominence. The vacuum tube was in existence all this time, but the radio public had not yet reached the tube stage. When this time came, they were satisfied with the single tube set which gave them several times the signal possibilities of the crystal set. Then followed various stages of evolution, bringing the one and two stage audio frequency amplifier, the stage in which the wave trap was employed for securing selectivity, that in which radio frequency stages were used for securing selectivity, and so on. From the point of view of selective reception, we are at present in the super-heterodyne stage. The promising thing about this shifting of attention is that it is progressive; the attention of the radio public shifts always to the better things.

The quality of reception does not depend entirely on the receiver, of course. If the broadcast transmitting station does not send out perfect material the best receiving set will not make the quality perfect. But as they have developed today, broadcast transmitting stations are considerably better than most receivers. The really good broadcast stations transmit very excellent material. It therefore remains with the receiver to reproduce this good quality transmission into good quality reception.

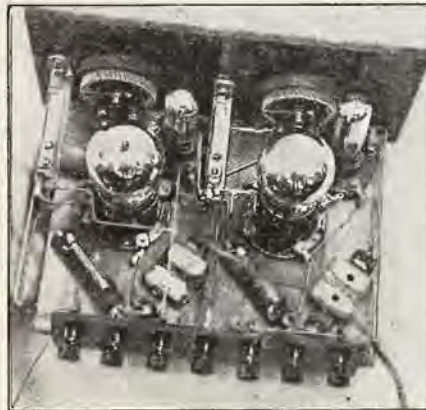
And to date the weak point in the radio receiver has been the audio frequency amplifier. While transformer coupled amplifiers give quite good results, they are not perfect. They have the very big advantage that they give considerably more amplification than any other type of amplifier. But for those fastidious people who really desire *distortionless* reception, another type of amplifier must be employed, for iron core transformers inherently have a distorting tendency, even though it may not be very great.

A PERFECT AMPLIFIER FOR AUDIO FREQUENCY WORK

An Unusual Article

By L. R. Felder

AS a result, the resistance coupled amplifier is beginning to come into favor. The resistance coupled amplifier is no new invention, though there may be some who would exploit it as such. Those who have been in the radio game for some years back know that resistance coupled amplification was in use during the war as radio frequency amplifiers at long wave lengths. It is now coming into its own as an audio frequency amplifier and the principles underlying its operation are exactly the same as those



(Hadel & Herbert)

Above is a new type of resistance coupled amplifier that permits operation on low "B" battery voltage. It has just been perfected by J. W. Marshall of Philadelphia. Note the diode tubes which are used as resistances.

underlying the operation of the radio frequency amplifier.

The resistance coupled amplifier is the *perfect amplifier*; that is, when the amplifier is properly designed and built. It will be instructive to review briefly the principles of the resistance coupled amplifier to see why it is the perfect amplifier, after which the design constants of a suitable type of resistance amplifier will be given.

An amplifier always includes a vacuum tube, for it is the tube itself that does the amplifying. We must have some unit across which our amplified

voltage appears and which transmits this amplified voltage to the succeeding tube or to the phones or loud-speaker. This unit is called the coupling unit. Thus in Figure 1 we have the very familiar circuit of the one stage audio frequency transformer amplifier. The vacuum tube amplifies the voltage which is impressed on its grid. This amplified voltage appears across the transformer primary and secondary and is transmitted to the succeeding tube or loud speaker by the transformer secondary.

In the same way a resistance coupled amplifier employs a coupling unit, only in this case the coupling unit is a resistance instead of a transformer. In Figure 2 we show a vacuum tube with a simple resistance R in its plate circuit. Suppose an audio frequency voltage is applied to the grid of the tube. The tube will amplify this voltage because of its amplifying properties, and this amplified voltage will be developed within the tube itself. But we are not interested in the voltage inside of the tube; we are interested in securing this voltage outside of the tube where we can use it. If the plate were open circuited, we would have nothing to draw our voltage from. There is a voltage developed in the armature but there is nothing in the generator circuit across which a voltage is secured. If a resistance is placed in the generator and the circuit is closed, a current will flow through it and there will be a voltage drop across it which may be used.

However, we are not merely interested in securing a voltage across this plate coupling resistance; we are primarily interested in securing a maximum amplified voltage across it, so that our signal will be loudest. The magnitude of voltage secured across R of Figure 2 depends upon the value of this resistance compared to the tube resistance. The reason for this will be apparent from this simple analogy of the direct current generator of Figure 3, in which is shown a generator and a resistance in series with it. Suppose this resistance is extremely small; let us say a short circuit on the

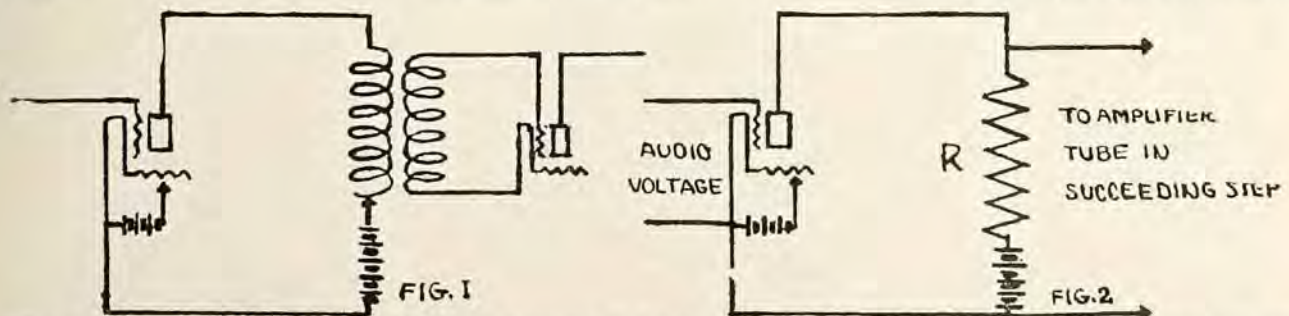


Figure 1. Showing the respective amplifying components of a standard cascade transformer coupled amplifying circuit as compared with the resistance coupled type of Figure 2. The resistance R in Figure 2 substitutes for the primary and secondary windings of the audio transformer shown in the first illustration.

generator. Since the external resistance is a short circuit, there can be no voltage drop across it, because all of the voltage drop is taken up by the resistance of the generator. Thus there appears no voltage outside of the generator. This conclusion is well known by all. Now suppose that the external resistance of the generator circuit is just smaller than the generator resistance itself. Then the entire voltage developed by the generator is divided between the generator resistance and the external resistance, and since the external resistance is less than the generator resistance, it requires a smaller voltage across it to drive the given current through the circuit. Thus we will have voltage developed across the external resistance, but it will be small. Now suppose finally that the external resistance is very much greater than the generator resistance. The generated voltage has to divide itself between the generator resistance and external resistance. But since the external resistance is so very much greater than the generator resistance most of the voltage will appear across the external resistance and only a small part will be across the generator resistance. Thus most of the generated voltage appears now outside of the generator where it can be used.

The Resistance Amplifier

EXACTLY the same principle applies to the resistance coupled amplifier. The grid voltage is amplified inside of the tube and the amplified voltage inside of the tube sends a current through the tube and plate resistance R , Fig. 2. If R is small compared to the tube resistance, most of the amplified voltage will be consumed inside of the tube itself and very little will appear outside where we can use it for working a loud speaker. Like the generator, although there is a voltage generated or developed inside of the tube, we are not able to avail ourselves of it because our circuit is not right. If R is made very much higher than the tube resistance, however, only a very small part of the voltage developed inside of the tube will be consumed by the tube itself, for most of it is required to drive current through the most higher external resistance R , and thus the amplified voltage is available across the resistance R . Thus the first important principle in the design of a resistance coupled amplifier is that the external coupling resistance must be very great compared to the internal resistance of the tube. In practice a value for R is chosen which is about 5 times that of the tube resistance.

Now, what is there about the resistance amplifier which makes it such a perfect amplifier? Suppose the resistance R is 100,000 ohms. Its resistance will be 100,000 ohms whether we measure it at 10 cycles or 10,000 cycles. The tube resistance is the same whether we measure it at 10 cycles or 10,000 cycles, assuming a given plate and grid voltage and filament current. No matter what the frequency is which we are amplifying, whether it is the low notes of a bass or the high ones of a coloratura soprano, the resistances remain the same, and

therefore the amplification remains the same. Thus the resistance amplifies all frequencies alike.

The plate resistances R are the coupling resistances across which the amplified voltages appear and which transfer these voltages to the succeeding tubes. As explained before, these resistances must be high compared to the tube resistance. The voltage which appears across these resistances is applied to the grid of the following amplifier tube through a stopping condenser. This stopping condenser serves the purpose of preventing the positive voltage of the plate battery from getting on the grid of the amplifier tube. Any condenser which will stop the plate battery voltage from getting on the grid will not do. For the am-

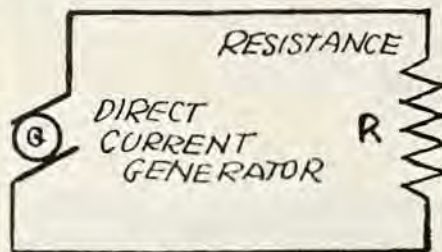


FIG. 3

Figure 3. A simple analogy of the principle of the resistance coupled amplifier. By properly applying the most efficient value of resistance across the generator terminals, the greatest current is effected across R .

plified audio frequency voltage which appears across R is applied to the following grid through the condenser C , which has a reactance depending upon the frequency. If the condenser is too small, it will have a very high reactance and a large part of the audio frequency voltage will be consumed across the condenser and will not be applied to the grid therefore, thus causing a loss in amplification. The condenser should therefore be large enough to prevent any appreciable loss of audio voltage.

The grids of the amplifier tubes are biased with a "C" battery through a grid leak "r". The biasing potential has the effect of producing first distortionless amplification because it enables working the vacuum tube on the straight portion of its characteristic curve, and, second, it helps battery economy, for it limits the plate current. This is accomplished without any loss of amplification.

Values to Consider

IN the actual construction of a two stage resistance coupled amplifier, the following values will be found to be the best. The vacuum tubes now obtainable, such as the C-301 A, UV199 and so on, all have approximately 20,000 ohms resistance. The plate coupling resistance should therefore be about 100,000 ohms. The resistances come in standards values such as 48,000 ohms, 96,000 ohms. The 96,000 ohm unit is entirely satisfactory. The resistance does not change in value and most important of all it is quiet and will not develop noise as some others do. The stopping condenser should be at least

1 microfarad, and should be capable of withstanding the full amount of the "B" battery potential. If higher values of condensers are available, say 2 microfarads, they should be used, as then the reactive drop across the condenser will be still less and practically all of the amplified voltage will be impressed on the grid of the succeeding tube. The usual type of grid leak employed in all receiver construction may be used here, and the value should be much greater than the plate coupling resistance. It should be not less than 1-2 megohm. 1-2 to 1 megohm will be found satisfactory. As to the biasing potential on the grids, this depends upon the plate voltage used. If 110 volts are used on the plates of the larger tubes such as the C-301A 7 to 9 volts will be found necessary. In case smaller voltages are used the grid bias should be reduced proportionately.

A resistance amplifier constructed along the above lines, using the given constants, will function properly without any trouble. Approximately the full amplification of the tube will be secured. This is less than that secured by audio frequency transformer coupled amplifiers, for the reason that in the latter case the transformers themselves amplify considerably due to their step up ratio. For this reason it will be found that it will take about three stages of resistance coupling amplification to equal the volume output of two stages of audio frequency transformer amplification. There will not be a very great difference in cost, for two good audio transformers cost about as much as the additional tube and the coupling resistances together.

In constructing a three stage or even two stage resistance coupled amplifier, the following refinement will be found to contribute to securing good quality. As everyone knows, the loud speaker is a source of weakness in every receiver. It is as much responsible for distortion as any other element in radio broadcasting. One of the things tending to increase this distortion is the presence of direct current through the loud speaker magnet windings. The direct current produces saturation and distortion results.

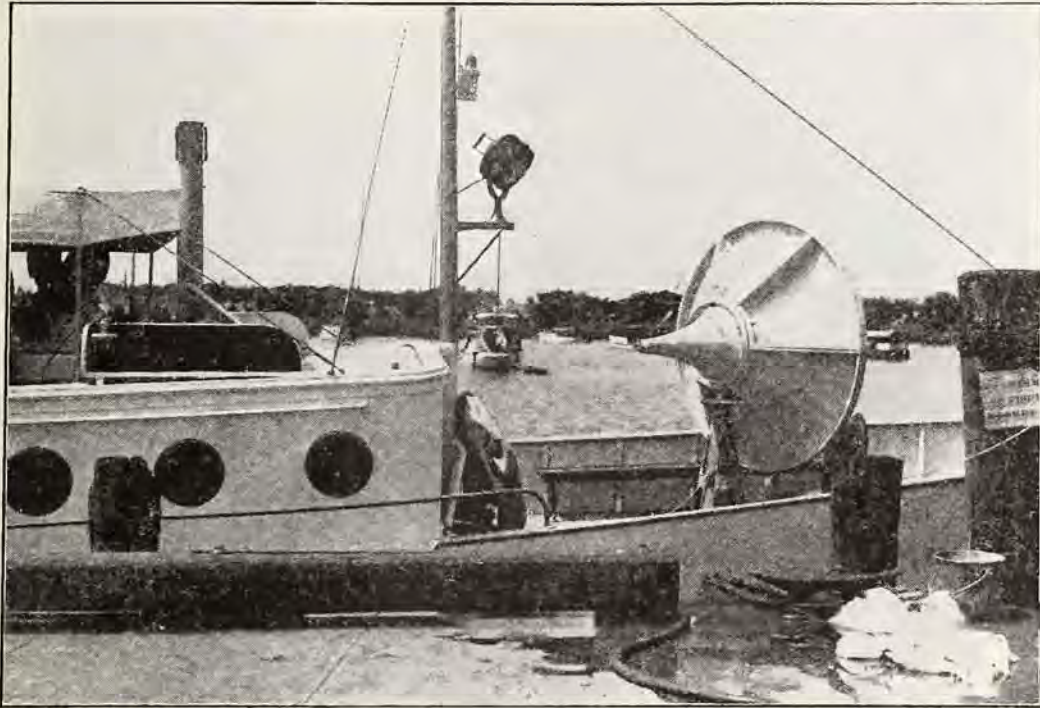
Inasmuch as the plate potential of a resistance coupled amplifier has to be applied to the plates through an extremely high resistance, it will be evident the entire plate potential will not be effective. It will be found necessary to employ high plate batteries from 110 volts to 150 volts in order to secure the desired amplification. This is because the high plate resistance takes most of the "B" battery drop. The life of the plate batteries will be much greater than in any other type of set for the drain on it will be exceedingly small.

The disadvantage of using such high "B" battery voltages may be overcome in another type of distortionless amplifier of which not so much is heard; namely the reactance coupled amplifier. When properly constructed this is practically as distortion free as the resistance amplifier, and details of this will be given in a later paper.

Uniting VOICE and ACTION

By ARMSTRONG PERRY

At the right is a coast guard patrol boat equipped with a loud speaker that carries orders, announcements and entertainment to thousands assembled on the Potomac to witness a water pageant.



Synchronization of Sound and Action Must be Perfect or the Most Serious Event will Become a Farce—Eastern Man Has Device to Annul Divorce of Voice and Action

AFTER the phonograph had made it possible to hear a distant or even a deceased person, but not to see him, and after the motion picture had made it possible to see a distant person but not to hear him, thus divorcing voice and action, inventors turned their attention to the problem of producing a device that would make it possible to see and to hear at the same time any person whose voice and action had been recorded.

There was a near-success when someone devised a system whereby a motion picture projector in the rear of a theater could be connected mechanically with a phonograph in the front of the house. With a new film and a perfect start, these "talking movies" ran along smoothly, barring accidents; but after the inevitable breaks in the film had occurred, after the leader and tail-piece had been damaged by long use and emergency repairs had been made by operators of various degrees of skill, the voice and the action began going their separate ways without regard for co-operation. The most serious tragedy became a comedy, because a word fitly spoken so often came at a time when the mouth

Pictures by the Author

that was supposed to be speaking it was otherwise engaged.

After several attempts to make the movies talk had been abandoned, radio broadcasting appeared, making it possible for any number of audiences to hear a speaker at a distance while he was speaking, but not to see him. C. A. Hoxie then brought out his Pallophotophone, and Dr. DeForest his Phonoflms, which show to an audience a man in motion and let it hear what he said, but not at the time he makes his motions and does the speaking. With these systems, motion and sound must first be recorded and then reproduced, and this is true also of DeForest's latest system, which uses his thermophone and photographic process.

A New Method

C. F. JENKINS promised something better; namely: that he would make it possible to transmit actual scenes by radio, right while they were taking place. This, combined with broadcasting, would make a radio fan a witness of the distant

scene while it was being enacted. Mr. Jenkins already is transmitting still pictures and, in laboratory tests over short distances, motions of the hand and other small objects. Although some physicists say that his ultimate goal is unobtainable, the lay mind remains open to conviction. In the meantime the race to be the first to show the world and make it hear persons who are somewhere else goes merrily on.

Among those who are working on the problem is Marcus C. Hopkins of the Hopkins Laboratories in Washington, D. C. Mr. Hopkins worked with Eastman and Edison in years gone by. He understands the operations of light, sound and radio so far as they have been determined. It was his amplifier, mounted on the roof of Keith's Theater during Shrine Week in the National Capital, that projected speech and music brought in by radio from various parts of the country so that it was heard distinctly and with satisfying quality above the roar of the city's traffic as far away as the corner of K Street and Connecticut Avenue, half-a-mile away. In a quiet rural district this loud speaker has been heard over distances of from two to five

miles. Its secret is that it maintains the true form of the sound wave and sends it forth in such fashion that it is not dissipated as sound waves are when projected from poorly designed horns. The United States Coast Guard used one of these loud speakers in controlling river traffic on the Potomac and giving announcements during Shrine Week. It carried like a fog horn, though with a much more pleasing tone.

Mr. Hopkins has invented a synchronizer which, connected between a phonograph and a motion picture camera or projector, insures the perfect coordination of record and film, either when they are being made or when they are being projected. It has an application to radio also.

This synchronizer includes a rheostat of about 27 points with a total resistance of about 80 ohms. The rheostat is operated by the motion picture machine and controls the motor that runs the machine. Motion picture cameras and projectors usually have detachable handles, used only when the machines are operated by hand. When a projector or camera is operated by an electric motor, a practice common in the case of the projector, the handle may be detached and a universal shaft attached in its place, connecting the motion-picture apparatus with the rheostat of the synchronizer.

How It Works

THE synchronizer rheostat has a commutator. To this is applied a brush, operated by the motor of the phonograph. As the brush advances it cuts out resistance, and if retarded it adds resistance.

The motion-picture machine, the synchronizer and the phonograph being connected, the apparatus is started by placing the phonograph needle on a certain point, previously marked at the beginning of the record, and turning on the motor.

The moment the phonograph motor starts, it turns the brush ahead on the commutator of the rheostat, cuts out resistance and sets in operation the motor of the motion-picture machine. When the motor of the picture machine starts, it turns the commutator of the synchronizer. When the moving picture and the speech that accompanies it are perfectly synchronized, the rheostat commutator and the brush go around together, the brush remaining constantly on one segment of the commutator. When the motion-picture machine tends to move more rapidly than the phonograph, the commutator is advanced so that the brush makes a contact with a segment behind the one with which it has been traveling. This adds resistance and retards the motion-picture motor. When the phonograph tends to exceed the speed of the motion-picture motor, it advances the brush and accelerates the motor. The phonograph can be speeded up or down and the synchronizer will keep the motion-picture machine accurately with it.

The greatest variation in synchronization observed in the many tests that have been made is but twelve degrees

on the commutator, which represents half of a picture on the film. As there are sixteen separate photographs to each foot of film, and each foot of film passes the projecting lens in one second, this variation is by one-thirty-second of a second between voice and action as observed by the audience. Four times that amount of time is required to make an impression on the retina of the eye, so the synchronization is perfect for all practical purposes.

If anything goes wrong, such as an interruption of the electric current, a device on the commutator automatically lifts the brush and stops the picture motor, which cannot be started again until the operator replaces the brush on the commutator.

The rheostat of the synchronizer works in conjunction with that which is a part of the equipment of the motion-picture projector. If resistance is increased or diminished by adjusting the latter, the synchronizer automatically adjusts its resistance to meet the new condition.

Its Limitations Seen

PHONOGRAPH speech and music at its ordinary volume is useless in modern auditoriums where motion pic-



M. L. Hopkins, noted inventor of Washington, D. C., is shown above. He has just perfected a synchronizer which, after being connected between a phonograph and a movie camera, insures coordination of voice and actual vision.

tures are shown, and Mr. Hopkins has not developed his synchronizer with the idea of shooting sound out of the motion-picture booth. His horn has an electrical device at the small end that is operated through electron tubes. With a radio set it is a loud-speaker; with a phonograph it is an amplifier of the energy transferred from the motor through the record to the needle and diaphragm. The horn can be placed on the stage, the tubes and batteries at any convenient place, and the whole sound amplifying system operated in perfect synchronization with the motion-picture machine through the device in the booth. Electrical connections can be made through an ordinary pair of telephone or bell

wires. The picture machine and the phonograph can be started from the stage. The synchronizer requires no more space than the phonograph motor. It can be assembled with the phonograph in the same cabinet. The universal shaft makes it unnecessary to line up the phonograph with the motion-picture machine. All that is necessary is that they shall be somewhere near each other. The connection can be made in a second.

The day when we shall both see and hear what is going on at a distance, while it is happening, may be yet far off. Experts who admit its possibility have made predictions placing it from ten to twenty years in the future, although no one can tell how soon it may come. The next best thing is to see and hear, simultaneously, some interesting event that has been recorded as it was transpiring. The Hopkins synchronizer makes this possible.

The Hoxie and DeForest systems of photographing sound on motion-picture film, at the same time action is being recorded on the same film, appear to have some advantages over the Hopkins synchronizer. They have disadvantages also. Special apparatus for recording and reproducing is required, whereas the Hopkins device utilizes standard apparatus that is already in use throughout the world. It has yet to be demonstrated that the tiny mirrors and the lamps used in recording sound photographically will take in the complex sounds that, for example, help to make a baseball game enjoyable. Sensitive microphone pick-ups, connected by wires to amplifying apparatus located at any convenient point, and through that to a phonograph record cutter synchronized with a moving-picture camera that was filming the scene, probably would give better results. Phonograph records we know can be broadcast by radio. If motion pictures ever can be transmitted and received by radio, synchronized phonograph records can go through the ether with them.

While a presidential candidate is making a speech before a visible audience, and the same speech is being sent broadcast to an invisible audience, a motion-picture camera and a synchronized phonograph recorder can catch every tone and gesture to be reproduced later.

IN THE recording of history, this synchronizer may play a highly important part. Desirable as it may be for everyone to keep himself in touch with the events of the day, it is even more important that truly great occasions should be preserved in visible and audible form for the generations that are to follow. Written history, inaccurate as it often has been, has guided all who have striven to lead humanity upward. History recorded in such fashion that it can be repeated before the eyes of future leaders, as vividly as when it occurred, with all the movements, sounds and even colors that characterized the event when it took its place in the annals of Mankind, will make an impression that could not be produced by books, still pictures or any other medium of the age that is passing.

TWO YEARS ago there was practically no information available to the public on the super-heterodyne receiving system other than that given in textbooks, and that of a purely theoretical nature. Then suddenly the super rushed in to its well-deserved and ever-increasing popularity and with it rushed many manufacturers, all eager and intent upon producing equipment suitable for super-heterodyne use with the least possible delay, in order that they might take advantage of the phenomenal business in this field.

The result was nothing more than what might be expected—the adaption—and in many cases an extremely crude adaption—of existing equipment which could be made with existing manufacturing facilities into a form believed to be suitable for super use. This was most noticeable in the case of the intermediate frequency transformers and the oscillator

couplers marketed and heralded as being perfection themselves; given into the hands of radio enthusiasts by the Almighty himself.

To deal with the oscillator coupler at this moment would be futile, since its requirements have already been gone over in the public press. Therefore, let us suffice it to say that it should be small and compact, suitable for use with any standard tube to produce with the minimum of in-put power a uniform output from which harmonics have been suppressed as far as possible.

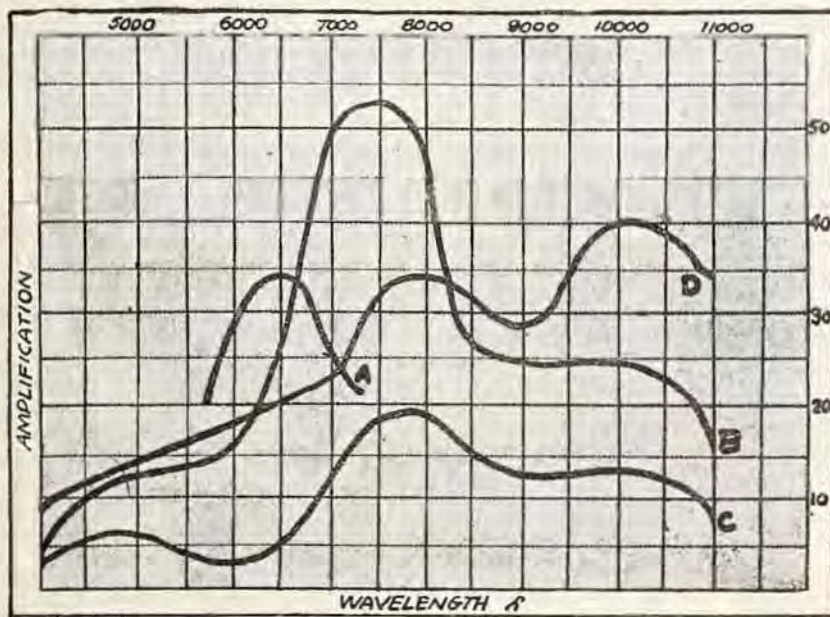
The Heart of the System

IT is not so simple with intermediate frequency transformers, for the intermediate amplifier of the super-heterodyne is the heart of the system, and like all important things, has provoked extensive controversy on the most suitable method of effecting the desired amplification. Yet we still read advertisements of manufacturers who believe themselves to be in the pre-super days, advertising intermediate transformers covering wave length ranges of a few thousand to twenty or twenty-five thousand meters, apparently blissfully unaware that this is not required for a good super amplifier.

And in the case of practically no transformer are any figures given as to the approximate voltage amplification that

The Best Intermediate TRANSFORMERS FOR YOUR SUPER

By McMurdo Silver



The voltage amplification curves on three standard intermediate frequency transformers. Curve B shows a decided peak, between seven and eight thousand meters. The voltage amplification factor is 53 at that wave length.

may be obtained per stage with it, in conjunction with different tubes and with varying numbers of stages. Little mention is made of the best peak of the iron core transformers, as apparently there is a desire not to admit the fact that the transformers have such a thing as peaks. And as for stability, the manufacturers who mention how negative the tube grids used with their transformers may be run without oscillation—well, they may be numbered upon the fingers of one hand.

The writer is not here concerned with air core intermediate transformers, for it is generally accepted by authorities that iron core transformers operating at comparatively long waves are very much more satisfactory under practical operating conditions than air core transformers with their attendant difficulties; difficulty of peaking stages at the same wave length, poor stability, poor selectivity when not peaked, and poor voltage amplification as compared with good iron core transformers.

Good Amplification

What is desired in the intermediate amplifier, and consequently in the intermediate transformers, is good amplification, selectivity sufficient to eliminate unwanted signals, yet not to distort speech, and stability when cascaded. Just what may be expected from three

standard transformers may be seen by referring to the curves in the accompanying figure. Curve C represents a widely advertised 30 KC transformer. It will be noticed that the amplification obtained is quite poor—only about equivalent to what may be expected from standard air core transformers, and that its best operating point is at 7500 meters or 40 KC as against the 30 KC or 10,000 meters advertised for it. This is an unsatisfactory type of transformer, since it has no very sharp hump, and the amplification obtained is not good. Its great advantage is its extreme stability.

CURVE D illustrates another transformer for which no peak is advertised. It is interesting to note that it has two peaks, one at about 38 KC, the other at 30 KC, probably due to the step-up ratio employed. The amplification here is quite good, the disadvantage being the double peak and the

tendency of the higher peak to drop off slowly into the audio frequency range. This would mean that the system would amplify a good deal of noise which would have to be eliminated by the use of an excessively sharp filter which would in turn effect the quality of reproduction on broadcast signals.

The ideal transformers curve is that shown at B, which operates at about 40 KC. The top of this curve is comparatively flat and it is evident that it embraces a wide enough band so that it will transmit undistorted speech; yet it is not too sharp. This transformer, despite the fact that it is the best of the lot from the viewpoint of selectivity, gives better amplification than any of the other types.

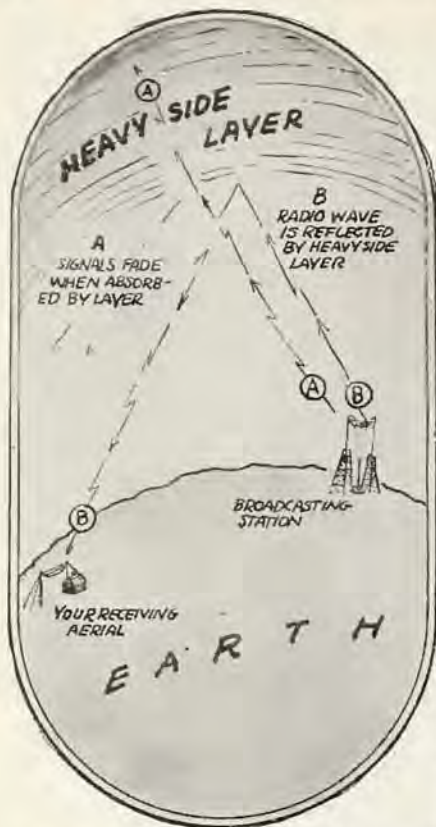
What Tubes Give

These three curves were taken between UV 201-A tubes at 45 volts plate potential. Curve A, the same transformer as B, indicates what may be expected with UV 199 tubes. The amplification has dropped off considerably and the frequency has arisen so that the peak is at 45 KC.

If all transformer manufacturers would publish figures such as these, which are at best of a comparative nature, the fan would have no difficulty in determining just which transformer was best suited to his particular requirements.

Opening the LESSONS FOR

By EDMUND



It is supposed that a "Heavy-side layer" as illustrated in the diagram above is responsible for the fading of signals, as well as their propagation along the surface of the earth. When this layer absorbs signals, we have fading.

THE business of answering questions for radio beginners is indeed a difficult task for any radio man whether he is an expert or not. In order to give a correct and specific answer to a question, it is really necessary to know just how much about radio the questioner knows, in order that the query may be made plain and without an excess of explanation leading up to the actual answer to the problem asked.

Invariably, when a question is asked by an absolute greenhorn in radio, the one answering the person must give him a general idea of the rudiments of radio, with regard to various branches of the art; its development and its present standing. Theories must be expounded in order to make the beginner understand the question he is asking. All of which, we are sure, is a tiring and hopeless task, when one considers the tremendous influx of new radio bugs into the game.

In order to do our part to alleviate this "radio question-asking game," we are publishing a series of questions dealing with the beginner's viewpoint of radio. Those who find themselves innoculated with the "radio fever" should arm themselves with the knowledge of the answers to the questions printed in this department from time to time, in order to keep from incurring the wrath and ill-treatment of not-too-courteous radio men who have just about talked themselves to death answering questions similar to the ones we are answering herewith.

The answers are brief but complete, and are reliable and accurate. The first thirty-five of these questions were published in the October issue, and should be referred to before reading the following.

What is it that keeps you from hearing every station that is transmitting when you listen in on your radio set; how are the stations kept separate?

Every station broadcasting sends out signals on a certain wave length allotted by the Department of Commerce. This wave length can be compared to a number in common telephone work. In telephony when you call for a certain number, the proper connections must be made before you can talk or hear the party you wish to call. Similarly in radio, you must make the proper adjustments in your receiver so that it will respond to certain number of waves or cycles per second. When you tune or adjust your receiver, it will (if it is a good set) respond to one wave length only. In this manner you can select the station you want by knowing the wave of that station, and tuning your receiver to that wave. When the adjustment is properly made, the set is said to be "tuned" to the station or in "resonance."

What instruments are used to determine the wave length of the receiver I am using; how do you make a unit that has this power of selecting or responding to certain waves?

The simplest way to explain the phenomena of tuning or resonance can be made by reference to Figure 2. In this illustration you have what is called a "simple oscillatory circuit." This circuit is made up of nothing more than a coil of a certain number of turns of wire and a condenser. Either the coil or condenser should be variable or both. When the coil (shown as a fixed

number of turns) is shunted across the terminals of a variable condenser, this unit has the property of being able to respond to certain frequencies or wave lengths. By changing the position of the plates in the variable condenser, you change the tune or wave length of the circuit. The more condenser plate area you use, the higher the wave length will be and the lower the frequency. When the two terminals of the condenser are connected to some detecting apparatus (an apparatus that makes it possible to hear radio waves) and the oscillatory circuit is coupled to an antenna with another coil, you can select certain waves or frequencies with this oscillatory circuit, and deliver the one you select to the detecting apparatus for changing into sound waves.

Can a tube filament be damaged in any other way than through "burning out"?

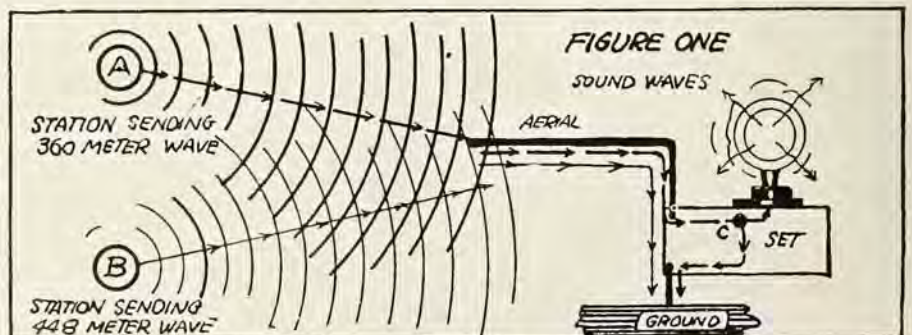
Yes. Filaments are sometimes broken by jar through careless handling. The manufacturer does not accept responsibility for such breakage.

Can I tell anything about the quality of the tube by the color of the glass?

No. In the process of manufacturing, the tubes seem to take on different colors. This is no indication whatever of the quality of the tube. Some are silver, others are a mottled blue and brown and others are a reddish color.

Can some tubes be used only with storage batteries and other tubes only with dry batteries?

Any tube can be used with any source of current. The expression "dry battery tube" refers to tubes like WD-12 and UV-199, which consume such a low rate of current that they may be economically used with dry cells. The same tubes are frequently used with storage batteries, although you must be careful to apply only the voltage specified for that particular type of tube. The



When the set as shown is tuned to Station A, the signals from that station enter the detector C and are changed to sound waves. Waves from Station B pass through the set unchanged, and go off to the ground without being converted into sound, because the set is not in resonance with that frequency.

Door to Radio

THE BEGINNER

H. EITEL

only reason that tubes like UV-200 and 201-A are not used with dry cells is that their current consumption is so high that dry cells used with them would last only a very short time.

Are the so-called "storage battery tubes" superior to the "dry battery tubes"?

Yes, from the point of view of reliability, clarity, and volume.

How long should a tube last?

This is a question that no one can answer. Tubes sometimes give service for years, but in such cases they have been operated with extreme care and intelligence.

Do not burn your tubes any brighter than is necessary. The most sensitive point of most tubes is considerably below the maximum point of brilliancy. To burn the tube brighter than this does not improve results, but it does decrease the life of the tube, because it boils the electrons off the filament. If you have done this by giving the tube an overcharge, burn it at a low heat for ten to twenty minutes, or longer if necessary, and you may very likely be able to bring electrons from inside the filament to its surface, and therefore restore it.

Tuning and Interference.

What makes my set howl?

First, are you sure that the howling complained of is within your own set? Have you learned to distinguish the howling of an oscillating tube in your own set and the howling that comes from the neighboring radio set?

The only howling noise that can come from your own set is due to the oscillation of one or more of your tubes. If you have a regenerative set you may be advancing the regeneration dial too far from the zero point. Be careful about this. Remember that the oscillation of your tubes not only prevents your hearing anything but it sets up an

interference very disagreeable to your neighbors. The point of greatest sensitivity and volume comes before you reach the oscillating point. Learn from experience how far you can go in turning your regeneration dial.

What can I do to overcome howls and whistles that are not caused by the oscillation of my own tubes?

The only thing you can do is first to learn the proper tuning yourself and then teach your neighbor how to tune his set properly. Inter-set interference is one of the biggest problems in the radio world today. It is receiving the combined attention of the world's greatest radio experts. If regenerative sets were prohibited unless a stage of radio frequency or at least a periodic primary plus a secondary were used, such interferences would soon be nil. Until then we must depend on the radio public being educated to tune their sets without disturbing their neighbors. After all when you think of the wonderful things that radio has accomplished you should not let a few little squeals spoil the enjoyment you can get out of it.

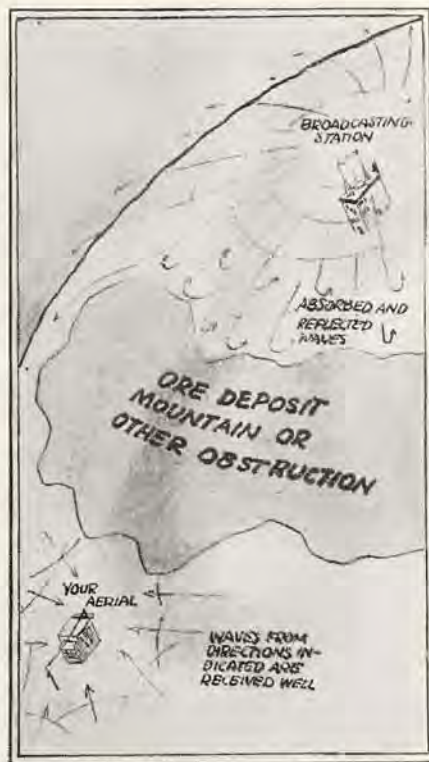
What can I do to eliminate interference from code stations?

There is absolutely no set that will tune out all codes.

There are still some commercial code stations and ships using wave lengths within the broadcasting band. The Government radio authorities are dealing with this subject as rapidly as they can. In a short time it will undoubtedly be done away with.

At certain settings I get a disagreeable humming, buzzing noise, or a noise that sounds like a spark-set operator holding down his key. What can I do to eliminate it?

Unfortunately nothing. Keep away for the time being from a wave length on which this interference is trouble-



Many beginners are at a loss to know why it is sometimes impossible to receive stations from certain directions. The illustration offers one explanation of this difficulty.

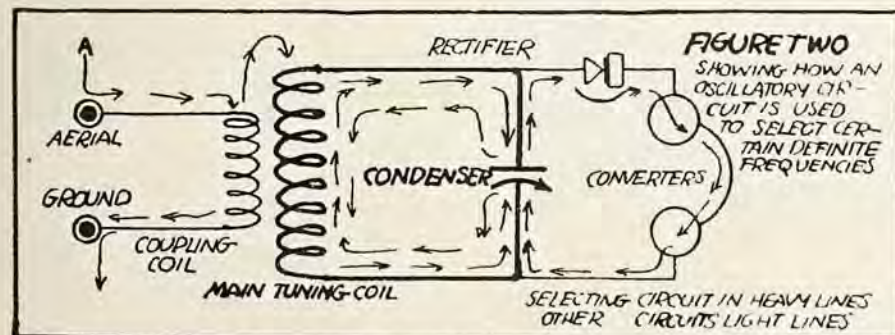
some. You may be close to a high-power transmission line. You may have a leaky transformer in your vicinity. If there are any electric motors in your neighborhood the interference may come from them. A "static" machine in a physician's office blocks away may be responsible. Even some fault in the electric wiring of our own home may set up what is known as the "60 cycle hum" or "A. C. Hum."

At what range should I be able to receive satisfactorily on a loud speaker?

So many things enter into this subject that it is impossible to give any definite answer. Broadcasting stations vary in power from 50 watts to 1000 watts. Many of the smaller stations are not expected to reach out more than a distance of a few miles. Remember, too, that atmospheric conditions, which are not fully understood even by expert engineers, will sometimes prevent your receiving a station that you get very easily at other times. These matters are being given a great deal of attention by the Government Radio authorities.

The U. S. Government once sent a corps of engineers to see if they could determine why operators in Duluth, Minnesota, were unable to receive broadcasting from the Twin Cities, only 150 miles away. The experts of the Westinghouse Electric Manufacturing Company spent a great deal of time trying to determine why operators in Milwaukee could not get powerful KYW station in Chicago, only 80 miles away. There was a time when a commercial station in Cincinnati could not reach

(Turn to page 77)



The secondary or oscillatory circuit is the part of the set which accomplishes the action of selecting the desired stations. The impulse or wave is transferred to the main tuning coil by induction and surges back and forth as indicated in the circuit shown in black. The current of a pulsating direct nature is converted by the phones to mechanical energy.

C Adventures with
the Sinister
Death Ray

The Invisible MENACE

*How a
Streak of
Ethereal
Conceit and
A Jealous
Plot were
Exposed by
a Radio
Sleuth*

By
FRANK HONEYWELL

CHAPTER I.

CHRISTOPHER CATWHISKER!
What's that?"

Sidney Cash was alone in the house, tuning, tuning, tuning. He had listened to several numbers which to him were tiresome radio programs and was now trying to find something in the air to afford him relief from his loneliness. His father and his mother had gone to the opera and he had been left alone to receive a long distance telephone call relative to an out-of-town real estate deal in which the family was interested.

The call had come and Sid had taken the message. But it was too late for him to think of going out for any evening entertainment; so he sought to enliven the monotony of the pulseless night by magic twists of the dials and knobs of his radio.

What had startled him was a single sentence announcing a news bulletin from one of the local metropolitan news-

paper broadcasting stations; and in that sentence was the name of his prospective grandfather-in-law, sometimes spoken of, perhaps inaccurately, as a multimillionaire.

"Sensational attempt to blackmail Arthur P. Wellman, wealthy resident of Glen Forest," the announcer "head-lined."

SID had stumbled onto this sensation and held to it carefully. The broadcaster continued:

"About a week ago a millionaire resident of Glen Forest, a suburb of this city, received a letter demanding from him \$100,000 and threatening him with death if he failed to comply with the

demand. This millionaire is Arthur P. Wellman, former member of the legislature and until his retirement about a year ago a leading figure in the rubber industry. The letter read in part as follows:

"One hundred thousand dollars is a large demand, and we do not expect you to pay it without some education on the subject. Our first lesson will be given at 7 o'clock on Tuesday night of next week. A violent explosion will then take place in your garden, and you will not be able to determine its source. We merely wish to prove to you that we can cause a deadly explosion at any point—in the air, in your house, in your garage. After you have witnessed a few



demonstrations of our power, you will realize the truth of our assertion that we can cause an explosion in your body and blow you to atoms.

"You will have three weeks in which to get \$100,000 in \$100 bills together. Another letter will follow, telling you how to deliver the money to us.

The First Warning

"On Wednesday night, at 22 minutes and 31 seconds after 9, a second explosion will occur 15 feet in the air and 100 feet from your house. If you will take the trouble to station yourself at the south end of your front porch, you will witness the explosion at precisely the time and place here indicated."

"That is the end of the letter," continued the broadcaster. "It is signed with the initials 'R. D.'"

"Tonight was the Tuesday night set for the first explosion. It took place as per schedule and was also seen by Wellman's grandson, Harry Raymond, 16 years old. It hollowed out a crater-like hole twelve feet in diameter in the garden.

"Read the TIMES tomorrow morning. This newspaper will carry complete story and pictures of this remarkable affair."

Sid released a long pent-up breath.

"That is Ruth's grandfather, and the boy who saw the explosion is her brother," flashed through his mind.

Five minutes later he succeeded in getting Ruth on the telephone. Yes, she knew all about it. She lived only a block from her grandfather and had been over there and seen the blackmail letter and the hole in the ground.

"What do you say to my laying off work tomorrow and seeing what I can do toward solving the mystery?" the young man asked. "I had some experience in investigation work in France, you know."

"That would be fine," she replied. "I'm sure grandfather would like it."

A little retrospection is here needful. Sidney Cash had not forgotten his radio amateur days, although they were now memories of several years past. He had met "in the ether" the girl he was about to marry. She lived about a mile from his home. His friend, Hugh Dodge, had arranged the introduction by radio, and it was handled by radio in every respect. The two boys were then college chums.

Several months later their education was interrupted by the World War, and after the armistice Sid finished his college course, meanwhile keeping up his courtship with the unwavering hopefulness of youth. Hugh was buried in France, the victim of an "accident" in the air service. Sid felt certain that his friend's death was due to a treacherous shot in the air by a comrade, Lawrence Vickers, who was known to be a jealous rival of Hugh, but the suspicion could not be proved. Vickers lived in the city several miles from the Dodge home.

Sid was now struggling for a start in life, planning to be married as soon as that start was satisfactory to him and to Ruth. He was somewhat embarrassed and perhaps a little handicapped by the fact that Ruth's grandfather had in-

dicated that he might disinherit her or will her a comparatively insignificant legacy if she insisted on marrying a man with only a moderate business outlook. However, the aged millionaire had indicated no personal dislike for young Cash, except for the fact that the latter held only a clerical position in an insurance office.

CHAPTER II

The Bird-House Clew

NEXT morning Sid obtained leave of absence from his employer by telephone and then went with Ruth to her grandfather's home. Mr. Wellman, who was in his seventies and had lost a good deal of the vigor of youth, exhibited unwonted animation at the proposal of his granddaughter's fiancé to help him in his nerve-straining quandary, and received the young man more graciously than he had ever received him before.

Sid examined the letter and the hole in the ground. Then he returned to the front porch, speculatively taking the position at the South end which was suggested in the blackmail missive.

"Mother of Vinegar!" he exclaimed suddenly, for the idea that came to him was funny enough to revive some of the facetiousness of younger years.

"What is it, Sidney?" inquired Ruth, who stood near, making a wry face at his sour expression.

"See that bird house there?" returned the young investigator. "How far is it from the house?"

"About a hundred feet," the girl replied.

"Yes, and how high up on that pole is it?"

"Twelve feet."

"No, fifteen. Is there a ladder here? Yes, there's one out by the garage. I'm going to peep into that bird house."

Three minutes later he had set the



"Christopher Catwhisker! What's that?" he ejaculated. What had startled him was a single sentence announcing a news bulletin from one of the local metropolitan stations; and in that sentence was the name of his prospective grandfather-in-law, sometimes spoken of as a multi-millionaire.

ladder up against the sturdy, well-anchored pole "foundation" of the bird house and was ascending it rapidly. Young Harry and his grandfather now appeared on the scene and watched the proceeding, eagerly on the part of the boy, curiously on the part of the man.

The Mysterious Package

Arrived at the top of the ladder, Sid reached one hand into the bird house and, after a little feeling about, brought out a tin can four inches deep and three inches in diameter and labeled "baking powder." Then he descended to the ground.

"Did you know that was up there?" he asked, addressing all present.

All denied such knowledge.

"Well, I haven't opened it yet, but I bet I can tell you what is in it—not baking powder but plain melnite. See if I'm not right."

He took the lid off the can, and, sure enough, his divination was correct. It was half full of a fine white solid familiar to the ammunition manufacturers of the recent war. Mr. Wellman looked as if ready to hand his prospective grandson-in-law a legacy ante-mortem.

"I'm going to solve this mystery," the young man declared. "Harry, do you want to help me?"

"You bet," replied the boy.

"This is a radio mystery pure and simple," continued Sid. "You're a radio fan with an elaborate outfit of your own; that's the reason I pick you. Now, I'm going to put this explosive back where I found it. That bird house will be blown to smithereens at 22 minutes and 31 seconds after 9 o'clock tonight."

He ascended the ladder again and replaced the can in the house on the pole.

"Now, Hal," he said after returning to the ground; "I want to have a long talk with you."

NUMEROUS radio principles and apparatus were discussed at length and another radio fan, living several miles distant in the city, was taken into confidence and his co-operation enlisted.

Sid, knowing that the explosion was caused by some form of a radio frequency oscillation, set himself to the task of designing a receiver that would respond to a low frequency. His knowledge of radio very easily assumed that to make a receiver capable of receiving a frequency of some several million cycles would be impossible; but the happy thought of resorting to listening for odd harmonics of the main wave occurred to him, and a good deal of the time not spent in actual sleuthing was utilized in developing a receiver that would tune to a lowest possible wavelength.

His plans bore fruit, for several days after his initial experiments he chanced to stray upon the third plus harmonic of a 15,000,000-cycle signal, and keeping his receiver trained upon this frequency, he was surprised to find that his headphones were growing terrifically hot, —in fact, too uncomfortable to wear. This he compensated for by placing resistances in series with the headphones, which had several thousands ohms resistance.

(Turn to next page)

That night at the appointed time, the charge in the bird house exploded. Mr. Wellman was thrown from the south end of the porch by the impact. The bird house was indeed "blown to smithereens," and several windows in the Wellman residence were shattered.

Getting 5,000,000 Cycles

But Sid, Hal, and radio fan No. 3 were not present. They at that moment were enjoying thrills of much deeper import. Each was intently, eagerly, delicately tuning, tuning, tuning, with a specially made multi-wave tuner, for a suspected harmonic of a 5,000,000 cycle frequency and adjusting radio compasses for maximum readings.

Soon after the explosion Hal called Sid on the telephone. Caution advised him not to use the radio.

"I got it," he said.

"What did you get?" Sid inquired.

"Ninety degrees and 13 minutes."

"Good. I got mine, too—101 degrees, 27 minutes, and 3 seconds. But my relay burnt out."

"So did mine."

A little later Elmer Creesman called Cash on the telephone and announced:

"I got 156 degrees, 24 minutes and 8 seconds. It burnt out my relay."

Immediately thereafter Sid busied himself at a table with pencil, compass, and simple draftsman's tools, and when he had finished his task he had before him a carefully prepared diagram that caused him to feel warranted in assuming the self-confidence of a "geometric prophet."

"I'll land that fellow as sure as shoot-in," he told himself.

CHAPTER III "Ray Diablo"

THINGS moved less rapidly after these events, but there was no lack of thrills up to the very time of the solution of the mystery. The young radio expert and his two boy assistants became exceedingly mysterious in their plans and actions.

Sid had a very clear and definite course in view, but he refused to divulge it to any but those actually working on his scheme, with one sentimental exception. He did not even take Mr. Wellman into his confidence, and he gave Ruth the lesson of her life in "holding her tongue." Girl-like, she could hardly keep the secret, so "stupendous" did it seem to her. Sid told her all, but impressed on her the danger of letting a hint of it leak out, and she proved herself equal to the occasion.

"If this should get into the newspapers, our scheme would be blown as high as Betelgeuse," he said. "I don't want the papers, nor even the police, to know what we found in that bird house."

He cautioned every person familiar with any detail of the affair not yet given to the public to "keep his mouth

shut." This was inelegant language, but it was forceful and there was no mistake as to its meaning. There were two servants in the house, a man and a woman, and Sid's instruction regarding them was that any suspicions they might have

instructions will result in an explosion in your bedroom, and if that does not kill you, another explosion will take place in your body, blowing you to atoms.

"Yours fatally,

"Ray Diablo."



The "\$100,000 night" arrived. The miniature dirigible was filled with gas. Below it was suspended a cabinet of light, thin wood, in which was boxed the propelling and steering mechanism. In front was a two-bladed aluminum propeller and at the rear end was a cross-plane rudder.

should be dispelled, if possible, by a studied manner and attitude of dissimulation.

"Let it be generally understood that you are scared," the "radio detective" said to the aged millionaire, who obediently adopted the policy. The newspapers carried a story to the effect that he was thinking seriously of paying the price set on his life. Sid took unto himself the task of handling the newspaper reporters, and he did it very successfully.

The Second Warning

Two days after the explosion in the bird house another letter and a parcel post package were received by Mr. Wellman. The letter renewed the threat to cause an explosion in his bedroom if the final orders with reference to the \$100,000 demand were not carried out in detail. In part this letter said:

"In this package you will find a watermelon-shaped balloon, with a strong, heavy cord attached to it underneath. At the mouth of the balloon you will find an opening with an automatically closing escape valve. Fill the balloon with gas generated with hydrochloric acid and scrap zinc. After it is filled, tie a package containing \$100,000 in \$100 bills to the cord and at exactly midnight of August 7 release the balloon in your yard. Do not try to examine the mechanism of the balloon, as you may injure some of the operating parts, and that would be fatal to you.

"Your failure to carry out these in-

SID read this letter and examined the balloon. He then made two mental notes regarding them.

"Dirigible balloon four feet long," was note Number One.

"His egotism has caused him to expose to me clue Number Two," was his second mental note. "My first clue was in the location of that can of powder in the bird house. Egotism caused him to give that away. More egotism in that signature—'Ray Diablo'—diabolical ray—death ray."

Sixteen days elapsed with much taking place in the meanwhile, measured in degrees of importance, but with much time resting heavily on the investigators' hands. Sid had taken an indefinite vacation. By means of the compass readings he had taken with Hal and Elmer Creesman, they located the house from which the death ray was sent on the night of the explosion in the bird house. A little inquiry in the neighborhood resulted in information that there was an elaborate radio outfit on the second floor of that building. Four days before the date when Mr. Wellman was ordered to send \$100,000 up in the air by balloon, another letter came, warning him that un-

less he complied with the money demand at the stipulated midnight hour, an explosion would take place in his bedroom at 1 a.m. next following, and that a portion of that side of the house would be blown out.

Sid then ordered that the two servants be sent away and Mr. Wellman's room was searched. A long, slender can of melnite was found in one of the hollow posts of his bed. This explosive was taken home by the "radio detective" and secreted in a safe place.

At last the "\$100,000 night" arrived. The silken bag of the miniature dirigible was filled with gas. Below this bag was suspended a cabinet of light, thin wood, in which doubtless was boxed the propelling and steering mechanism, as well as storage batteries for power. In front was a two-bladed aluminum propeller, and at the rear end was a cross-plane rudder. An incandescent searchlight on the prow indicated lighting possibilities.

A dummy package was tied to the rope, and all was ready. Sid gave instructions to his two assistants, Hal and Elmer. They were to be at their receiving stations when the balloon went up and were to remain there, keeping record of the wave that moved the balloon and directed its course, as well as the duration of that wave and its compass reading. The purpose of this was to make doubly sure of the source of the ingenious villainy under investigation.

(Turn to page 61)

MY Jamaica-Philadelphia voyages, plus three special trips farther south to Panama and Colombia, covered a period from November, 1909, to May, 1911. This run, like that of the "Seminole," was an outside route, i. e., one on which most of the wireless work was a standing contest against distance, all U. S. shore stations being out of range and workable only at night on "freaks." It was our business to study these freak conditions to determine if possible some regularity about them, on which we could base our informal communication schedules.

A trip or two on a run would show up the consistent performers among the land stations, and ship and shore operators possessed an uncanny faculty of slipping through great wads of "OS" (ships' positions) and messages on these "regular" freaks.

An experienced "op" possesses a "feel" of the situation hard to explain to the novice. To passengers who would stop to condole with me, as they thought marooned in a tiny cabin with an inanimate chunk of hard rubber clamped on each ear, I would try to picture the situation as it really was. To me, placing on the receivers always seemed like clairvoyantly reducing our half of the earth (at least) to a hemispherical relief map, upon any part of which I could at will place my finger. Every dot and dash in the phones was immediately recognized and understood. The tone of a land station's spark, coupled with the style of the operator's fist, served to identify every signal. A stranger on the air was immediately discerned and placed either by his station sign, or, before the International Call Books were issued, by a direct question by one of the regulars.

All this prelude so that the reader will understand that the "op" sits in on another world in which little is hidden and everything highly comprehensible;



The Steamship "Schley," steaming off the coast of Jamaica, carried on communication with stations indicated by the towers in the photo-diagram above. A log of the stations: AX, Atlantic City; HA, Hatteras; UG, Schley; DF, Coney Island; PD, Tampa; WST, Miami; SI, Guantanamo, Cuba; JCA, Jamaica; WA, Waldorf Astoria; BS, Philadelphia.

"Brass-Pounding" Along the Atlantic Coast

Part III: Reminiscences of an Old Operator

By ARTHUR LEECH

that the snappy operations are all clearly deduced when traffic is slipped through a jam of signals to a certain station, with a possible shift to another station where more favorable conditions obtain; assisted perhaps by a few friendly dots and dashes from an interested listener five hundred or a thousand miles in another direction, fully as awake to the situation as the principals themselves. And, of course, our only detectors were crystal or electrolytic. Tubes were known to us only experimentally—even when I left the sea in 1916.

A "Rapid Relay" Man

ONE class of work which energetic operators could do when within easy day range of the land stations—usually the first or last day out—was what I always termed "rapid relay" work. A mass of ships leaving or concentrating on a port like New York create an unimaginable jam, and the

ships just barely in range have little chance to be heard at the land stations whose high aerials are flooded with signals from a hundred sending sets. Being young at the game and full of pep, and on the "UG," ("Schley"), having a 120-cycle spark set easy to hear over the coarse 60-cycle notes of the mob, I was a favorite central station during these conditions. About which, more later.

At home after my first trip, the all-compelling reasons for my intention to resign faded and only the glamorous details were to the fore. I was somewhat chagrined at my childish weakness. Upon leaving Philly for New York to make my second trip, however, I was again threatened with a severe case of chilled pedal extremities, and aboard the "Seminole" with sailing about due I had a bad attack of the

homesick blues and was much in mind of deserting ship and rushing back to Mother.

My deliberations were rudely interrupted by the sudden inrush of a messenger escorting my relief and bearing glad tidings of my transfer to the "Admiral Schley," lately laid up in New York and sailing in half an hour for Philadelphia to run regularly between the latter port and Jamaica. Hearing of the opening at the last minute, dear old H. J. Hughes, Operating Superintendent, had dispatched a messenger with positive instructions to get to the "Seminole" before she sailed.

A nervous ride to New York and a mad run to the Battery, and I found myself aboard my new home just as the lines slid over the dock's edge. In those days the law did not require that an operator be aboard and it was strictly up to that gent to be aboard of his own accord or he was simply left behind. The new job looked good. The "Schley" was a modern, white, yacht-like steamer and the wireless quarters of two rooms

were palatial—comparatively. The set was a duplicate of the "Seminole's," but the name plate on the generator said "120 cycles," which stirred up mild excitement that was considerably heightened by a few dashes on the spark with the aerial disconnected, disclosing a wonderful smoothness to the spark that informed me I had a history maker of a sending set. My conclusions on this were quickly corroborated. I found the "UG" a marked ship, being one of only two or three in existence with a high (!!) frequency spark.

Then began my real participation in the commercial game. The ensuing Winter was a record breaker for bad weather and I was dutifully sick every time we passed Hatteras, both up and down, for several months. This condition interfered somewhat with my wireless ambitions, but as I conquered ole mal de mer, my last reason for a threatened bolt from the business disappeared and I became a confirmed young salt.

I found rapid relay work almost as interesting as the long distance stuff. True, there was not that feeling of triumph embraced in the mastery of space consummated when one had com-

THE principal spot for this lively work was about half way between "HA," Hatteras, and "AX," Atlantic City, on Sunday morning when all of Saturday's sailings from New York were clustered two-score strong within a hundred or so miles—absolutely too close for any duplex work with waves

off first. The resultant jam was a wow! I didn't know if I was here or there. Here was where my 120-cycle spark came in good. "AX," "HA" and I would clear the ones nearest us and I would unload to one of the shore stations every time I got twelve or fifteen, my spark cutting clear over the interference. Lacking proximity

and a club for the more ravenous of these birds, to keep them quiet until their turn came, my most effective weapon was to threaten to close up and clear nobody until they calmed down and waited to be called. Every time my switch went up to receiving, after giving one ship a final OK,—Zam! it would be on again, with about fifteen all calling at once. Through the fearful din I might be able to recognize one call, to which I would shoot "GA," leaving the rest to cuss their luck until the next contest.

My diary notes a couple of amusing incidents in connection with this work—more amusing now, as is always the case, than when I was worked up to a lather over the proceedings. On one occasion, just as I was loaded with twenty-two relays and about to shoot them to "AX," my juice went off and I was left flat. Investigation disclosed that we were to lay to for four hours to delay our arrival on account of an over-ripe condition of the fruit, the Captain figuring the cargo would keep better fifty miles at sea than alongside the dock through a hot July night. All hands flopped for a four-hour rest and with not enough steam to run a peanut roaster there was nothing doing on the dynamo being started. With "AX" and "HA" calling every minute and saying "GA that wad;" "wake up;" "come to life," etc., and with the gang getting panicky over

my disappearance with a bunch of their commission-bringers, I did anything but rest, and when I finally got back on the air with a snappy "AX AX AX UG .. —." there were yelps of joy from all, including myself.

On the other occasion I got caught with a wad on account of the static coming up suddenly so strong that "AX" could not read me. I was threatened



One morning as he started calling Limon, "X," there was a terrific commotion back of the jar rack, sounding like the setting off of a bunch of large firecrackers, combined with the release of a giant clock spring . . . like shots from a gun a pair of good-sized monkeys sprang past him and through the window, screen and all. 20,000 volts had pepped them up considerably

pleted a satisfactory two-way communication over a thousand or two miles, but there was some delight in surveying a foot-high pile of business which had been handled. To make it worth the effort, problem enough existed in extracting the stuff from the terrific jam of signals which in the first place made it necessary for some ship to jump in and help the land stations

flatter'n a billiard table and tuners as selective as an ash sieve made of three-inch chicken wire. Ships were bursting with traffic, all the land lubber passengers sending messages back home telling the folks how fine the weather was and wishing they were along, etc., etc., and with big commissions in sight every "op" threw his manners overboard and vigorously plied the key to get his business

with the disgrace of having to carry the bunch up to Philadelphia and to the Western Union office, but old "RM," Bob Miller of the slow, steady fist, evolved the bright idea of copying me on a ten-foot wire in place of his high, static-eating aerial, and the day was thus saved. Strange we had to wait ten or twelve years before putting the idea into general use by building loops.

After listening carefully for a couple of trips, getting the "feel" of the situation, I got busy on that fascinating night distance work, and from that time on most of my sleeping was done in the day time and my work during the dark hours. The layout resembled that of the "rapid relay" work, except that it was on a huge scale of two or three thousand miles instead of two or three hundred miles. There was more "quality" to the work than "quantity," so to speak. As against the terrific jam of the in-range work, we had the fading—or swinging of signals from a roar to a faint whisper and out, characteristic of freak work between sets out of range.

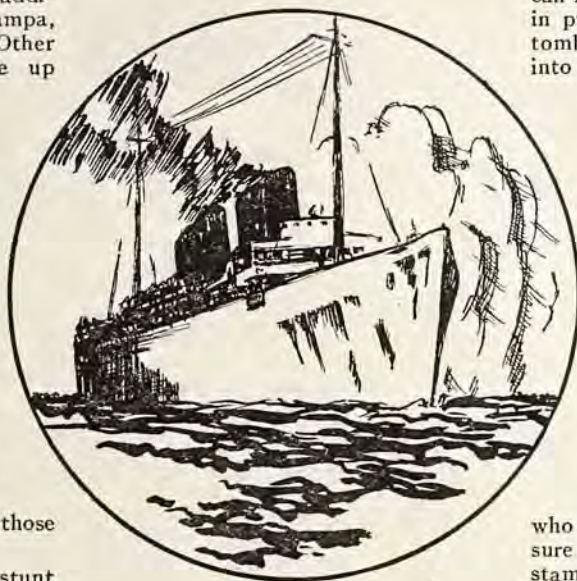
Our land connections were, in addition to "AX" and "HA," "PD," Tampa, Fla., and "DF," Coney Island. Other stations would occasionally come up strong enough to relieve us of some traffic, but the four mentioned habitually kept a long distance watch and could be depended upon. "DF" was the most consistent of all, seeming to be in a sensitive spot never equalled until the advent of "WST" at Miami, Fla., several years later, in an entirely different period of my sea experience. "DF" had the usual crude junk, including the crystal detector, but he was a marvel at responding to calls from anywhere. Opr. "RO," Vosburg, was my buddy at that station and many a bundle of "OS" from the far waters did we pass through in those balmy days.

My first two-way long distance stunt was from dock at Port Antonio, Jamaica, to "HA," about 1100 nautical miles—a "knot" being about one and one-sixth land miles. I had finally made up my mind to get in on this distance—smashing work and as "HA" was coming good I gave him a short call. He came back pronto and I slipped him "OS 4 p. m. UG arrived Port Antonio," to which he gave immediate OK. I shut off my motor with the feeling that at last I "belonged" in the business. And keep in mind, dear reader,—a two-slide tuner and a piece of coal.

In milling around in my diary for notable instances to relate, I note that the stuff was so regular as to almost pass out of the category of freak work. I note a long one, but one worth writing about, under December 30, 1909. I had collected a bunch of twelve relays; one I got direct from a cable ship digging up some trouble along the Brazilian coast, about 1500 miles southeast of us. We were off Cape Maysi, Cuba, about a thousand knots from "HA" and 1300 from "DF." The interference was bad up to midnight and several attempts

to clear to "HA" or "DF" were unsuccessful. I napped until 3 a. m., when I broke up a little chat between "HA" and "DF" and got a "GA" from "DF." "DF" gave me OK fine on No. 1, then lost me on No. 2 and when I came on I heard "HA" filling him in on No. 2. "DF" then OK'd No.2 and said shoot another. "DF" took three more then said I was getting weak and to finish the bunch to "HA." "HA" and I then cleaned up the bunch, but toward the last, "DF" began to get me good again and he copied the last four messages right from me and broke in ahead of "HA" to give me OK direct. I then gave "DF" a list of OS I had collected and we called it a night. "DF's" last signals were rather weak, and no wonder! I suddenly noticed it was getting unusually light in the room and glancing over the porthole I saw the first act of a glorious sunrise. It was 5 a. m. and in that latitude good and daylight.

This was a good instance of a long



Two of our special trips took us to Panama, and there I met up with the string of United Fruit Stations that keep company with their large fleet of ships, as well as handle traffic for the U. S. Theirs was a formidable fleet.

sustained communication, but plenty of short snappy work could be done right in the early evening in between the heavy jam.

A Distance "Stunt"

OUR regular run never took us more than 1500 knots from New York, so there was little chance of doing bona fide work much farther, and working distance for the mere sake of doing it was not in favor on account of the unnecessary jam caused. Occasionally, however, we could not resist a brief call to some ship a couple of thousand out in the Pacific, but if we got a response, these incidents were rarely logged, because of the rebukes they were sure to bring from the office.

Every time I heard one of these

Pacific stations, I would wish I could carry my 120-cycle spark over to one of those Japanese runs, where with superior atmospheric conditions and possible runs up to 6,000 miles, the boys used to do (and probably still do) some marvelous work.

My best direct distance stunt with "DF" was from Santa Marta, Colombia, on one of the special trips we made there. About 11 p. m. I got on the warm tropical air, laying for one of the stations up where the snow was flying, and soon had "DF" coming in fair. My diary records show that old "RO" was not at the key, and I believe that was why it took a number of calls to get "DE" to hear me.

However, about 2 a. m. I slipped him "OS 3 p. m. UG arrived Santa Marta" for friend H. J. H. to look over in the morning.

I recall using a home-made loose coupler of Oscar's on the "UG," in defiance of Company orders, and getting into a peck of trouble on account of its EXTREME SELECTIVITY. You can imagine! However, it nearly resulted in putting "nipped in the bud" on the tombstone of my wireless career. I got into trouble with my friends at "SI"

Guantanamo, Cuba, U. S. Naval Station, through not hearing them answer about twenty-five calls. I waxed abusive and when I got back to Philadelphia that trip I had three official letters on the subject. Be assured, I was ultra-respectful to Naval stations thereafter. Another funny thing about that case—several months later I met "LR," Chief at "SI," on the Fall River boat coming down from Boston when I was transferred to the "Farragut." Instead of the roaring bull I had imagined him to be, I was talking to a mild-mannered gentleman

who reciprocated my surprise and pleasure at meeting so far from our tropical stamping grounds. And after the way of operators, a bit of lunch in the buffet settled all our differences and when he returned to "SI" our good relations were resumed.

On my sixth Jamaica trip one night I had an awful jolt in the memory tank by hearing the following "4:30 p. m. VJ (The "Seminole," you remember) left Monte Christi." Owwoah! It gave me a sickness around the stomach to hear that familiar name, and by the way he was laying on the key he was in the same fix I had been—nil comunicado, you might say. I took pity on him and shot him an OK and passed his OS up the coast, but when I turned in at midnight his receivers had apparently told him nothing. He was still broadcasting. That night I had a nightmare and woke up groaning just as the aerial lead broke and was swirling down for a sure catch in the Mate's nose!

Jamaica I found to be a delightful bit of tropical island. I wondered at the women doing such heavy labor, and of course got into the usual traffic jams suffered by tourists due to the

(Turn to page 58.)

The Radio Organ Has Its Day

☞ Karl Bonawitz, of WIP, Proves that Even an Organist Can be Popular

By Harry Aldyne

☞ Radio Announcers and Entertainers Vie for Popularity Honors

TO Karl Bonawitz, Organist of Station WIP, goes the palm of victory for receiving the greatest number of popularity votes through the period between Aug. 16 and Sept. 15.

Incidentally, the great wave of sentiment in his favor made him not only victor for the month, but carried the popular musician to a point of vantage at the head of the list where is shown the standing of the candidates to date, from the beginning of the contest last July. But the real contest is only one quarter of the way through, and if history repeats itself, each thirty days will change the complexion of things decidedly before the final count is made.

Those who have not been following the RADIO AGE Popularity Contest, and therefore may not know what it is all about may be guided by the following:

Clip the Popularity Contest Coupon from this and the back numbers of RADIO AGE and send in the name of your Radio favorite. You will take particular note that your candidate may be any person, or group of persons, in any way identified with the great radio industry.

Writeup Each Month

Each month there will appear in the columns of RADIO AGE an intimate write-up about the candidate receiving the greatest number of votes during the thirty days of the second month preceding.

In the meantime, a careful record is being kept of the total number of votes received for each of the candidates, and at the end of the twelve month period the winner will be crowned king (or queen) of them all.

So far, with the major contest only one quarter of the way through, The Duncan Sisters, Bill Hay and Karl Bonawitz have led the field for the month during July, August and September in the order named.



And here is Karl Bonawitz, the first organist we know of who ever walked away with a Radio Popularity Contest. Karl performs regularly from WIP, Philadelphia.

THE WINNER FOR SEPTEMBER

Karl Bonawitz...Organist.....WIP—Philadelphia
STANDING TO SEPTEMBER 15th

Name	Classification	Where Heard
Karl Bonawitz	Organist	WIP—Philadelphia
H. W. Arlin	Announcer	KDKA—Pittsburgh
Bill Hay	Announcer	KFKA—Hastings
Lambdin Kay	Announcer	WSB—Atlanta
John S. Daggett	Announcer	KHJ—Los Angeles
Jack Nelson	Formerly Announcer	WGN—Chicago
E. W. Tyson	Announcer	WWJ—Detroit
Harry M. Snodgrass	Entertainer	WOS—Jefferson City
Hired Hand	Announcer	WBAP—Fort Worth
Edward H. Smith	Director and Player	WGY—Schenectady
J. Remington Welsch	Organist	KYW—Chicago
Bert Davis	Entertainer	WGN—Chicago
Duncan Sisters	Entertainers	KYW—Chicago
"Husk" O'Hare's Orchestra	Entertainer	WLS—Chicago
Nichols B. Harris	Entertainer	KFI—Los Angeles
Wendell Hall	Entertainer	WDAF—Kansas City
Jerry Sullivan	Director-Entertainer	WQJ—Chicago

The above are some of the leaders, showing their relative positions and counting all votes from the beginning of the contest.

How will they stand next month and who will receive the greatest number of votes through the coming months? The December number of RADIO AGE will have a story about the candidate receiving the greatest number of votes from September 16th to

October 15th. The November contest closes November 15th. December contest closes December 15th.

Will you be one of those to give your radio idol the fitting and lasting tribute he deserves by sending your vote to the Popularity Contest Editor of RADIO AGE? Do it NOW!

A Word About Bonawitz

Karl Bonawitz, or KB, as he is familiarly known by the hundreds of thousands of radio fans who have heard him over WIP, is one of the pioneer organists in radio broadcasting. The first organ recital was broadcast from the Germantown Theater, Philadelphia, on May 15, 1923, and during the following year and a half more than two thousand compositions have been played and broadcast through WIP, owned and operated by Gimbel Brothers, Philadelphia.

Four thousand letters and cards and seven hundred and thirty telegrams have been received directly by Karl Bonawitz in appreciation of his unusual programs.

Bonawitz was born in Philadelphia in 1894, and studied organ, piano and musical composition in that city, in London and in Berlin. His broadcasts from WIP have entertained countless thousands of radio fans.

"Bonawitz can make the organ talk" has been heard often from his listeners-in. The wonderful personality that Karl broadcasts with his music is not acted. He is that way all day long and all year 'round.

Having "at his finger tips" one of the largest organs in the country, he is able to broadcast many interesting effects from WIP.

Stations Co-operate

Perhaps one of the reasons why Bonawitz continues to draw most of the votes is the unusual co-operation Station WIP is giving RADIO AGE in its popularity contest. Ether fans who listen in regularly to WIP's programs have been told to vote for their favorite, and almost unanimously they have lined behind the organist.

Other stations—particularly KYW of Chicago and KFKX at Hastings, Neb., are doing the same thing, and as a result their announcers and entertainers are leading the field.

This just goes to show what a bit of co-operation on the part of your favorite radio station can do.

So ask your announcer to urge his listeners to vote for his entertainers, you fans! Every vote counts, especially when the contest is as close as it is at present.

POPULARITY CONTEST COUPON

Harry Aldyne,
Contest Editor,
RADIO AGE,
500 N. Dearborn St., Chicago.

I wish to cast my vote for.

Name of favorite.....

Classification.....

Station.....Date Heard.....

Name [optional].....

Address [optional].....



(Photo copyright by Apeda, N. Y.)

THE GOLDEN SONGSTRESS

Such is the title earned by Florence Macbeth, soprano with the Chicago Civic Opera Company, who rose to radio fame last year through her performances in operatic successes. Miss Macbeth will appear over several Eastern and Middle Western Radio stations this Winter, so fans who applauded her last season will be treated again. At present she is in New York.



What the Broadcasters are Doing



The "Sunshine Station"— KFLR

By M. R. Brown

THIS is the Korber Wireless Station, owned and operated by the University of New Mexico, located at Albuquerque, New Mexico, the sunshine center of America." You may possibly have heard these words, even though you live in Maine, California, or any other part of the United States. They are familiar to the radio fans of the southwest, where broadcasting stations are few and far between. Unlike New York or Ohio, New Mexico does not have a station every few miles.

There are only two stations now operating in this, the fifth largest state in the Union.

If you accidentally tuned in on KFLR during the middle of a program and did not hear the voice of the announcer, you may have thought you were listening to Havana, or Mexico City for the wild waves have carried some of those beautiful Spanish melodies so typical of the southwest.

Good Programs, Too!

During the past year many special programs have been broadcast as well as the regular weekly program each Friday evening. A wire to the football field made it possible to announce the progress of the games play by play. The president of the University and the members of the faculty have contributed their services to make the programs not only doubly interesting, but educational as well. All the local artists have willingly aided to make KFLR a source of pleasure, culture, and education.

Radio in the southwest presents many unusual problems. A local station which can scarcely be heard a hundred miles here is heard all over the United States. The cause may be due to the peculiar characteristics of climate and geography. Nearly every day of the year the sun cooks the parched mesa, making daylight radio practically impossible. It is very dry and only certain kinds of trees will grow even with constant irrigation. Ten miles to the east are the tall pine and fir covered slopes of the Sandia Mountains. At the west is the Rio Grande, and across from that river are five extinct volcanoes with giant lava beds. The altitude is about 5,000 feet. Just what part each of these features play in radio has not been definitely determined, but some of them play a mighty important role.



"Bob" Boniel Directs at WEBH

Robert D. Boniel, who won fame as the popular program director of Station KYW, Chicago, in the early days of radio, is now winning new adherents as Station Director at WEBH, located in the Edgewater Beach Hotel, Chicago.

Mr. Boniel left KYW on September 1 to take over the reorganized WEBH, and it is because of his efforts that the Edgewater Beach Station is so popular today. Bob's picture is shown in the insert above.



Miss Maurine Marselles, shown above, won instant favor with Middle Western Radio fans when she introduced "Charley My Boy" and "Jimmy Gee" from several stations. She is a dancer by profession.

Paying Radio Artists Starts Row

New York: A battle of the air, which may decide the life of the radio as an amusement, has been begun here.

The first phase of the fight will concern itself with whether the radio is to pay for the things it broadcasts or whether the present policy of using volunteer talent is to endure.

Broadcasters not affiliated with the National Association of Broadcasters announced that under no circumstances would they come in on the latter's new policy of paying artists for what they contribute to programs.

The National Association, if the recommendations of its investigating committee be adopted next month at its convention, will put its entertainment on a basis similar to the theatrical business, said Paul B. Klugh, executive chairman of the association.

Stars of opera and the stage and musicians of the best concert platforms will be booked to sing or play for the radio, the association announced.

How They Stand

A statement issued by the national association described present conditions as "chaotic," and added:

"Radio broadcasting cannot continue on its present basis. All radio programs now are made up of volunteer talent, and some performers are paid by advertisers. The best known performers refuse to broadcast without being paid. Obviously the time has arrived when programs must be improved in quality."

Some of the big independent broadcasters said they were convinced that there was no need for paid talent and their present gratis policy would continue "for several years."

Representatives of the Radio Corporation of America and the General and Westinghouse Electric Companies said they would not enter the adventure.

"Paying performers will not improve the program one bit," said Bertha Brainard, assistant program director of WJZ. "The programs we are broadcasting now are as good as any that could be arranged with artists who demand pay."

"Those whose efforts we broadcast do not wish pay. They feel that they are being rewarded amply by the advertising they derive from contributing to a program."

This Girl Specializes in Radio Love Songs

*Popular Canadian Soprano, After
Trying All Brands of Music,
Decides She Likes Best to Sing
For Sweethearts of All Ages*

An Intimate Personality Sketch

BY OWEN E. MCGILLICUDDY

THERE never was a time in the history of this old world when people were not fond of love songs." Such is the opinion of winsome Jean McLean of Toronto, whose fine soprano voice has been heard many times from Canadian stations and has won for her a host of friends throughout the United States and the Dominion of Canada.

"All healthy people have some romance in their systems," continued this charming soloist, "and to please the majority, one must discover the attitude of the normal person. I have found that the 'Darby and Joan' sentiment is a sound and wholesome one, and one that no artist can afford to overlook if he or she wishes to gain and hold the approval of the general public.

Jazz Had Its Day

"It has been my experience that the invisible audience considers classical songs too stiff or formal. The syncopated,

ed, or jazz, songs have their day, but it is a brief one, for the listener grows tired of the constant repetition. On the other hand, the semi-classical, or better type of modern sentimental ballads, are always appreciated and never seem to lose their appeal."

Asked what songs she had found to be most popular with her invisible audience, Miss McLean selected "The Silver Lining," "The Nightingale of June," "Love Was Meant to Make Us Glad," "At Dawning," "For You Alone," and "A Rose, A Kiss, and You."

"I have sung these songs a number of times over radio and have found that each seems to have a distinctive following, for I have received requests by letter, postcard, telegraph, and telephone, to repeat them at future recitals. Some of them are new, while others have been sung for years. Generally speaking, people prefer a number with which they are familiar, for the old songs seem to establish a friendly contact, no matter how many miles away the unseen listener may be."

MISS McLEAN takes a keen enjoyment in singing for the radio. "When I first faced Mr. Microphone," she declared, "I felt terribly nervous and apprehensive, for I missed the sight of the audience to which I had been accustomed. I had a peculiar, all-alone feeling, but after the first solo, when friends assured me they had heard my voice perfectly, I felt considerably buoyed up. I consider that singing for radio has many compensating ad-



Perhaps one of the reasons why Tillie Thorpe, soprano, is so popular is because she sings nothing but well-known, old-time love songs. She is now making a tour of radio stations in the middle west.

(Photo Copyright by Draka Studio)

vantages, the greatest of which being the larger audience and the sincere appreciation evidenced by the correspondence from listeners all over the continent.

"I am sure radio has opened up not only a new world of usefulness for the artist, but has also brought good music to the ears of those who ordinarily would not be able to hear concert recitals. In this way it has helped to cheer the loneliness and remove the isolation of those who live in far-away communities. People may get tired of the city, but they also get tired of the country. Radio, I am sure, will tend to make our young folks more satisfied with their own homes and bring contentment to many weary hearts."

A Friendly Singer

This conscientious artist "has a way wid her," as the Irish say, and she manages to make her unseen audience feel that they are listening to a really friendly sort of person who is doing her best to please each listener. She has an international reputation as a vocalist and has won the gold medal at the Welsh Eistodfodd; she is a member of the teaching staff of the Toronto Conservatory of Music; and is organist and choir leader at Central Baptist Church, Toronto.

Miss McLean, who has large demands on her time, is a firm believer in physical fitness. "If a musical artist does not keep fit, he will find it next to impossible to get all the work done he should do," she asserted. "I plan out every hour, and,"—here came a confiding smile—"I sometimes split them into half hours. I simply love basketball, lawn tennis, and motoring, and make time for at least one of them every day."

What Songs Do You Like Best?

Radio Age Wants to Know!

RADIO AGE would like to find out what kind of songs its readers like best over the radio, and why. Maybe we can do something to give RADIO AGE readers the kind of songs and instrumental selections they would like to hear, instead of inconsequential numbers.

Write the Music Editor, care RADIO AGE, and tell him what you, personally, prefer to hear; whether it's love songs, jazz, classical, martial or what. We'll tabulate the results and print a few letters in an early issue.

Also, What One Song Do You Like Best?

We believe there are several songs that will never lose their popularity over radio, such as "It Ain't Gonna Rain No Mo'," "After the Storm," "Marcheta," "Love Sends a Little Gift of Roses," "At Dawning," etc. What do you think? Let us know—NOW.

The Music Editor.

The Home of Artistic Engineering

New York's TWIN Stations

By RUSSELL H. HOPKINS

NEW YORK:—Radio Broadcast Central is one of the most unique broadcasting stations in the world.

With one pair of antenna towers, one transmitting house and one control room, it broadcasts two distinct programs on two different wave lengths from two separate studios.

Briefly, two stations known by the call letters WJZ and WJY, operating on 455 and 405 meter wave lengths respectively, are under the same roof, management and operation.

The twin stations are located in the Aeolian Building, on 42nd street just West of Fifth avenue, which itself is the very center of musical and artistic life in New York City. Because they are under the same management these stations can book unusual events with ease.

The engineering installation is of the most advanced in the world, amplified as it is by the latest discoveries in the radio world. The control room adjoins the two studios on the sixth floor and contains two exactly duplicate installations, one for the WJZ channel and the other for the WJY channel. It is here that the delicate sound waves impinged upon the microphone in the studio are modulated to the proper quality, amplified to sufficient quantity and then relayed to the transmitter room atop the roof.

Imposing Antenna

STRETCHING above the roof is the imposing stretch of aerial—175 feet between the cross-trees of the two antenna towers, themselves 100 feet above the roof and 452 feet above the street. The two antennas are in the form of inverted "L's," each leading from one end of the transmitter house, the 50-foot horizontal section being joined by a 35-foot stretch of support.

Perfect transmission of programs is assured by the use of a device known as the oscel-

graph, which visualizes to the control-room operator the reaction of the radio waves to the voice waves, enabling him by a glance and a twist of one or two dials on the neighboring control panel to maintain perfect transmission.

The studios and reception rooms are the most attractive part of Broadcast Central. Entering the door marked "radio Broadcast Central—Entrance," the visitor or artist (and in this case it's a visitor only) finds himself in a large, sunny and tastefully decorated room, the WJZ reception room. From three big windows he may look down on the green park behind the Public Library or may sit in luxurious easy chairs and skim through the pages of the photograph album of every famous personage who has performed through WJZ; and in the meanwhile he may listen to the receiving set which is tuned to WJZ's own wave—actual proof of the transmission which is given the broadcasting in the next room.

The Twin Studio

PASSING back to the WJZ reception room and turning one's back to the entrance from the hall, we see the door to the WJY reception room, with a perfectly appointed dressing-room on either side of the connecting passage. This room is as lavishly furnished as the other, with an elaborate receiver tuned to WJY's wave length. The panelled walls are furnished in blue and green, the trim and mouldings of salmon pink (can you imagine that?) and the draperies in heavy, vividly-flowered cretonne. This studio, located in the corner of the building, looks out upon the Public Library to the South and on Fifth avenue on the East, with the busiest corner in the world—Fifth Avenue and 42nd Street, almost within speaking distance.

(Copyright, 1924, by Radio Age)



In the center of New York's musical and artistic life, the towers of WJY-WJZ take their place in Manhattan's new radio skyline.

Keeping Up-to-Date with Radio



(From Foto Topica)

Marilyn Miller, musical comedy star, takes a bit of morning dancing practice while her hubby, Jack Pickford, operates the family radio set. Marilyn reports that the radio helps her regularly in keeping nimble between productions.



(Photo from P. and A.)

This giant radio set, one of the many surprises at the New York Radio World's Fair, should be able to get Mars without any difficulty. Gertrude Belville, shown tuning above, reports that the volume on this set could be heard for miles around. Oh, yes!



(Kadol and Herbert)

Although he has not taken much of an active part in the present political campaign, President Coolidge is appearing before the Microphone at every opportunity. His informal speeches are being broadcast frequently from WEAF, WJZ and WCAP. Above he is shown before the WJZ "Mikc."



E. F. McDonald, president of the Zenith Radio Corporation and owner of WJAZ, discontinued his station in the heart of Chicago's residential district and built a portable station on a truck. It's now touring through small towns near Chicago testing broadcasting facilities.

(Underwood and Underwood)



(Foto Topica)

Radio has been installed in New York brokerage houses to enable stockbrokers to keep in touch with market quotations from other cities, as well as to keep up with the presidential campaign. Above is a typical office keeping its stock board from radio reports



"All Aboard for the WLS Unlimited!" George Hay, announcer of this famous station, is shown above fully attired as Conductor of WLS and its equally famous locomotive whistle.

By Milton Lieberman

"NOW little kiddies, fold your tiny hands and sing the Lord's prayer with us—ar-r-r-rrrk—Good-bye—Hello—Polly don't want a cracker."

"Shhh, don't make a sound," Ford Rush said to us, "and the parrot will keep up talking for half an hour. He's got a vocabulary of one hundred words and he uses them as often as a woman."

We were listening very closely while the polly had his talk out.

"Oh, pshaw, now he'll shut up tight." This last came when two young ladies stepped into the studio of radio-phone WLS and started asking the polly if he wanted a cracker. Polly looked at them with a cocked eye, as if to say, "My gosh, are you still asking that silly old question? Why should I want a cracker more than a glass of beer?"

But Polly just kept quiet, apparently insulted that his little monologue should be interrupted. Ford Rush, a member of the famous team of Ford and Glenn (Rowell) who are nationally known as the bed-time story tellers of the station and singers of "How Do you Do?" explained that Mr. Static was just kidding himself and Mr. Rowell when he screamed with that cracked voice of his: "Now little kiddies, fold your tiny hands and

sing the Lord's prayer with us." That's the way they close their bed-time stories each evening between 7:45 and 8 o'clock.

"Ford and Glenn" are distinguished because they are the first radio entertainers who ever succeeded in making bedtime stories popular. In fact, so popular has their fifteen-minute "Kiddies' period" become that one day last month when they quit work to attend the Illinois State Fair, the station was deluged with inquiries about their whereabouts. When they returned there was a universal sigh of relief.

Ford and Glenn's success in the bed-time story line can be attributed to their originality. Even their songs are original, and they boast they can put any nursery rhyme to music on a moment's notice.

Some "Big Kids"

THE kiddies aren't the only ones who listen in, either. Ford and Glenn are eagerly awaited on the air by many men and women who won't see even their second childhood again. Glenn estimates that a large proportion of the members of the WLS "Lullaby Club," which was originally intended for little tots only, consists of scores of fathers and grandfathers.

WLS is owned by the Sears-Roebuck Agricultural foundation, and has its studio located on the mezzanine floor of the Sherman Hotel, Chicago. The towers which send out its 500 watts are located at the Sears-Roebuck plant, several miles away.

Mr. Static isn't the only pet of the station. There is "Smoky the duck," who quacks obligingly for the children who are listening in. However, Mr. Static is quite important, and he bears himself with a dignity which shows that he knows how important he is. He is a double-yellow-headed Mexican parrot from the Gulf country and was brought to the station by George Hay, one of the most popular announcers in the country.

"Static" comes from a family of theatrical parrots, as his father and mother do tricks in a circus, his youngest sister is with a carnival and his three older brothers are in vaudeville. This species of parrot usually live to be 150 years old, but Static is just a baby—five years old.

So much for the parrot-mascot of WLS, the greatest station devoted to the interests of rural communities in the world. It is a station literally built by

Good Evening, Listening In with

HAVE YOU MET

farmers and intended solely for farmers. When the station was conceived and the money appropriated, plans were thought out how it may best serve the farmer. Sam Agaard, director of the Agricultural foundation of the Company, and Edgar L. Bill, his assistant, formulated these plans, and they have been quite successful.

Farm talks are given, schools are conducted for farmers, their wives and children and lessons are taught to better the countryman's mode of living and increase his profits on the products of his profession. Cows and pigs and goats are dissected and put together over the microphone to explain the "innards" of live stock and help the farmer better them. He is told how to grow cabbage and wheat, and what kind of scarecrows best keep those parasites away. Officers of the state granges make regular talks over the WLS microphone and the very cow-paths that lead off of Main street are trod by the WLS teachers.

"All Work and No Play"

EVEN the farmer's amusements are considered and cared for. Every Saturday night old-time fiddlers give a barn dance and the leader calls his steps over the radio. "Turkey in the Straw," "Money Musk," "After the Ball," and old-time cotillions and reels are broadcast.

And Si and Hank and old Sam Hicks like it. To show how much interest they take in it, a rather humorous incident can be told. A contest was being conducted to determine the most popular of the "Old-Time fiddlers" and it was announced that all of the listeners could vote for their favorite. From down in Illinois a regular storm of votes came in. A champion of one of the players had taken several hundred stamped post-cards and printed on the back "This counts as one vote for so and so," and about everybody in the township was given one of the cards to send in. Then from another section of the country a similar stunt was tried, until the votes ran up into numbers. Yes, the farmers are quite strong for WLS.

But the station is not lacking in metropolitan entertainment, either. Regular jazz is a prominent feature and there are many musical programs. The station caters to the railroad, also, and the Pennsylvania Railroad System broadcasts a series of concerts. Talented employes of the road come up about

Everybody!

FORD and GLENN

"THE BEDTIME STORY BOYS"?

every two weeks and give programs. One night on one of these programs the stars of all past Pennsylvania programs were chosen. These were G. W. Morris, an employe-singer of Pittsburgh, with a voice that plans to enter opera; a quartet of Pullman singers that entertain on Pennsylvania trains; Miss Ruth Radkey, pianist-daughter of an employe at Washington Heights, and others. On that night a very unusual thing happened, much to the profit of Miss Radkey. A member of some woman's club heard her play over the radio and enjoyed it so much that she called the studio by telephone and asked her to play at an entertainment to be given by the club.

RADIO AGE has broadcast feature programs from WLS at frequent intervals.

WITHOUT a doubt the most popular character in the station is George Hay, the engineer of the "WLS Unlimited" train. His "This is WLS, Chi-caw-go" announcement, and the toot-toot of his train whistle, are known to all fans. Clem Dacey announces, too, on the late evening programs. Dacey is a vaudeville man, and appears on the stage with Van Alstyne, the composer of "In The Shade of the Old Apple Tree."

A new feature has been tried out by the station which, it is planned, will become a permanent part of its weekly entertainment.

This is the weekly radio play given by the WLS theatre, directed by Henry D. Saddler, of Bloomington, Ill. Every Friday night a one-act play, especially adapted for the radio, is acted, and it has met with much success. Extensive tests have been conducted to determine the most effective way to broadcast drama, and the ingenuity of the station has resulted in schemes to imitate every conceivable sound, so that the imagination can build from the sounds broadcast the scenery, costumes, and facial expressions which ordinarily are necessary parts of the stage play.

A visit to WLS' studio while Ford and Glenn and George Hay are in operation is considered better than a box seat at any legitimate theater. The studio is quite small, and as a result admission is a hard thing to achieve. So packed has the studio become on certain occasions that "The Judge" is threatening to put attendance on an "applied-for-in-advance" basis.

The fun usually begins about 7:45 each evening, when Ford and Glenn seat themselves comfortably on their piano stool and reel off their "Good Evening, Kiddies" greeting to the thousands of youngsters who gather around the family radio for their not-to-be-missed bedtime stories.

IN SPITE of a packed studio and scores of restless, noisy fans who are trying to get in, Ford and Glenn manage to keep their composure enough to amuse the listeners in the studio and the thousands outside of it. Their harmony has won them many vaudeville offers, and their original repartee, which is made up on the spur of the moment and not by laborious preparation, is about the best to be heard at any station—anywhere.

Enter "The Judge"

After the bedtime stories have signed off and "Little Ford" and "Big Glenn" have retired to take a temporary rest, "The Solemn Old Judge," nee George Hay, appears on the scene, doffs his coat, rolls up his sleeve, and lights a fag.



Introducing "Static" the only parrot whose profession is radio broadcasting. And "Static" knows the ropes, too.

Seated at a small table, he talks into the "Mike" in his intimate, pleasing way, and keeps WLS' evening program humming till well past midnight, on feature nights.

Ford and Glenn usually appear later in the evening to sing a few popular songs, and on several evenings a week Ralph Emmerson, at the Barton studio organ, plays request numbers, most of which are popular or semi-classical.

With such an aggregation of stars as its studio personnel, it is no wonder that the Sears-Roebuck Company has made its station one of the best loved in the Middle West.

Programs from Hotel

Most of the broadcasting from WLS is conducted at the Hotel Sherman Studio, although some of the farm programs come from the studio in the Sears-Roebuck Building on the West Side of Chicago, where the apparatus and towers are located.



Ford Rush and Glenn Rowell, who made "Lullaby Hour" for the kiddies an institution over WLS, are shown above in a moment of harmony. Their bedtime tales make just as much a "hit" with the grownups as they do with the open-eyed youngsters.

Enter WJJD

Two Famous Radio Favorites Manage New Mooseheart Station



Photo Copyright by Drake Studio

And here is Jack Nelson, himself, who is to be announcer and director of Radio Station WJJD.

By Jack Nelson
Director-Announcer, WJJD.

MOOSEHEART! A city in Illinois which is, as the name implies, the very Heart of Moose.

On the emblem of the Loyal Order of Moose are the letters P. A. P., standing for Purity, Aid and Progress, and inasmuch as every member of Moose is a father to all the children at Mooseheart, it is common to hear "Howdy Pap" when a Moose is concerned, and we say it now at the birth of W J J D in the Radio World, "Howdy Pap!"

October 27th, Navy Day and the birthday of Secretary of Labor James J. Davis, was chosen as the opening day of this new 500 watt station. The letters "J J D" in the call exist because of a sincere desire on the part of those who know what he has done for the establishment of Mooseheart and for the betterment of thousands of children to give him some public recognition of his service, and it is very appropriate that the Mooseheart Station include his initials for it is due largely to his efforts that Mooseheart exists.

Mr. Davis was successively a bootblack, iron puddler, organizer of the Loyal Order of Moose, founder of Mooseheart and Secretary of Labor in President Harding's and President Coolidge's cabinet and Director General of the fraternity. Mooseheart is a co-operative, fraternal, philanthropic non-money-making enterprise of the Loyal Order of Moose, sustained by its 600,000 members each contributing two dollars a year for the support, care, education, vocational training and the protection of the otherwise dependent children of its deceased

members. To date more than \$6,000,000 has been expended on this city of childhood.

A Real Paradise

IT IS beautifully situated on its own 1,100 acre estate in the famous Fox River Valley on the Lincoln Highway between Aurora and Batavia, Ill., thirty-five miles west of Chicago. For miles around there is open space, beautiful trees and clear skies. The Fox River runs through the premises and a 16-acre lake offers opportunities for swimming, camping and skating.

Mooseheart is remarkable because (1) it accepts only the dependent children of deceased Moose; (2) it has the lowest death rate of any place in the world; (3) its athletes are highly respected by their opponents and there are a comparatively small number of boys from which to select their teams; (4) its boys' band is one of the most famous in the world; (5) great industries compete for the services of its graduates; (6) every graduate possesses practical knowledge of a trade. There are now about 1,200 children there.

Mooseheart is ideally situated for a broadcasting station. Away from the unwelcome effect of the tons and tons of steel in Chicago, the 150-foot towers are on the top of a fairly large hill, so that in first seeing them from the Lincoln Highway they look to be at least 250 feet high. The wave length is one where there is little interference (278) and the operator, Ralph Shugart, who worked with me at the Drake for so long, has

great expectations. The set is the Western Electric standard 500 watt transmitter, and while we promise no world's record for distance, it is hard to conceive of a more ideal location for a station.

The Mooseheart studio will be adjoining the operating room and lines to the Auditorium, the Athletic field and Superintendent Adams' home will permit the broadcasting of solos, readings, duets, trios, band, orchestra and glee club numbers, football games, etc., all by the students of Mooseheart.

Champion Athletes, Too

THE foot-ball team, for instance was defeated only once last year, and that time by the Champions of the State, and there are less than one hundred and fifty boys of size enough to pick from. The Mooseheart Band has just returned from a tour through nearly every state and it is famous for its quality. The Novelty Orchestra (a "Jazz Band") is a "hot aggregation" of some of the boys in the Band and Symphonic Orchestra.

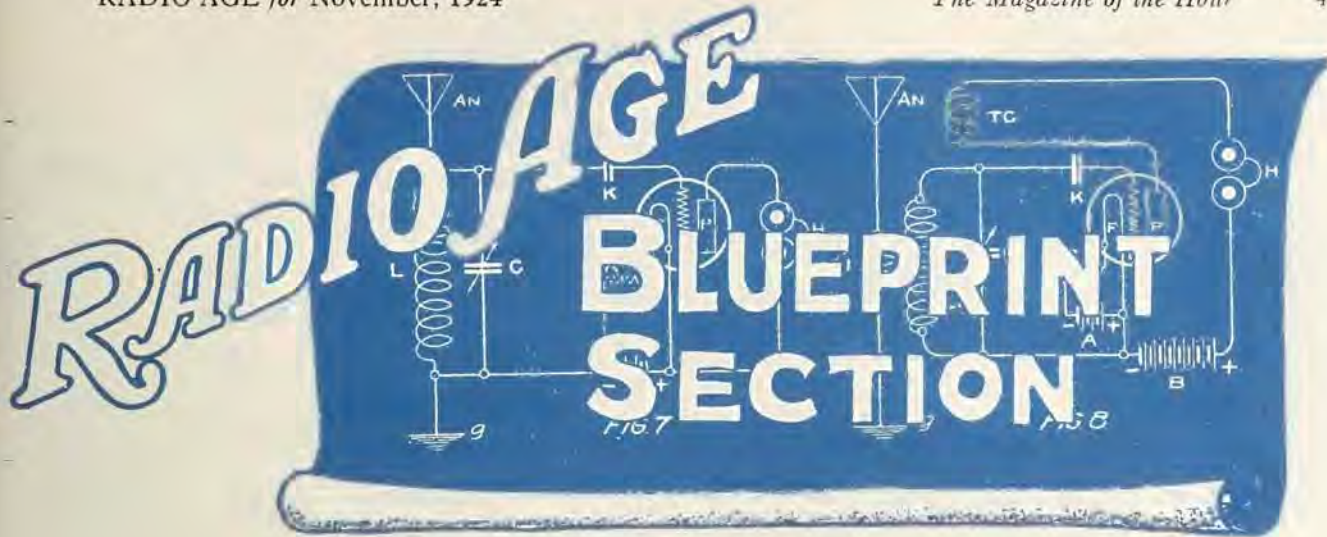
There will be a program every afternoon and every evening from Mooseheart and only youngsters of Mooseheart will perform. The entertaining feature of these programs will be in listening to these children, orphans and half-orphans who have tasted unhappiness in watching their progress and hearing the effects of Mooseheart training. There must be something to the training, for in all the years Mooseheart has been in existence there has not been one case demanding

(Turn to page 70)



Photo of Shugart by Drake Studio.

Above are shown the impressive antenna towers and operating building of Station WJJD, Mooseheart, Ill. Another studio in Chicago is to be connected with the Mooseheart operating room by a direct wire. In the circle is Ralph Shugart, formerly chief operator at WDAP, who will hold that position at WJJD. Ralph is known to old-time broadcast listeners as "The Sheik of the Drake."



An Easily Tuned Single Tube Loop Set

By JOHN B. RATHBUN

Copyright: 1924

MAKING one part of a radio receiving set do the work of two or more of the parts ordinarily employed is the basis of simplification, and simplicity in amateur radio is a virtue, always providing of course that the rearrangement does not interfere with the proper functioning of the receiver. It will be remembered that a distinct step in the direction of simplicity was taken in the reflex set described in the September issue of RADIO AGE, the tuning coupler acting in the dual role of tuning inductance and radio frequency transformer. In the simple one tube regenerative set about to be described, the loop aerial acts both as a collector of radio energy in the usual way, a tuning inductance and tickler coil. In fact, the only tuning instruments in the cabinet are two variable condensers which tune the grid and plate circuit respectively.

As with any loop aerial set, the range for a given number of tubes is considerably less than with an outdoor or "flat-top aerial," but this deficiency is more than compensated for by the greatly increased selectivity and the sweet clear tone. In a certain sense, the directional effect of the loop acts as a third auxiliary to the tuning elements in securing selectivity, and this is of great importance in congested areas where there are two or more local stations broadcasting at the same time. The use of the loop eliminates much of the interference ordinarily experienced due to sign flashers, X-ray machines, violet ray apparatus, and all the other elements that combine to make a bedlam of noises in city reception.

This circuit was tried out thoroughly under very difficult conditions a year ago last summer in the Hotel Commodore, New York. It was assembled from parts roughly stuck together in

Loop Acts as Aerial and As Inductance

the confines of a hotel room and the loop was made by sewing wire in and out of a sheet of newspaper. With the loop inside of a steel frame building, stations as far away as Pittsburgh, Pa. (KDKA) were heard with considerable volume, WOR of Newark came in loud and clear, and the local stations were tuned in and out without difficulty. To receive any signals at all with a loop installed in a steel frame building seems a notable achievement for a single tube set, particularly when the parts were only stuck together temporarily without any thought to the proper layout.

Tapped Loop Used

FROM the blueprints it will be seen that the loop aerial is of the ordinary

type but that a tap is taken at the eighth turn, thus dividing the loop into the grid and plate sections. Eight turns of the loop form the plate circuit or tickler coil while the remaining sixteen turns form the grid or tuning inductance. According to the construction of the loop and the constants of the apparatus employed in the circuit, some slight readjustment may be required in this distribution of the turns of wire in the loop, but ordinarily it will be found that the specified tapping point is very near that required for the ordinary set. The loop is two feet square, two feet on each side, but this is not critical if the total length of wire in the circuit remains about the same. The wire spacing between turns is taken at one-quarter inch but this may be varied within reasonable limits. A factory made loop, such as can be purchased ready made is of course the most effective and best appearing, but the loop can also be made at home by those who have the patience.

Fig. 1 is a "picture diagram" or plan view of the complete set in a cabinet, while Fig. 2 just below it is a conventional diagram which shows the experienced builder how the set functions. These two views on the same blue print sheet should be used in wiring up the set. The isometric view of Fig. 3 shows the appearance of the assembly taken from the rear of the panel and is a guide in laying out the apparatus. For greater volume, one or two stages of audio amplification can be added in the usual way for the operation of a loud speaker or for better volume on distant stations when using the head phones.

Looking at Fig. 1 or Fig. 2, depending upon the experience of the reader, we see the two variable condensers (C1) and (C2) which comprise the tuning controls. Condenser (C1) tunes the
(Turn to page 48)

HOW TO USE RADIO AGE BLUEPRINTS

The blueprints printed in this section are so arranged as to form a complete unit with the explanatory articles when desired by the reader. For example, the center sheet consisting of pages 43, 44, 45 and 46 contains two blueprints and two pages about a capacity feedback set. Just follow this four-page sheet at the center and you will have a complete section to follow when you make this hookup. Likewise the second center sheet, which also can be followed as one unit, is devoted to the single tube loop set. The blueprints for this hookup are on pages 42 and 47, and the article on pages 41 and 48.

Blueprints appearing in future issues will be arranged in the same manner.
—The Editors.

Blueprints for the Single Tube Loop Set on Pages 42 and 47.

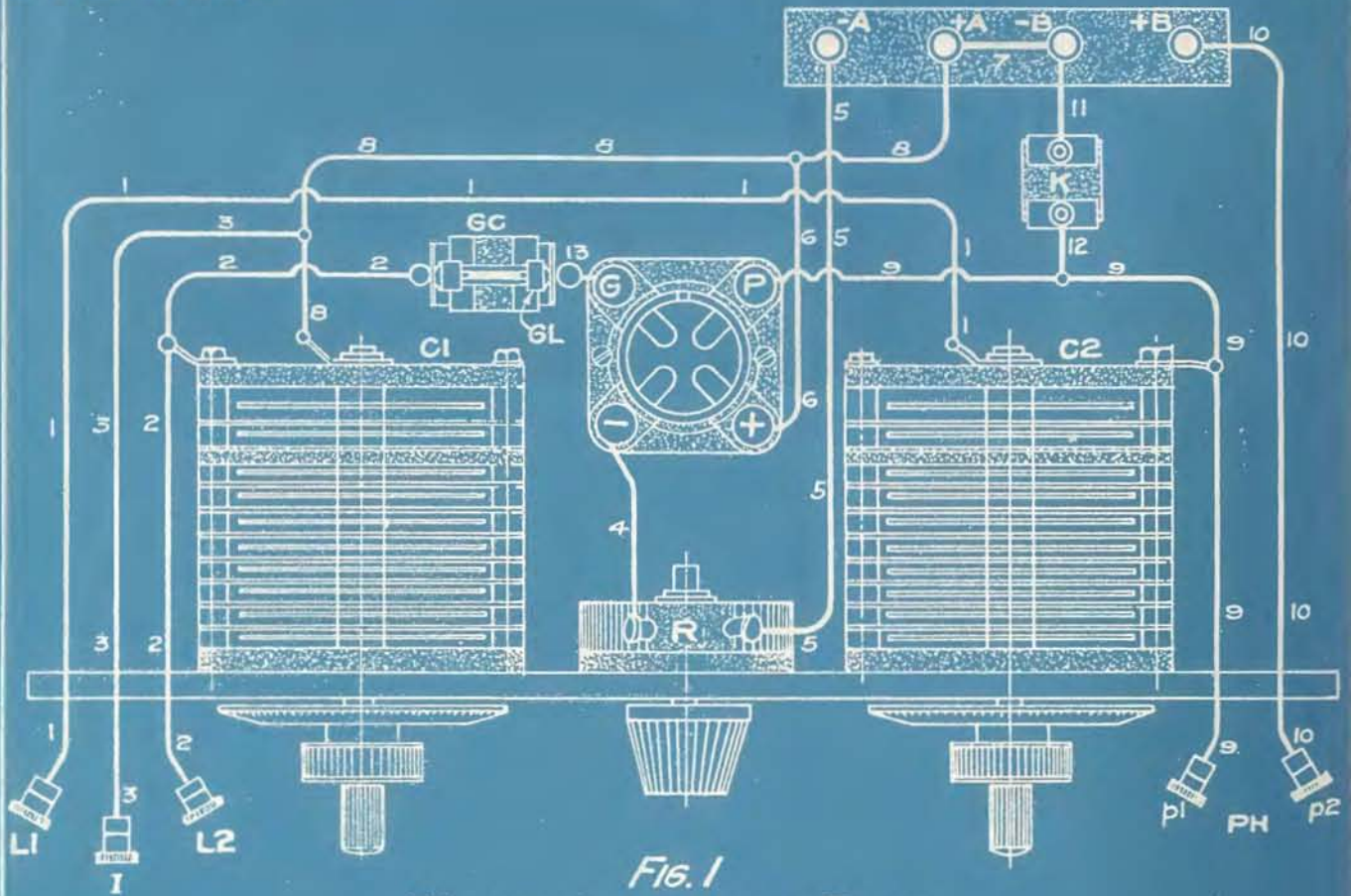


FIG. 1
WIRING LAYOUT AND PLAN

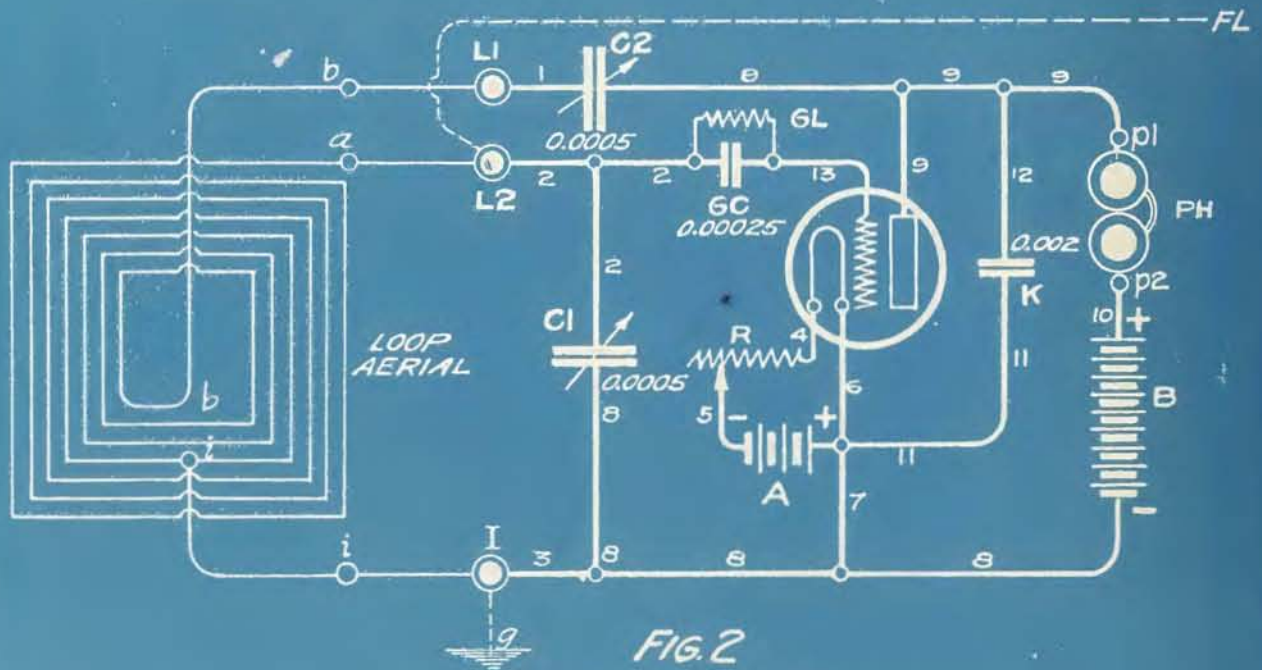


FIG. 2
CIRCUIT DIAGRAM
SINGLE TUBE LOOP SET

Close Regeneration Control With A Capacity Feed-back Receiver

By JOHN B. RATHBUN

NEARLY all of our readers are familiar with the inductive feed-back types of regenerative circuits in which the plate energy is returned to the grid circuit through the inductive effect of a tickler coil, or by means of tuning the plate and grid into a mutual resonance by means of plate and grid variometers. He is also familiar with the direct feedback type in which the plate circuit is connected directly with the aerial as in the single circuit Ultra-audions and Wizard circuits.

However, there is a third means of feedback which is highly effective, known as the "capacitive feedback" by which the plate energy is returned to the primary and controlled through a variable condenser between the primary inductance and the plate.

As with the inductive feedbacks, there are a great number of circuit combinations possible with the capacity feedback system and one has only to consult an English radio magazine to discover this fact. Its popularity in England is undoubtedly due to the fact that a capacitive feedback circuit has a lesser tendency toward breaking down into free oscillations when the circuit is being forced, and as we all know, re-radiation from the aerial is the Englishman's private pet peeve. Another factor which stands in favor of the capacitive system is the fact that much closer control of regeneration is possible by means of a vernier variable condenser than by the standard tickler coil arrangements, and that the tube can be brought closer to the spilling point without actually causing trouble.

A Sensitive Hookup

ICLAIM no originality for the general type of circuit which is demonstrated in this article except in points of minor refinements. It has been variously known as the "Super-Reinartz," as the "Inverted Weagent," and the "Capacitive Ultra-Audion" at various times. However, no matter what its origin may have been, it is an exceedingly sensitive circuit and gives great signal strength on local. The circuit is tuned to wavelength by means of a variometer while the feedback is controlled by means of a vernier variable condenser. The principal improvement introduced in this article is the use of a spiderweb type of variometer.

In Fig. 1 of the accompanying blueprints we show a wiring diagram and plan view (Looking down on top of the set) which is for the use of our readers who are not familiar with conventional or symbolical diagrams. In Fig. 2 is the symbolical diagram of the set for the information of the advanced readers who may wish to learn how the circuit functions. An isometric view in Fig. 3

A Sensitive Circuit with Greater Volume; Variable Condenser Controls Reaction

shows the general arrangement on the rear of the panel and the run of the wiring, but we advise the reader to make the actual wiring connections with the aid of either Fig. 1 or Fig. 2 as in these views the wiring is clearer and easier to follow. Keep these blueprint diagrams for reference and you will have no trouble with this set.

Looking at Figs. 1-2 we see the tuning variometer (VA) which is really a specially connected vario coupler of the spiderweb type. In the particular coupler shown a movable coil or "rotor" marked (r) is connected in series with the stator (s), the latter being the tapped coil. The tapped portion (L) of the coupler stator is simply the tapped portion of this member but is drawn out separately in Fig. 2 for emphasis in showing the application of the tap switch (TS). The tap switch gives closer control of the tuning and it will be noted that no variable condenser is included in the grid circuit.

Regeneration Control

AT (C1) we have the vernier variable condenser in the plate circuit which controls the regeneration or feed back into the aerial or primary circuit. On tracing out the hookup we will see that the condenser (C1) is effectively in series with the variometer (VA) and therefore that the variometer acts as an auto-transformer for the plate circuit, increasing the potential applied to the grid of the tube. This is very similar in action to the Weagent circuit except that an auto-transformer (Single circuit inductance) is applied instead of the two circuit transformer used in the Weagent. Maximum potential is developed between (C1) and (VA) at the point where the grid circuit is connected through the grid condenser (GC) and the grid leak (GL). The detector tube is at (T1) with its controlling rheostat (R1).

The use of a spiderweb inductance in this circuit eliminates a great deal of the wasteful distributed capacity which commonly grounds a large percentage of the aerial current in single circuit receivers of this class. This is a marked advantage over the layer wound type of coupler and shows up well in practice. The tap points on the section (L) are connected to the tap switch (TS)

in the conventional manner, and the blade of the switch is then connected to ground.

Variable condenser (C1) should have ample capacity, hence should be a 43 plate or 0.001 mf type. The grid condenser (GC) is a mica dielectric type with a capacity of 0.00025 mf while the grid leak (GL) should be either a variable leak or else a fixed type with a resistance of about 1.0 to 1.5 megohms. The tube (T1) can be any standard tube of the amplifier type such as the UV-201A or UV-199 type. It will be noted that both the detector tube (T1) and the audio amplifier tube (T2) are connected to the positive terminal of the same "B" battery and therefore that both tubes carry the same high plate voltage. The "B" battery voltage will range from 45 to 90 volts, but the best results are obtained at 67.5 volts with the majority of tubes.

At the output of the detector circuit we have the primary coil (+B-P) of the audio frequency transformer (T) connected in the plate circuit. A fixed condenser (K1) is connected across the primary which has a capacity of 0.001 mf. The secondary coil (-F) and (G) is connected to the audio amplifying tube (T2) through the 4.5 volt "C" battery (C). The transformer (AT) should have a ratio of from 5-1 to 6-1 for the best combination of amplification and clear tone. Lower ratios give less distortion but also less volume. It should be particularly noted that the (-) negative pole of the "C" battery should go to the grid post (G) of the amplifying tube socket (T2).

Simple Output Arrangement

SIMPLE single circuit jacks (J1-J2) are used in both stages, and while this leads to slightly diminished volume in the detector stage, yet this is no practical disadvantage as the detector is used only for receiving local stations in the majority of cases. The advantage lies in the simplicity of the jack connections and in the fact that the circuit is not broken at any time in switching from one stage to the other. There can be no open circuits due to poor jack contact nor microphonic noises set up as this point. In the hands of the novice a two circuit jack in the detector stage very frequently leads to trouble. Jack (J2) in the audio stage is of the usual type and requires no further explanation.

The only special instructions that seem necessary for this circuit are those which relate to the conversion of a vario-coupler into a tapped variometer. One lead from the rotor or movable coil shown by (r) in Fig. 2 is connected to the outermost lead from the stator coil (s). In this way the rotor and

(Turn to page 46)

Blueprints of the Capacity Feed-back Receiver on Two Pages Following.

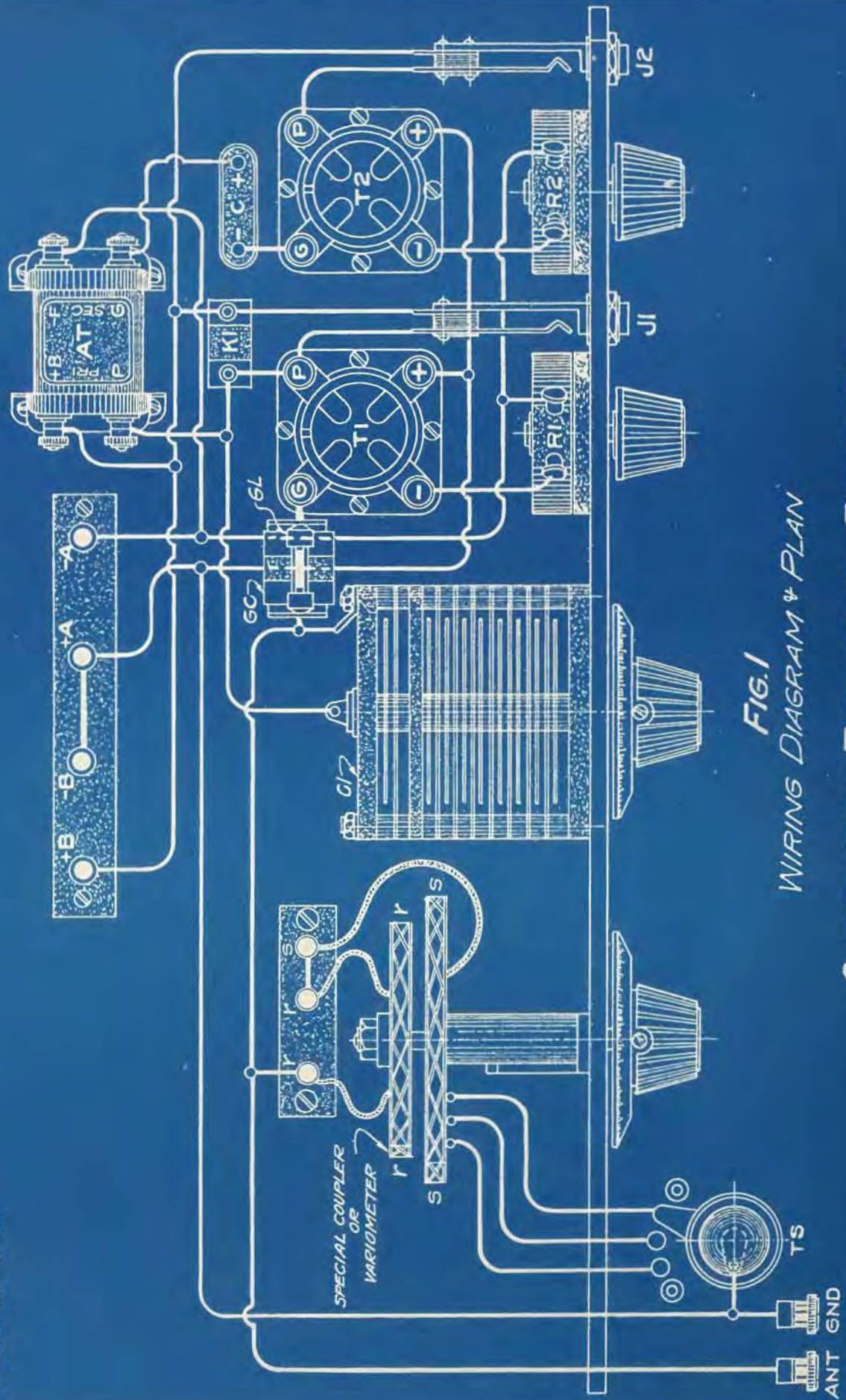


FIG. 1
WIRING DIAGRAM & PLAN
CAPACITY FEEDBACK RECEIVER
(WITH ONE STAGE OF AUDIO FREQUENCY)

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RADIO AGE, INC.,
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PAT. PENDING

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FB-236

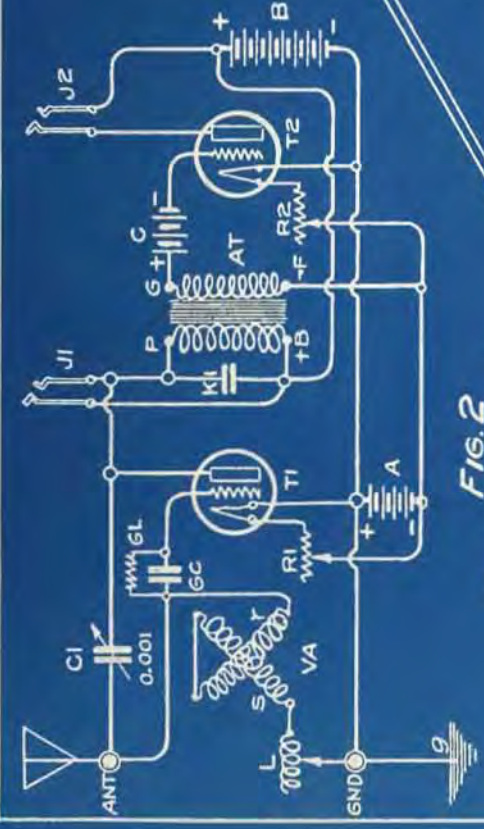


FIG. 2
CIRCUIT DIAGRAM

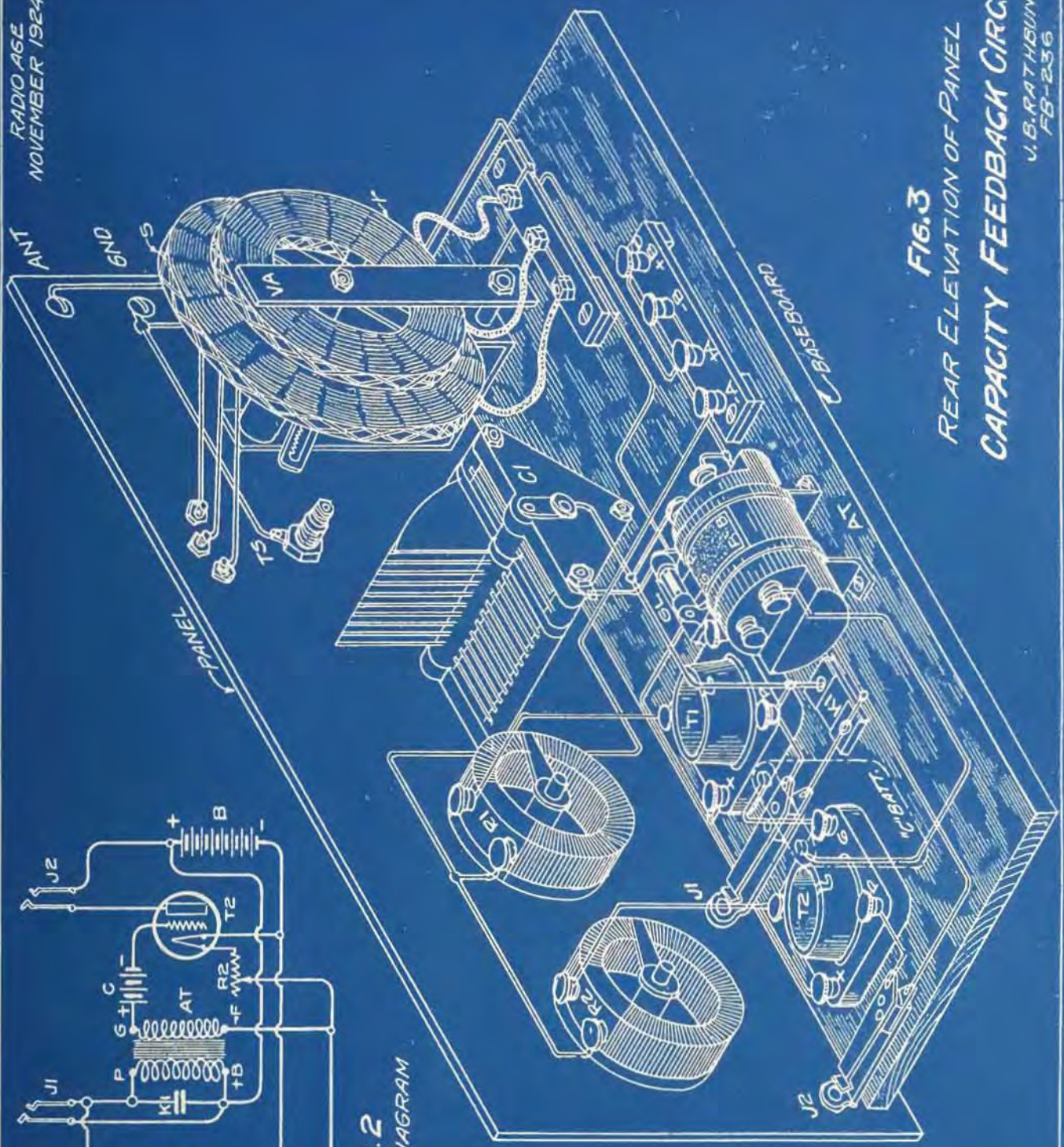


FIG. 3
REAR ELEVATION OF PANEL
CAPACITY FEEDBACK CIRC.

A New Capacity Feed-back Receiver

(Continued from page 43)

stator are connected in series and the device now becomes a variometer. Do not make the connection with the tapped end of the stator coil. Leave the tapped end open for the inductance switch connection.

With this set, the writer has pulled them in for very considerable distances and with surprising volume. It has all the signal strength of a single circuit receiver combined with a great percentage of the selectivity of the three circuit type. It is not quite so selective as a three circuit tuner, especially when two or three local stations are going at one time, but it is much better than the average single circuit arrangement in this respect. One stage of audio frequency amplification is always desirable with any regenerative and is quite economical. It is the addition of the second stage that leads to complication and expense.

One stage of audio permits of excellent loud speaker volume on stations up to 100 miles or so and makes headphone signals audible that would often be passed by with the detector tube alone. With UV-199 tubes, both stages can be worked off of three No. 6 dry cells for a long time and with excellent results. By biasing the audio tube (T2) the total demand on the "B" batteries is very light and the smallest size of cells can be used for long periods.

"B" Battery Current

WHILE the amplification is slightly better with 90 volts of "B" battery on the plate yet 67.5 volts gives nearly the same volume with a much smaller consumption of "B" battery current and with less tendency toward whistling. With 45 volts on the plate the tone is probably purer but the amplification is very much reduced. If only 45 volts are used, then the "C" battery should be reduced to a two cell, three volt type in place of the three cell 4.5 volt battery used for 67.5 to 90 volts.

From 40 to 60 feet of outdoor flat top aerial will give very good results. If the aerial is made longer than this there will be trouble in maintaining the required selectivity although a longer aerial may give a slightly greater range. The great trouble with the majority of amateurs lies in the fact that they try to hang up too much wire in their aerial circuit and in so doing increase the interference and disturbing noises that may originate in the neighborhood. A single wire is better than two wires in parallel.

A 7"x14" panel can be made to accommodate this apparatus as laid out in the drawings without much squeezing. If it is likely that a second stage of audio will be added in the future then a panel 7"x18" should be used. Bakelite or hard rubber are the best materials for the panel, and while the baseboard is usually made of wood this can also

be made of hard rubber or bakelite to advantage.

[Mr. Rathbun has perfected a new "super" for publication in blueprint form in the December RADIO AGE. Don't miss it!]

**No Other Magazine
Prints**
ORIGINAL BLUEPRINTS
**Such as You Find Every
Month in**
RADIO AGE
Blueprints for the Capacity
Feed-Back Receiver on
Pages 44 and 45

Baby Hetrodyne Notes

By John B Rathbun

WHILE I believed that the Single Tube Heterodyne circuit which was published in the February issue of RADIO AGE would be of interest to many of our readers, I did not foresee the deluge of correspondence which has poured in upon us steadily for the past four months.

As might be expected with such a critical circuit, the results obtained by the many builders varied widely. The customary 30 per cent of experienced radio experimenters who generally obtain good results wrote in and reported results which were high above the average for a single tube receiver. The remaining 70 per cent, who always experience trouble in some form or other with any circuit, reported every degree of trouble ranging from noisy reception to no reception at all.

Out of all the correspondence which I have handled on the subject I have two heart warmers which have tickled me way down to the ground. One records a reception of 2,600 miles, while the other comes a close second with 2,100 miles, both without amplification and with the circuit exactly as specified. Our booby prize of a fur lined straw hat goes to four of our readers who consistently report zero miles. The leader in our "Longest Aerial Contest" leads by several hundred feet, his aerial, according to his letter, being 400 feet long.

What Some Fans Do

In the words of Captain Favour, who writes in from Fort Sheridan, Ill., "We are constantly hearing of new circuits, but seldom hear of the results obtained by them." Acting on this suggestion I am attaching a very few of the results obtained by our readers which may be a guide for those who are working or who have worked on the Single Tube Heterodyne.

"Los Angeles, Cal. Have just finished building the 'Single Tube Heterodyne' as

described by John B. Rathbun in your February issue. Had a little trouble in getting it to work properly at first; it whistled and howled until I placed a 0.005 fixed condenser between the plate (P) and the (+F) posts of the tube sockets, and a 0.001 fixed condenser across the phones. It works fine now and is very selective and clear.

"I am living at present within a half dozen blocks of four broadcasting stations. Five nights a week they all work at the same time. I have absolutely no trouble in shutting them out. With a fifty-foot aerial on the roof I can tune in any one of the stations without a trace of the others, and this I believe is going some, as it is the general belief here in Los Angeles that a single tube set is useless in the downtown section without wave traps.

"(Signed) Frank C. Meislalin."

(NOTE): The addition of the 0.005 mf fixed condenser bypass between the plate (P) and the (+F) is quite interesting, and upon experimenting with this addition, I find that it is quite effective under certain conditions where the tube tends to howl. This may be of benefit to those of our readers who have reported howling. Phone condensers placed across the phone posts may or may not be effective, depending upon the characteristics of the phones used. However, this is well worth trying.

"Bethlehem, Pa. Just a question or two that I would like to have answered. I constructed the single tube heterodyne described in the February issue of RADIO AGE. The set works fine and I am delighted with it. I picked up at least thirty stations, but what bothers me is that all of my stations come in at such a low dial reading that the condenser (C1) is never over (30) and at low wave lengths both condensers are at nearly (0). I find that a three megohm leak works best with the C-301A tube. My aerial and lead-in approximate 85 feet.

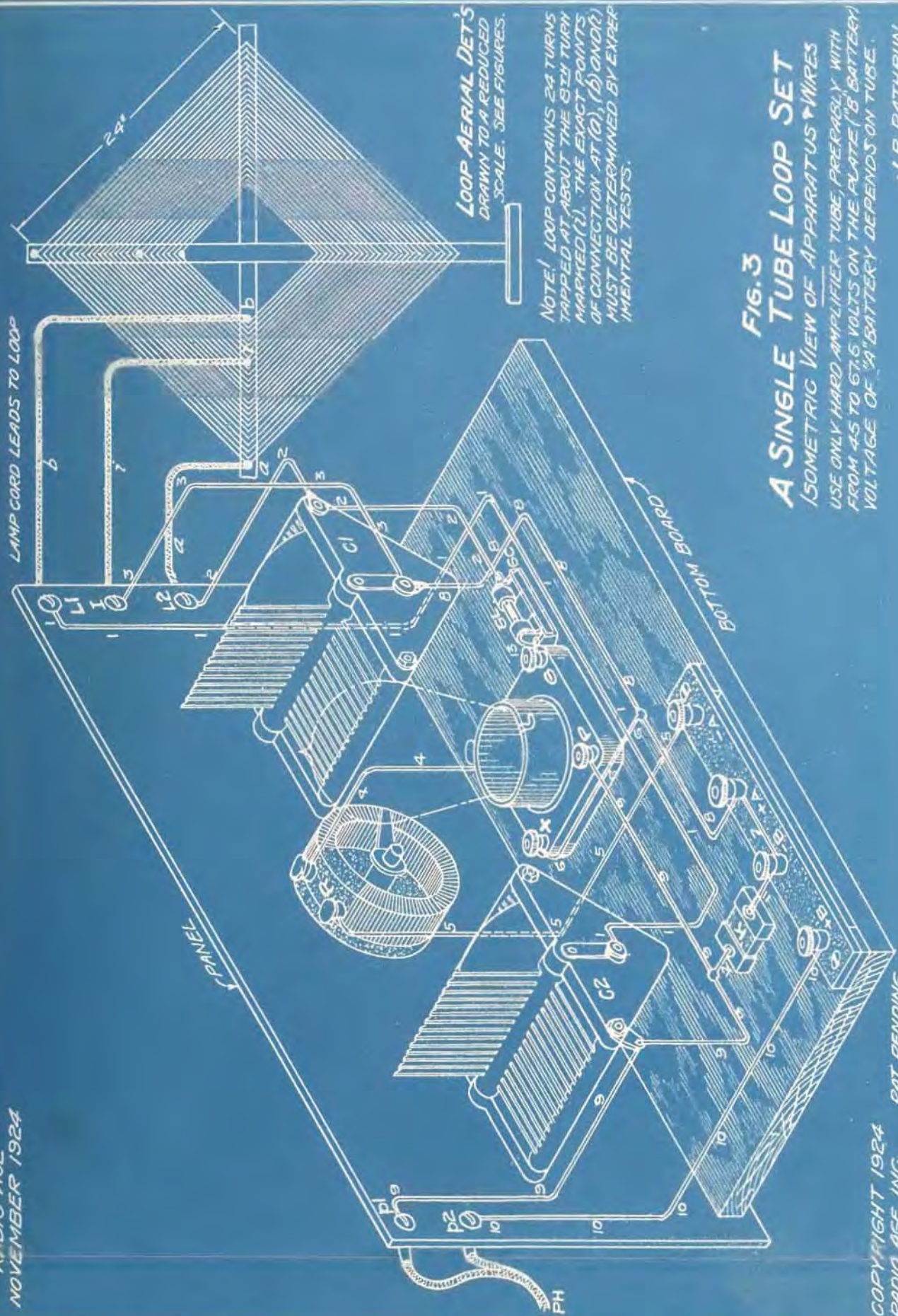
"(Signed) Leonard R. Krause."

(EDITOR'S NOTE): The condenser positions vary with your local conditions and with the length of the aerial. Either your condensers have not the rated capacity or else you should remove a few turns of wire from the secondary coil of the fixed coupler. The wave length of the set increases with the number of turns on the secondary coil of the coupler, and to reduce the wave length so that your set will work with positive condenser settings on short waves, we should remove a few turns at this point.

"Washington, D. C. I have made up the Baby Heterodyne as described in the RADIO AGE of February. This hookup deserves much praise. However, the length of the coils (M) and (N) makes it impossible to put this set in a cabinet. Could these coils be bank wound? Would Litzendraht wire improve the set any?"

"(Signed) Maurice A. Coates."

(To be continued)



LOOP AERIAL DET'S
DRAWN TO A REDUCED
SCALE. SEE FIGURES.

NOTE! LOOP CONTAINS 24 TURNS
TAPPED AT ABOUT THE 8th TURN
MARKED (1). THE EXACT POINTS
OF CONNECTION AT (a), (b) ON (2)
MUST BE DETERMINED BY EXPER-
IMENTAL TESTS.

FIG. 3
A SINGLE TUBE LOOP SET
ISOMETRIC VIEW OF APPARATUS Wires
USE ONLY HARD AMPLIFIER TUBE, PREPARABLY WITH
FROM 45 TO 67.5 VOLTS ON THE PLATE ("B" BATTERY)
VOLTAGE OF "A" BATTERY DEPENDS ON TUBE.

V. B. RATHBUN
UA-301

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PAT. PENDING

An Easily-Tuned Single Tube Loop Set

(Continued from page 41)

loop aerial to wavelength while (C2) controls regeneration and also aids (C1) in sharp tuning. Connections to the outer turns of the loop are made by the binding posts (L1-L2). Connection to the intermediate tap on the loop is made by binding post (I). Ordinarily the set works very well without a ground connection, but in some cases increased volume with decreased selectivity can be had by grounding one of the posts (L1) or (L2), the exact post to ground being determined by experiment. Grounding increases the effectiveness of the loop as a collector of radio energy but at the same time it partly destroys the directional effect and hence also decreases the selectivity. As this varies with local conditions, no recommendation can be made on this point which will fit every case.

Use Low Loss Parts

OWING to the wide separation of the wire turns on the loop, the distributed capacity is much less than with the more usual tuning coil and it will be found that the loop tunes sharper and more critically than a coil. This means that a vernier type variable condenser is very desirable for both tuning controls if we expect to get the best results with certainty. Both condensers (C1) and (C2) have a capacity of 0.0005 mf or are 23 plate commercial types. The low capacity of the loop results in a minimum of electrostatic coupling between the grid and plate circuits with an attending sharp control of regenerations and a marked absence of whistling and howling when tuning in.

Hard amplifier tubes such as the UV-201A, C-301A, UV-199 or C-299 are best adapted to this circuit, but very good results have also been attained with the WD-12. In fact the New York test was made with a WD-12 tube. Moderate volume can be had with 22.5 volts of "B" battery on the plate but higher voltages are better as they give more volume. With the UV-201A and C-301A we can employ 67.5 to 90 volts with profit while with the UV-199 and C-299 we will find that 67.5 volts is about the limit. Soft detector tubes of the UV-200 type give indifferent results owing to the low plate voltage that must be carried and they take too much filament current to be practicable for this sort of a circuit.

The rheostat (R) is of the ordinary type, the resistance of which depends upon the type of tube used. A plain type rheostat can be installed but a vernier gives better control of the filament current and electron emission. The tubes also control the "A" or filament battery voltage, hence we must first choose the type of tube and then select our rheostat and filament "A" battery to correspond. A 0.002 mf fixed condenser (K) bypasses the radio frequency current around the phones and "B" battery in the usual manner, and is of great assistance, particularly

when old "B" batteries introduce a great amount of resistance into the plate circuit.

Grid Biasing Scheme

WITH low plate voltages, ranging from 22.5 to 45 volts, a one megohm grid leak (GL) and a 0.00025 mf grid condenser (GC) give good results as shown in Fig. 2, and will also function well at higher voltages. However, when the voltage exceeds 45 volts it will generally be found that a biasing "C" battery will be better as shown installed in Figs. 1 and 3. This is simply a small three cell flashlight battery of 4.5 volts with the negative pole connected to the grid (G) of the tube socket. This polarity is of the greatest importance and the negative bias must be maintained on the grid (G) by this connection.

THE ORIGINAL RADIO AGE BLUEPRINTS

On Pages 42 and 47
Will Aid You
In Making This Novel

SINGLE TUBE LOOP SET.

Another unusual Group of Blueprint
Hookups in December RADIO AGE.

When the constructor wishes to build his own loop aerial we advise him to use a large gauge of silk or cotton covered magnet wire. Small gauges such as No. 22 to No. 24 will bring in the stations but larger wires or stranded cable such as lamp cord is better. There are 24 turns in all with a width of about 24 inches across the sides of the square. Spacing the wire about 1-4 inch between turns will be perfectly satisfactory for the ordinary range of wavelengths.

IN Fig. 2 we show the probable location of the ground (g) by dotted lines. This ground may or may not be used but it should be at least tried out. It generally stabilizes the circuit, and prevents any tendency toward body capacity, even though it does affect selectivity adversely.

While this set has been mounted on a 6 inch by 7 inch panel, yet it is more desirable to use a 6 inch by 10 1-2 inch size as the larger panel makes it easier to wire up the receiver. From this it will be seen that it is a portable of the first order and that a panel size of 7 inch by 18 inch will permit of carrying batteries and all within the cabinet. In case that it is desired to install the batteries within the cabinet it will be found best to use "A" batteries of a square shape as such batteries pack up closer and are easier to hold in place. Vertical type "B" batteries are now on the market which require a minimum of space and which are very easy to connect.

When range is required regardless of selectivity, noise and other charac-

teristics, it will be found advantageous to connect a short length of aerial to the post (L2) with the ground (g) as shown by the dotted line. In effect this gives us a single circuit tuner in which the inductance is still represented by the loop. When the short flat top aerial is connected in this way, we must still use the loop as the 20 to 40 foot stretch of flat top is simply an auxiliary to the circuit and does not supplant the loop. The combination of flat top and aerial gives greater selectivity than a flat top aerial alone as the loop still gives a strong directional effect, but at the same time the selectivity is reduced in the vicinity of powerful broadcasting stations and the flat top collects various disturbances which result in noises in the phones. The auxiliary flat top aerial is indicated by the dotted line (FL) in Fig. 2.

In making adjustment of the tap point (i) on the loop we must strike a compromise between the wavelength range and the regenerative effect. The turns between (a) and the tap point (i) determine the wavelength range in meters while the loop turns between (b) and (i) determine the regenerative effect. Temporarily, at least, connect up 16 turns between (a) and (i) and eight turns between (b) and (i). Now attempt to tune in stations on very long and very short wavelengths to determine the range. Thus, if the condenser (C1) includes stations having wavelengths of 500 meters and over, and also stations or telegraphic code on as low as 200 meters, then we can feel that the tuning section of the loop (a-i) is of ample range and then can pay our attention to the tickler section of the loop.

If we can obtain a whistle by means of condenser (C2) on any of the stations within the above band of wavelengths, with the tube turned up to normal brilliancy, then we can feel sure that we have sufficient turns in the tickler section (b-i). If we have a great margin left in our condenser (C1) after we have tuned in a station of 500 meters or higher, and if the signals are weak and no whistle appears at any position of (C2), then we can change our tapping point (i) so that more turns are included in the tickler (b-i) and fewer turns are in the grid section (a-i). By experimentally moving the tapping point (i) from one turn to another, we can determine the maximum performance.

Adding Stages

ANY type of audio frequency amplifier can be added, resistance or transformer coupled, with one or two stages as may be desired. The output posts (p1-p2) are connected to the input of the audio stages as is usually the case with regenerative circuits, and the same "A" and "B" batteries can be used for both the detector and amplifier tubes. One or more stages of TUNED radio frequency increase the range but also increase the complication and expense.

Watch for a "dyne" blueprint hookup—the greatest yet, in December RADIO AGE.

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2 All American or Columbia Audio Transformers. 35 feet Hook-up Wire.
3 4" Bakelite Dials. 8 Binding Posts.
3 Filament Control Jacks. 1 Grid Leak and Condenser.
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1 strip Bakelite, 6x1 1/2. 1 Dubilier By-Pass Condenser. 3 Bezels.
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May Be Used in Connection With Any Receiving Set
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 - 2 Bakelite Rheostats.
 - 2 Bakelite Sockets.
 - 2-circuit Jacks.
 - 1 1-circuit Jack.
 - 1 Baseboard.
 - 9 Binding Posts.
- \$10.90**
- Diagram and Instructions for wiring.



COMPLETE PARTS FOR 3-TUBE COCKADAY RECEIVING SET

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 - 2 23-plate Hy-Grade Cond.
 - 1 Bakelite Rheostat, 30-ohm.
 - 1 Bakelite Rheostat, 6-ohm.
 - 3 Bakelite Sockets.
 - 1 high ratio Columbia or All-American Transformer.
 - 1 Single Circuit Jack.
 - 1 low ratio Columbia or All-American Transformer.
 - 1 Baseboard.
 - 1 7x21 1/2 Drilled Bakelite Panel.
 - 2 Double Circuit Jacks.
 - 2 3" Bakelite Dials.
 - 1 Grid Leak and Mica Cond.
 - 7 Switch Points, 2 stops.
 - 1 Bakelite Binding Post Strip.
 - 8 Binding Posts.
 - 1 7x21 1/2 Drilled Bakelite Panel.
 - 3 Bezels.
 - 1 Baseboard.
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SUPER Heterodyne

Containing 3 Intermediate Frequency Transformers, Filter Transformer, Oscillator Coil and 2—1 M.F. Condensers.

\$19.75

with Audio frequency Trans.



PARTS FOR ONE-TUBE REINARTZ RECEIVING SET

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 - 1 Vernier Bakelite Rheo.
 - 1 Bakelite Socket.
 - 1 23-plate Lo-loss Var. Cond.
 - 1 11-plate Lo-loss Var. Cond.
 - 2 Bakelite Dials.
 - 3-Tube Set.
 - 1 Genuine Reinartz Coil.
 - 2 doz. Switch Points and Stops.
 - 3 Switch Levers.
 - 25 feet Busbar Wire.
 - 1 Freshman Grid Leak and Condenser.
 - 1 Baseboard.
 - 9 Binding Posts.
- Blue-print and Complete Instructions.
- \$17.55**

- Complete Parts for 2-TUBE HARKNESS SET**
- 7x14 1/2 Drilled Bakelite Panel, 2 Harkness Flexo-transformers with Condensers, 2 Dials, 2 Bakelite Sockets, 1 Connector, Battery Switch, 2 American Bell Transformers, 1 Jack, 1 R-W Detector, 1 Bakelite Rheostat, 5 Binding Posts, Baseboard and Bus Bar Wire—17.95
- Acme—1 Tube Reflex Set
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 - 1 400-ohm Frost Potentiometer.
 - 2 6-ohm Rheostats.
 - 2 30-ohm Bakelite Rheostats.
 - 1 00025 Fixed Condenser.
 - 4 .002 Condensers.
 - 1 .006 Condenser.
 - 1 Bakelite Terminal Strip for Binding Posts.
 - 1 Multicolored Cable for connecting batteries.
 - 1 8x36 1/2 Dr'd. Bak. Pan.
 - 8 Bakelite Sockets.
 - 7 Binding Posts.
 - 1 Filter Transformer.
 - 1 Oscillator Coupler.
 - 1 "C" Battery.
 - 1 Battery Switch.
 - 1 11-Meg. Leak.
 - 2 4" Bakelite Dials.
 - 1 Single Circuit Jack.
 - 2 2-Circuit Jacks.
 - 8 x 35 Baseboard.
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 - 3 All-American or Columbia Long-wave Transformers.
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Pick-ups and Hook-ups by our Readers



The material appearing under the title "Pickups and Hookups by Our Readers" in RADIO AGE, is contributed by our readers. It is a department wherein our readers exchange views on various circuits and the construction and operation thereof. Many times our readers disagree on technical points, and it should be understood that RADIO AGE is not responsible for the views presented herein by contributors, but publishes the letters and drawings merely as a means of permitting the fans to know what the other fellow is doing and thinking.

THE Editor of this department owes the readers an apology with regard to the Static Puncturing Contest for August. It was promised that a report of the results of that month would appear in the October RADIO AGE, but—

During the month of September—which is the month when the staff of RADIO AGE is busy making up the October issue, hundreds of letters were received, submitted by fans who had made lists, and the problem of selecting the winners was even so great as to require additional help in the Pickups Department. Now the Editor promised all those who submitted lists a fair chance, and all the letters got it,—some of them being read over and over as many as four or five times.

What the fellows did to Old Man Static—the letters and list tell more plainly than anything that we can write. All we have to say is that he was handed an awful trimming, and further, that the fellow who goes around with a long face saying that "Summer is a bad time to listen to radio" is an unpleasant memory of the past.

With this issue, our readers will find that the Dial Twisters have become an international organization. At the time of this writing we have made no less than five English radio bug Dial Twisters; in our membership lists we have a great many Canadian bugs, and if the interest keeps up, we hope to extend the idea even to more foreign countries afflicted with the indoor sport of radio DX fishing.

The Editor awaits with great expectations the arrival of a letter or two from some "bug" in Australia. We know that if these Australian fans get in with the bunch, there will be something doing. We have heard reports of those fellows working and hearing American stations on absurdly simple receivers, and when they do hear them,—their mileage runs up into four figures and more.

—The Pickups Editor.

Mr. Robert M. Hillis of 1462 Belle Ave., Lakewood, Ohio, sends in the following communication from an English fan with the notation that we write him and tell him about the Dial Twisters. This we did as the following letter will testify:

CONTRIBUTORS

Phillip Sidney Weggitt

P. Edward Chapman
Farwell C. Long

Lloyd Stove

DIAL TWISTERS

Name	Address	Circuit
W. A. Neeld	238 N. Galloway, Xenia, Ohio	RCA
R. L. Link	Kirkville, Mo.	Baby Het
W. H. Barlow	Rdo Opr SS Alpena	Grebe CR5
Fred Harrison	34 Virginia Ave., Cumberland, Md.	Special
R. W. Lowe	414 Walnut Ave., Fairmont, W. Va.	Capudine
F. C. Long	1122 Church St., Flint, Michigan	Ultradyne
Vincent T. Kenney	124 West 96th St., New York City	Globe Trotter
Roy G. Harber	32 Northumberland Ave., Buffalo, N. Y.	Reinartz
W. B. Tucker	R. R. 3, Hortonville, Wis.	Pfanstiehl
S. W. Wendel	521 Taylor St., Topeka, Kans.	Single Circuit
Wilber Milnor	196 16th Avenue, San Francisco, Calif.	3 Circuit
Henry E. Leise	2444 Hazelton Ave., NS, Pittsburgh, Pa.	Haynes
Robert C. Simpson	Vincennes, Ind.	Atwater-Kent
Arthur T. Meyer	Templeton, Wisc.	Reinartz
Arthur Goyer	406 Drummond Bldg., Montreal, Can.	Not Stated
T. C. Mahoney	1610 Market St., Burlington, Ia.	Kopprasch
R. K. Ashdown	P. O. Box 139, Freeport, N. Y.	Haynes
Tony Gibas	520 Broad St., Kenosha, Wisc.	Woods
George H. Baker	P. O. Box 755, DeLand, Fla.	Crosley V.
W. C. Wolverson, M.D.	Linton, N. D.	Neutrodyne
John Mullikin	128 Bates St. N.W.	Not Stated
W. J. Head	24 First St., Bristol, R. I.	Single Circuit
Neal O'Donnell	38 Clark St., Astoria, L. I.	Reinartz
Thomas Lawrence	Box 488, Brampton, Ontario, Canada	Special
E. C. Maizniski	Box 403, Tawas City, Michigan	Tryrdin
P. E. Miller	1252 N. Campbell, Chicago, Ill.	Tuned Plate
J. Sulouff	325 6th Ave., Altoona, Pa.	Portable
Oswald Faubel	Box 224A, R.F.D. 4, Brooklyn Station, Cleveland, Ohio	Flewelling
W. L. Bausserman	Gilmore City, Iowa	Go-Getter
P. Kilkenny	478 Frontenac St., Montreal, Can.	Single Circuit
F. A. Carswell	Box 158, Oxbow, Sask., Can.	Ultra Audion
Kester Brewer	626 King St., Monrovia, Calif.	Regenerative
Herbert E. Zebuth	638 N. Refwal St., Allentown, Pa.	Single Circuit
Arthur M. Roach	1006 Grand Ct., Davenport, Ia.	Split Variometer
Russel Caffey	Halfway, Mich.	Reinartz
Edward C. Liker	742 Collingwood Ave., Detroit, Mich.	Ultra Audion
J. D. Kelly, Jr.	262 Lawton St., Atlanta, Ga.	Single Circuit
Benton Pantall	1618 Widener Pl., Philadelphia, Pa.	King Tuner
LeRoy Garman	Franklin Grove, Ill.	Not Stated
Wilbert Waterman	35 S. Edison Ave., Elgin, Ill.	Haynes
O. C. Fletcher	1267 Johnson St., San Diego, Calif.	Not Stated
Gordon Wilcox	2248 Sturtevant Ave., Detroit, Mich.	Single Circuit
Raymond Hall	Johnson St., Wauwatosa, Wisc.	Single Circuit
Ralph Page	716 Iglehart Ave., St. Paul, Minn.	Single Circuit
M. Lundsow	1067 6th Ave., Kenosha, Wisc.	Single Circuit
Vincent T. Kenney	124 W. 96th St., New York City	Not Stated

Editor's Note:—These names are not listed according to standing with respect to actual operating records.

PICKUPS EDITOR.

Mr. Philip Sidney Weggitt,
35 Kings Road,
Bournemouth,
Hants., England.

Dear Sir:

Mr. Robert Hillis, of 1462 Belle Avenue, Lakewood, Ohio, has forwarded to me a copy of your letter, with a notation that it would perhaps be of interest to the Pickups

pages of our magazine, RADIO AGE, of which I take the liberty of sending several copies for your reference.

The circuits you enclose seem so entirely different and unusual from the types we use, that I am going to feature them in the November issue of RADIO AGE, in our reader's department. Incidental thereto, I

have Mr. Hillis' permission to publish parts of your letter to him, which I trust will meet with your approval.

Since contributions to the Pickups Section of RADIO AGE are acknowledged by conferring the much-desired honor of "Dial Twister" upon the contributor, I am enclosing herewith the emblem which proclaims this honor, and would casually mention that you hold the honor of being the second of your countrymen to gain entrance among the Dial Twister faction of RADIO AGE readers.

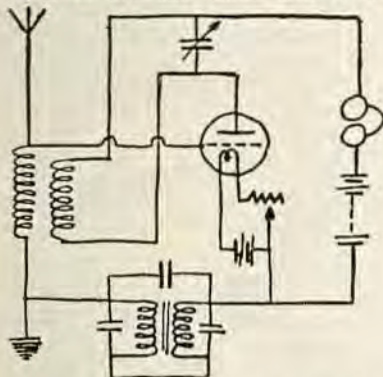
I would be pleased to hear further from you with any news, circuits or other items of interest that you feel would be valuable to your American radio friends.

Very truly yours,
RADIO AGE, Inc.

Mr. Weggitt's letter is as follows:
35 King's Rd.,
Bournemouth Hants.,
England.

Dear Mr. Hillis:

I have heard that you wish to correspond with an English radio experimenter. I am nearly seventeen and have had over two years experience in radio experimenting. I have made dozens of sets, and I test out all the circuits I can get hold of, from crystal to 6-valve sets. The circuits, which I am most interested in are one valve and reflex

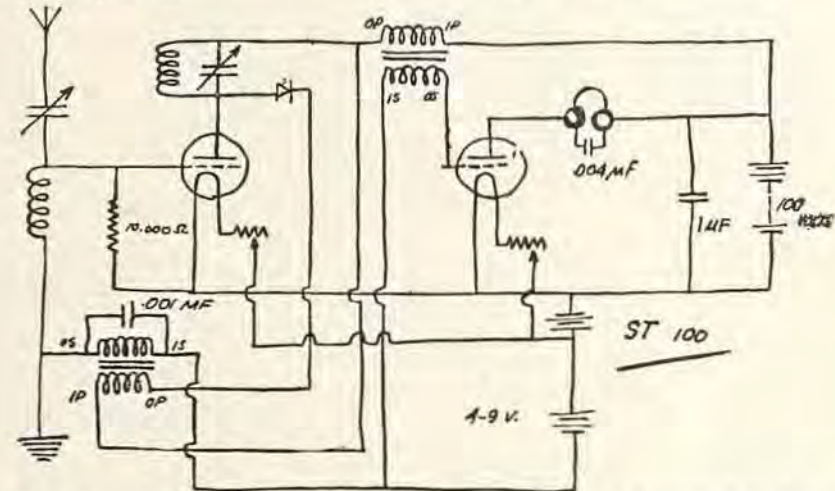


circuits. I will now try to describe my testing-lab and station. I am situated about a mile from the Bournemouth broadcasting station, call sign 6BM. My aerial is a "cage," with a "cage" lead-in. The aerial is 60 feet long and to the lead-in end it is 35 feet high and at present I am engaged in erecting a 45 foot mast, instead of a 30 foot one at the other end. There are 4 wires mounted on 3 ft. hoops in the "cage." My earth-wire is about 20ft. long, composed of 3-18 copper wire. On this aerial I have received KDKA Pittsburgh, U.S.A., on about 100 meters, with an inductively coupled single circuit. One evening or early morning I received KDKA from 11:30 p. m. until 2:30 a. m. continuous. On the ordinary one-valve and reaction set I can get all British broadcasting stations and Paris, etc. These stations are

easily readable. I am sending you an old photo of my testing-bench will get a friend to take some more.

I can test out most circuits up to 6 valves but I go in mostly for long distance work with one or two valves. I should be very pleased if you could send me some one valve circuits; I don't mind how complicated, I will test them. I should also like some rejector or wave trap and some super-crystal circuit.

I am trying to get a transmitting licence using an artificial aerial but transmitting licenses are so difficult to get in England. It took me three months before I obtained my experimental license and I had to answer bags of questions.



Reflex Circuits seem to be the pet hobby of the English fans, as shown in these diagrams submitted by a British broadcast listener. To the left is a one tube regenerative circuit which embodies some form of special connections for reflexing the AF on to the grid circuit. Above, a two tube reflex circuit of the tuned impedance variety which uses a crystal detector. Notice the prevailing use of conductive coupling to the antenna.

I don't know whether you try to make all your apparatus. I do. If you have any stunt or bits of apparatus that I could make, I should be very pleased to have details.

I will now send you a few circuits and I hope you will be able to try them out, and let me know of the results.

I must close down now. I hope to receive a letter from you soon.

Yours truly,
Philip Signey Weggitt.

Please address P. S. Weggitt, 35 King's Rd., Bournemouth, Hants., England.

As we go to press, we have another letter from an English radio bug which is highly interesting. We regret that it came too late to feature it with Mr. Weggitt's letter, but in next month's Pickups Pages will have this item in its contents. Mr. Weggitt's circuits are shown on various pages herewith and fans who desire more detail are invited to write him. Interesting, this radio game—isn't it?

A circuit from P. Edward Chapman of 805 Preston St. N., Philadelphia

should be of interest, so we publish the following:

We have been flooded with letters concerning Mr. Chapman's "Selectdyne" and as a result we are publishing his communication, which will no doubt relieve many of the DTs interested in his circuit and the results.

RADIO AGE,
Gentlemen:

Having fallen victim to your good magazine, which I purchased in June for the first time, you may now count on me as one of your regular readers, for I certainly enjoy reading the technical information you offer your readers.

In reading the June issue, I was very much interested in the diagram of a circuit called the "Superdyne," submitted by M. C. Williams, which resembles very closely a circuit I evolved in 1923 and have been using successfully for eighteen months.

Having had such remarkable success with my circuit (which was published in one of the Philadelphia newspapers) I was overwhelmed with visitors and correspondence, and in order to relieve the situation, I had a few hundred blue prints of my circuit made and gave them away in an effort to help those who wished to build this type of receiver.

My circuit is extremely sharp in tuning, and gives wonderful volume from stations 2,000 miles away. I am enclosing herewith a copy of the circuit, which I call the "Selectdyne" which is the result of about three years' experimenting. Only the best material (Ed. Note: From an electrical standpoint and a mechanical aspect, of course) is recommended for maximum results. I am also enclosing a list of stations which I have received, in hopes that will entitle me to membership to the "Dial Twisters."

Using a loop with this circuit, I

have heard stations 500 miles away on the horn without using headphones.

I trust this circuit may prove of interest to you, and I want to thank you in advance for any interest you may show in the matter.

Yours very truly,

P. EDWARD CHAPMAN.

805 Preston St. N.,
Philadelphia, Pa.

Selectiveness

The receiver I have found to be very selective, reading from my log under the date of August 19, 1924, as follows—Heard music and announcements from KOB and KLX on loud speaker, although both were operating on 360 meters wavelength. Time, 7:10-7:30, Pacific standard time. As to close tuning, any station may be tuned out by turning the

Beach, KGO, Oakland; KPO San Francisco; and twice KGW, Portland, when broadcasting their afternoon programs. I have found by connecting a twenty to twenty-five foot length of No. 18 (B & S gauge) silk covered wire, stations at right angles to the small internal loop come in with sufficient volume to operate a loud speaker, in fact is little difference whether headphones or loud speaker is used. I always use loud speaker in logging new stations.

The following are the stations I have received at least twice on the loud speaker since Jun 15, 1924:

KDPT.....	San Diego, 8 miles
KFON.....	Long Beach, 100 miles
KFI, KHJ, KJS, KFSG, KNX.....	Los Angeles, 120 miles
KPO.....	San Francisco, 456 miles
KGO, KLX.....	Oakland, 470 miles
KOB.....	State College, N. M., 595 miles
KFPT.....	Salt Lake City, 625 miles
KGW.....	Portland, 935 miles
KFOA, KTW.....	Seattle, 1,080 miles
KFKX.....	Hastings, 1,155 miles
WFAA.....	Dallas, 1,165 miles
CFCN.....	Calgary, 1,265 miles

Headphones

WTAM.....Cleveland, 2,000 miles

Five other stations have been logged, but I was unable to hear call letters because of static.

This list is very short, but I don't think it is so bad considering I am perched down here in the Southwest corner of little old U. S. A., and I hope it is good enough to land me among the "Dial Twisters" of RADIO AGE.

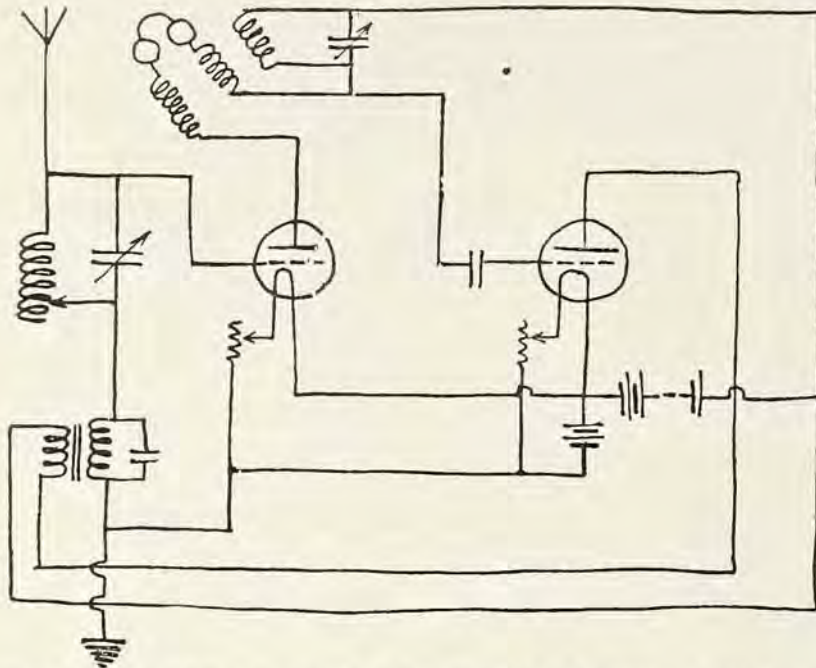
Yours truly,
Lloyd Stove.

Farwell Long, of Flint, Michigan is owner of a super-heterodyne, and he submits the following as the summary of his brief experience with a super-het. He feels that there are great possibilities in store for him.

RADIO AGE,
Gentlemen:

I have been reading the greatest little radio magazine commonly known as RADIO AGE every month.

(Turn to page 54)



Another type of reflex circuit which is very popular in England. Notice the queer arrangement of energy transfer between the plate circuit and grid circuit of the first tube.

Mr. Chapman's circuit is shown in an adjoining figure.

Box 363,
National City, Calif.

The Pickups Editor,
RADIO AGE

Dear Sir:

Upon reading the "Pickups" Department of RADIO AGE, I noticed that you made a request for information from readers who are owners of Super-Heterodyne receivers, so here goes

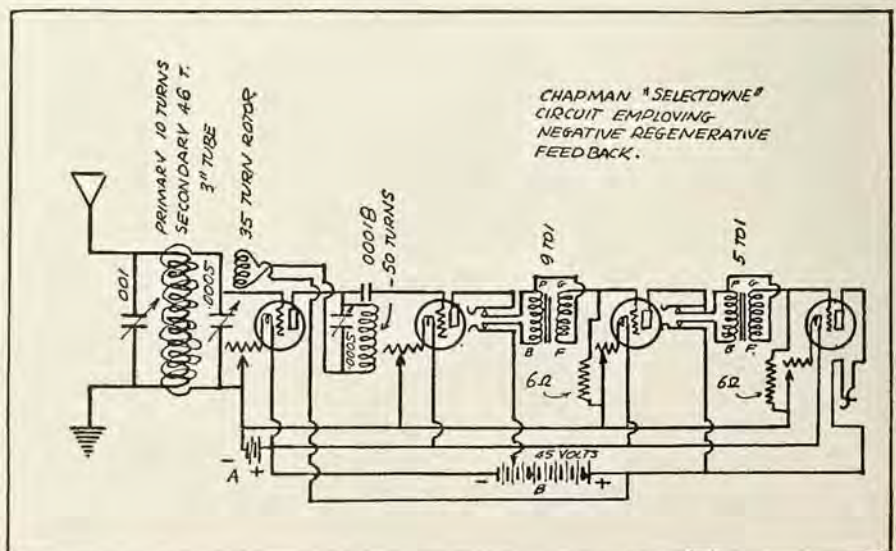
The second week of June, 1924, I purchased a Super-Heterodyne radio receiver which is a second harmonic regenflex receiver, and since I read your request for information, I have kept a record of happenings.

Upkeep

I have taken upkeep first because it is one of the important factors to be considered. The six dry cell radio "A" batteries used will last from one to two hundred lighting hours. The length of life depends upon use and periods of rest. Let's take an example: The receiver being used on an average of two hours a day, will last from seven to eight weeks or even longer. The length of life of the B and C batteries I do not know, as I have not as yet had occasion to change the ones that came with the receiver.

selector pointers either way, 1-16 of an inch. I have been able to separate the following stations so that they come in with no interference, although they are from five to ten meters apart in wavelength: WTAM, 390; KHI, 395; KFI, 769; WFAA, 476; and KFSG,

Although National City is in the static belt, as it is only twelve miles north of the Mexican border, I have succeeded in receiving KFON, Long



Pfanstiehl

Pure Inductances for Low Loss Receivers

The Pfanstiehl "Pure Inductance" type of winding is designed for supreme efficiency.

Much is being said about the necessity of good parts, especially of condensers. Inductances are of extreme importance for efficiency. Pfanstiehl Pure Inductances are good because:

1. Air-cored means no absorption of signal strength;
2. Stagger-wound means no appreciable distributed capacity;
3. Vernier control of adjustment means distance getting.

The Pfanstiehl variometer, with two 50-turn untapped coils as a variometer with **PERFECT RATIO OF INDUCTANCE**, sells for \$4.75 at your dealer's or postpaid. Order by number P-301 Variometer.

The P-300 Variocoupler is another efficient unit. Using this unit in our

Efficiency hook-up (furnished with unit) a Wisconsin radio fan picked up Hawaii! Let us suggest that you improve your favorite circuit with this vario-coupler, which sells for \$5.00 at your dealer's or prepaid by us.

The P-600 Pfanstiehl Oscillator for super-heterodynes oscillates sharply and steadily. In addition it improves the hook-up. It sells for \$6.00 at your dealer's, or we will send it postpaid. This is one of the most popular Pfanstiehl parts on the market.

Other Pfanstiehl Pure Inductances are:

	Turns	List Price	Wave Length
P-201.....	25	\$0.55	100-340
P-202.....	35	.59	125-470
P-203.....	50	.65	170-650
P-204.....	75	.74	220-960
P-205.....	100	.90	300-1300
P-206.....	150	1.10	470-1980
Pfanstiehl Ultra Audion.....		\$0.95	
Pfanstiehl Reinarts.....		1.75	



Pfanstiehl Variometer



Pfanstiehl Oscillator



Pfanstiehl Vario-coupler

Manufactured by

THE PFANSTIEHL RADIO CO.

Highland Park, Illinois

Chicago Office: 1001 West Washington Boulevard.

Telephone Haymarket 8010

TOWER'S

TOWER'S
WEIGHS ONLY 80Z
Scientific
Perfect Tone Mates

\$2.95
plus a few cents postage



OUR \$200,000.00 COMPANY STANDS SQUARELY BACK OF EVERY HEADSET

WORLD'S GREATEST HEADSET VALUE

Longer Cord (full 5 feet), Stronger Magnets, Higher Resistance, Increase of Sensitivity, Perfect Tone Mates
EVERY SET TESTED BY LICENSED RADIO OPERATORS

Send no money - Order on a Post-Card

THE TOWER MFG. CO. : 98T BROOKLINE AVENUE, BOSTON, MASS.

Scientific

Have noticed the absence (which is quite pronounced) of accounts of results with super-hets, neutrodyne and other multi-tube receivers, and believing that I can do a little share in contributing my experience, which is brief, I can help out somewhat in giving the rest of the bunch an idea as to what it really is to own and operate a big set.

I have an Ultradyne which is an improved Super-heterodyne, designed by R. E. Lacault. I am all wrapped up in it you might say, for my wife has to drag me away from it. It is only 3 months old, and has given me fair reception throughout the Summer, having received Texas in the early part of the Summer with good volume, though the static was bad. I have some poor parts in the set, but I am replacing them as fast as my finances will permit.

I am enclosing my list of stations heard more than twice over 400 miles. They are as follows:

Stations Heard by Farwell C. Long

WFAA, WBAP, WFAF, WGY, WLAG, WBZ, WRC, WOS, WHAA, WIB, WDAF, WHAZ, WDAF, KFEX, WOL, WMC, WTAT, WDAE, KFID, WHO, WCAP, WCAI, WDAF, WSAI, WLS, KDKA, WBI, WTAM, WHAS, KTW, WOC, WEA, WCN, WCAE, WABM, WCAP, WWJ, WLW, WCAI, WEBB, a grand total of 16,774 miles.

Pretty good for the last three months considering the fact that the house is full of people who are content with the programs from WCX, WWJ, and KDKA. I hear these stations nearly every day when they are on the air. I do not expect to make the grade for the DT with this list but hope to soon as I am going to try for a record that makes your hair stand on end.

I have enjoyed reading the Dial Twisters' columns and couldn't resist the temptations to do my stuff. I think I have said enough so will sign off. I am not a subscriber, but you may expect my remittance any time, for there is no other radio magazine than RADIO AGE.

Very truly yours,
FARWELL C. LONG.
1122 Church St., Flint, Mich.

We suppose when Mr. Long really gets the hang of that Ultradyne of his, he'll tear out the broadcast list of RADIO AGE, and make the notation on the margin "Enclosed is a list of the stations I have heard. Omit the stations checked, and you have my log." Atta' boy, Mr. Long!

And now we're going to give you the belated report of the August Static

Busting Contest. The biggest list came from John Mullikin, as follows:

Pickups Editor,
RADIO AGE.

Below is my list for August. There are 121 stations in all.

KDKA, WCAE, KSD, CNRO, WHK, WGI, WFI, WRC, WTAS, WNAV, WEBJ, WJAX, WMH, WTAR, CKAC, WEAD, WSB, WJAZ, CHYC, PWX, WGBA, WGN, WLY, WTAM, WOO, WHAA, WJZ, WTAB, CHCB, WFAF, WAAM, WTAT, WMAQ, WCAO, CFCE, WSAI, WTAY, WWJ, WQQ, WIP, WJAR, WF, WDM, WEAL, WCAI, WQJ, WLS, WJAS, KOP, KYW, KFEX, KQV, WCAP, WABM, WDAF, WEAQ, WOAW, WOR, WOS, WCX, WBZ, WBDL, WHAM, WHAS, WBBR, NAA, WCBQ, WDAF, WEAN, WEBH, WGR, WGY, WTAR, WJY, WCAQ, WSBQ, WABF, WNYC, WHAK, WPAW, WLAU, KJZ, WFBH, WBS, WBY, WDBH, KENF, GKW, 3ALK, IAAE, 3XAV, 3SB, 3CAB, 3AKV, 3LX, 3AHP, 3RS, 3CIR, 3BE, 3BFE, 3CEL, 3LAB, 1OM, 2AIG, 8BVZ, 8AMG, 8DRT, 3AR, 2WH, 2CV, 9BQT, 9AM, CJSC.

I heard Havana four times. My set can tune to low and high wave lengths. I picked up an aver-

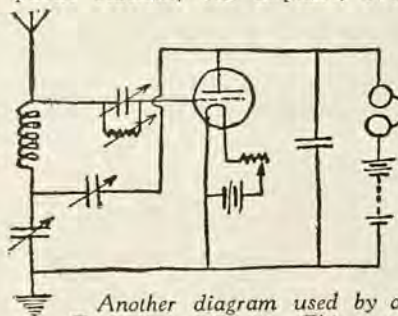
age of 3 amateur stations a day but lost many of them.

Yours very truly,

John Mullikin,
128 Bates St. N. W., Washington,
D. C.

SECOND PRIZE LETTER AND LIST RADIO AGE, Gentlemen:

In the August issue of RADIO AGE you stated that there would be a "Static Puncturing Contest" and for everybody to send in their list of stations for August. Below are the stations I have logged since August 1, 1924 to September 1, 1924. In all there are eighty-four radiophone stations, one airplane, one



Another diagram used by our English contributor. This circuit is a form of Ultra-Audion with a capacitive feedback control.

army station, two ships, and thirty-four amateur stations. I used a Westinghouse RC set, a 90 ft. aerial 26 feet high, and heard a great many of the stations on my loud speaker.

Yours very truly,
WM. A. NEELD.
238 N. Galloway, Zenia, Ohio.

KGO, PWX, CNRO, KDKA, KFEX, WHB, WHK, WIP, WJAX, WJZ, WLS, WJAS, KSD, KYW, WBAY, WHAZ, WHAS, WGY, WGN, WGR, WEAN, WFAA, WDBS, WFAF, WCX, WDAF, WCBQ, WCAP, WBZ, WCAE, WMAQ, WNAC, WMC, WWJ, WTAM, WTAS, WRC, WSB, WQJ, WOS, KFEX, WBR, WRK, WBAA, WBN, WHN, WABX, WNYC, WTAB, WOO, WOC, WOAW, WOR, KFEX, KFEX, WSAI, WMH, WLW, WQQ, WEAQ, WABP, WTAY, KOP, WMAN, KOV, WBT, CYL, WEBB, WSAI, WMAF, WJAR, WGI, WCK, CNRT, WOI, WJY, WAAM, KFEX, SES, KDBZ, WEA, AW5. The amateurs are as follows: 8alk, 8awn, 8wl, wml, 8cuo, 8lbr, 8lbnk, 8alk, 8bnz, 8aln, 8bnz, 8lbn, 8dor, 8ew, 8oiz, 8oiz, 8of, 8evv, 8dmr, 8eag, 8azg, 8dc, 8cl, 8bml, 8boc, 8qj, 8bd, 8baw, 8lcm, 9wc, 8dbj, 9eis, 8ef.

Mr. Neeld explains that the amateurs are not phone stations—he heard them in code. He says he is not a transmitting "ham," but is a BCL who has learned the code, and has much fun copying. His list contains close to 125 stations, and certainly deserves a prize. We like that code work, since we know the terrible interference which exists down to 200 meters, and also the fact that copying a weak ham signal with static pounding in is a real accomplishment. More power to you Mr. Neeld, and may your signals never fade.

Mr. Neeld hadn't seen our magazine before the August issue, and therefore was quite surprised when he found just as others have found that it was a real book. It may be of interest to print the following letter from him, received just before his entry into the static puncturing contest, since it tells a little about past records, and also some of his other accomplishments.

RADIO AGE, Gentlemen:
I bought a copy of RADIO AGE this afternoon at the newsstand and say—it sure is some radio magazine. I was greatly interested in the Dial Twister's Club.

Here is the record of my Westinghouse RC Set. I have heard 700 stations; 450 radiophone stations; 250 amateur stations, since May 1, 1924. I have heard KFHS, Lihue, Hawaii, PWX, Havana, WKAQ, San Juan and CYL and CYB of Mexico City besides hearing all the states except Montana, New Hampshire and Vermont. I have also heard every amateur district and four provinces in Canada.

I heard 53 stations one night from 7 to 12 p. m. with a total of 43,000 miles.

I have acknowledgments from over two-thirds of the stations I have heard.

(Turn to page 71)



Howard Standard Parts For Clear Reception

Howard Rheostat With Dial Control

Carrying capacity 1-5 amperes; beautiful 2 1/8 in. dial with 100 point markings covering full sweep of contact arm. Made in resistances of 6 1/2, 25, 40 and 60 ohms. Each **\$1.10**

Write for log sheet and further information on our full line of parts, including Rheostats of all kinds, Potentiometers, Positive Contact sockets, Grid and Bridging condensers, Binding Posts, Multi-Terminal Plugs, and Neutrodyne Receivers

If your dealer cannot supply you with Howard Parts send remittance direct to us.

THE HOWARD RADIO COMPANY, Inc.
4248 No. Western Avenue Chicago, Ill.

K H J, Los Angeles, Cal.

We are glad to confirm your report of reception of our program.

John S. Daggett
"Uncle John",
Mgr. Times Radio Staff

GENERAL ELECTRIC COMPANY
Pacific Coast Broadcasting Station KGO
5555 E. 14th St. Oakland, Cal.
Sept. 11, 1924.
Mr. T. J. Kennedy
1360 University Ave., New York, N. Y.
We are glad to confirm your reception of KGO on the evening of Sept. 6 as we were broadcasting the opera "Carmen."
We always appreciate hearing from our radio listeners and hope that you will be able to pick up KGO regularly.
Yours very truly,
Jennings Pierce
Radio Broadcasting Pub. Dept.

K L Z, Denver, Colo.

We are pleased to acknowledge receipt of your report of reception of our phone station. We have placed a tack in our map for you.

Reynolds Radio, Inc.

DX Fans! Confirmations Stop All "Doubting Thomases"

Confirmation of Stations Received from New York, N. Y., with

KENNEDY TUNER

DX Fans! If you want real results, get a KENNEDY TUNER and HAVE THE WHOLE U. S. A. AT YOUR FINGER TIPS.

Only one dial to get stations and the other to increase or decrease volume. Kennedy Tuner is used in place of variocoupler, variometer and honeycomb coils, saving the cost of over \$9.00 worth of unnecessary junk that is in most receiving sets, and no dead end losses.

KENNEDY 500 TUNER
Including Globe Trotter Diagram

GUARANTEE:
If not satisfied after 30 days, we will cheerfully return your money.

Send for Free Diagram

T. J. KENNEDY

RADIO GLOBE TROTTER

1360 University Ave., New York, N. Y.

K F I, Los Angeles, Cal.

Thanks for your letter received. Yes, "The Minuet", by Louis Parker, was broadcast from the Anthony station during the late program.

Yours, Radio KFI

GENERAL ELECTRIC COMPANY
Pacific Coast Broadcasting Station KGO
5555 E. 14th St. Oakland, Cal.
Sept. 4, 1924.

Mr. Vincent T. Kenney
124 W. 96th St., New York, N. Y.
We are glad to confirm your reception of our late program from the Hotel St. Francis on the morning of August 27th.
We are always glad to answer any questions of our radio friends and hope you write in often with your comments.

Yours very truly,
Jennings Pierce
Radio Broadcasting Pub. Dept.

2-L O, London, England

We beg to acknowledge your reception of our program. You're faithfully for the British Broadcasting Co., Ltd.
Jr. Director London Station, C. C. H. King

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Worm Drive Vernier
Finest Condenser Made
and the
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NEWARK, N. J.

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JUST SEND A POSTCARD YOU GET absolutely free—the A-K "Library of Latest Radio Literature," written by foremost radio authorities. Contains HUNDREDS of valuable wiring diagrams, HOOK-UPS, illustrations, articles, data, etc.

EXPLAINS in clear, understandable language the popular new circuit: reflex, neutrodyne, phonyform "nameless" super-heterodyne, etc., and how to build sets. Covers long and short wave amplification, push-pull and audio amplifiers. Latest information on multitude of other radio subjects. **LOG BOOK INCLUDED FREE.** Also our latest Radio Catalog featuring **NATIONALLY ADVERTISED** lines at attractive savings. Write today—offer limited. Address
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Dept. P-11163 W. Washington St., Chicago

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INC.

NEXT TIME INSIST ON

"COMET"
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At all good radio stores or write

ELECTRICAL MFG. AGENCY
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BAKELITE

TRADE MARK REGISTERED U. S. PAT. OFF.



Western Electric and Bakelite

In each of these Western Electric Telephone Head Sets is a molded Bakelite terminal block.

The use of Bakelite by this company, with its years of experience in the manufacture of electrical communication apparatus, is evidence of its value as an insulating material.

Bakelite dials, panels, variometers and other parts are standard radio equipment. Mechanically strong, unaffected by atmospheric changes, and beautiful in appearance, they may be depended upon to render years of good service.

Send for our Booklet H.



BAKELITE CORPORATION

247 Park Avenue, New York, N. Y.
Chicago Office: 636 West 22d Street

Send for our Radio Map

The Bakelite Radio Map lists the call letters, wave length and location of every broadcasting station in the world. Enclose 10 cents to cover the cost and we will send you this map. Address Map Department.

THE MATERIAL OF A THOUSAND USES

New York Radio Fair Shows Stability

By Frederick Smith

What are the big surprises in radio development, as shown in the exhibits of manufacturers in New York from September 24 to 28?

That is a question which was in the minds of scores of thousands of radio fans who paid their way into Madison Square Garden to see the Radio World's Fair.

It is the same question that is being asked all over the radio world by those who were not privileged to see the displays of equipment at the eastern show.

There are two answers to the question. One big surprise to those who had thought that radio interest had reached its peak was the vastly increased number of those who want radio sets. The show in New York broke all previous records for attendance.

It is confidently predicted that the Chicago show, which opens in the Coliseum on November 14, will shatter the New York mark.

Another outstanding radio development is the uniform increase in quality of sets and accessories. The most casual observer in Madison Square Garden did not fail to carry away the impression that persistent and effective efforts have been made to bring the excellence of transmission and reception to the highest point possible.

Industry Is Elevated

In seeking the best tone quality, the greatest durability of mechanism, the lowest percentage of required technical knowledge for the operator and a finished appearance of the whole apparatus, the manufacturers have added immensely to the atmosphere of radio stability.

There were no circus stunts in the big radio fair. It is true that both eastern and western manufacturers displayed receivers which, for selectivity and easy operation, are surprisingly far ahead of the sets in use last year.

There were sets with single control, sets that tune out the most stubborn interference with but a turn of a few degrees on the dial. There are sets that may be hooked up to the electric light sockets, portable sets, sets that rest elegantly in polished hard wood consoles and sets that hide conveniently away in talking machines and ride about on what used to be dinner wagons.

Sales to Increase

All of this has nothing in it that should discourage fans. On the contrary it should be encouraging to fans and manufacturers alike. It tends to show that, instead of revolutionary changes, indicating that radio conditions have been chaotic, there is only solid improvement. The old circuits are still our best friends. The most forward-looking manufacturers and engineers simply have brought them to a greater excellence.

KRACO RADIO AERIAL MASTS

A Permanent All-Steel Six-Foot Aerial Mast

Finished in a deep, rich shade of green that adds a touch of beauty to your home. The KRACO aerial mast was designed so as to meet the objection of landlords who prohibit anything for its appearance that might mar the appearance of their buildings. Durable and sturdy, it never will warp or break.

Dealers and Jobbers Write for special discount sheets for ordering in lots of half dozen and up.

Can Be Easily Attached To Any Type of Building or Down, Flat or Cable roof, side wall, post or tree—in fact anywhere, in just a few minutes. The popularity of the KRACO aerial mast is shown by the rapidity with which it is replacing thousands of flimsy tip amateur constructions.

Order KRACO Masts direct from this ad or purchase them at your nearest Radio Dealer. Wt. 17 lbs.

Price \$3.75 EACH FOR CHICAGO

Fast Seller
CAN BE ADJUSTED TO VARIOUS POSITIONS

Kedmont Mfg. Co. 1351 Cornelia Ave., CHICAGO, ILLINOIS

Dealers & Jobbers—Send for Attractive Proposition

PRECISE TRANSFORMERS

"NONE BETTER"

Model 285A

Price \$5

Recommended by leading radio experimenters everywhere.

THE BARSOOK CO.
53 W. Jackson Blvd. CHICAGO



Puts the Joy in Radio

After all, what is sweeter to your ears than the music from some DX Station coming in on the loud speaker, clear and undistorted? To insure amplification without distortion, use the "HEGEHOG." This marvelous little audio transformer, half the size of any other made, is different in design—the most efficient construction known for transformers. It has an exclusive self-shielding feature that shuts out foreign noises. Unsurpassed for volume and tone quality. Saves space, mounts anywhere and easy to connect. Ideal for portables.

RATIOS 1 TO 3, 1 TO 4 AND 1 TO 5 \$9.50
RATIO 1 TO 10 \$4.00

Write for Free Bulletin No. 94

showing complete line of Premier Quality Radio parts. Ask your dealer for Premier Free Hook Ups. If he does not have them send his name and receive a set free.

Premier Electric Co.
3803 Ravenswood Ave., Chicago

MAKER OF

Premier

Quality Radio Parts

You need not wait to buy a receiver, in the fear that if you buy now some inventor will put something on the market that will make your old set seem obsolete. Vast sums in the hands of radio buyers have been held back waiting to see whether it was not "too early to buy."

At the Waldorf Astoria banquet several distinguished engineers addressed the radio trade representatives. Their themes concerned improvement in receiving sets and improvement in broadcasting. They offered nothing radical, nothing revolutionary.

The answer of the New York radio show could be given in one word, "stability." Better financing, better engineering, vastly better results, now benefit the individual who listens in.

Chicago Show in November

The eyes of the radio world will be focused on Chicago from November 18 to 23, when the Chicago Radio Show will open at the Coliseum. Radio fans from all over the Middle West have announced their intention of being "among those present" when the doors are thrown open to those who are eager to see the advances made in radio manufacturing during the past year by local, Eastern and foreign factories.

One of the big features of the New York show will be repeated in Chicago; namely, two contests for amateur builders of receiving sets. Prizes ranging from cash awards to radio sets and parts will be given the lucky winners.

New Inventions There

Displays of new inventions from radio amateurs, experts and other experimenters will be another feature. All entrants in the various contests must submit their apparatus on November 16, at the Coliseum, in order to be declared eligible.

Although the New York Radio World's Fair attracted nearly 20,000 visitors daily, manufacturers and others connected with the Chicago Show declare it will far surpass the Manhattan exhibition, due to the constantly growing interest in radiophone reception in Chicago and vicinity during the past eight months. Accordingly, capacity crowds are expected daily.

(A picture of one of the prize exhibits at the New York Show will be found on page 37, this issue.)

New Crosley Station 25 Miles From Cincinnati

Cincinnati, O.: Radio engineers and surveyors selected Harrison, Ohio, as the ideal place for the new powerful radio broadcasting station of The Crosley Radio Corporation.

Locating the powerful new five-kilowatt WLW broadcasting station 25 miles from the new studios in Cincinnati and away from thickly populated districts will not interfere with the majority of radio fans. Population distribution maps were prepared before the final selection was made for the station. Radio fans will find tuning to the powerful equipment at Harrison extremely sharp as a result of using the very latest apparatus developed for radio broadcasting.



A \$20.00 Transformer for \$7.00

BEFORE Karas developed this perfect transformer, any transformer that could deliver TRUE music would necessarily have been so large and would have cost so much to build that \$20 would be a cheap price for it.

Over a year ago our engineers tackled the problem of reducing both size and price without sacrificing any of the qualities of such an ideal transformer. Through their untiring efforts and the expenditure of many thousands of dollars, the Karas Harmonik is now a reality!

The price of this ideal transformer is \$7.00—no more than the price of other transformers that used to be considered best. Only long experience and a highly efficient manufacturing organization could effect the economies that make this price possible. We gained this experience making hundreds of thousands of a very popular brand of transformer, on contract during the past 3 years. Before that we had been making precision electrical instruments for 30 years.

When you first hear the full, round natural tones of speech or music amplified through the

KARAS Harmonik

you will be astonished at the vast improvement in reception we have brought about.

What is it that has made this wonderful change? The scientist will point to the nearly straight line amplification curve produced by the Karas Harmonik in laboratory tests. He will show you that the low, as well as the high, audio frequencies are amplified by the Karas Harmonik uniformly with the middle tones. He will explain that this even amplification brings out the all-important Harmonics of musical tones—and that the presence or absence of Harmonics makes all the difference between music and noise.

Our Special "Money Back" Offer

After all, the one real test is what your own ears tell you. Put a pair of Karas Harmonik Transformers in your old set, or in the new one you plan to build.

Test them thoroughly for 60 days. Then if you are not satisfied that Karas Harmoniks deliver a far finer musical quality of reception than you have ever heard before, send them back and your money will be refunded at once. All dealers we have been able to supply so far are authorized to make you this same offer. Send no money. Just fill in the coupon below. Please write very plainly.

Send No Money with this Coupon!

Karas Electric Co., 4040 N. Rockwell St., Dept. 58-98 Chicago
Please send me pair of Karas Harmonik All Stage Ratio Audio Frequency Transformers. I will pay postman \$7 apiece, plus postage, on delivery. It is understood that I am privileged to return the transformers any time within 60 days if they do not prove entirely satisfactory to me, and my money will be refunded at once.

Name

Address

City

Dealer's Name

Dealer's Address

If you send cash with order we'll send transformers postpaid

To Jobbers and Dealers

Distribution of Karas Harmonik Transformers through regular jobbers and dealer channels is being carried out as rapidly as the output of our factory permits. Write us for test records, discounts, etc.

To Set Manufacturers

We positively prove that Karas Harmonik Audio Frequency Transformers will vastly improve the musical quality of your set by any form of test you wish to impose. Write or wire us and arrangements for tests will be made promptly.



A Speaker of Distinction VOLUME, CLARITY, BEAUTY

14 inch Pyralin Bell. Aluminum Sound Column
No. 205B-Black Pyralin Bell.....\$22.50
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Designed and built by experts, for 30 years makers of telephones.

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Main Storage "B" Batteries

Soon save their cost, improve reception, and are more satisfactory. Rechargeable at home. Rubber tray. High Grade battery at popular price. Be late to yourself, get our proposition before buying. Write now.

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Everyone interested in radio should have this

68-page book of approved
parts and sets—it's free!

Ward's New Radio Catalogue

ONE copy of Ward's New Complete Radio Catalogue is yours Free—you need merely to write for your copy.

It shows you everything new in Radio, everything that has been tested and approved by the Radio laboratories. Simple instructions are furnished with every Ward receiving set enabling you to put up and operate it without outside help.

And the prices on everything in this book are surprisingly low!

A Price and Quality Guide

Study this Catalogue every time you need anything in Radio, whether parts or a complete set. See what is the lowest price for standard quality goods.

Everything shown in this Catalogue has been selected by an expert. Everything is standard. Remember at Ward's we never sacrifice quality to make a low price. Yet our prices are always low because we sell direct to you by mail—and without the usual "Radio Profits."



Write for
Your Free Copy

Bring the Joy of Radio Into Your Home

You can get the most enjoyment out of Radio only by using standard, high grade equipment. You know what you are getting when you buy at Ward's. You are sure of high quality as well as a big saving when you order from this book, for our Radio equipment is sold under the same liberal guarantee we have made for 52 years on every article sold by Ward's—"Satisfaction Guaranteed or Your Money Back."

Write for your free copy of the new Radio Catalogue—Write to our house nearest you and address Dept. 43-R.

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The Oldest Mail Order House is Today the Most Progressive!

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OPERADIO

Everything You Want in a Radio Set

PERFORMANCE—BEAUTY—AVAILABILITY—the three things you really want in a radio set, are offered to a new degree in the 1925 Operadio.

The efficiency of this compact receiver has called forth the highest praise—clear natural tone, range, volume and selectivity, simplicity of operation and reliability under severe conditions.

In its attractive new case, the Operadio conforms to the most discriminating standards of good taste—harmonizing with the most beautiful surroundings.

And, in addition, the Operadio is so compactly designed that it may be readily carried to any part of the house or easily taken along when travelling or visiting.

Write for an illustrated folder giving complete particulars.

THE OPERADIO CORP.
8 So. Dearborn St. Chicago, Ill.

OPERADIO

"Brass Pounding" Along the Coast

(Continued from page 31)

"keep to the left" rule. Jamaica is always verdant, in contrast to countries farther south which often get brown and barren during the dry season. The Jamaican station was "JCA" and had a funny foreign set with only about three parts to the sending outfit. It used a very low voltage at the spark gap—they told me only 600. I know there was no step-up transformer and only a 600-volt direct current dynamo. I also know they had the deuce's own time making the blighter jump in rainy weather, but when it finally would get across the gap of .009 inch it was good for two or three hundred miles day time. The "ops" were extremely English and very skeptical. They point blank refused to believe accounts of my distance work and as they never listened after six p. m. they had no idea what really was done.

Two of our special trips took us to Panama and I met up with the string of United Fruit stations that keep that company in touch with their large fleet of ships as well as handle much traffic for the U. S. that would otherwise bear heavy cable tolls. Theirs was a formidable fleet. At Bocas del Toro I spent some time with Smith, "op" from "B," who regaled me with many a comical tale of life in the tropics. One of these stories I remember vividly. He said that one morning as he started calling Limon, "X," there was a terrific commotion back of the jar rack, sounding like the setting off of a bunch of large firecrackers combined with the release of a giant clock spring. Startled, he stopped sending, then as quiet reigned he doubted his senses and pressed the key again. Immediately came another loud clatter and like shots from a gun a pair of good-sized monkeys sprang at and past him and through the window, screen and all. 20,000 volts had pepped up the animals considerably and they made wild time back to their habitat, the jungle, close by. I would not vouch for the gospel truth of this yarn, but it is no wilder a tale than I have lived through many a time in person, as I will relate in the course of my later accounts.

While on the "UG" I tried out the famous "break key" originated, or at least introduced to us, by Opr. "PK," Pickerell, of "WA" (Waldorf-Astoria) fame. This consisted of placing your receiving set permanently in the aerial and ground, shunting same out by a "lightning arrester" with about one square inch of sparking surface. Contacts on the key also cut out or shunted



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Insist on "STURM BUILT" products. If your dealer cannot supply you, write us direct.

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RADIO CABINET FACTORY**
321 S. Jefferson St. Chicago, Ill.

your detector. "WA" and "BS," Philly, worked this fine and one dash from "BS" would be heard at "WA" instantly, and he would stop to see what was wanted. This might have been OK at a nice dry land station, but the first time I pressed the key on the "UG" I got a jolt through the head set that sent me clear across the room. I found that the receiving set was altogether too much connected to the business end of the transmitter and the only way I could handle it at all was to crouch high on the chair, absolutely clear of floor, table and everything else and reach over carefully to tap the key. At that, I was full of shocks at every dot and I gave it up. Probably "PK," who, I read, is Chief on the Leviathan will drop me a line and tell me where I had the thing hooked up wrong.

A Change in Ships

MY transfer to the "Admiral Farragut" put a sad crimp in my wireless activities. The set was a Shoemaker, finely built and containing many innovations, but the ship's dynamos were in bad shape and every time I would start my motor the ship would be plunged into darkness until an engineer would rush over and give 'er more steam.

Divorced from my first love, I awoke to another interesting phase of this sea existence—that of the social possibilities present in contact with people from all the world. However, another barrier presented itself in the ideas of friend Captain on the subject of wireless operators and ship society, said ideas running anti-clockwise to my own. This stirred up considerable unrest in my soul and I began agitating with H. J. H. for a transfer to some New York ship where there was social life worth mentioning and a captain to match.

On my last fateful trip on the "Farragut" I left port in a wrathful state of mind. Up to the last minute I had fondly hoped for a transfer, and none coming I perpetrated some mental malpractice on the poor old "Farragut" by wishing that she would slam into something and have to go back. Of course, I was only thinking of some minor smash in the river and little did I know how vigorously my evil wish was to be granted. At 12:20 Friday morning we loosened a bit of inferno on the waters by crashing full speed into the passenger-laden "Merida," who had slipped up on us in a fog bank some hundred wet miles from shore. Climbing out of the debris of my aerial, I joined the ship's officers in fighting fifty crazed Spanish firemen away from the lifeboats—but Ye Editor says I am to tell you about that next month.

Haynes-Griffin

RADIO SERVICE, Inc.

145 W. 45th St.
New York

MAIL ORDER DEPARTMENTS

111 S. Clark St.
Chicago

The Super-Heterodyne Made Easy



A. J. HAYNES,
Associate,
Institute Radio Engineers

The Super-Heterodyne is no longer a mystery. The "Rolls-Royce of Radio Receivers" has been successfully built and operated by thousands of average radio fans who have read

"Super Success"

This new booklet, written by A. J. Haynes, tells the whole story of the Super-Heterodyne in language that the layman can understand.

It contains the information gathered by Mr. Haynes in his year of experimentation with twenty different "Supers". And it is complete, from the theory of the circuit down to detailed instructions for building and operating a "Super" exactly like the one Mr. Haynes uses in his own home. The price is 25 cents. Send to our nearest store for your copy.

A Brand New Radio Catalog Free to You Every Month

Thousands of fans in the New York and Chicago districts depend upon our stores in these cities to keep them informed of the newest radio developments.

They know that Mr. Haynes and his assistants test every new set, circuit and part as it appears. Then, if the apparatus is efficient and if it fills a real need, it is immediately offered to our retail customers.

Now, no matter where you live, you can enjoy this same up-to-the-minute radio service. Once a month, we issue a catalog called "Radio Dispatch." It is edited personally by A. J. Haynes, and every edition contains entirely new material.

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Radio Dispatch

The Last Word in Radio Development

Published Monthly by Haynes-Griffin Radio Service, Inc.
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Here is a new publication for Radio experimenters. A. J. Haynes tells Radio fans how they can keep up with the latest developments in Radio Engineering.

It contains information on the latest radio developments, including the Super-Heterodyne, and is a must for every radio enthusiast. It is published monthly and is available to you for the price of 25 cents. Write for your copy today.

Subscription price is \$2.00 per year in advance. Single copies 25 cents. Write for your copy today.

I want to keep in touch with every new radio development. Send me "Radio Dispatch" every month.

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Build Your Own Neutrodyne
Easy to Build—Easy to Operate

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| 1 7x27 Drilled Panel | 1 Double circuit jack |
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Price \$34.75

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20 FT MAST

Install this steel aerial mast for greater range and better results. Neat, substantial construction. 20 Ft. Mast, \$10. 40 Ft. Mast, \$25. 60 Ft. Mast, \$45. Freight prepaid if remittance is sent with order—otherwise C. O. D. Write for circular.

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Coming—The 1925 ANNUAL!

SUPER-HETERODYNE
Ultradyn—Haynes Griffin—Remler
Dealers: Send for Discounts

HUDSON-ROSS
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New! Scientifically correct and guaranteed!



hand calibrated
Unless grid potential is correct, incoming signals will be blocked. You can set Fil-KO-Leak for a specified resistance and adjust for best results! Hand calibrated and doubly checked over the operating range for all tubes—1/4 to 5 megohms. Unconditionally guaranteed for service and accuracy—not affected by atmospheric conditions or wear. Markings are read through panel peep-hole. Table mounting bracket furnished.

2.00
In Canada \$2.75

Terminal posts spaced to fit the standard grid condensers.

FIL-KO-LEAK
SCIENTIFICALLY CORRECT
VARIABLE GRID LEAK

—with battery switch



And at no extra cost! Fil-KO-Stat gives perfect control of any type tube in any hook-up—maximum signal strength—longer tube and battery life. Stops tube noise. Brings in DX stations you never heard before. Switch attaches to regular Fil-KO-Stat mounting screws.

2.00
In Canada \$2.75

FIL-KO-STAT
SCIENTIFICALLY CORRECT
RADIO RHEOSTAT

—with \$100 guarantee



Protects your set from lightning or we pay you \$100 or repair the set. That's our guarantee. "Umbrella" shield keeps dust, moisture, etc., from the hermetically sealed Bakelite insulation. Maximum reception assured, because all radio impulses reaching antenna reach your set. No leakage losses.

1.50
In Canada \$2.05

FIL-KO-ARRESTER
SCIENTIFICALLY CORRECT
RADIO LIGHTNING ARRESTER

Simple - Sure



Made entirely of non-magnetic metal. Wipe action contacts, assuring clean, sharp "make and break," are positively insulated from the nicked brass housing and knob. Scientifically correct to avoid current leakage and added capacity. It carries the usual Filko guarantee for Radio Parts.

50c
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FIL-KO-SWITCH
SCIENTIFICALLY CORRECT



MADE AND GUARANTEED BY
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HARRISBURG, PA.
New York Office, 220 W. 34th Street

Send 2c stamp for booklet "Improved Reception Through Scientific Tube Tuning" and learn how to get the most out of your radio receiver.

Days, R.A. 1124

Who's Who
in Radio

World War Experience Aids
Rauland

Some of the most successful men in the radio business today owe their good fortune in large measure to experience, both executive and technical, acquired as officers in the Signal Corps of the U. S. Army during the World War. Conspicuous among these is E. N. Rauland, president of the Rauland Manufacturing Company of Chicago.

Although Mr. Rauland has been an active worker in the radio field for the past fifteen years, it was during active service overseas with the famous 82nd "All-American" Division that he first visualized the enormous service which radio telephony might perform when the war was over.



E. N. Rauland

With the benefit of his long experience in charge of the entire coil winding department for one of the oldest manufacturers of insulated wire and coils of all descriptions, Mr. Rauland went into business in a small way in 1919 making transformers for radio use. He adopted as his trade name the name of the division with which he had served, and it was but a few months until All-American Transformers were in use all over the world. Statistics compiled from the record of business done, by the larger distributors now prove that All-Americans are in very truth the largest selling transformers in the world.

"The greatest need in radio at the present time," said Mr. Rauland recently, "is that of standardized radio sets of the highest quality, which do not 'bloop' and which can be had at a low price. The only way that quality sets can thus be sold is by leaving the hand work of wiring and soldering up the set to the purchaser himself—a task which is pleasure for him but expensive if done in a factory. The complete sets we are putting out this year are aimed exactly to supply this demand, since they come with the parts completely assembled and mounted, and nothing to be done but to connect the proper points by wires.

"Although we are just now getting into production on them, it looks from the orders already coming into us as though the All-American complete receivers will be sold out even beyond our best production capacity for several months to come."

Always Mention RADIO AGE When Writing to Advertisers



12 Cells
24 Volts
Solid Rubber Case

\$3.50 COD SPECIAL

INTRODUCTORY PRICE
For a limited time only, and to introduce this new and superior Storage "B" Radio Battery to the Public, we are selling it for \$3.50. Regular Retail Price is \$5.50. You save \$2.00 by ordering NOW. A finer battery cannot be built than the

World Storage "B" Battery
(12 CELLS—24 VOLTS)

To ten million homes with Radio Sets—and to countless millions of prospective buyers—this World Storage "B" Battery brings a new conception of battery economy and performance. Here is a battery that pays for itself in a few weeks—will last for years and can be recharged at a negligible cost. And you save \$2.00 by ordering now.

A Superior Battery Equipped With Solid Rubber Case
Has heavy duty 2 1/8 in. x 1 in. x 1-4 in. plates and plenty of acid circulation. Extra heavy glass jars allow ready observation of charge and prevent leakage and decrease of current. Holds its charge, while idle, at constant voltage. You will find this battery a boon to long distance reception. It does away with a great many noises so often blamed on "static." Mail your order today.

SEND NO MONEY
Just state number of batteries wanted and we will ship day order is received. EXTRA OFFER: 4 batteries in series 195 volts, \$13.00. Pay Express on arrival. 4 per cent discount for cash in full with order. Send your order NOW and save \$2.00.

WORLD BATTERY COMPANY
Makers of the famous World Radio "A" Storage Battery
1219 S. Wabash Ave., Dept. 81 Chicago, Ill.

SAVE \$2.00 BY ORDERING NOW!

LARGEST RADIO STORES IN AMERICA



509 S. State St. CHICAGO Dept. R.A.6

We guarantee **RADIO**
our new 68-page
Catalogue will save you money

on brand new fully guaranteed, nationally advertised radio apparatus. We buy up manufacturers' and government surplus stocks, jobber and dealer bankrupt stocks, etc. Our enormous buying power permits us to pay spot cash and get rock bottom prices—even way below manufacturer's costs. That's why our catalogue is crammed with thousands of wonderful radio bargains. That's why we Guarantee to save you money.



Write for your **FREE** copy today!

YOUR CRYSTAL SET
will work 400 to 1000 miles if made by my plans. No tubes or batteries. Copyrighted plans \$1.00. Satisfied customers everywhere. Particulars free

LEON LAMBERT
642 Kaufman Bldg. Wichita, Kansas

Watch for the story of your favorite
Radio Star in RADIO AGE.

Fighting "The Invisible Menace"

(Continued from page 28)

"Now, come with me; we'll see the rest of the fun," he whispered to Ruth. Then to Mr. Wellman he said: "We're going to see that that raid on that rascal's headquarters is handled properly."

THEY drove away together to the police station. At midnight they were parked in a dark, obscure position, from which they were able to see the "death ray" house—an old, two-story brick structure in a short street, two blocks from a business thoroughfare. With them were two plain clothes men and the owner of the house under suspicion.

They waited half an hour. Ruth discovered the first sign of something doing. It was a moonless, star-lit night.

"There's a light moving up there—see it?" the girl said, pointing upward to the west.

"Yes, that's it," Sid declared after a few moments' gazing in the direction indicated.

Five minutes later the "moving star," hovered over the "death ray" house; then it settled down onto the flat roof.

"Now is our time," said Sid.

Aided by the owner, they entered the house, with scarcely a noise to alarm the occupants. The only light in the building was in the upper story. Sid kept Ruth at the foot of the stairs while the two policemen ascended. There was not a suggestion of alarm in her manner. In fact, she indicated a desire to ascend with the policemen, but Sid forbade this.

Nothing was heard from the officers for about five minutes.

Then a voice called down to them: "Come on up."

A Radio Paradise

Sid and Ruth ascended. They entered a large room, a bewildering elaborate radio laboratory, with an array of massive transmitting coils, a large transmitting loop antenna, radio compass, and a mysterious looking transmitting set with an unusual type of tube. In the midst of these stood the policemen and their prisoner, and on a table near them was the miniature dirigible and the dummy package.

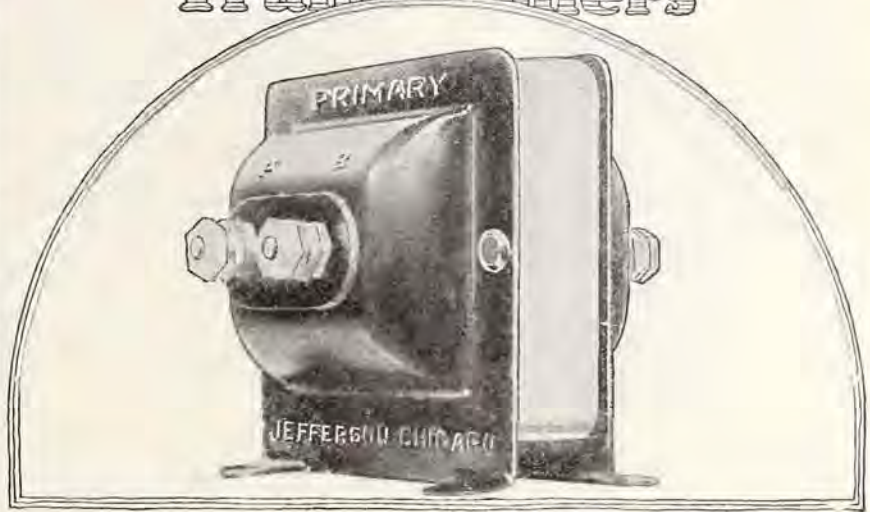
"He went up on the roof by an outside stairway and got this balloon and was opening this package when we stepped in on him," one of the officers explained.

But Sid was scarce listening to this detail. He was gazing at the prisoner, and the prisoner was gazing sullenly at him.

"Lawrence Vickers, slayer of Hugh Dodge," the former A. E. F. aviator exclaimed. "So you're the death ray blackmailer!"

But Vickers did not answer. Silently he accompanied one of the policemen to the station, while the other took

Jefferson Transformers



-the choice of experts

THE fact that Jefferson Transformers are preferred for experimental work by many radio experts and authorities is a clear indication of Jefferson supremacy.

Proper amplification—perfect reproduction—clear, undistorted reception; that's the why and wherefore! To radio authorities the country over Jefferson means the utmost in transformer performance.

Jefferson Transformers are the result of twenty years experience in the manufacture of transformers. To maintain a uniform quality every Jefferson Transformer is subjected to a series of exacting electrical and mechanical tests which must be successfully passed before leaving our hands.

Jefferson Transformers meet matched construction specifications.

Jefferson Electric Mfg. Co.
438 S. Green St. - Chicago

Manufacturers of



Jump Spark—Make and Break Coils
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Sign Lighting Transformers
Radio Transformers
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Bell Ringing Transformers

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PERFECTION CONDENSERS

Deserve Their Name

THEY are made of corrugated, hard aluminum plates, which provide closer spacing and greater capacity. As the plates are very strong and will not warp, short-circuiting is impossible. The end plates are of specially treated, hard rubber, which past experiments prove to be the best.

PLAIN and VERNIER

A Type for Every Circuit—Ask for Full Particulars

Perfection Machine & Mfg. Works
314-322 Market St. Newark, N. J.



Do you want a receiver that will positively reduce static? Read about it in December RADIO AGE. On the stands about November 15 with many other features.

Always Mention RADIO AGE When Writing to Advertisers



PATTERN No. 57

SET OWNERS

—Should check their batteries daily—run-down batteries take all the joy out of radio.

§ Avoid battery grief by using a Jewell No. 57. Sturdy, accurate and a real all around radio portable instrument.

§ We are anxious to get a copy of our 15-A radio instrument catalog into the hands of every radio "fan."

"A" and "B" battery voltmeter,
 $7\frac{1}{2}$ and 150 volts }
 or } **\$10.50**
 12 and 120 volts }

Order from Dealer

Jewell Electrical Instrument Co.

1650 Walnut St. - Chicago

"25 Years Making Good Instruments"

charge of the radio room to preserve its integrity as criminal evidence.

* * * * *

Need we say much more? It developed that Vickers had learned the secret of the "death ray" from the Germans while with the army of occupation following the war, and that the man servant in the Wellman household, as co-conspirator with Vickers, had "planted" the two charges which were exploded in the garden and in the bird house and the one discovered in a post of the rich man's bedstead.

Vickers had so perfected the "death ray" that by placing pre-arranged relays at definite places, he could concentrate the rays of high frequency electricity with such force as to destroy the insulation of the windings of electromagnets.

The charge of melnite which had been placed by the man-servant in the Wellman bird house had been detonated by the closing of an electric relay. The windings of the relay, having been subjected to the terrific strain of the current focused upon it by Vickers at his apparatus, had short-circuited, and the circuit to explode the charge so closed. Since minute quantities of power supplied by a small battery kept the relay open, the explosion could take place at any time he saw fit to focus the power of the death-ray upon it, the relay to burn it out. As Vickers later explained, he had sufficient power to cause the atoms of the body of a human being to move so quickly as to cause so rapid disintegration that the body subjected would charr with a noise very much like an explosion. He felt that the melnite explosion would convey a greater display of fire and noise, and as he explained, used it to avail himself of the psychological effect which a large explosion of a powerful agent would produce.

When Sid was asked as to how the dirigible was controlled while it was in the air, he explained:

"That was simple enough, once he had the secret of the death ray. Vickers knew that nothing would interfere with the direction of the balloon if he used a frequency high enough to keep interference away. By the simple expedient of using one frequency to start the propelling mechanism, and various other frequencies to raise or lower it, to direct it either right or left or even destroy it, he could control it with the greatest ease. The searchlight on the prow of the ship gave him his bearings after the dirigible came into his vision. After he was sure of its position, it was a simple matter to turn the light off and on at will.

"He felt himself quite safe in directing the dirigible by ultra-radio frequency, since he knew that no one had as yet invented a tuner capable of measuring frequencies that high."

And as for Sid and Ruth, the former had well earned a substantial salvage commission on the \$100,000 demanded from his prospective grandfather-in-law, who insisted on paying the commission on an admiralty court basis and, in addition, withdrew his objection to the young man as a grandson-in-law.

INTERNATIONAL BABYDYNE RECEIVER



Tested and approved by the Department of Radio Engineering, RADIO AGE INSTITUTE.

RADIO TUBES

Write today for descriptive literature and low prices of our guaranteed tubes.

Beside its appearance and sturdy construction, three factors place the Babydyne above the average one tube set, i.e., compactness, a scientifically well-balanced hook-up, and greater ability to perform.

List Price **\$10**
 (Without the tube)

Territories open to distributors outside of New England.

INTERNATIONAL BABYDYNE RADIO RECEIVER

TRADE MARK

Manufactured by

A. & T. RADIO COMPANY
 Dept. B, DANVERS, MASS.

Hoover Defends Local Stations

Excerpts from his talk before the National Radio Conference

IT IS a pleasure to me to open the Third Annual Radio Conference at the Department of Commerce and to welcome you to its sessions.

Radio has passed from the field of an adventure to that of a public utility. Nor among the utilities is there one whose activities may yet come more closely to the life of each and every one of our citizens, nor which holds out greater possibilities of future influence, nor which is of more potential public concern. It must now be considered as a great agency of public service, and it is from that viewpoint that I hope the difficult problems coming before this conference will be discussed and solved.

At the first radio conference I hazarded some modest anticipations as to its development and use. Some thought them visionary; yet we passed every point of these anticipations within eighteen months. We have, in fact established an entirely new communication system, national in scope.

In the whole history of scientific discovery there has never been a translation into popular use so rapid as in radio telephony. So late as the year before I became Secretary of Commerce there were no broadcasting stations. At the end of four years 530 are in operation, making radio available to every home in the country. The sales of radio apparatus have increased from a million dollars a year to a million dollars a day. It is estimated that over 200,000 men are now employed in the industry, and the radio audience probably exceeds 20 millions of people.

No Time to Relax

We may well be proud of this wonderful development, but in our self-congratulation let us not forget that the value of this great system does not lie primarily in its extent or even in its efficiency. Its worth depends on the use that is made of it. It is not the ability to transmit but the character of what is transmitted that really counts. Our telephone and telegraph systems are valuable only insofar as the messages sent from them contribute to the business and social intercourse of our people. For the first time in human history we have available to us the ability to communicate simultaneously with millions of our fellowmen; to furnish entertainment, instruction, widening vision of national problems and national events. An obligation rests upon us to see that it is devoted to real service and to develop the material that is transmitted into that which is really worth while. For it is only by this that the mission of this latest blessing of science to humanity may be rightfully fulfilled.

I have been convinced that development could only be accomplished by organized co-operation of the industry itself; and the industry is unique in that unless it has stringent rules of conduct

to which all elements adhere, it will die of its own confusion.

At each succeeding conference we have had more difficult problems to solve, and those which we present today are of a complexity greater than ever before. In a large sense the purpose of this conference is to enable the listeners, the broadcasters, the manufacturers and the marine and other services to agree among themselves as to the manner in which radio activities are to be conducted.

Radio an Experiment

LIKE the two previous occasions, this may be called an experiment in industrial self-government. Radio activities, so long as they remain within the legislative restriction which holds for the government the fundamental control of the ether, are largely free. The industry's future conduct with a single view to public interest, a voluntary imposition of its own rules and a high sense of service, would go far to make further new legislative or administrative intervention unnecessary. The two past conferences have been successful in these purposes. With only slight modifications, made necessary by changing conditions, the Department has been able to follow their recommendations in the performance of its duties. The industry has supported and conformed to these recommendations cheerfully and uncomplainingly, although at some self-sacrifice. I congratulate you on this spirit, and know that you will enter upon your new deliberations in the same attitude.

When broadcasting first started, the phonograph was a sufficient attraction to the radio telephone listeners, who were swayed chiefly by curiosity and marvel at the new discovery. Public interest has long since passed this stage. The radio telephone would now die in 24 hours if it were limited to transmission of phonograph records. We have made great improvements in material transmitted.

Original music, speeches, instruction, religion, political exhortation, all travel regularly by radio today. Program directing has become one of the skilled professions. I have indeed a great feeling for the troubles of the director in his efforts to find talent and to give to his audience the best that lies at his command.

But we require a still further advance in the character of material beyond the capacity of local station directors if the art is to emerge entirely from the curio and entertainment stage to that of fundamental service.

Experimental broadcasting upon a national scale during the past year has now brought us to the stage where we know it can be done. The local material available for the local program is not in my view enough to maintain assured

(Turn to page 67)

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Bound Volumes of Radio Age are available from the circulation department for the unusually low price of \$1.00, postpaid. Formerly sold at \$3.50. These volumes contain issues from May, 1922, to April, 1923, and are bound in a durable cloth, lettered with a handsome gold inscription. A welcome addition to any radio library.

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Publishers
500 N. Dearborn St., Chicago, Ill.

WITH THE MANUFACTURERS



New Paragon Line

Alfred P. Morgan, President of the Adams-Morgan Company, Inc., of Upper Montclair, N. J. announces:—

"A new line of Paragon Receiving Sets—new in looks, new in their simple control, new in price—will be offered



to the trade in October. Partial advance information is now ready."

A radical departure has been made from former designs, especially in simplicity of control and lowness of price.

The new models retain the quality of tone, selectivity and sensitivity for which Paragon has enjoyed a world wide reputation for more than ten years. The highest grade of material and workmanship is employed throughout the line, but because of large production, extreme simplicity in design and construction—a major dial control—they will retail at popular prices.

Paragon "Two"—a two tube set—with major dial control—capable of giving loudspeaker volume from stations within a moderate range or coast to coast range for head phone operation.

Paragon "Three"—a three tube set of exceptional sensitiveness, unmatched loudspeaker tone and volume—major dial control.

Paragon "Four"—a four tube set with single major dial control—capable of giving loudspeaker reception over an almost unlimited range.

A Real Low Loss Inductance

One of the most outstanding developments in tuners and radio frequency transformers for this season has been brought to our attention in the Henninger Aero-Coil.

This self supporting coil, though quite rigid, is wound on a light skeleton frame, the amount of insulating material in the field of the windings having been cut down to 5 per cent of similar coils wound on tubing, yet no dope is used on the windings.

The result is a tuner and radio frequency transformer with incomparable selectivity and great increase of volume over any inductance wound on tubing.

Coast Wholesalers Open

The Coast Radio Supply Company, San Francisco, California, organized by

Henry E. Lapkin, formerly of the National Carbon Company, and Harry L. Auger formerly of McCoy Motor Supply Company, have opened their new quarters at 648 Howard Street with a complete stock of Radio receiving sets, accessories and parts.

This company will wholesale only. Both Mr. Lapkin and Mr. Auger are well known to the trade. Mr. Lapkin has just returned from the East with some of the newest sets and parts in Radio.



New Solder On Market

Kester's Radio Rosin Core Solder has just been placed on the market by the Chicago Solder Company, of Chicago.

The solder is especially made for radio work and will not cause dangerous fumes, nor will it spatter. It is a hollow ribbon of genuine tin and lead, having inside a pure rosin flux. This flux is in proportion to the surrounding solder and feeds out as the solder is used.

The attractive box shown above is furnished to dealers.

A Broadcasting "Album"

Here's something new! The Ekko Broadcasting station stamp album, made by the Ekko Company, 111 W. Monroe St., Chicago, contains 96 pages with spaces for the stamps of all recognized radio stations in the United States and Canada, arranged alphabetically by states and call letters. Ekko stamps prove reception of each station, and their collection has created a new form of radio amusement. With the album come "Proof of Reception" Cards. The cards are sent to the stations, who in return send the listener their Ekko stamp, which is placed in the album for definite reference.

The "Thank You" Card

"The "Thank You" card, frequently called applause card, has become a nation wide fad—in fact it is all the rage. The very latest is a special INDIVI-

DUAL "Thank You" card made by Radio Printers, Mendota, Illinois. On each card is printed the name and address of the sender.



These cards show the day and hour the message was received. The kind of instrument used is also given. There is a large space for remarks as to the weather, the program or anything else. Possibly the most interesting feature is the space for a request of talent or special numbers the sender of the card would like to hear. The fact that the cards contain the printed name and address of the sender shows that he or she is very much interested in radio and such cards should be more appreciated and receive special attention by the radio stations.

Stations really appreciate these cards and so do the musicians and speakers, just as the entertainer does when his audience applauds. Many stations read the cards and names of senders over their microphone. You can listen for your own cards.

Automatic Filament Control

In various multitube and larger receivers which have numerous dials one finds that the nuisance of having to continually regulate the filament current of the less important tubes is often very great. Even in small three tube sets, the business of having to turn on a separate dial or control to adjust the filament of the amplifiers is needless.

The Radiall Company, of New York City, N. Y. well known electrical engineers have perfected an automatic resistance unit that takes care of the filament current automatically. They have justly labeled this unit the "Self Adjusting" rheostat, since once the little device is installed no further attention is necessary. Like any other control cartridge, this unit is so designed that it fits in a set of clips.

The device is made in various sizes to suit varying conditions and is inexpensive. It is especially adaptable to larger sets, where space is at premium, since it requires no control on the panel. One "Amperite" as they are called is capable of controlling the filament current of several tubes at one time.

Heard of the "Balcon"?

The Pacent Electric Company, Inc., of New York, have recently developed and placed on the market a new balancing condenser. This new condenser, known as the Balcon, is especially designed for use with Tuned Radio Frequency circuits or any other circuit where a capacity balance is desired.

The Balcon consists of two nickel-plated electrodes, their ends being 3-16 inches apart and enclosed in a 1-4 inch glass tube. Around the outside a piece of split brass tubing three-fourths inches long is fitted so that it may be moved from one end of the glass tube to the other. This forms a condenser of very low capacity, the glass tube forming the dielectric. The maximum capacity is obtained when the center of the brass tube coincides with the center of the space between the electrodes. The metal parts are nickel plated and are mounted on a small Radion base.

Why Neutrodyne Receivers Are Popular

"The popularity of the neutrodyne radio receiver," said R. E. Thompson, President of R. E. Thompson Mfg. Co., "from the standpoint of the radio public is primarily due to three things. The elimination of reradiation, the simplicity of operation and the securing of maximum possible effect out of each tube are the outstanding reasons for the general acceptance of this type of receiver.

"What technicians call the feathery quality is absent in the neutrodyne when properly constructed, giving clearness of reception. By simplicity of operation I refer to the ability of the neutrodyne to be easily handled by anyone without skill or experience in radio. The reason is that once you have found a station and noted the dial positions, that same station can be found at the same dial settings any time thereafter. This is most important for the army of radio users not experts in playing around with this more or less new art. And lastly, it is human nature to want to get the maximum possible effect and this is surely permitted by the neutrodyne."

New Manhattan Line

New Manhattan Radio Products prepared for fall distribution include six new items, making a fairly rounded out and complete line of parts.

The new items include the Manhattan Junior Loud Speaker, the line of Red Seal Variable Condensers, the Manhattan 180° Vario-coupler, the Red Seal Collapsible Loop Aerial, and the Red Seal "Map-Loop," in addition to which the Manhattan Loud Speaker has been re-designed and furnished with a new horn of increased efficiency and size.

We particularly call to your attention the new Manhattan Junior Loud Speaker as being a reproducing unit especially designed for Loud Speaker work, having the now famous Manhattan Concert Modulator selling at \$10.00.

Sea to Sea—Trouble-free and Easy to Build



THE SILVER SUPER-HETERODYNE

Designed by McMurdo Silver, Assoc. I. R. E.—hailed by Editors, Engineers and Fans alike as the 7 Tube wonder receiver. RADIO BROADCAST called it an "ELECTRICAL MASTERPIECE" and it is. Simple to construct—easy to operate—Quality parts throughout—Sea to Sea with Loud Speaker Volume on an 18-inch Loop, right thru the "Locals"—Never failing—Trouble-free.

YOU NEED only a pair of pliers, a screw driver and a soldering iron with the book of instructions.
AND THESE PARTS:

2 Silver .0005 Low Loss Condensers No. 301	\$4.50
2 4-inch Moulded Dials—Tapered Knobs	1.00
1 7 Ohm Rheostat Amisco	1.00
1 250 Ohm Potentiometer Amisco	1.25
7 Insulated Top Binding Posts	.05
1 Carter 102A Jack	.80
1 Carter 101 Jack	.70
1 Silver R. E. Transformer Unit No. 401	14.00
1 Silver Oscillator Coupler No. 101	2.50
7 Benjamin Spring Sockets (199 or 201A)	1.00
2 Jefferson Audio Transformers No. 41, 3.75:1	4.25
1 On-off Switch	.60
3.5 MFD By-pass Condensers	.90
2 .00025 Mica Condensers with Leak Clips	.45
2 .002 Mica Condensers	.40
1 .0075 Mica Condenser	.75
1 .000045 Balancing Condensers	.50
1 5 Meg Ohm Grid Leak	.50
1 1 Meg Ohm Grid Leak	.50
1 7x23x3/16-inch Bakelite Panel, Drilled, Grained and Engraved	7.00
7x23x3/16-inch Oak Base Board, Bus-Bar, Spaghetti, Screws, Nuts, Solder, Lugs	1.50
ALL PARTS POSTPAID	\$63.85

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Bringing your old "Super" up-to-date

OSCIILLATOR COUPLER No. 101	\$2.50	50 KC RF TRANSFORMER UNIT No. 401	\$14.00
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.0005 LOW LOSS CONDENSERS No. 301	4.50	Collapsible Center-Tapped loop No. 601	6.50

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Blue Prints Show You How To Build Your Own 17"x 27" blue print gives complete instructions, pictures, hook-up, wiring diagrams. Shows full size templates for drilling panels. Your choice of these hook-ups:

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5 TUBE VOLUME

from only TWO TUBES

using the wonderful inexpensive Harkness Reflex Circuit and **EQUITY Low Loss Air Core Spiderweb Harkness Coils.** By substituting these special **Low Loss Coils** for the old style, cylindrical coils, this simple Harkness receiver is made to give results almost beyond belief. Distance and volume are greatly increased; selectivity greatly improved. Nothing else like these coils, . . . and they cost less than the old style high loss Bakelite tube kind. Only \$2.00 post-paid for the complete set of coils. Order today. Free blue print showing circuit. Money back if not satisfied.

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PER SET Postpaid

NOTE: Manufacturers! Send in your blue prints for quotations on any inductance requirements you may have. No order too large.

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BUYERS' AND SELLERS' SERVICE SHEETS

"A" BATTERIES No. 5-A-24

1. **Type.** Economy of operation—The battery is the one thing about a radio set that wears out even when not in use. The first consideration which arises in connection with the choice of the "A" battery is whether it should be a storage battery or a group of dry cells. The principal factor which governs this choice is the operating cost of the receiving set with either type of battery.

In the case of receiving sets employing so-called "dry-cell" tubes, such as WD-11, C-11, WD-12, UV-109, C-299, or UV-3, it is always more economical as a cell as more convenient to use dry cells as the filament current, because these tubes take only a fraction of one ampere each.

Any receiving set which contains a UV-200 tube which draws one ampere can be served more economically from a storage battery.

The UV-201-A tube is on the border line between dry cell and storage battery operation, and choice of the battery is determined by the number of tubes in the set. Sets containing up to three UV-201-A tubes can be operated more economically from dry cells than from the storage battery, but where the set contains three or more, 201-A tubes, a storage battery becomes the more economical.

Quality of reception—The rechargeability of storage batteries not only makes them the economical source of power for the multi-tube set, but recommends them for use with UV-201-A tubes already referred to, since storage batteries yield continued clarity of reception due to steady voltage. Of course, the current from a storage battery will not give any better reception than the same current from a dry battery, but the storage battery gives full voltage to your tubes as long as kept charged, assuring uniform reception.

2. **Storage A-Batteries.** Design—Storage batteries for filament work are almost invariably 6-volt batteries of various ampere-hour capacity ratings. In general, any 6-volt storage battery can be made to serve as an "A" battery, but special radio storage batteries have been developed which not only give better radio service but have better appearance, and therefore are better suited for use in the home. It is well to choose the type of storage battery which has been developed especially for radio use in the home because the better grade of radio storage "A" batteries are so designed that they can be placed on hard-wood floors without marring the finish, and are provided with specially constructed vent caps which prevent the spilling of acid onto furniture or rugs if the battery should be carelessly handled.

Insulation—Insulation is of utmost importance in radio apparatus. It is equally important in a storage battery and considerable attention should be given to the kind of insulation or separator used when buying a radio battery. Wood is one of the oldest and most satisfactory materials used for this purpose because it is porous enough to permit the necessary action between positive and negative plates, yet will not permit the plates to come together. A soft wood, however, while porous, is soon eaten through by the acid, resulting first in poor reception, and then in failure altogether. A hard wood, while not as porous as a soft wood, when cut as separators are usually cut, makes the ideal wood separator if quarter sawed; that is, cut so that there is an alternate layer of hard and soft material over the whole face of the separator.

3. **Container and Charge Indicators**—A battery in a glass container, especially one with a hydro-meter or charge-indicator enclosed in one cell, has many advantages. With such a battery it is easy to see when it needs water and when it needs charging.

It is an ideal practice to use a double-pole, double-throw switch connected so the battery can be switched to the radio set or to the charger. This makes it impossible to connect the battery to the radio set and charge at the same time which would very likely burn out tubes.

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RADIO AGE

COMPILED BY
EDMUND H. EITEL

NO. 5-A-24

"A" BATTERIES—"DRY-CELL" TYPE. No. 6-A-24

1. **Difficulty of Determining Quality.** Dry batteries are very much like eggs, in that the only test of the quality is to use them. In trying to list the points a battery user should have in mind in buying batteries, I feel little more confidence in its usefulness than I would have in a set of directions telling a bride how to pick fresh eggs without shaking or candling them. Like egg a battery deteriorates in time whether it is used or not. If batteries could be candied, it would be a simple matter to select the good from the bad, but among batteries there is no test which will show whether a battery has run out one-fourth or one half its capacity.

2. **Special A Batteries.** Buy the special radio A batteries, not ignition or general service dry cells. The radio "A" cells are adjusted to furnish a maximum of energy above one volt, whereas the general service cell is adjusted for a voltage spread between 1.5 and 0.75 volts.

3. **Brand.** Buy from a reputable concern which guarantees its products against mechanical or electrical defects. Such goods are bound to be more uniform, and of better quality due to rapid turn-over.

Each battery is, or should be, stamped with the date on which it was made or when the makers guarantee expires. Charge the battery having the latest date.

4. **Voltage.** The voltage shown on a high grade volt meter should be not less than 1.5 volts per cell. Do not allow a dealer to sell you dry cell radio "A" batteries on the so called flash test; i.e. the number of amperes shown by short circuiting the battery through an ammeter. Most specially built radio "A" batteries will show lower than a general service cell on this test, yet the special radio "A" cell will outlast two general service cells as an "A" battery.

5. **Ampereage.** This is no indication of the quality, but among a group of cells of satisfactory voltage and of the same grade, the high-ampere battery will probably give better average service.

6. **Connection.** The connections of terminals must be such that good contacts can be made with the heavy leads of the "A" circuit.

7. **Battery Seal.** The battery seal should not be bulged, cracked or wet.

8. **Assembled Batteries.** If not competent to wire single batteries in series and parallel groups, buy the assembled battery for the particular tube in question, thereby avoiding short circuit batteries.

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RADIO AGE

COMPILED BY
EDMUND H. EITEL

No. 6-A-24

Hoover Defends Radio

(Continued from page 63)

interest, and therefore the industry, or to adequately fulfill the broadcasting mission. So far as the art has developed, I think we all agree that for accuracy and regularity of reception we can depend only upon the local broadcasting stations. My proposition is that the local stations must be able to deliver every important national event with regularity. The local station must be able to bring to its listeners the greatest music and entertainment of the nation, but far beyond this it must be able to deliver important pronouncements of public men; it must bring instantly to our people a hundred and one matters of national interest. To this it must add its matters of local interest. This can only be accomplished by regularly organized interconnection on a national basis with nationally organized and directed programs for some part of the day in supplement to more local material.

Interconnection Realized

IT MAY be stated with assurance that the greatest advance in radio since our last conference is the complete demonstration of the feasibility of interconnection. We owe a debt of gratitude to those who have glazed the way. The pioneers have been the American Telephone X Telegraph Company in wire interconnection, and the Westinghouse Electric X Manufacturing Company in radio interconnection through the use of short wave lengths. Their experiments have involved technical skill of the highest character, which could be found or contributed by few other organizations in the world. Their expenditures, running into the hundreds of thousands of dollars, have been made without direct consequential return. It has been possible to broadcast many national events over three-quarters of the United State during the past year, and the whole country has been covered twice.

It is our duty to consider the possibilities and potentialities of interconnection as a regular daily routine of the nation. Unless it be systematically organized, we cannot expect its continuation. I realize that this matter, except insofar as it may be fostered and encouraged, does not lie in the Government. It would be unfortunate indeed if such an important function as the distribution of informatic should ever fall into the hands of the Government. It would be still more unfortunate if its control should come under the arbitrary power of any person or group of persons. It is inconceivable that such a situation could be allowed to exist. But I am not now dealing with monopoly. Nor is this a question where any one lays claim to a monopoly. Interconnection is going on to local extent and over the wires of the telegraph companies, the telephone companies, and by radio itself. We have promises of super-radio and we have promises of interconnection of wired wireless. If there are

(Turn to page 69.)

Telmaco Acme Receiver

The Ideal Receiver for all Seasons



The Telmaco Acme Receiver is truly portable. May be instantly removed from handsome carrying case and inserted into beautiful two-tone mahogany case. No outside loop, no aerial, no ground required.

Size of Case 8" x 10" x 18". Weighs only 27 pounds complete. Easily Carried.



Acme 4-Tube Reflex Circuit Used

securing selectivity, distance and volume with minimum battery consumption.

Complete in itself. Easily carried from room to room in your home or to office, neighbors, etc. Take it along and have music, entertainment, speeches, news, market reports wherever you happen to be.

Instantly ready for use as it is. You can use external antenna and ground, loop and loud speaker if desired. 4 tubes (fully protected by shock absorber sockets)—equal to 7 tubes, due to reflexing and use of crystal detector.

Reasonably Priced Write for Free illustrated circular fully describing Telmaco Acme Receiver.

Complete Telmaco 64 page catalog containing 20 circuits in blue and describing the best in radio sent postpaid for 10c.

Dealers! Catalog and Price List furnished to all bona fide dealers making request on their business stationery.

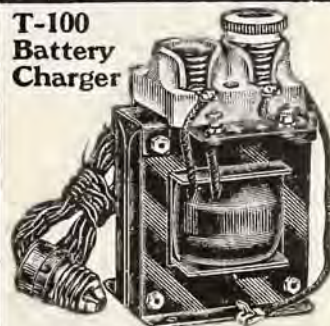


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T-100 Battery Charger



The Best and Lowest Priced on the Market

This battery charger operates on 110 volt, 60 cycle, A. C. circuit, charging a 6 volt battery at a 2 ampere rate. Standard 2 ampere charging tube is used. The T-100 is the lowest priced first-class charger on the market. Large numbers now in use have proved entirely satisfactory. No vibrating parts to get out of order. Absolutely noiseless in operation. Furnished with plug and cord for lamp socket. Battery leads marked. Fuse protects charger from accidental short circuit of 110 volt leads. Fully guaranteed.

Price complete, with 2 ampere tube, \$12.00

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Free Mailing Lists
Will help you increase sales
Send for FREE catalog giving counts and prices on thousands of classified names of your best prospective customers—National, State and Local—Individuals, Professions, Business Concerns.
99% Guaranteed 5¢ each by refund of 5¢ each
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The Traffic Cop of the Air
FERBEND Wave Trap
Add a Ferbend Wave Trap to your set and "Police" your reception. Regulate the Traffic! Guaranteed to tune out any interfering station. Sent postpaid on receipt of \$5.00, or C. O. D. plus postage.
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Standard The World Over.

Don't accept a substitute.

B-Metal Refining Company
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Price 50c 53 W. Jackson Blvd., Chicago Ill.

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**nabs those elusive
Stations and holds 'em!**

Wave lengths from 150 to 1,000 meters in single circuit; 150 to 700 meters in triple circuit—the bank wound and tapped primary and tapped secondary do the trick.

Six efficient hookups with each coupler or sent for ten cents to cover mailing.

At all dealers or sent prepaid on receipt of price

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Wider Antenna Surface Means Better Reception

Jiffy RIBBON ANTENNA

Provides maximum surface for the pathway of incoming signals. It brings in hard-to-get stations clear as a bell.

Jiffy Ribbon Antenna is positively non-corrosive, will not kink or curl, makes a neater antenna job and has exceptionally high tensile strength.

Supplied with two insulators, ready for installation, put up in 100 foot lengths.

At your dealer's
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A real night and day, summer and winter crystal. Get it at your dealer's.
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DETROIT, MICH.

An Unusually Selective Receiver

(Continued from page 18)

the stationary plates of the 23 plate condenser and the revolving plates of this condenser are connected to the other side of the rotor, to the positive binding post of the plate battery and to one side of the variometer. The other terminal of the variometer is connected to the plate binding post on the socket.

The phones are connected between the negative binding posts of the filament and plate batteries. The filament circuit is connected up in the usual way, from the positive binding post of the filament battery to the switch lever on the rheostat and from the resistance of the rheostat to one of the filament binding posts on the socket.

The other filament binding post on the socket is connected to the negative binding post of the filament battery and to one side of the phones. The grid condenser should be of the fixed mica type and is to have a capacity of .00025 M. F.

Sockets, having a bakelite base with a metal tube are usually considered good, or a good bakelite socket will do the work, but because it is sometimes so hard to tell this type of socket from the "moulded mud" type, the other is recommended.

The detector tube may be any of the well known brands, although the larger type such as the UV-200, or the C-300 will probably give the best results. The tube used will determine the resistance of the rheostat. For either of those mentioned, the ordinary 6 to 8 ohm-rheostat will be right, but if the UV-201-A or the C-301-A, UV-199, or WD-11, or WD-12 are used, the rheostat should have a higher resistance. Any type having from 20 to 40 ohms will be satisfactory for these tubes.

A grid leak may also be necessary in some cases, but because its resistance will vary according to the tube used, no specifications are given. It would be well to experiment with those having a resistance from one to four megohms. The plate battery voltage will also vary according to the kind of tube used. For the UV-200 or the C-300, the plate voltage should vary between 16 1-2 volts to 22 1-2, which can be taken care of by the taps on the standard plate batteries now in use.

But for the 201-A or the 301-A tubes a higher voltage will be necessary. This set can very nicely be mounted on a 7x18x3-16 inch bakelite panel and a baseboard of the proper size to fit the cabinet selected.

Do not attempt to wire up the parts with small wire, as the leads are too easily bent out of place and some consideration should be given to the resistance of the connecting wires. No. 14 tinned copper bus bar wire will serve very well, as this is substantial and the tinned coating on the wire will make the soldering of connections a very simple matter.

Your Radio Troubles Ended for 30c in Stamps

We have laid aside a limited number of back issues of RADIO AGE for your use. Below are listed hookups to be found in these issues. Select the ones you want and enclose 30 cents in stamps for each desired.

May, 1922

—How to make a simple Crystal Set for \$6.

September, 1922

—How to make a Regenerative Set at a low cost.

October, 1922

—How to make a Tube Unit for \$23 to \$37.

—How to make an Audio Frequency Amplifying Transformer.

November, 1922

—Design of a portable short-wave radio wavemeter.

May, 1923

—How to make a portable Reinartz set for summer use.

June, 1923

—How to build the new Kaufman receiver.

—What about your antennas?

December, 1923

—Building the Haynes Receiver.

—Combined Amplifier and Loud Speaker.

—A selective Crystal Receiver.

January, 1924

—Tuning Out Interference—Wave Traps—Eliminators

—Filters.

—A Junior Super-Heterodyne.

—Push-Pull Amplifier.

—Rosenbloom Circuit.

February, 1924

—How to make a battery charger.

—Single Tube Heterodyne.

—Adding two audio stages to selective receiver which began as a crystal set.

—Superdyne receiver.

March, 1924

—An Eight-Tube Super-Heterodyne.

—A simple, low loss tuner.

—A Tuned Radio Frequency Amplifier.

—Simple Reflex Set.

April, 1924

—An Efficient Super-Heterodyne (fully illustrated).

—A Ten-Dollar Receiver.

—Anti-Body Capacity Hookups.

—Reflexing the Three-Circuit Tuner.

—Index and first two installments of Radio Age Data Sheets.

May, 1924

—Construction of a Simple Portable Set.

—Radio Panels.

—Third Installment of Radio Age Data Sheets.

June, 1924

—Important Factors in Constructing a Super-Heterodyne.

—A Universal Amplifier.

—A Sure Fire Reflex Set.

—Adding Radio and Audio to Baby Heterodyne.

—Radio Age Data Sheets.

July, 1924

—A Portable Tuned Impedance Reflex.

—Operating Detector Tube by Grid Bias.

—A Three-Tube Wizard Circuit.

—Data Sheets.

August, 1924

—Breaking Into Radio Without a Diagram.

—The English 4-Element Tube.

—Filtered Heterodyne Audio Stages.

—An Audio Amplifier Without an "A" Battery.

—Data Sheets.

September, 1924

—How Careful Mounting Will Improve Reception.

—One Tuning Control for Hair's Breadth Selectivity.

—Four Pages of Real Blueprints of a New Baby Heterodyne and an Aperiodic Variometer Set.

—Data Sheets.

October, 1924

—An Easily Made Super-Het.

—Two Radio and Two Audio for Clear Tone.

—A Simple Regenerative Set.

—The Ultradyne for Real DX.

—Real Blueprints of a 3-Tube Neutrodyne and a Mid-get Reflex Set.

RADIO AGE, Inc.
500 N. Dearborn St. Chicago

(Continued from page 67)

several methods, it means that we might have several alternative programs always available. But whatever the method of interconnection may be, we are lacking in a definite organization of a national system of programs and a basis of support.

I believe that the quickest way to kill broadcasting would be to use it for direct advertising. The reader of the newspaper has an option whether he will read an ad or not, but if a speech by the President is to be used as the meat in a sandwich of two patent medicine advertisements, there will be no radio left. To what extent it may be employed for what we now call indirect advertising, I do not know, and only experience with the reactions of the listeners can tell. I do not believe there is any practical method of payment from the receivers.

I wish to suggest for consideration the possibility of mutual organization by broadcasters of a service for themselves similar to that which the newspapers have for their use in the press associations, which would furnish programs of national events and arrange for their transmission and distribution on some sort of a financial basis just as the press associations gather and distribute news among their members.

Problem of Wave Lengths

ONE of the most important subjects for your consideration is the providing of operating channels for broadcasting stations. Of the present 530 stations, 57 are Class B, operating on from 500 to 1,000 watts and having a wide range, and 387 are Class A, many using small power and covering small areas. There are still 86 Class C stations, most of which have low power, all on a wave length of 360 meters.

Our chief trouble is with the Class B situation. They are all assigned within the band of 288 to 545 meters, within which there are, under the present system of allocation and excluding the Class C band, only 44 available channels, and only 33 that seem desirable at present. To assign these among the 57 stations necessarily means duplication, although it was the theory of the last conference that individual wave lengths could be assigned to each. At present, 23 stations either have exclusive wave lengths or are sharing with stations so distant that both may operate simultaneously, while the remaining 34 are compelled to divide time. The greatest congestion is in the large cities, New York and Chicago particularly.

An editorial on the radio conference is in this issue.

IS YOUR NEUT RIGHT?

To revitalize unneutralizable Neutrodynes, we devised this Kladaq Coast-to-Coast circuit. Uses same panel, etc., as Neut, except three less parts. Merely rewire. Success certain. Necessary stabilizer, 22 feet gold sheathed wire, circuit and complete, simple instructions—\$5.00 prepaid. Many have already rebuilt their Neuts and written us wonderful testimonials. Thousands will do it. Be FIRST—have the finest, five-tube set in your neighborhood and revitalize others' Neuts. Description, etc., 10c. Radio list, 2c. Stamps accepted. KLADAG RADIO LABORATORIES, Kent, Ohio.

**New Models
Bristol Radio Receivers**

**Incorporating the Patented Grimes
Inverse Duplex System**

*Watch for further announcements in all leading
radio publications.*

**Grimes' System Insures Natural
Tone Quality**

Improved Bristol Audiophone Loud Speakers—give greater volume, are more sensitive and still maintain their round, full tone and their distinctive freedom from distortion.

Ask for Bulletin No. 3017-P.

Manufactured by

The Bristol Company

Waterbury, - - Conn.



SENIOR AUDIOPHONE
15 inch Bell
Price.....\$30.00



JUNIOR AUDIOPHONE
11 inch Bell
Price.....\$22.50



BABY AUDIOPHONE
With Fibre Horn
Price.....\$12.50

Make \$100 Weekly—sell RADIO

Demonstrate once—results mean sure sale. Coast to Coast, lowest prices, attractive four tube instrument \$39.50. Big commission to you. Exclusive territory to proven salesmen. Territory going fast. Write today for large illustrated book No. 100. Don't fail to give name of your county.

OZARKA, INC.
829 Washington Blvd., Chicago, Ill.



Big Profit

**DEALERS WRITE
FOR QUICK SELLING**

**KITS
RADIO PARTS**

WHOLESALE ONLY

HAROLD M. SCHWAB, INC.

55 VESKY ST., DEPT. R-11
NEW YORK CITY, N. Y.

HUDSON-ROSS

**Largest exclusive Radio
Jobbers in middle West.**

Write for discounts.

123 W. Madison St. Chicago

Special for November: RADIO AGE for one year and RADIO AGE ANNUAL—both for \$2.50.

Always Mention RADIO AGE When Writing to Advertisers

EARN

\$3,000 to \$10,000 a Year as Radio Expert

Enter fast growing radio field, thousands of big pay jobs waiting for you. U. S. Gov't., Steamships, R. R's., Corporations eagerly seek Radio trained men. Advancement rapid, earn from \$3,000 to \$9,000 yearly.

Pleasant Home Study In

RADIO

Prepare for Big Pay in Spare Time

My reputation as Radio Engineer and instructor insures you complete, speedy success, at home in spare time; earn while you learn. I make you expert in radio designing, building, repairing and operating and teach you only practical "inside" dope. You quickly complete my course



A. G. MOHAUPT

and a few pleasant hours prepare you to step into Big Pay. No experience required.



FREE 1000 Mile Radio Outfit

This set, when completed, has a range of over 1000 miles. I give it free with my course. I give you practical training by having you work on this set. The knowledge you gain is not mere book knowledge but is usable, practical experience.

When you have finished my course, you can sell this set at a price that will pay the cost of the course. For a short time only, by my special plan, I will give a tube radio set in handsome cabinet to men, absolutely FREE. Send at once for my FREE wonder-book of inside Radio "dope." Act quickly.



MAIL COUPON

A. G. MOHAUPT, Radio Engineer, Radio Association of America, 4513 Ravenswood Ave., Dept. 211, Chicago

Name..... Address..... City..... State.....

DON'T BUY THAT "B" BATTERY!

—Until You've Considered the "Royal!"

The Royal "B" Battery—the only battery most economical for Neutrodyne, Super Heterodyne, and all sets using vacuum tubes. Furnished in 100 and 140 volts. Made of Edison elements; superior in workmanship and appearance; noiseless in operation. Extremely low recharging cost; no acids to tamper with. WILL OUTLAST YOUR RADIO SET. 100 Volts. \$20.00; 140 Volts. \$25.00 delivered. Early delivery assured; satisfaction guaranteed. Buy direct from manufacturer and save money. Order today. Send for descriptive circular No. 4.

Royal Radio Company - Dumont, N. J.

Mooseheart—A Station with a Purpose

(Continued from page 40)

drastic discipline or one case where the officials have scratched their heads and said, "Well, it's happened. Now, what will we do with them?"

Mooseheart officials, of course, realize that a diet of numbers by their charges would not suffice all the time, so arrangements are being made to run a line into Chicago, where we will broadcast every night from 9:00 or 9:30 on, without interruption. The Chicago Studio will probably be in a downtown hotel, where we will have a fine dance orchestra playing for us, and where I will arrange the best programs of the best artists I possibly can for your entertainment.

Not being a Chicago Station, we will be on the air Monday nights, having our silent night somewhere in the middle of the week.

If the station is a success, it will be because there is co-operation all the way through. The faculty and members of the staff of the general offices of the Fraternity are a fine group of people, the children have promised me their support, and I have one of the best Radio Operators behind the scenes, who is also a good scout. He was with me at the Drake, as I say, and I believe that was one of the reasons why WDAP was so well liked. We had co-operation, and that's half the battle.

And while I'm talking about co-operation, may I extend to you the urgent invitation to write often concerning our programs? That is a very important thing to those of us who are responsible for radio programs. Unless you write and tell us what you like and don't like, it is harder for us to give you what you do like. That goes for all stations that you ever heard, and you will be doing me and my "worthy contemporaries" a distinct favor if you will take a few minutes once in a while to write us your comments, suggestions and criticisms.

Please. Thanks.
"And may you laugh in your dreams."

A Radio Thunderstorm

WGY, the Schenectady broadcasting station, recently broadcast the music of a thunderstorm and it probably had a pleasing sound to those living on sun-parched farms. The storm occurred during the broadcasting of a concert by the Schenectady Little Symphony orchestra from Central Park, Schenectady. The musicians had just started "The Calm" section of Rossini's overture from William Tell, when unexpected and unwelcome reinforcements joined the orchestra. Contrary to the prediction offered by "It Ain't Goin' to Rain No More," it was a real storm with an accompaniment of hail. To the listener it might have appeared that the orchestra was taking liberties with the score, but the apparent improvisations were introduced by elements. The sound of thunder, wind and rain was picked up by the microphone and broadcast with the tranquil music of the overture.

Always Mention RADIO AGE When Writing to Advertisers

Have you your EKKO Broadcasting Station Stamp Album?

Here's what every radio fan has wanted—a convenient, permanent and authentic means of recording all stations heard over your set. The Ekko Album contains spaces for a stamp from each of more than 650 stations. These stamps are verified and prove your reception of the station.

Proof of Reception cards are furnished with the album. Send the card to the station, together with ten cents, to cover cost of verification, give facts which prove you have heard their broadcasting. In return they send you their verified stamp as evidence of actual reception. The stamps are beautifully engraved in different colors, an individual stamp for every station showing the call letters.

The album is 9 1/2 inches, handsomely bound in a two color cover. It contains 96 pages, with spaces for stamps of all recognized stations arranged alphabetically by states and call letters. Also an alphabetical list of the official names and other interesting features of stations, as well as a convenient log.

See your dealer today, get a copy of the Ekko Album and start a collection of these stamps. You will find this a new and fascinating method of verifying the stations you hear. If your dealer cannot supply you, sent direct on receipt of price. Money back if not satisfied.

Price \$1.75

THE EKKO COMPANY
111 West Monroe Street, Chicago

Here's the Newest!

95% AIR DIELECTRIC

NO DOPE USED ON WINDINGS

The Henninger AERO-COIL

PAT. PENDING

PREVENTS R. F. LOSSES

Here is the greatest, most important advancement in Tuner and tuned R. F. Transformer construction ever made. Think of it! A rigid self-supporting Tuner and tuned R. F. Transformer having 95% air dielectric, and with no dope on the windings. The Aero-Coil actually uses and amplifies hundreds of times, the energy lost by "doped" coils or coils wound on tubing.

Replace your old coils with Aero-Coils. You will get enormous volume on distant stations; reception will be crystal clear—your set will tune "needle" sharp. You will be amazed at the difference. Primary 5:1-4 turns; secondary 50 turns; beautifully made. Go to your dealer now and get a set of Aero-Coils. If he hasn't them yet, send us the purchase price with your dealer's name and we will send the coils and brackets postpaid at once. \$3.50 each or \$10.00 set of three. Also write for bulletin H-3 "Radio Frequency Losses and their Prevention"—it's FREE!

THE HENNINGER RADIO MFG. CO.
1772 Wilson Ave., Dept. 10, Chicago
DEALERS and SET MANUFACTURERS: Write for Attractive Proposition.

FREE YOUR OWN Name and Address Printed on Thank You Cards

Hear what YOU like. Stations are glad to put on numbers at your request. We print Special Cards that get ATTENTION. All the RADIO CARDS (Printing FREE) 100—only \$1.35; 200—\$1.45; 500—\$2.35. POST PAID. Order TODAY.

MONEY REFUNDED if Not Satisfied
High grade printing—Good quality cards—You will be DELIGHTED.

Send order with check or money order today—NOW.
RADIO PRINTERS, 68 Main Street, Mendota, Illinois

Pickups and Hookups

(Continued from page 54)

I use an Inverted "L" aerial 95 ft. long, 25 ft. high.

I am not an amateur which my records seem to show but I know how to read code. I am 14 years old and still have a lot to learn about radio.

Yours till inductance coils,
WM. A. NEELD.

THIRD PRIZE SUBMITTED FOR ONE NIGHT WORK

RADIO AGE,
Dear Sirs:

Being a subscriber of your magazine I believe I am entitled to send you a list of stations that I have picked up between the hours of 8:30 p. m. and 10:55 p. m. Eastern Standard Time. (These stations were received the night of September 4, 1924.)

WBZ, WCX, WJY, WGY, WHO, WEAN, WTAS, WTAJ, KDKA, WEAQ, WGN, WEL, WHAS, WBB, WSB, WCAP, WEAF, WSAI, WTJ, WOC, WWJ, WNYC, WOAW, KFKX, WCBQ.

I am using a portable set of my own design, it being a double circuit using a Kelcoil for tuner and two UV 199 tubes and had two sets head phones attached, as greater part of the time there were two parties listening. Am going to send you a photo of the set soon as same are finished.

Very truly yours,
J. SULOUFF,

325-6th Avenue, Altoona, Pa.

4th Prize Letter

478 Frontenac St.,
Montreal, Can.

RADIO AGE,
Gentlemen:

I've tried nearly every hookup from the RADIO AGE for nearly two years. I tried with a U. V. 201A; it was not so bad, but the "B" battery killed it. Then I replaced it with a W.D. 12 and it gave me awful static during the last few months. Now I have a Canadian Peanut Valve which I think beats them all. I'm using a "Single Circuit" from the April RADIO AGE. My antenna is umbrella style, 55 feet from the ground, and I put two fixed condensers .00025 on the antenna binding post for high wave length.

Here is what I tuned in during the month of August:

LOG
WOR, WJZ, WEAF, KDKA, KYW, WCBQ, WJY, WBZ, WBBP, WHAS, WFBH, WDAR, WKAC, WLS, WQJ, WTAM, WNYC, WOS, WOO, WGN, WCAE, WFI, WGY, WHIN, WIP, WEBJ, WRC, CNRO, WTAE, PWX, WIGF, WEBH, CHYC, WCAP, KOP, WGR, KFKX, WNAC, WJAX, SXG, WQAM, WMH, WMC, WSB, WSAI, WMAF, WAAM, WHAZ, KSD, WIAM, WEAN, WCX, WWJ, WLW, WBSQ, CFCE.

WAAF, WBZ, WCAP, WCBQ, WCAE, WCX, WDM, WDAF, WDAR, WDAJ, WEBH, WEAR, WEAF, WIF, WFAA, WSY, WJAB, WJZ, WJAS, WGW, WSR, WGN, WGAN, WHAZ, WHAN, WHN, WHAM, WJAZ, WJY, WYAR, WOR, WOO, WQJ, WRC, WSAI, WSAJ, WASAP, WTAM, WTAS, WTAJ, WLS, WLW, WMH, WMAA, WLAS, KDKA, KYW, KFKX, KFOA, CKCH, CNRO, CKCK, CKY, CFCE, CKAC, CHYC, CNRM.

P. KILKENNY,
478 Frontenac St.,
Montreal, Can.

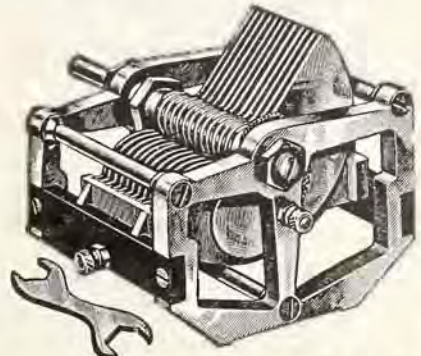
(Turn to page 75.)

Again BREMER-TULLY Scores with the only Low Loss Straight-line Wave Length Condenser

Nothing like it, either electrically or mechanically.

Everything you could wish for, every improvement, every advanced feature in radio has made this condenser the one and only.

Go to your dealer and examine it for yourself. We guarantee it to last a lifetime—we know you will agree with us that it has no equal. "20 point" folder gives the full details. Write for it.



- 150 m.m.f. 7 plate \$4.25
- 250 m.m.f. 11 plate 4.50
- 520 m.m.f. 23 plate 5.00
- 800 m.m.f. 35 plate 6.50

BREMER-TULLY MFG. CO.

532 South Canal Street, Chicago

How to Build ULTRADYNE
The Improved
SUPER-HETERODYNE

32 page illustrated book with detailed instructions on drilling, wiring, assembling and operating Model L-2 Ultradyne Receiver. Latest authentic edition by R. E. Lacault, A. M. I. R. E. inventor of the Ultradyne, the most selective receiver known. Write for descriptive circular.

Phenix Radio Corp.
3-9 Beekman Street, N. Y.



Flint Distortionless A.F.T.



The finest, nearest built Audio Frequency Transformer. Equally efficient in all stages of amplification. Ratio 4.25 to 1. Windings absolutely accurate. Core of finest grade silicon steel. Carries away high flux densities which cause distortion in others. Only \$3.00 each! Order today. Money-back guarantee. Dealers! Manufacturers! Write for particulars. **FLINT RADIO CO., 1604 Wilson Ave., Chicago.**

ONLY \$3.00

Always Mention RADIO AGE When Writing to Advertisers

FREE

To Each Purchaser of a World Battery

A 24-Volt "B" Storage Battery positively given FREE with each purchase of a WORLD "A" Storage Battery. The WORLD Battery is famous for its guaranteed quality and service. Backed by years of Successful Manufacture and Thousands of Satisfied Users. You save 60%.

Prices That Save and Satisfy

Auto Batteries		Radio Batteries	
6-Volt, 11 Plate	\$12.25	6-Volt, 100 Amps.	12.50
6-Volt, 13 Plate	14.25	6-Volt, 120 Amps.	14.50
12-Volt, 7 Plate	17.00	6-Volt, 140 Amps.	16.00

Shipment Express C. O. D. subject to examination. 6 per cent discount for cash in full with order.

2-Yr. Guarantee Bond in Writing With Each World Storage Battery

proves satisfactory World performance. Mail this ad with your name and address—we will ship battery day order is received; and give you your choice of "B" or "C" size Batteries—a handsome nickel finish Auto Spottite, FREE. Write TODAY.

WORLD BATTERY COMPANY
1219 So. Wabash Ave. Dept. 36, CHICAGO, ILL.

This FREE "B" Storage Battery takes the place of dry cell "B" batteries. Can be recharged and will last indefinitely. To be sold retail for \$6.00. It is the only battery of its kind equipped with solid rubber casing—in warm climates acid and leakage. Take advantage of this remarkable introductory offer NOW! (To those who prefer it, we will send FREE a handsome nickel finish Auto Spottite, instead of the "B" Battery. Be sure to specify which is wanted.)

GIVEN FREE

To introduce this new and superior World "B" Storage Battery to the Public.

Exhibit Space in the
**Third Annual
 Chicago Radio Show**
 At the Coliseum, Nov: 18 to 23,
Is Entirely Sold Out!



**Radio Manufacturers' Show
 Association**

James F. Kerr,
 General Manager

127 N. Dearborn St.,
 Chicago, Illinois

*Is the Radio Age Annual a
 Part of Your Library?*

The supply is rapidly becoming exhausted, so we are making this last appeal to the fans to order their ANNUAL now if they have not already done so. 120 pages of diagrams and articles.

A Few of the Features

Simple Crystal Set	Baby Heterodyne I	Reinartz
Long Distance Crystal Set	One Tube Loop Aerial	Haynes
Your First Tube Set	Wave Trap, Filter and	Hopwood
Erla Reflex	Eliminator	Cockaday
Kaufman Tuner	Loading Coils	Neutrodyne
Grimes Inverse Duplex	Transformers	3-Circuit Tuner
Two Stage Amplifier	Battery Charger	Super-Heterodyne
Rosenbloom	Wave Meters	Simple Radio Frequency
Push-Pull Amplifier	Two-Circuit Crystal	Ultra Audion
Portable Reinartz		

For this month only, we are offering the ANNUAL at a special price of 50c, to clear the remaining copies. ACT NOW!

This offer will not be made again, for the ANNUAL for 1925 will be on sale early in December.

USE THIS COUPON NOW!

RADIO AGE, Inc., 500 N. Dearborn St., Chicago, Ill.

Gentlemen: Attached find Fifty Cents (50c) for which kindly forward me by return mail one copy of RADIO AGE ANNUAL FOR 1924. If not satisfied with it I will return it to you within three days and you will refund my money.

Name.....

Address.....

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

**This Coupon
 Will Bring
 You The
 ANNUAL
 by
 Return Mail!**

**Overcoming "Super-Het"
 Obstacles**

(Continued from page 14)

drawings. The following schedule gives the most desirable and economical rheostat distribution for an eight-tube set, and one which will afford the most accurate control without complicating the tuning operations.

- (1) One rheostat for oscillator tube.
- (2) One rheostat for both detector tubes.
- (3) One rheostat for all radio frequency stages.
- (4) One rheostat for all audio frequency stages.

When desired, the stages (3) and (4) can both be controlled by a single rheostat, but this is wasteful when the audio stages are not in use and the finest adjustment of the R. F. tubes is not possible. The oscillator rheostat is a critical control in nearly all circuits, hence this must be independent of all the other tubes. Very often it is possible to tune and detune the set by simply adjusting the oscillator rheostat, and in all cases the adjustment has an important bearing on the selectivity, particularly when the first circuit is of the regenerative type.

Conditions are greatly simplified in the filament circuit when automatic filament controls are used in the radio and audio stages. The use of such controls reduces the rheostats to two—the oscillator and detector rheostats.

First and Second Detectors

In the conventional super-heterodyne circuit two detector tubes are ordinarily used, the first detector being connected in the input and in front of the R. F. stages, while the second detector is connected after the last radio frequency stage. Both detectors are usually supplied with grid condensers and grid leaks as in any other circuit. This arrangement has been blindly accepted for a long time, although I have never yet met anyone who could give me a logical reason for the introduction of the first detector; in fact, it has seemed that this modification of the first tube is an actual drawback in a transformer coupled circuit using air core transformers.

RECENT developments, however, seem to indicate that nearly all makers are dropping the first detector and are using the first tube simply as a straight radio frequency amplifier, the grid condenser and grid leak being dropped on the first stage. From the experiments I have performed on the heterodyne, this shows a marked improvement in range and selectivity over the conventional type, particularly when the grid of the first tube is even a negative bias. Biasing this tube very noticeably increases its sensitivity and volume as is the case with any other radio frequency tube, and the circuit seems far more stable than with the more usual construction.

With iron core transformers, impedance, or resistance coupling, the audio frequency component developed by the first tube when used as a detector is con-

MAKE YOUR RECEIVING SET SELECTIVE



The Benson Wave Filter eliminates annoying interferences. It is of the inductive coupled type. Mounted in a beautiful leather covered cabinet with an engraved bakelite panel.

PRICE \$8.75



2125 No. Halsted St.

CHICAGO, ILL.

ARROW BATTERY SLASHES Prices TO CONSUMERS ONLY

Prices Smashed!
Quality Not Sacrificed

Here is real battery quality, guaranteed to you, at prices that will astound the entire battery-buying public. Order direct from factory. Put the Dealer's Profit in your own pocket. You actually save much more than half, and so that you can be convinced of true quality and performance, we give a

Written Two-Year Guarantee

Here is your protection! No need to take a chance. Our battery is right—and the price is the lowest ever made. Convince yourself. Read the price list

- Special 2-Volt Radio Storage Battery, \$3.75
- Special 4-Volt Radio Storage Battery, 6.00
- 6-Volt, 60 Amp. Radio Storage Battery, 7.00
- 6-Volt, 80 Amp. Radio Storage Battery, 8.00
- 6-Volt, 100 Amp. Radio Storage Battery, 9.50
- 6-Volt, 120 Amp. Radio Storage Battery, 11.50
- 6-Volt, 140 Amp. Radio Storage Battery, 13.00

We ask for no deposit. Simply send name and address and style wanted. Battery will be shipped the day we receive your order Express C. O. D., subject to your examination on arrival. Our guarantee accompanies each battery. We allow 5% discount for cash in full with order. You cannot lose! Act quick. Send your order today—NOW.

Arrow Battery Co.
1215 South Wabash Ave.
Dept. 11 Chicago, Ill.



CABINETS

If you are interested in a radio cabinet in which is combined both beauty and practicability, just write

LAKESIDE SUPPLY CO.,
Dept. R
73 West Van Buren St.
CHICAGO, ILL.
Telephone, Harrison 3840

sistently amplified during the successive stages and a certain gain in volume results. However, with the ordinary air core transformer coupling the audio component receives very little amplification; hence it is better to drop the first detector and devote our energies to concentrating on R. F. amplification by means of a biased first R. F. stage.

In the second detector we meet a condition which is not often appreciated by the experimenter and one which has resulted in the partial failure of many heterodyne sets. This is the proportion of the grid condenser of the second detector tube. To use the standard 0.00025 mf. fixed condenser, commonly recommended for simple receivers, is a mistake, for a little thought will show that the second detector is rectifying much longer waves than in the common regenerative circuit and therefore requires a considerably larger grid condenser. With intermediate frequencies ranging from 5,000 to 10,000 meters wave length, it is likely that 0.0005 to 0.001 mf would be a more suitable grid condenser at this point.

Patent Duoplug on Market

The Pacent Electric Company of New York, manufacturers of the Pacent Radio Essentials, have developed and placed on the market a new plug of unique design and unusual merit.

The new Essential, known as the Duoplug, accommodates two pairs of phones in parallel. No tools are required for making connections. The special type thumb nut connectors may be tightened with the fingers. The nut is slotted so that with a dime or other thin coin an especially secure connection may be made.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of Radio Age, published monthly at Chicago, Illinois, for October 1, 1924.

State of Illinois, County of Cook, ss.
Before me, a Notary Public in and for the State and county aforesaid, personally appeared Frederick Smith, who, having been duly sworn according to law, deposes and says that he is the Editor of Radio Age and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and, if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Radio Age, Inc., Chicago, Ill.; Editor, Frederick Smith, Chicago, Ill.; Managing Editor, Frederick Smith, Chicago, Ill.; Business Manager, M. B. Smith, Chicago, Ill.

2. That the owner is: (If the publication is owned by an individual, his name and address, or if owned by more than one individual, the name and address of each, should be given below; if the publication is owned by a corporation the name of the corporation and the names and addresses of the stockholders owning or holding one per cent or more of the total amount of stock should be given). Radio Age, Inc., Chicago, Ill.; Frederick Smith, President, Chicago, Ill.; M. B. Smith, Secretary and Treasurer, Chicago, Ill.; John H. Lohbeck, Vice-President, St. Louis, Mo.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state). None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any person, association, or corporation has any interest direct or indirect, in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is: (This information is required from daily publications only.)

FREDERICK SMITH,
Editor.

Sworn to and subscribed before me this 1st day of October, 1924.

FLORENCE A. SMITH,
Notary Public.

(My commission expires Sept. 21, 1926.)

Always Mention RADIO AGE When Writing to Advertisers

All Building Parts for 5 TUBE NEUTRODYNE \$39.49



A five tube assembly kit, which includes everything necessary to build a genuine Hazeltine 5 tube set.

WHAT THIS GENUINE STANDARD SET CONSISTS OF—

- 1 Drilled Mahogany Panel, polished mahogany effect engraved in gold.
- 3 Four-inch Mahogany Dials, gold engraved.
- 2 Gold Plated Jacks.
- 3 Genuine Hazeltine Neutrodyne Transformers mounted on the famous Brunswick Low Loss Condensers. Positively the only Neutrodyne kit including them.
- 2 Hazeltine Neutrodyne Heavy Bakelite Sockets.
- 1 6-Ohm Rheostat with plated knob to match panel.
- 1 30-Ohm Rheostat with
- gold plated knob to match panel.
- 2 Genuine Tillark Completely Shielded Audio Transformers.
- 1 Baseboard.
- 20 Feet Tinned Bus-bar.
- 1 .00025 Freshman Grid Condenser.
- 1 Tubular Glass Grid Lens.
- 1 Set Engraved Binding Posts.
- 1 .002 Micon Condenser.
- 1 .006 Micon Condenser. Exact size special blue print and instructions.

All packed in attractive box Complete Building Kit, \$39.49 C. O. D.

OPERATING OUTFIT

- 5 Tested Tubes (Type 201A).....\$19.50
- 2 45-Volt Extra Large Variable "B" Batteries for Neutrodyne.....\$ 6.50
- 1 60-Ampere Hour Storage Battery,

guaranteed 2 years, 11.25
1 pr. 3000-ohm Head Phones and Cord \$.90
1 Antenna Equipment 1.50
Complete Outfit, \$43.40, C. O. D.

(Parts Also Sold Separately)

FREE

If you order Building Kit and Operating Outfit both together, we will include Fine Mahogany Finish CABINET, FREE.

SEND NO MONEY

We ship C. O. D. When shipment arrives pay your postman. Then enjoy your purchase under our WRITTEN MONEY - BACK GUARANTEE. Just send name and address and state kit you want—Now!

THE RADIO SHACK

Executive Offices
Dept. R.A. 11
55 Vesey St., New York
Largest Radio Dealers in America. Every article sold on Written Money - Back Guarantee.

THE RADIO SHACK

Jiffy Blow Torch



Here You Are Mr. Set-Builder!

Do your soldering with a "Jiffy"—a neater, cleaner job in a shorter time. It's self-blowing—can't explode! Burns with blue hot flame! Complete "Jiffy" outfit—Copper Soldering Iron, Non-Corrosive "Jiffy" Flux, String Solder, "Jiffy" Blow Torch with accessories, \$2.50.

At your dealer's or direct

Apex Stamping Company
Dept. 29 Riverdale, Ill.

Dealers! Write for proposition

How to make a loud speaker for clear tone in December Radio Age.

CLASSIFIED ADVERTISEMENTS

Don't overlook the value of RADIO AGE'S classified advertisements. Many such messages have paved the way to independent incomes.

The classified advertising rates are but ten cents per word for a single insertion. Liberal discounts are allowed on three, six and

twelve-time insertions, of five, fifteen and thirty per cent, respectively. Unless placed through an accredited advertising agency, cash should accompany all orders. Name and address must be included at foregoing rates and no advertisement of less than ten words will be accepted.

RADIO SALESMEN WANTED—Make \$50.00 weekly selling standard, well advertised radio sets and parts. No investment required. Write for free outfit. Desk 27, WAVELAND RADIO COMPANY, 1027 N. State St., Chicago.

FOR SALE

Silver Wire—Most perfect Conductor known. No Loss of Current. Easy to Solder. In 25-foot Coils. Per Coil \$1.25. Aragon Radio Co., 222 N. State St., Chicago.

RADIO JOBS

If you want to turn your knowledge of radio into dollars, insert an ad in the classified section of RADIO AGE at 10 cents a word. You will find that manufacturers and radio dealers are looking for radio men like you.

RADIO CIRCUITS

SPECIAL FOR NOVEMBER

The Reinartz Radio Booklet, by Frank D. Pearne, fully illustrated, and RADIO AGE, for \$2.50. Price of booklet alone is 50c. Send check, currency or money order to RADIO AGE, 500 N. Dearborn Street, Chicago.

MISCELLANEOUS

158 Genuine Foreign Stamps. Mexico War Issues, Venezuela, Salvador and India Service. Guatemala, China, etc., only 5c. Finest approval sheets, 50 to 60 percent. Agents Wanted. Big 72-p. Lists Free. We Buy Stamps. Established 20 Years. Hussman Stamp Co., Dept. 152, St. Louis, Mo.

RADIO TUBES

I have just bought a set requiring 201-A tubes, leaving me with two UV-201's and one UV-200. All three have been used only a short time. Who'll take them for \$1 each? Guaranteed. Address Box X11, RADIO AGE, 500 N. Dearborn St., Chicago.

Classified ad copy for the December issue must reach RADIO AGE not later than October 25.

AGENTS

90c an hour to advertise and distribute samples to consumer. Write quick for territory and particulars. American Products Co., 2130 American Building, Cincinnati, Ohio.

CASH IN ON RADIO! Build and sell sets for us. No trouble to earn \$5 an hour in spare time at home. Auburn Radio Co., Dept. N, Cincinnati, O.

MAKE GOOD MONEY selling radio hookup blueprints. Hookups for all types of receivers from the simplest crystal to the most complex super-heterodyne. Address, Box 111, RADIO AGE, 500 N. Dearborn St., Chicago, Ill.

BUSINESS OPPORTUNITIES

WANTED—A Chicago organization desires radio proposition of merit from manufacturers, that should prove profitable, sellers direct to the consumer or from jobbing standpoint. Merchandise of established trade name considered, but propositions providing for the use of our own trade name preferred. Give full details in first letter. Address Box 112, RADIO AGE, 500 N. Dearborn St., Chicago, Ill.

FOR SALE

BLUEPRINTS—Make your own set from proven original and up-to-the-minute blueprints. The following are merely three of a choice of almost one hundred different types:

- HT-1-3—Five tube neutrodyne—50c.
- FB-6—Three-honeycomb regenerative—35c.
- D10-4—Diode single circuit—25c.

All three of above, for \$1.00. These tested blueprints are all made up in easily read circuit drawings. MIDLAND PRODUCTS COMPANY, 1413 Hood Ave., Chicago, Ill. Ask for our complete list, No. R11.

Ingenious

The "SELF ADJUSTING" Rheostat



Write for FREE Hook-ups everywhere

\$1.10

AMPERITE controls perfectly and automatically the current flow from battery to tube. No Rheostat knobs on panel to turn. No ammeter needed. No worry. One AMPERITE for each tube inside the set regulates current on thermo-electric principle. Simplifies wiring and operation. Facilitates tuning. Proven in use. Adopted by 50 set manufacturers. Be sure your set is equipped with AMPERITE.

RADIALL COMPANY
Dept. RA1 50 Franklin St., New York

AMPERITE
"means right amperes"

Pickups from Page 71.

5th Prize

Mr. R. Kneeland Ashdown, P. O. Box No. 139, Freeport, N. Y., wins the fifth prize for busting static:

RADIO AGE,
Gentlemen:

I am enclosing a list of the radio broadcasting stations heard during the month of August and which I started on the 6th.

My present set, which is a three-tube Haynes Griffin Regenerative single circuit set and on which I use a loud speaker, tuned in these 57 stations through static that was at some times quite impossible.

The set, while not a portable, can be transported easily, and while I have used it as a portable receiver, I was not designed as such. I use the old type of tubes, the UV 200 and 201 tubes for detector and amplifier, which permit me to hear most of the stations with considerable volume on my loud speaker.

R. KNEELAND ASHDOWN.

P. O. Box 139,
Freeport, N. Y.

And now it's time for us to sign off before we crowd some good feature out of the book, so;

If you liked the Pickups Page

To any great extent,

Just drop the gang a letter

And a button will be sent;

You can be a Dial Twister

If you'll quickly write today;

Obey that impulse,

Let's hear from you;

Don't let anything delay.

Mastering the 3-Circuit Tuner

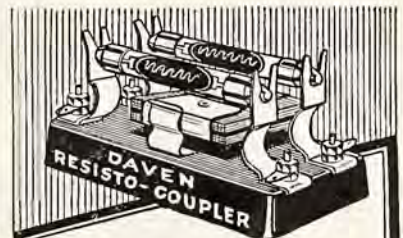
(Continued from page 12)

condenser are placed by using the drilling templates furnished with them. A single 5-16 inch hole suffices to pass the shaft for the tickler, the coupler itself being supported by the baseboard and brackets.

The three-circuit set works admirably on a dry cell tube such as the WD-12 or UV-199, and the rheostat selected should have 6 or 30 ohms resistance, depending upon which tube is bought. With either of these a 45 volt "B" battery is advised.

With the aerial connected to point No. 1, the dial adjustments for the tuning condenser should be noted for each local station. They should be recorded again in case either of the other two points are tried, for they will be decidedly different. In the one bulb class, the three-circuit receiver is a most satisfactory outfit to operate, from standpoints of clean-cut selective ability and signal strength—these sterling qualities present in superlative degree only when the optimum value of antenna coupling has been reached.

Not too much, for tuning'll be broad; nor too little, for signals'll be weak; the happy medium is perfection.



Imitation is the Sincerest Flattery

—and is inevitable with so fine and worthy a product. But an imitation rarely satisfies. The discriminating fan will insist upon the original and only

RESISTO-COUPLER

Price, \$1.25

Sold Everywhere

Get from your dealer the DAVEN "RESISTOR MANUAL," a practical handbook on Resistance Coupled Amplification. By Zeh Bouck. Price 25c.

DAVEN RADIO CORPORATION

"Resistor Specialists"

Newark, N. J.

HUDSON-ROSS

Sells only Guaranteed Radio Apparatus. Send for discounts.

123 W. Madison St. Chicago

Always Mention RADIO AGE When Writing to Advertisers

RADIO Buyers' GUIDE

For Consumers Get it now—before you buy any set or parts to build one. Bargains in all kinds of complete Sets, Parts and Accessories (Will you be so kind as to add the name of one or more friends you believe will soon want radio goods? Thank you!)

FREE 100 Pages Just send your name.

Liberty M.O. House, Dept. 693Y, 106 Liberty St., N.Y.

Table listing various radio-related companies and their locations. Columns include company names (e.g., WCBK, WCBL, WCBM), descriptions (e.g., Northern Radio Mfg. Co., Charles Swartz), and locations (e.g., St. Petersburg, Fla., Houlton, Me., Baltimore, Md.).

COMING IN DECEMBER RADIO AGE

THE "super" fans will be pleased to know that RADIO AGE plans to devote part of its blueprint section in December to a recently perfected "dyne" hookup, by John B. Rathbun. A clearly drawn isometric blueprint of this wonder circuit will be spread across two blueprint pages, with an accurate, easily followed circuit diagram. Don't miss these

SUPER - HETERODYNE BLUEPRINTS

Another contribution by that famous author-technician,

PAUL THORNE

who will tell you

HOW TO MAKE A SIMPLE LOUD SPEAKER FOR CLEAR TONE.

Efficient Hookups for Beginner and Expert by

FRANK D. PEARNE

ROSCOE BUNDY

FELIX ANDERSON

BRAINARD FOOTE

EDMUND H. EITEL

PAUL GREEN and

KENDALL NORTH

RADIO AGE'S ever-popular Broadcasters' Feature Section will be augmented on a greater scale than ever with the December number, with a group of interesting features, including:

The Royal Flush from Station WSAI.

Staying Up Late with the Kansas City Nighthawks.

Popularizing Radio on the Pacific Coast.

Winner of the RADIO AGE POPULARITY CONTEST FOR OCTOBER.

Also fiction features and a liberal portion of PICKUPS AND HOOKUPS.

ON THE STANDS ABOUT NOVEMBER 16.

BURNT OUT?

AUDIO TRANSFORMERS

WE FIX 'EM!

\$5.00 TRANSFORMERS - \$2.00
OVER \$5.00 \$3.00

CASH OR MONEY ORDER

SUMMIT CITY RADIO CO.

1404½ Spy Run Ave., FT. WAYNE, IND.

Little Lessons in Radio for Beginners

(Continued from page 25)

Cleveland only about 235 miles away. All messages had to be relayed by way of Indianapolis. These curious circumstances may be due to ore deposits.

What is it that sometimes causes a station to fade away without my having changed the tuning controls?

This is a subject about which scientists are still in some doubt. Fading, believed by some authorities to be due to atmospheric disturbances in the "Heavyside Layer." By this term, scientists refer to a strata of rare atmosphere miles above the surface of the earth. This strata produces the effect of an enormous reflector of radio waves. When disturbances affect the "Heavyside Layer," radio waves are absorbed instead of being reflected. Such fading generally lasts for a short time only. The station usually comes back if you leave the controls set as they were when you were receiving the station at proper length.

Why is it that my set will not receive with the range and volume during the day time that it will at night?

It is an accepted fact that radio waves have a range and strength during the day time less than one-fifth as great as they have after dark. The rays of the sun practically absorb radio energy. There is no receiving set made that can change this condition. Get what you can during the day time, but do not attempt the impossible.

What is it that sometimes causes a set to howl when I place my hand upon the controlling dials?

It is the effect of "body capacity." The human body possesses a certain amount of so-called "electrical capacity."

What is it that causes a crackling, pounding noise, at times very much worse than others?

This is what is known as "static." Static is electricity in the air which becomes so intermingled with the radio waves that there is no possible way for separating the two. The finest, most sensitive radio set will naturally bring in "static" even louder than a sluggish receiver, which is not sensitive either to "static" nor to the radio waves you are trying to receive.

"Static" is due to atmosphere conditions beyond control of anyone. "Static" is generally more pronounced in summer than in winter but even on some winter nights, static is bad and on some summer nights, it is almost entirely absent.

Why is it that receiving conditions vary so greatly from time to time?

The latest theory of the transmission of radio energy from broadcasting station to receiving set is that the radio energy is shot off in all directions from the transmitting antenna in absolutely straight lines. (The old theory was that the energy traveled in waves, bounding along on the surface of the earth.)



LEGO WONDER FIXED DETECTOR for REFLEX & CRYSTAL SETS

Something entirely new.
100% SENSITIVE

10 IMPORTANT FEATURES READ THEM CAREFULLY

- 1—No parts to replace or wear out.
- 2—The use of a NEW MATERIAL that effectively eliminates distorted and interrupted reception, and substitutes clarity and increased volume.
- 3—Absolutely 100% sensitive. No searching for sensitive spot.
- 4—Glass encased, it is immune from sun and dust.
- 5—Especially designed to withstand high voltage in reflex circuits.
- 6—Solidly constructed throughout, it is practically everlasting.
- 7—It is ALWAYS READY—no adjustments of ANY kind needed.
- 8—As good looking as it is efficient. Highly nickel-plated throughout and attractively designed. It enhances the appearance of any set.
- 9—Constructed so that it is thoroughly VIBRATION-PROOF.
- 10—Carefully tested, approved and unconditionally guaranteed by its makers.

For Sale by All Dealers 80c. or Sent Postpaid Insured \$1.

Lego Corp., 225 W. 77th St., N. Y. C.

PATENTS

To the Man with an Idea

I offer a comprehensive, experienced efficient service for his prompt, legal protection and the development of his proposition.

Send sketch of model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea free on request. Write today.

RICHARD B. OWEN, Patent Lawyer
81 Owen Bldg., Washington, D. C.
2278-M Woolworth Bldg., N. Y. City

REFLEX
Erla—Acme—Harkness
Dealers! Send for Discounts
HUDSON-ROSS
123 W. Madison St. Chicago

Canadian Stations

CFAC	Calgary Herald	Calgary, Alberta	430	CHCM	Riley & McCormack	Calgary, Alberta	415
CFCA	Star Pub. & Print. Co.	Toronto, Ontario	400	CHCS	The Hamilton Spectator	Hamilton, Ont.	420
CFCE	Marconi Wireless Tel. Co. of Canada	Montreal, Quebec	440	CHYC	Northern Electric Co.	Montreal, Quebec	410
CFCH	Ahitibi Power & Paper Co.	Quebec Falls, Ont.	400	CJCA	Edmonton Journal	Edmonton, Alberta	455
CFCL	La Cie de L'Evenement	Quebec, Quebec	410	CJCC	London Free Press Print. Co.	London, Ont.	430
CFCK	Radio Supply Co.	Edmonton, Alberta	410	CJCD	T. Eaton Co.	Toronto, Ont.	410
CFCL	Centennial Methodist Church	Victoria, British Col.	400	CJCE	Spratt-Shaw Radio Co.	Vancouver, B. C.	420
CFCN	W. W. Grant Radio (Ltd.)	Calgary, Alberta	440	CJCI	Maritime Radio Corp.	St. John, New Brunswick	400
CFCR	Radio Specialties (Ltd.)	Vancouver, B. C.	450	CJCM	J. L. Phillips	Monti Joli, Quebec	430
CFCO	Laurentide Air Service	Sudbury, Ont.	410	CJCN	Simons Agnew & Co.	Toronto, Ont.	410
CFCW	The Radio Shop	London, Ont.	420	CJCS	La Presse Pub. Co.	Toronto, Ont.	430
CFDC	Sparks Co.	Nanaimo, B. C.	430	CKAC	Yanover Daily Province	Montreal, Quebec	430
CFDC	The Electric Shop (Ltd.)	Saskatoon, Saskatchewan	400	CKCK	Canadian Independ. Telephone Co.	Toronto, Ont.	450
CFRC	Queens University	Kingston, Ontario	450	CKCK	Leader Pub. Co.	Regina, Saskatchewan	420
CFUC	University of Montreal	Montreal, Quebec	400	CKCO	Ottawa Radio Association	Ottawa, Ont.	440
CHAC	Radio Engineers	Halifax, Nova Scotia	400	CKCX	P. Burns & Co.	Calgary, Alberta	440
CHBC	Marconi Publishing Co.	Calgary, Alberta	410	CKLC	Wilkinson Electric Company	Calgary, Alberta	440
CHCB	Marconi Company	Toronto, Ont.	420	CKDC	Wentworth Radio Supply Co.	Calgary, Alberta	400
CHCD	Canadian Wireless & Elec. Co.	Quebec, Quebec	10	CKY	Manitoba Telephone System	Winnipeg, Manitoba	450
CHCE	Western Canada Radio Sup. (Ltd.)	Victoria, B. C.	9	CNRO	Canadian National Railways	Ottawa, Ont.	435
CHCL	Vancouver Merchants Exchange	Vancouver, B. C.	450				

Cuban Stations

PWX	Cuban Telephone Co.	Habana	400	2K	Alvira Diaz	Habana	200
2DW	Pedro Zayas	Habana	300	2HS	Julio Power	Habana	180
2AB	Alberto S. de Bustamante	Habana	240	20L	Oscar Collado	Habana	290
20K	Mario Garcia Vello	Habana	360	20W	Anacleto Saenz	Habana	210
2BY	Frederick W. Burton	Habana	260	5 V	Leopoldo Y. Figueroa	Colon	360
2CX	Frederick W. Burton	Habana	320	6KW	Frank H. Jones	Tainucu	340
2EV	Westinghouse Elec. Co.	Habana	220	6KJ	Frank H. Jones	Tainucu	275
2TW	Roberto E. Ramirez	Habana	230	6CX	Antonio T. Fleueros	Cienfuegos	170
2HC	Heraldo de Cuba	Habana	275	6DW	Eduardo Terry	Cienfuegos	225
2LC	Luis Casaus	Habana	250	6BY	Jose Gandux	Cienfuegos	200
2KD	E. Sanchez de Fuentes	Habana	350	6AZ	Valentin Ullvarri	Stgo. de Cuba	250
2MN	Fausto Simon	Habana	270	8BY	Alberto Ravelo	Stgo. de Cuba	225
2MG	Manuel G. Salas	Habana	280	8FU	Andres Vinnel	Stgo. de Cuba	225
2JD	Raul Perez Falcon	Habana	150	8DW	Pedro C. Anduz	Stgo. de Cuba	275

British Stations

2LO	London	365	5NO	Newcastle	400
5IT	Birmingham	475	5SC	Glasgow	420
5WA	Cardiff	350	2BD	Aberdeen	495
6RM	Bournemouth	385	6SL	Sheffield (relay station)	303
2ZY	Manchester	375			

French Stations

YN	Lyon	740	6AJ	Paris	1,780
FL	Paris (Eiffel Tower)	2,600	ESP	Paris	450

Effective Inductances

By JOHN B. RATHBUN

Because of its exceedingly low distributed capacity, the spider-web type of coil has long been noted for its effectiveness as a tuning inductance or radio frequency choke. Properly constructed, such coils represent practically pure inductance due to the fact that adjacent turns of wire are not parallel, and hence have no wasteful condenser effect through which the radio energy can be short circuited. Almost any hookup can be improved to a marked degree by substituting spiderweb type coils for the

single layer drum windings more commonly employed as inductances.

In the older type of spiderweb, the wire was wound in and out through a number of radial wooden spokes with the latter imbedded in a wood disc core. The spokes at one time afforded a support for the wire and a means of winding the coil. While this was a marked improvement on the single layer and honeycomb type of winding, yet it was found that there was a loss due to the mass of wood within the magnetic field of the coil and that the coil functioned much better when the wooden spokes were withdrawn. When this latter method was adopted,

the coils were made self-supporting by coating them with a non-capacitative varnish which eliminated all dielectric material within the electric field except the wire covering and the thin coating of cellulose varnish.

Adopting this principle in its entirety, the Pfanstiehl Radio Company of Highland Park, Ill., have developed a full line of "Pure Inductances" ranging from simple and tapped inductance coils to complete variometers, couplers and oscillators. All of the coils made by this firm are of the self-supporting type without wooden cores and protected by a special non-capacitative varnish of great mechanical strength. So far as my tests have gone on this apparatus, and I have tried out the devices in a number of circuits, the coils show an improvement of from 20 to 40 per cent in the sensitivity and signal strength over the common single layer tube wound coils. They tune much sharper and there is less loss due to capacitance between turns.

The advantages of the disc windings are particularly in evidence in the Pfanstiehl couplers and variometers where two of the discs are magnetically coupled by placing them face to face with about one-quarter inch between the two coils. As the coils are only about one-quarter inch thick, all turns of wire are included in the mutual fields, which is not the case with tubular or honeycomb coils where the far turns of one coil may be removed several inches from the coil to which it is inductively coupled.

RADIO AGE SUBSCRIPTION BLANK

Radio Age, Inc.,
500 North Dearborn Street,
Chicago

Gentlemen: Please enter my subscription for RADIO AGE, the Magazine of the Hour, for one year, beginning with your next issue, for which I enclose \$2.50.

Name.....

Street Address.....

City.....

State.....

If RADIO AGE for one year and RADIO AGE ANNUAL are desired at special price of \$2.50, mark cross here.

Send cash, money order or check.

RADIO AGE

BUYERS' SERVICE

What do you want to purchase in the radio line? Let the staff of RADIO AGE save you time and money by sending in the coupon below. Look over the index for the articles you desire. Then enter the number of the article you would like to know more about in the spaces provided in the coupon.

RADIO AGE will write your letters and guide you in making careful selections by sending your name only to such organizations whose merchandise has been found reliable through tests in RADIO AGE INSTITUTE or from other authoritative information in our possession.

- 1 "A" Batteries
 - 2 Aerial protectors
 - 3 Aerial insulators
 - 4 Aerials
 - 5 Aerials, loop
 - 6 Aerials, patent
 - 7 Aerials, socket plug
 - 8 Amplifiers
 - 9 Amplifying units
 - 10 Ammeters
- B**
- 11 "B" batteries
 - 12 Batteries (state voltage)
 - 13 Batteries, dry cell
 - 14 Batteries, storage
 - 15 Battery chargers
 - 16 Battery chemicals
 - 17 Battery clips
 - 18 Battery handles
 - 19 Battery holders
 - 20 Battery paint
 - 21 Battery plates
 - 22 Battery substitutes
 - 23 Bezels
 - 24 Binding posts
 - 25 Binding posts, composition
 - 26 Binding posts, initialed
 - 27 Binding posts, insulated
 - 28 Binding posts, nickel-plated
 - 29 Books
 - 30 Boxes, battery
 - 31 Boxes, grounding
 - 32 Bridges, wheatstone
 - 33 Broadcasting equipment
 - 34 Bushings
 - 35 Buzzers
- C**
- 36 Cabinets
 - 37 Cabinets, battery
 - 38 Cabinets, loud speaker
 - 39 Carbons, battery
 - 40 Cat whiskers
 - 41 Code practisers
 - 42 Coils
 - 43 Coils, choke
 - 44 Coils, coupling
 - 45 Coils, duo-lateral
 - 46 Coils, filter
 - 47 Coils, grid
 - 48 Coils, honeycomb
 - 49 Coils, inductance
 - 50 Coils, Reinartz
 - 51 Coils, stabilizer
 - 52 Coils, tuning
 - 53 Compounds, battery sealing
 - 54 Compounds, impregnating
 - 55 Condenser parts
 - 56 Condenser plates
 - 57 Condensers, air
 - 58 Condensers, antenna coupling
 - 59 Condensers, by-pass
 - 60 Condensers, coupling
 - 61 Condensers, filter
 - 62 Condensers, fixed (paper, grid or phone)
 - 63 Condensers, variable grid
 - 64 Condensers, variable mica
 - 65 Condensers, variable air
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- 66 Condensers, vernier
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 - 68 Contacts, silver
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 - 70 Contacts, switch
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 - 74 Couplers, molded
 - 75 Couplers, vario
 - 76 Covers, battery
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 - 307 Voltmeters
- W**
- 308 Washers
 - 309 Wave meters
 - 310 Wave traps
 - 311 Wire, aerial
 - 312 Wire, braided and stranded
 - 313 Wire, copper
 - 314 Wire, insulated
 - 315 Wire, Litz
 - 316 Wire magnet
 - 317 Wire, platinum
 - 318 Wire, tungsten

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Test No. 14. VARIABLE CONDENSER. Manufactured by the American Brand Corporation of 8 West Park St., Newark, N. J. Embodies a new idea in vernier control of the plates. Mechanical construction of the condenser is very good. Insulating material so placed with respect to electrostatic field that losses are at a minimum. A worm drive gear system having a ratio of 100 to 1 is employed, this arrangement moving the entire set of plates. Plate ends finished in a new way to cut down radio frequency losses. Has a low zero capacity. The phase angle difference of this condenser is less than 20° and the insulation resistance is 6 ohms at approximately 1,000 cycles. Furnished with or without the worm gear vernier drive. Tested and approved by RADIO AGE Institute.



Pfanstiehl Silencer

Test No. 15. WAVE TRAP. Known as the Pfanstiehl Silencer, made by the Pfanstiehl Radio Company of Highland Park, Ill. This trap is an inductively coupled absorption circuit which can be used on any type of receiver, as an interference preventor. The unit is connected in the antenna lead of the receiving system and is tuned to the unwanted station. The un-wanted signal is absorbed and dissipated in this circuit, and any other frequency may be tuned to without interference. Tested and approved by the RADIO AGE Institute.



Marle Audio Transformer

Test No. 16. AUDIO FREQUENCY TRANSFORMER. Made by the Marle Engineering Company of Orange, N. J. Two ratios were submitted for test, both transformers showing up very well under rigid observation. Has binding posts conveniently located to facilitate connections. Both types encased in a durable hard rubber shield, well finished. Tested and approved by the RADIO AGE Institute.

Test No. 17. FIXED GRID LEAK. Made by the Durham & Company, Inc., 1936 Market St., Philadelphia, Pa. This grid leak is of the type using the system of blowing a resistant metal on the inner wall of a glass tubing, and connecting metal end thereto. This construction assures perfect contact, and prevents changes in resistance, a perfect resistance conductivity, and noiseless operation. Made in twenty-eight sizes ranging from 5000 ohms to 10 megohms. Tested and approved by RADIO AGE Institute.

Durham Grid Leak



Test No. 18. RADIO FUSE. Made by the Chicago Fuse Manufacturing Company. Designed to protect the filament circuit of radio receivers from overload, and short circuits. The fuse is so designed that it will burn out if a current of over 140 milliamperes is passed through the circuit. The fuse is made employing an element of very fine fuse wire stretched between two metal terminals and covered with a small glass globe to make performance uniform with all fuses. The fuse is inserted into a small clip arrangement, the end of the clips being used as soldering lugs as well as fuse holders. Tested and approved by RADIO AGE Institute. Sold by the Chicago Fuse Mfg. Co., Lavin and 15th Sts., Chicago, Ill.

Radio Tube Fuse



Test No. 19. TUNING UNIT, known as the Ambassador Coil. Made by the Ambassador Sales Company of New York. The unit is well made with the intention of keeping down losses to a minimum. All coils are wound with high frequency cable Litzendraht; to keep wire resistance low. The tuner has no other losses in the form of taps or other devices to change the coupling ratio. The primary is of the aperiodic design in fixed relation to the secondary coil, and the tickler is wound on a rotor ball, which is so designed to least affect the tuning of the secondary circuit. This unit is an excellent one for most any conventional circuit using tickler coil feedback. Tested and approved by the RADIO AGE Institute.

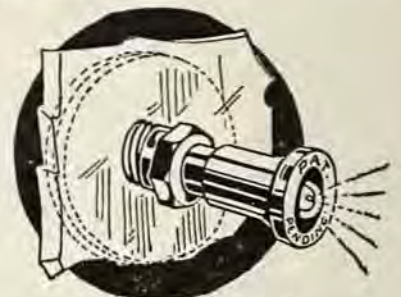


Ambassador Coil

Bakelite Insulating Material



Test No. 20. INSULATING COMPOUND, Known as Bakelite. Made by the Bakelite Corporation of 247 Park Avenue, New York, N. Y. This insulating compound is mechanically strong, does not chip and is impervious to moisture. It does not acquire the iridescent bluish glaze so common to other insulating compounds of poor quality. Used in the manufacture of hundreds of radio appliances. Tested and approved by RADIO AGE Institute.



Kant-Blo Signal

Test No. 21. FILAMENT CIRCUIT PROTECTIVE DEVICE known as the Kant-Blo Switch or Binding Post Signal. Manufactured by the Ganio Kramer Co., Inc., of New York City, N. Y. This device embodies the idea of using a small signal light similar to that of a switchboard which lights up immediately if the filament circuit is short-circuited with a heavy overload. Made in two styles, one the Kant Blo Binding Post, which has the tiny bulb inside of the cap, and the Kant-Blo Switch which has the signal light imbedded in the switch knob protruding from the panel. Tested and approved by the RADIO AGE Institute.



Flint Audio Transformer

Test No. 22. AUDIO FREQUENCY TRANSFORMER. Made by the Flint Radio Company of 1804 Wilson Avenue, Chicago, Illinois. Has a laminated core made of good silicon steel, with the design so effected as to insure an even distribution of flux throughout the entire field. Coils wound with No. 40 enameled copper wire, the layers being well insulated. Shielded in a black enameled metal case with nickled trimmings. The ratio of the transformer is 4 to 1. Each transformer is individually tested on broadcast signals before shipment. Tested and Approved by RADIO AGE Institute.

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Super-Zenith IX Same as VII except—built with legs and additional compartments containing built-in Zenith loud speaker on the one side and generous storage battery space on the other. Price (exclusive of tubes and batteries).....**\$300**

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