RADIO AGE

The Magazine of the Hour

December
1924

Price
25
Cents

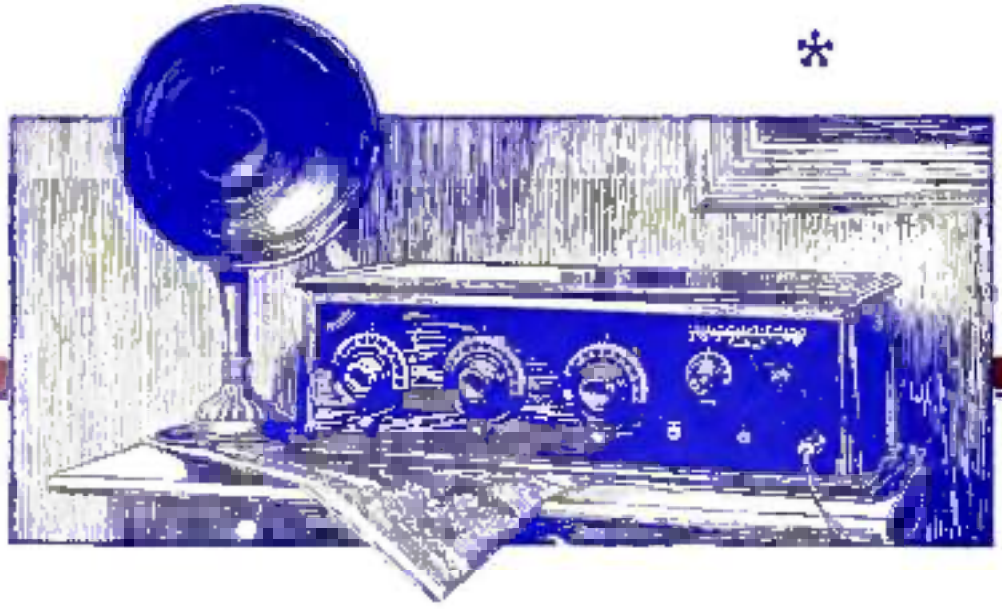
In This Issue

- Complete Blueprints of a New Super-Heterodyne.
- How to Make a Receiver that Minimizes Static.
- What Increased Power will Mean to Radio.
- Stories and Pictures of Your Radio Stars.
- "Pickups and Hookups" by Readers.

Blueprint Section Every Month

Let Our Hookups Be Your Guide

"1000 Miles Away the Same as a Local Station"



The PFANSTIEHL Model 7

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"After testing hundreds of radio sets, I decided upon the Pfanstiehl Model 7 for my own personal use, and I can recommend it because it produced the most satisfactory results I have yet attained with any set.

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The Pfanstiehl Non-Oscillating System

Radio frequency has had one serious obstacle to overcome; it has heretofore generated oscillations which caused howls, squeals and other disturbing noises, if not suppressed. Formerly these oscillations were considered as inevitable and were suppressed more or less effectively with resistances, potentiometers, neutralizing condensers, etc.

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DEALERS: Write for the facts about the Pfanstiehl Model 7 and special exclusive-territory proposition.

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Highland Park 22 S. Second Street **Illinois**

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The astounding growth of Radio has created thousands of big money opportunities. Millions of dollars were spent during the past year on Radio, and thousands of young men are needed right now to meet the ever-increasing demand of work.

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No matter if you know nothing about Radio now, you can quickly become a radio expert, by our marvelous new method of practical instruction—instruction which includes all the material for building the latest up-to-date radio apparatus.

Scores of young men who have taken our course are already earning from $75 to $200 a week. Merle Wetzel of Chicago Heights, Ill., advanced from lineman to Radio Engineer, increasing his salary 400% *even while taking our course!* Emmett Welch, right after finishing his training, started earning $300 a month and expenses. Another graduate is now an operator of a broadcasting station—PWX of Havana, Cuba, and earns $250 a month. Still another graduate, only 16 years, is averaging $70 a week in a radio store.

Wonderful Opportunites

Hardly a week goes by without our receiving urgent calls for our graduates. "We need the services of a competent Radio Engineer." "We want men with executive ability in addition to radio knowledge to become our local managers." "We require the services of several resident demonstrators"—These are just a few small indications of the great variety of opportunities open to our graduates.

Take advantage of our practical training and the unusual conditions in Radio to step into a big paying position in this wonderful new field. Radio offers you more money than you probably ever dreamed possible—fascinating easy work—a chance to travel and see the world if you care to or to take any one of the many radio positions all around you at home. And Radio offers you a glorious future!

The National Radio Institute is America's Pioneer Radio School—established in 1914. Our course is the absolutely complete one now being offered which qualifies for a government first-class commercial license. It gets you the biggest paying jobs in Radio.

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We have just prepared a new 32-page booklet which gives a thorough outline of the field of Radio—and describes our amazing practical training in detail. This Free Book, "Rich Rewards in Radio," will be sent to you without the slightest obligation. Mail coupon for it now.

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Please send me without the slightest obligation your Free Book, "Rich Rewards in Radio," and full details of your special offer of Free Equipment Service. Please write plainly.

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RADIO AGE
The Magazine of the Hour
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WITH WHICH IS COMBINED RADIO TOPICS

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CONTENTS

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A Chat With the Editor

POPULAR RADIO for November, with delicious aplomb, launches several announcements which indicate that our contemporary's swelling superiority complex is about ready for the anaesthetic and the surgeon's knife.

The magazine at last introduces picture diagrams into its pages, at the same time making a left-handed apology to "experienced experts" who may encounter them.

Picture diagrams were first published in RADIO AGE in May, 1923, and a year ago we predicted that eventually other radio publications would adopt this obviously excellent method of aiding the inexperienced beginner. We were fortunate enough to increase the number of our regular readers by this improvement, for we consistently published wiring diagrams along with the picture diagrams, so that both the experienced and the inexperienced readers might have what they wanted. This policy has been followed in our free blueprints published as a part of RADIO AGE each month.

After making its announcement that it is now falteringly taking the well-worn trail, our contemporary goes on to say:

> Of course the Editor believes that the average reader of Popular Radio is quite a bit more intelligent and exacting than the reader of any other radio periodical.

We have suspected all along that the editor of Popular Radio believed just that. But to have him broadcast it places us in a condition bordering on incrustation. And think of our readers! (Our December press run was more than 80,000 copies!)

We are convinced that the teaspoon still is mightier than the pen in negotiating apple sauce.

Frederick Smith

Editor of RADIO AGE.

The Satisfaction of Perfect Reception

An evening of reminiscence with the radio; cherished memories recalled by songs of younger days—school—and sweethearts—and shady lanes—songs long unsung but not forgotten, scenes of the present—jazz—orchestra—speech—all perfectly received with no distortion to mar their full enjoyment.

That's the work of Jefferson Transformers! Perfect reproduction of the voice or instrument with the natural tones faithfully preserved. Full, smooth amplification over the entire musical range. Radio fans the world over will attest as to these Jefferson qualities.

Such excellent performance is but the natural outgrowth of over 20 years specialization in the perfection and manufacture of high-grade transformers. Jefferson Transformers meet matched construction specifications. You have the advantage of the best transformer that science and engineering can produce at almost nominal price.

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Write for our latest booklet giving information on how to secure proper amplification. It's free.

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Jefferson Super Sensitive Transformers

* *Tested and Approved by* RADIO AGE *

RADIOTORIALS

MORE power to you! That, in effect, is the United States Government's official greeting to radio broadcasting stations, expressed during and since the Third National Radio Conference in Washington, D. C.

We would not have it understood that this was merely a friendly slap on the back. It was direct word from headquarters that more power in broadcasting stations would mean better reception for millions of receiving sets. Inasmuch as Uncle Sam wants radio reception to attain maximum efficiency, the government allied itself on the side of those who wanted increased wattage behind the microphone.

The Washington conference was participated in by government officials, manufacturers, scientists and broadcasters. There was stubborn opposition to the decisions finally made, and that fact alone justifies a thorough study of what was done and of the probable immediate results. Numerous broadcasting station owners argued that increased power would mean accumulated interference. They protested that stations which lacked the funds to finance greater power would be forced out of business. Therefore, they argued, the project meant eventual monopoly of the air by a few broadcasters.

We believe that such a monopoly would be a radio calamity. At no distant day the majority of American homes will have installed receiving sets. Nobody with vision or conscience would desire to have the control of the great voice that will reach those millions of firesides placed with an interlocking directorate of very rich gentlemen. Anybody who has sufficient optimism and money may start a newspaper or a magazine if he likes, and he may say what he likes in his newspaper or magazine, always providing that he does not step on the rights of others.

Any man who has sufficient capital or credit may build a broadcasting station and he may put on the air nothing but funeral dirges, if he so chooses. It would not pay him to do so any more than it would profit an editor to publish death notices exclusively. In the first instance, the radio fan would tune out the broadcasting station and in the other case the public would stop buying the newspaper.

But it takes all sorts of men to make society and it takes all sorts of broadcasting to fill the radio bill. For that reason radio must remain as free as free speech and the free press. The public must decide what shall survive. It is not so in Europe, either with relation to the press or to radio, but it is certainly so in America.

It is probable that radio broadcasting will resolve itself into a survival of the fittest stations. There may be fewer stations and stations may require more financial capital. But there will be no broadcasting monopoly. Also there will be no censorship of broadcasting. The Department of Commerce is definitely committed to those two propositions.

Would super-power stations and those many lesser stations which are soon to materially increase their present power without essaying the status of super-stations, cause radio confusion on the air? Would the result be chaotic interference in congested centers?

The answer to that is the emphatic declaration of the Department of Commerce that all increases of power are to be licensed *experimentally*. If reception is found to be more difficult under the new conditions, the licenses will be withdrawn.

Among the most vigorous advocates of super-power at the Washington conference were two very important manufacturers of receiving sets, neither of whom could possibly be thought of in connection with an effort to aid the so-called radio combine for the simple reason that both are independent manufacturers in active competition with the "Big Four." Both have been earnest promoters of quality broadcasting for the obvious and perfectly worthy purpose of maintaining and stimulating interest in radio.

It is logical to assume that if E. F. McDonald, Jr., president of the Zenith Radio Corporation, and Powel Crosley, Jr., president of the Crosley Radio Corporation, are in favor of more powerful stations, it is because they believe such stations will improve radio reception universally.

THE radio scene shifts. New York, the Mecca of radio-land a few weeks back, now looks to Chicago for the latest in radio technique. From November 18 to 23, at Chicago's Coliseum, the best there is in radio and the men who made it possible will gather to show the equally enthusiastic Middle Westerners what is in store for them in 1925. Smaller shows in the East and in California are doing their bit to keep the public educated radiologically and to prove that no self-respecting citizen can afford to be without a radio. Phrases like "Make this a Radio Christmas" are being coined by alert radio advertisers and imprinted indelibly on the receptive American mind. Radio is becoming a National Institution. It is no longer a toy. It is something we must have, like three meals a day, 8 hours' sleep and political campaigns.

JUDGING from the letters we receive, America's radio fans are up in arms against broadcasting stations who have not mastered the technical art of keeping within their allotted wave lands. Irate listeners complain that "my whole evening was ruined because station W—— didn't keep to its own wave length and could be heard all the way up and down my tuning dial." There are several such violators of the transmitting laws. Whether intentionally or not, some of our most respected stations increase their power several times during an evening and spoil the DX hound's attempts at reaching out into the ether for faraway stations. Some of these broadcasters excuse themselves by explaining that to increase their power after midnight doesn't do any harm, because most of the local stations have signed off by that time. These persons forget that the Western and Middle Western fan's best and sometimes only chance to hear Pacific stations is after midnight. And when a high-powered broadcaster becomes even more powerful, the radio industry suffers several undeserved epithets. Therein lies a point of discussion for Mr. Hoover's conferees. The air is crowded enough as it is.

80,000 Copies of RADIO AGE This Issue

(Photos, World Photo and Wide World, New York)

With the advent of the new dramatic season, radio plays are coming into favor once more. In the East WGY is furnishing the theatrical entertainment over the air, and KGO, the Pacific Station at Oakland, Calif., is pleasing the fans with fresh masterpieces from Hollywood. Now comes KYW, at Chicago, with the announcement that several dramatic "hits" will be broadcast direct from the stage this Winter. The first was sent over the air last month, when "Applesauce," a farce comedy, was broadcast from Chicago. Miss Claiburne Foster, shown above, is one of the reasons the fans kept listening to the whole play, and Allan Dinehart, in the insert, was the object of masculine envy as the voluble lover of the aforementioned lady.

RADIO AGE
The Magazine of the Hour

M. B. Smith, Business Manager
A Monthly Publication Devoted to Practical Radio
Frederick A. Smith, Editor

What Does 'Super-Power' Mean?

HUGE Stations Still a DREAM

By S. R. WINTERS

Stormy Petrel of Conference Fades

THE term super-power, the stormy petrel of the early sessions of the Third Annual Radio Conference, lost its identity during the closing hours of this national gathering. The proposed 50,000-watt broadcasting station of David Sarnoff, vice-president of the Radio Corporation of America, lapsed into a remote possibility, if not a dream. Instead of the designation super-power, at once a bugaboo and a magic word, was introduced the conservative term increased power for transmitting stations.

When Mr. Sarnoff announced that the Radio Corporation of America is ready to begin the immediate erection of a great super-power broadcasting station at some point outside of the city of New York, he injected into the deliberations of the Third Annual Radio Conference the outstanding debatable issue. The ensuing debate between the advocates and opponents of this measure introduced both serious and humorous aspects of powerful transmitting stations.

For instance, Charles E. Erbstein, owner of a broadcasting station at Elgin, Illinois, facetiously classified the powerful radio companies as four horsemen riding for a control of the ether waves. On the other hand, Powel Crosley, Jr., in a serious mood, advocated the use of increased power as an agency in overcoming atmospheric disturbances or static and thus making of radio communication something more than a seasonal pastime.

U. S. Paves Way

THE subject of maintaining or removing the limitations on the amount of electric energy put into the antenna at transmitting stations was of itself of great importance. The gravity of the situation was further accentuated by the necessity of the United States Department of Commerce acting upon five or six applications already received from broadcasting authorities asking for permission to use an increased amount of electric power. For instance, Powel Crosley, Jr., has already purchased equipment for installing a 5,000-watt transmitter.

Another reason suggesting the necessity of liberalizing the government regulation with respect to power limitations came to the fore from representatives of broadcasting stations on the Pacific Coast under the serious restrictions of atmospheric disturbances and the effects of daylight. This condition applies generally all over the country, but seems to be especially a limiting factor on the Coast of the Pacific Ocean.

Powel Crosley, Jr., who sponsored "increased power" for broadcasters at the Third Hoover Radio Conference. He owns Station WLW in Cincinnati.

The problem of interference at once offered complications to broadcasting, if power limitations were to be lifted or liberalized to a great extent. Unfortunately, the members of the radio conference had no practical information upon which to base an intelligent opinion as to the amount of interference that would be caused by measurably increasing the power of transmitting stations. The only approach to the needed information consisted of experiments conducted by two or three of the now relatively powerful broadcasting stations —notably, KDKA at East Pittsburgh and WGY at Schenectady—which have been experimentally broadcasting with the use of as much as 5,000 watts. These tests, although not conclusive, seem to indicate that the use of five kilowatts does not appreciably contribute to the interference already existing in the reception of broadcasting programs.

One Favorable Case

THE situation in the United Kingdom, where broadcasting conditions are so dissimilar to those in this country as to make comparisons of little value, offers an instance where a high-power broadcasting station has created considerable interference. The powerful broadcasting station formerly located at Chelmsford, about 30 miles from London, has been removed to a point 70 miles from the congested centers of the city. This was found necessary when the British Broadcasting Company increased its use of electric power to 25,000 watts. This is clearly a case of where interference had been appreciably multiplied by building a super-power transmitting station even 30 miles away from the congested area of London. However, the General Manager of the Radio Corporation of America, in proposing a powerful transmitting station for New York, indicated that it would be located with due regard to the minimum of interference with listeners and with local stations maintained by other interests.

and capable of serving directly millions of people within the range of its voice.

The technical opinions of Dr. George K. Burgess, director of the Bureau of Standards, and Dr. J. H. Dellinger, Chief of the Radio Laboratory of this branch of the Government, were sought as authoritative and unbiased views for guiding the action of the Radio Conference with respect to permitting a more liberal use of electric energy by the transmitting stations. Their expert judgment indicated the necessity of locating broadcasting stations in the country, thirty miles or more removed from congested areas, if the power is to be increased measurably.

This action seems necessary owing to the interference that would arise from a transmitting station—say of 5,000 watts power—in the midst of hundreds and even thousands of radio receiving sets. After correctly appraising the great value of relatively strong signals from the local broadcasting stations, Doctor Burgess, Director of the Bureau of Standards, indicated the reason for this and the theory for establishing and operating high-power broadcasting stations in the following analysis:

The reason why the local stations give technically superior quality and satisfactory reception is simply because they deliver a radio wave to the receiving antenna of an intensity greater than that of the atmospheric disturbance. In order to deliver a signal of the same intensity to a larger number of people or a larger territory, it is necessary to use higher power in the transmitting station. Carrying this thought to its limit, we are led to the consideration of very high power broadcasting stations. There need be no fear that this will interfere seriously with the smaller stations nor displace them, provided some very simple principles are followed in their establishment.

In the first place, proper frequency separation must be observed. If a new class of specially high-powered stations is established, it should preferably be assigned frequencies at or beyond one end of the present broadcasting frequency band. In the second place, such stations should be separated from others, not only in frequency, but also geographically. It is merely necessary that the signal intensity with which the waves from such a station reach any large body of listeners shall not be materially in excess of the signal intensity from the more ordinary broadcasting stations. This will be readily attained if the broadcasting stations of specially high power are kept out of the cities. Many 1-kilowatt stations are now located in the midst of large cities. Supposing such station to be three miles from the average listener in the city, the average interference in that city will be the same as caused by a 10-kilowatt station located 30 miles out.

The utility value of broadcasting stations with increased power was effectively presented by Powel Crosley, Jr., of the Crosley Radio Corporation, in an address in which he emphasized this as means of overcoming atmospheric disturbances and the limitations of daylight transmission. Furthermore, he indicated that an enlargement of the effective range of broadcasting stations would result in penetrating farming regions and other rural areas.

Radio to farmers, according to Mr. Crosley, means more than a mere pastime. The rural dweller has accepted this art of communication as a medium for bringing information and entertainment to millions of homes. The city dweller has diverse interests and many forms of entertainment to engage his attention; radio is the one means of regularly bringing the information and enjoyments of urban communities to the country.

E. F. McDonald, Jr., President of the Zenith Radio Corporation, who was one of the first to apply for an "increased power" station outside of Chicago. The government is expected to permit several experimenters such as Mr. McDonald to test the feasibility of increased power before "super-power" is made a definite policy.

The speech of David Sarnoff, vice-president and general manager of the Radio Corporation of America, in which he defended his organization against the charge of monopolizing radio interests and in which he championed the cause of super-broadcasting stations, drew rapt attention. He said that all political parties and sects were permitted to make deliverances through stations allied with his company. Further, in answer to the charge of monopoly, he implied that if there were a monopoly it existed at present in the interconnection system of broadcasting, whereas in establishing super-power stations there would be maintained a competitive system.

In further advocacy of the building of a high-power transmitting station, he agreed to finance the undertaking, operate the station under supervision of the Government, and after a period of time that if it proved a public nuisance instead of a public service, he would abandon the project and sustain the financial loss thus incurred.

"Is there anything fairer than this?" he inquired in a dramatic conclusion.

SECRETARY of Commerce Herbert Hoover, in assigning the subject of high-power broadcasting stations for consideration of the committee on interference, suggested that recent experience during the development of radio seemed to indicate that somewhat higher power for all stations throughout the year during the daytime and also at night in the Summer would be one method by which static could be overcome and the distance range of listeners to each station maintained. In the farming districts the listeners who are located at considerable distances from the station were unable to receive signals during the past Summer and are now unable to do so during the daytime.

Hoover's Viewpoint

Mr. Hoover indicated that there arises a question as to how far power can be increased in the neighborhood of other stations without creating interference and damage to established stations, and he suggested that the question resolved itself into a matter of adjustment between the proposed increased power, the location of stations, and the wave-length assignment to these stations.

The final conclusions of the Third Annual Radio Conference with respect to the removal of the limitations of power for broadcasting stations will permit of an increased use of electric energy for this purpose by transmitting stations in Class B, which designation has been changed to Class 1. The decision of the Conference does not, however, specify the amount of the increase, but it is reasonable to anticipate that instead of a dozen broadcasting stations operating on 1,000 watts there will be this many or more pumping 5,000 watts into the transmitting antennae.

This additional power may be utilized by some stations throughout the year, while others may avail themselves of the increased output during daylight hours and in the Summer months, when atmospheric disturbances overwhelm orderly radio signals. There may be several stations that will use as much as 10,000 watts, although this is purely speculation, and a subject which rests within the regulatory powers of the Bureau of Navigation of the United States Department of Commerce.

"Super" or Increased Power?

The resolution embracing the subject of a super-power station permits of the experimental operation of such a project under government supervision. However, the power that can be used is to be prescribed by the Department of Commerce; its location and other conditions of operation are factors that must enter into the stipulations of any such experimental license issued by the Government. The statement of Secretary of Commerce Herbert Hoover that confusion had arisen between the terms super-power and increased power implies that the former term is thrown into discard for the present.

At any rate, if the writer correctly interprets the conclusions of the Radio Conference, the broadcast listeners

need not anticipate the reception of deafening signals from a 50,000 or 25,000-watt station in the immediate future. The owners of the more than 500 broadcasting stations might as well dispel any delusion that their offerings may ride the invisible waves under the handicap of being sidetracked by any signals from a giant broadcasting station that would hurl its energy across two continents.

For the present, it seems that there will be no masts or towers reaching, like the Tower of Babel, to the sky, and that the intimate association of 50,000 or 100,000 watts with broadcasting stations is but a dream of future accomplishment.

Better Service Assured

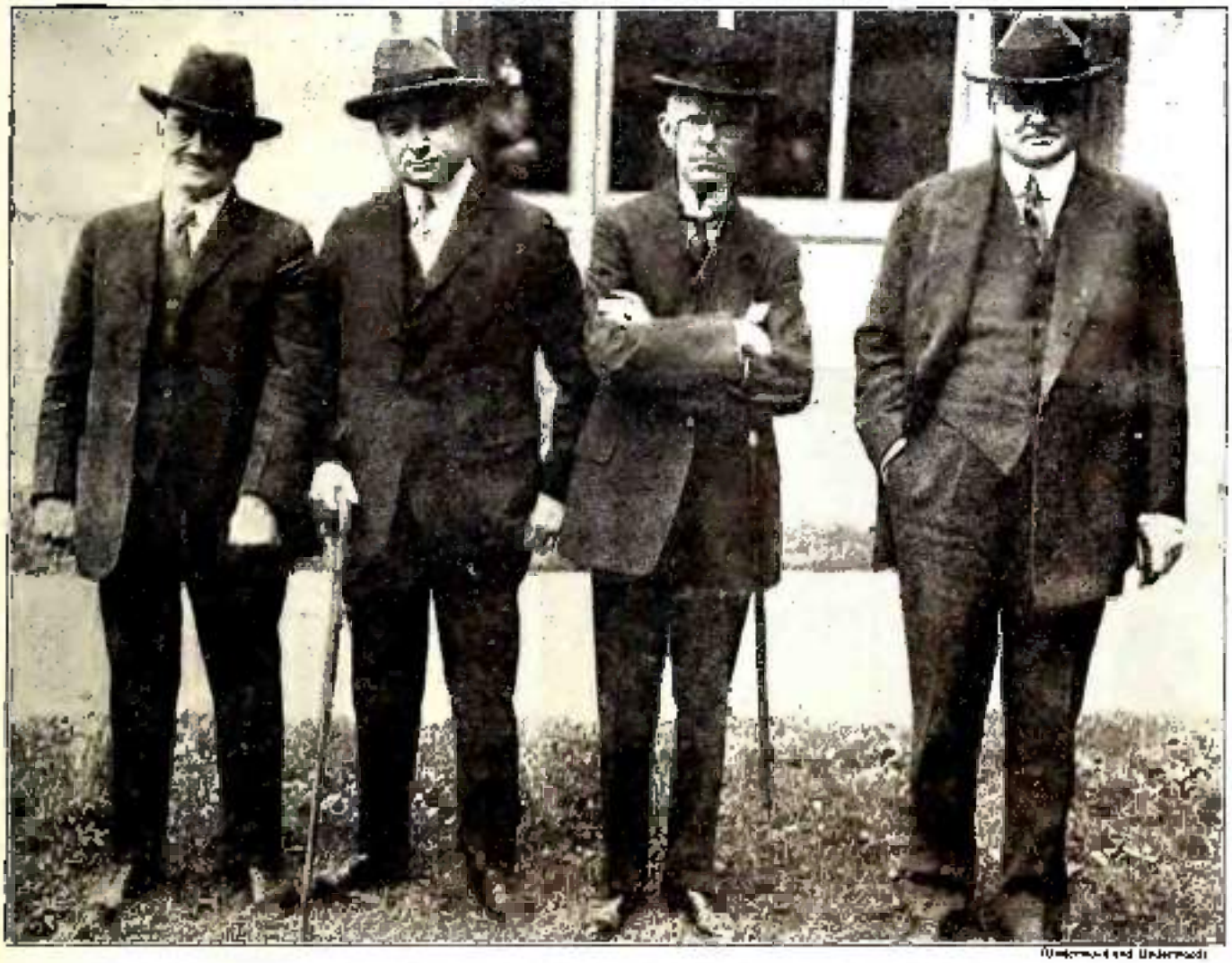
THE third annual radio battle is over and the clean-up squad of supervisors and technical experts finished its work re-zoning stations and reallocating wave lengths. Unlike the World Series, it was not a very bloody battle, and few casualties have been reported. Practically everything went through, and in general the radio public and, in fact, the whole industry will be better served in the future.

Although the Government refused to take off the lid in regard to power limitations, experimental licenses for high-power broadcasting are assured and it is up to the radio engineers to show the radio supervisors and the listening public the benefits of high-power broadcasting.

It is probable that one another broadcasters will also apply for permission to broadcast with 5KW sets under the same conditions, and, as was pointed out, a broadcasting system of pure radio may soon be competing for radio popularity with the chain of the inter-connected stations served by the American Tel. & Tel. Co., which has made possible nation-wide broadcasting.

Among the important decisions reached were: the addition of 30 wave channels for broadcasting stations, bringing the total to 100, the removal of the marine sparks on 300 meter from the broadcast band, and the designation of 600 meters for distress calls only, clearing the air programs of code interference. A re-classification of broadcasters and the transfer of all class C stations from 360 meters, improves the situation further, while the re-zoning of the country into six zones will further aid broadcast operation. This it is planned will provide a separate zone for the New England States, including New York City and part of New Jersey; Zone two will comprise the rest of the Atlantic states, Pennsylvania, West Virginia, and the western part of New York. Zone three, Michigan, Ohio, Illinois, Kentucky, Tennessee, West Georgia, Alabama and Mississippi; the Central states are divided horizontally, the southern states forming Zone 4, and the northern, Zone 5; all the Pacific states with Idaho, Utah and Arizona, constitute the sixth Zone. When assigning experimental stations power higher than now permitted, the Department intends to use this system and in assigning new class I station waves.

Marine communications will be handled on 660, 730, 875 and 706 meters, giving the ships five channels instead of two, also removing coast-wise interference and congestion. Amateurs retain substantially the same wave bands as heretofore, but benefit by low wave lengths assigned temporarily by the Department recently.



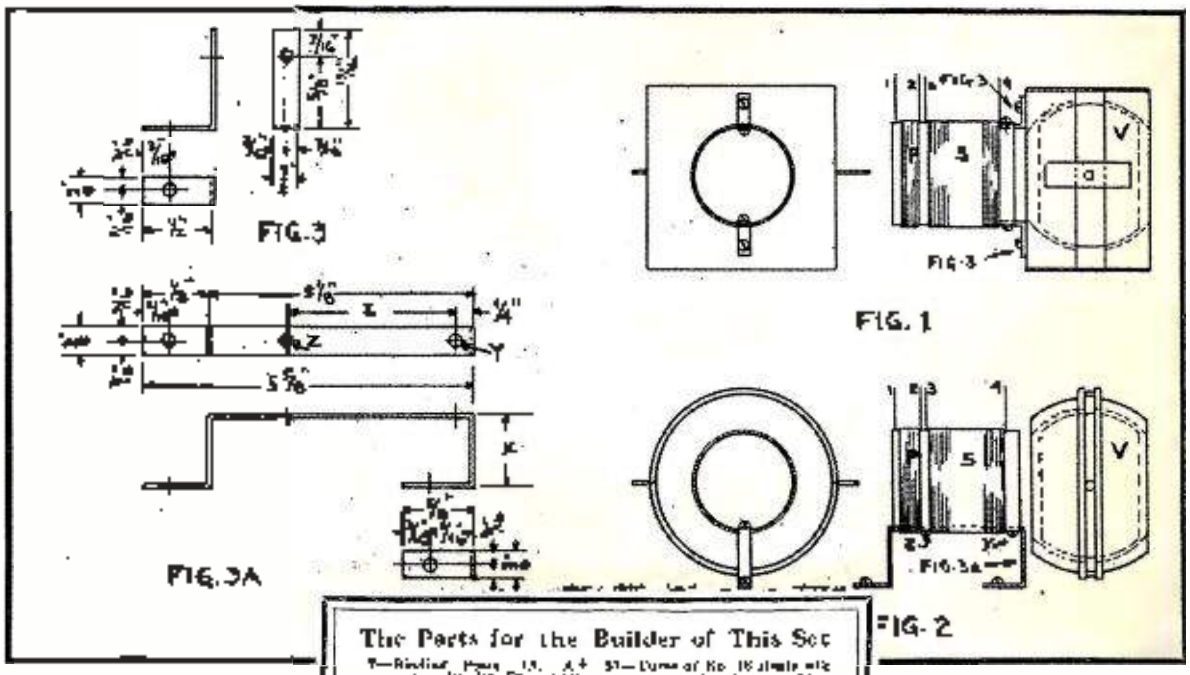
(Underwood and Underwood)

Four leading figures in the Third National Radio Conference in Washington are shown in the picture above. From left to right they are, C. Francis Jenkins, inventor of "radio movies," David Sarnoff, Vice-President of the Radio Corporation; Maj. Gen. George O. Squier, former chief of the U. S. Signal Corps, and Herbert Hoover, Secretary of Commerce. The results of this notable gathering are expected to be made known gradually within a few weeks. Re-allotment of wave bands is expected to be one of the first decisions of the members of the conference.

A Receiver Designed Especially for Selective

Unusual with a "SUPER

By H. FRANK



The Parts for the Builder of This Set

1—Binding posts (3, A+ A—, B+, B—, C+ and G+)
1—Variable condenser, (C2 .0005 mf.)
1—3" or 4" Composition dial, for same.
1—Variable condenser, (C1 .001 mf.)
1—3" or 4" Composition dial for same.
1—Three element, fixed condenser, (C3) Described in this article and shown in figures 4, 5 and 6.
3—Fixed resistance units (R, R1, R2) 1,000 ohms.
1—Grid leak (G)
1—Phone jack (J)
1—Tip-jack and link, (J1) 3 switches.
3—Vacuum tube sockets, (S1, S2, S3)
1—Audio amplifying transformer, (T1) Radio Ad.
1—Audio amplifying transformer, (T2) Radio Ad.
1—Composition tube, 3" to 3½" saddle diameter, about 5" long. (To be used as a rod for the "P" and "S" coils.)
18—Turns of No. 18 single cotton covered wire or Litzendraht cable. (Litzendraht cable is 48 strands of No. 38 enamelled copper wire, twisted to form a small cable and covered with a silk and cotton braid. The exact size of wire to be used is not important.)
51—Turns of No. 18 single silk covered wire or Litzendraht cable. (Secondary winding "S")
1—Variometer, fixed or mounted rotor-position type. (V)
1—3" or 4" Composition dial for same.
2—Binding posts, (R, R1)
1—Composition panel.
1—Composition base, 6" x 11" for mounting the apparatus.
2—Composition strips, 1" wide, 6" long.
1—Wood basket.
Miscellaneous items, such as screws, nuts, and wire and terminals.
1—Strip of brass, 0.01" thick, 0.87" wide and about 18" long for mounting the ordinary and secondary coil to the variometer rotor. (or bakelite to fasten the shaft to the panel. If a moulded variometer is used, about 12" more brass will be required.)
1—Strip of spring brass 3.5" wide and about 3" long. (or Details 1 and 2.)
1—Strip of sheet fiber, 3.12" thick, 3 1.2" long. (or Detail 3.)
This list and text cover the making of the three-element condenser (C3)

The diagram above shows assembly and mounting details for the tuning element. The top view, Fig. 1, shows the coil P and S mounted to a wooden type variometer. The lower view, Figs. 2 and 3A, shows the mounting of the coil when the moulded composition variometer is used.

WE WILL all agree that the biggest problem of today in DX radio broadcast reception with the average receiving outfit is static. We tune in a station a few hundred miles away, get all set to listen in on a real program and show the neighbors what they are missing by not having a radio, and Mr. Announcer cuts in and tells us that "This is station J—Crack—Z—Zizz-z-z-g, East SSS-Scratch—Bang, broadcasting their regular Whir-r-r-r-r-ram, the next number will be C-r-r tweet-r-r-reams."

Then we hear a most delightful overture of static, interrupted now and then with a few strains of our favorite piece of music, or it may be the interesting part of the current news of the day. You finally give up in disgust and tune in on one of the local stations. To quote a well-known cartoonist, "Thus the evening is utterly ruined."

A new problem will also confront the amateur in the near future, when the increased power stations get on the air, and unless our receiver is capable of very sharp tuning, we will be unable to hear little else than what these stations put on the air, or we can go turn on the old piano for a change.

An Up-to-Date Set

THE set described in this article is, therefore, right in keeping with the times, as it will give the maximum selectivity with few controls and will reduce static interference to a minimum, while it remains within the reach of the fan's pocketbook, being of the popular three tube, regenerative variety.

In all of the diagrams of this article, each part bears a designating letter or detail number. In this way it will be easier to distinguish each part and to connect it properly into the electrical circuit. The same designations and detail numbers are used throughout this article and are also shown after each part in the list of parts.

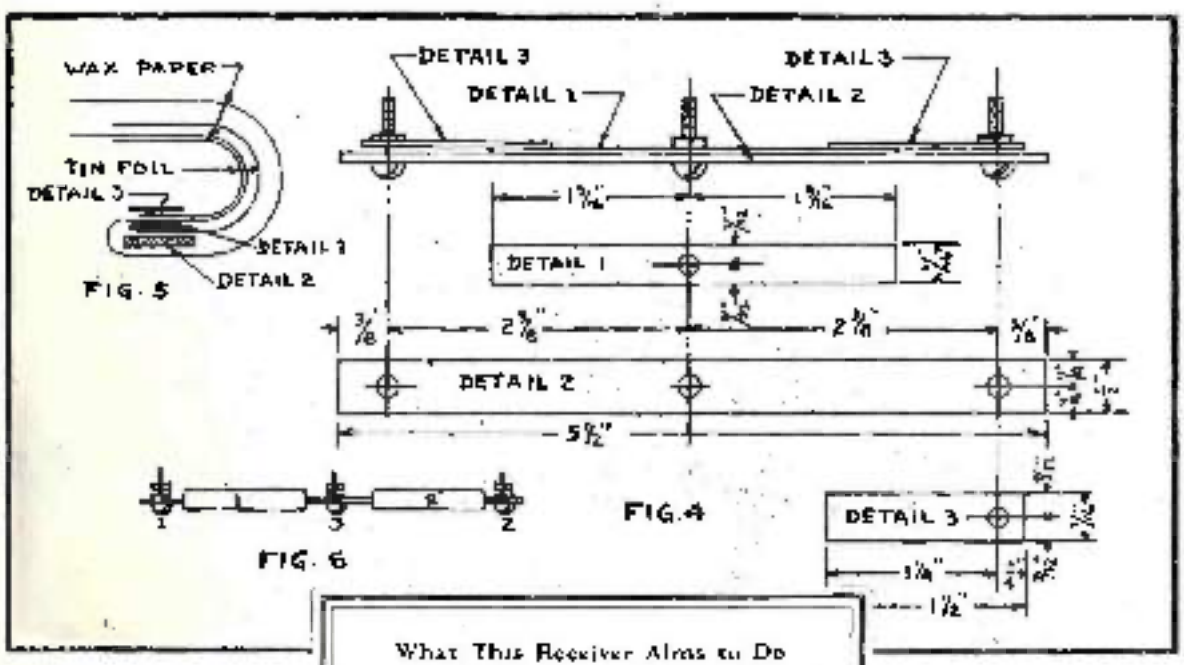
All of the parts used in building the set may be purchased at any radio shop, but as some of the prospective builders of the set may wish to build what parts they can, the construction of the most uncommon pieces is described and explained in figures 1 to 6.

The first step will be to list the parts that will be needed and it is well to have them all at hand before work is started. The cabinet, shelf or panel will not be detailed as to size or drillings, as most of you have your own ideas on how a set should be mounted. Some desire a long low cabinet and others prefer a square panelled outfit, while some just like to try new hookups and mount the apparatus openly. It is often difficult to secure a cabinet of just the shape or size described.

No Parts Specified

ANOTHER undesirable feature in laying out a panel is that the type of apparatus to be used would have to be specified, such as a John Jones Variometer, a Blank Condenser, a Henry Smith Resistance and Dorothy's Jacks, all of which would vary in size and shape from any other make to the extent that these particular parts would have to be secured, which is not always possible. However, to more easily describe the construction and operation of the set, a

Tuning and for *Eliminating* the Static "*Bug-Bear*"



Clarity 3-Tube CIRCUIT"

HOPKINS

A. E. E.

What This Receiver Aims to Do

This historical receiver described in the accompanying article will produce remarkable results when properly constructed, being noted both for its long distance range and clarity of tone.

The fan should not go about building this set, however, in the belief that it will positively cut out static. No receiver designed can do that. But it is hoped "Super-static set" will reduce static and when it was tested under the influence of static by RADIO ACE, the static was found to be minimized to an almost inaudible "crackle" as compared to the unbearable pounding heard when another set was tried under the same conditions.

This set was also designed for the purpose of tuning out the strong high-power stations to be built within the next few months, and although one test was made but a few blocks from a strong Chicago broadcasting station, amazing selectivity was shown and long distance stations tuned in without interference.

general arrangement is shown in figure seven, giving the relative location of each part.

The parts needed to build the set are to be found on page 10.

Let us now start building the tuning element by cutting the composition tube to a length of 3" and squaring up the ends. Mark a point 3-8" in from the left end of the tube and drill two small holes, in the direction of the winding and about 1-4" apart. These holes are for fastening the No. 1 lead of the primary coil "P," which is done by passing the wire down through one hole and back up through the other and again through the first hole, leaving about six inches of wire extending out from the inside of the tube. Now proceed to wind eighteen turns of No. 18 single cotton covered wire in an even row, in the direction of the hands of a clock. When the eighteen turns have been completed, drill two more holes in line with the last turn and fasten the end of the primary coil in the same way as was done before, making lead No. 2, being careful to leave about six inches extending out from the inside of the coil.

The primary coil "P" being completed, we will start on the secondary coil "S" by drilling two more holes as was done at each end of the primary coil. These holes should be 1-4" from the end of the primary winding. The end of the wire will then be made fast and brought out from the tube, forming lead No. 3. Now proceed to wind fifty-five turns of No. 18 single silk covered wire in the same direction as the primary winding, making the end fast in a like manner and bringing the end of the winding out from the tube forming lead No. 4.

Figure 4 in the diagram above shows the details and assembly required in making the three-element condenser used in this set. Fig. 5 shows the winding and winding of the elements and Fig. 6 shows the completed condenser.

THE Litzendracht cable may be substituted for the No. 18 wire on the coils if it is desired, which will afford slightly better results in both tuning and signal strength. The results obtained with the solid copper wire, however, will be nearly as good, as a regenerative circuit tends to reduce the resistance of the coils, eliminating the losses of the circuit.

Mounting the Coil

Upon completion of the coils, the next step will be to make the mounting details shown in figures 3 and 3A. If a wood feature variometer is used, two details, as shown in figure 3, will be required. The tube is then drilled on the secondary end, and the brackets fastened by small brass screws and nuts. The coil is then mounted on the variometer by small brass wood screws, as shown in figure 1. Care should be taken in the handling of the coils so as not to injure the insulation and ground the coils to the brackets.

If a moulded composition variometer is to be used, one detail, shown in Figure 3A, will be required. In making the detail, the dimension "X" will have to be determined by measuring the height of the variometer shaft from its base, subtracting one-half the diameter of the coil. The detail will then be formed and the holes drilled as shown. The tube can then be prepared by drilling a hole, 3-16" in from the secondary end for the mounting screw "Y"; and another hole, directly in line and on the same side, will be drilled between the primary coil "P" and the secondary coil "S." The hole "Z" will then be drilled in the detail to line up with this hole in the tube, and

the bracket made fast with small brass screws and nuts. The complete unit is now ready to be mounted as shown in Figure 2.

The Three Element Condenser

THE next step will be to make the three-element condenser, shown in Figures 4, 5 and 6. One detail 1 and two details 3 will be cut from the spring brass and mounted to the fiber strip, detail 2, with three No. 6 brass screws, 1-2" long, making an assembly as shown in Figure 4.

Now cut two pieces of tinfoil, 1" wide and 1 1-2" long and two pieces 1" wide and 2 1-2" long. Then cut two pieces of heavy wax paper, 1 3-4" wide and about 8" long. Take one of the pieces of tinfoil, 1 1-2" long and place it between the fiber strip and detail 1, as shown in Figure 5. One piece of wax paper will then be folded in the center, the top half will be inserted between the brass details 1 and 3, and the remaining piece of tin foil, 1 1-2" long, will be laid on top of the wax paper, directly over the first piece and under detail 3, as shown.

This should then be wound tightly around the assembly and the waxpaper made fast with glue, forming element No. 1 and half of element No. 3. The end terminal should then be marked No. 1 and the center terminal No. 3. The remaining half of element No. 3 and all of element No. 2 should then be wound on the other half of the assembly, using the pieces of tinfoil, 2 1-2" long.

The terminal at this end should then be marked No. 2. The condenser is now completed and ready to connect into the circuit.

Assembly of the Set

THE first step in the assembly of the set will be to cut the panel and shelf to the correct size to fit our cabinet. When this has been done, the edges should be smoothed off with a fine file and rounded with fine sand paper to avoid chipping. The shelf should be about two inches shorter than the panel and should clear the cabinet by at least a half of an inch on all other sides. The brackets for mounting the shelf to the panel are made from the remaining piece of 3-8" brass, in the same manner that detail No. 3 was made, except that they should be about twice the size and have two holes on each leg, to pass the mounting screws.

The next step will be to lay out the panel and shelf for drilling. This is usually done by placing the instruments around until a satisfactory layout is found, starting with the shelf. The holes for mounting each piece are then marked with a sharp pointed instrument, the instruments removed and the holes drilled. The panel will then be laid out in the same manner.

A great deal could be written about the placing of one piece of apparatus in relation to another and in some cases it is important that this be followed out in order to get the desired results. In this set, however, it is vital to only three pieces, the tuning element and the two audio amplifying transformers. With this in view, the shelf should be laid out so that the tuning element is at least five or six inches from the first audio transformer; also, that the transformers are mounted at right angles to each other and as far apart as is possible, making sure that they do not come closer to one another than 3 1-2".

If a square panel is used, it will be necessary to mount the transformers on the under side of the shelf in order that the required clearances may be obtained. The leads would then come through the panel below the shelf and much of the wiring would be taken from the top of the set. This is also a desirable feature as it will tend to reduce the internal capacity of the set.

When the panel and shelf have been drilled, the instruments should be mounted to each and the shelf fastened to the panel with the brass brackets. Brass mounting screws should be used in mounting all of the instruments, as iron screws are sometimes the cause of noisy sets, setting up little magnetic fields. The set will then be ready to wire.

BEFORE we start to wire the set, it may be well to first consider just what the wiring accomplishes or is meant to accomplish in a receiver. Many radio fans who make their own sets have a great feeling of relief when the panel is drilled and the instruments all mounted. They say, "Now all I have to do is wire it up and it is finished." They get out the circuit diagram and do just that thing, running all the wires nice and straight, with beautiful square turns and corners, and parallel runs, all bunched together in a fine workman-like manner.

Wiring the Set

Many sets, wired in this manner with the square bus-bar wiring that looks so neat, work poorly because the wiring does not accomplish what it is supposed to. The wiring is supposed to connect the different instruments in their proper electrical places so that they will all pull together with as little interference as possible. With this in mind, let us wire the set, keeping the control circuit wiring separated from the energy circuits, in other words, the grid leads, which control the vacuum tube circuits, should not be run parallel to the filament or plate energy circuits and should be as far apart as is convenient.

When connecting two instruments together with one wire, do it by the shortest path, unless it interferes with the moving parts of the tuning element or the condensers, or tends to bring two leads of a control circuit and an energy circuit, respectively, too close to each other.

Do not use too large a size of wire for the connections. No. 14 is plenty large enough to handle any of the currents flowing in the set. The use of too large a size of wire tends to increase the capacity of the set. The capacity between two parallel wires may be high enough to interfere with the proper functioning of the circuit. The little imaginary condensers thus formed will in reality act as filter circuits in the set and will filter out and weaken the signals.

When the wiring has been completed and the set mounted in the cabinet, it will be ready to operate.

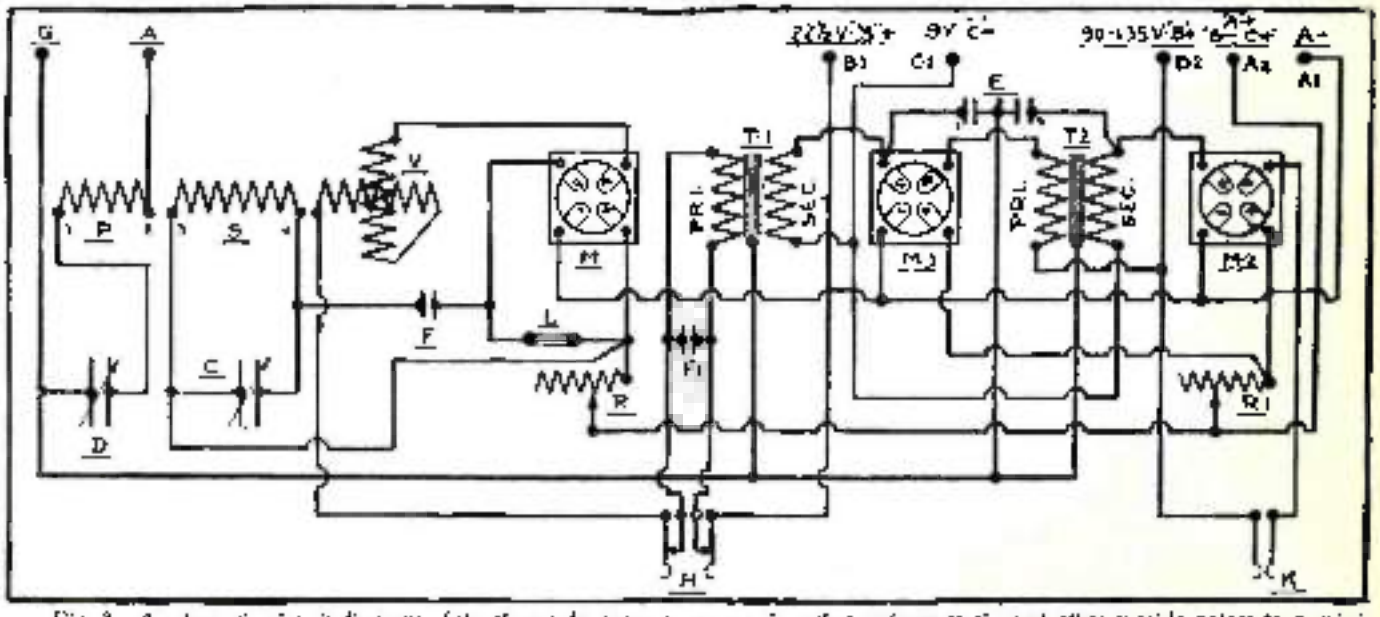


Fig. 3. A schematic circuit diagram of the three tube super-power receiver that reduces static and other outside noises to a minimum. The construction and operation is fully described in the accompanying article.

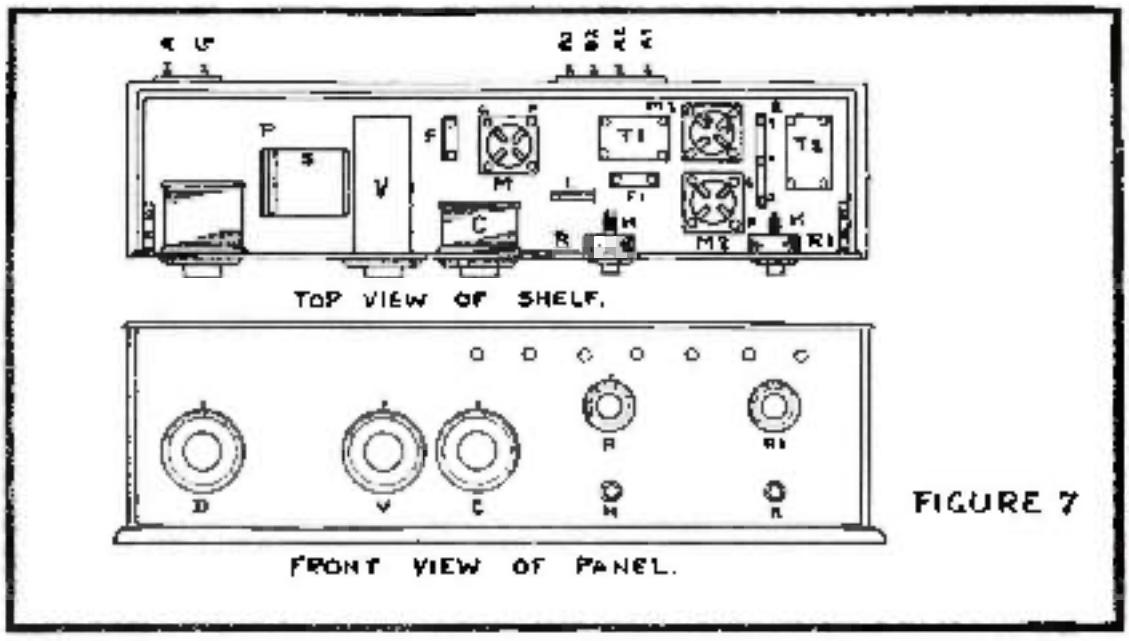


FIGURE 7

Fig. 7, the top view showing the relative locations of the equipment on the shelf and panel, with the cover of the cabinet removed. The lower view shows the front of the panel and the controls

Operation of the Set

IN CONNECTING the set for operation, care should be taken in handling the battery leads to make sure that the plate or "B" battery leads do not come in contact with the filament circuit, as the high voltage will burn out the tubes, which is a rather expensive accident.

The negative A battery terminal is connected to the binding post A1. The positive terminal of this same battery is connected to the binding post A2. Binding post B1 is for the positive terminal of the 22 1-2 volt B battery for the detector tube plate circuit and binding post B2 is for the positive terminal of the 90 to 135 volt B battery for the amplifier tube plate circuits. The binding post C1 will be connected to the negative post of the 9 Volt "C" battery. The negative terminals of the two B batteries and the positive terminal of the C battery will be connected to the binding post A2.

The antenna lead connects to the binding post A and the ground lead to the binding post G.

To put the set into operation, insert the plug of the loud speaker into jack K, turn the dials of resistance R and R1 until the tubes glow, but not far enough so that they oscillate.

The dial of the condenser D should be set at about 50 and the dial of the condenser C rotated slowly until the signal is heard. The volume will be controlled by adjusting the dial of the variometer V. Be careful not to cause too much regeneration as this will tend to distort the signals.

When this set is constructed properly, and the operator becomes familiar with the method of tuning, stations from all over the country may be tuned in clearly with little or no interference.

By watching the dial sets on different stations of a known wavelength, the dials may be slipped around on their respective shafts, until by setting all of them at 35, a station whose wave length is 200 meters is heard, and so on. It will then be an easy matter to calibrate the set.

The Ideal Antenna

SINCE the antenna is of the "fixed tune variety" it is not important as to how long this part of the system is. The ideal antenna for a set of this type is one having a effective flat top portion, factual length without lead in) of about 35 feet. This, with a lead in system of about 35 feet, is sufficiently long to give the easiest signals possible without loss of selectivity.

A word might be said here about the ground system, which should be of the very best type available if the maximum results are expected.

Use a cold water pipe, scraped clean and bright, and after wrapping a piece of tinfoil around the scraped portion, bind the wire around the tinfoil.

The tinfoil has a greater effective surface, and gives just about as good a contact as solder will. It is often impossible to solder a cold water pipe, due to the fact that the solder crystallizes before it really gets a chance to set.

A Grid Leak Mounting

If the reader happens to have some spring brass handy, it is a wise plan to make two little supports for the grid leak. Since the object of the set is to exclude and eliminate noises, this particular unit should be used very intelligently, as carelessness in respect to the grid leak will result in the failure of the entire receiver from a standpoint of internal noises.

The mounting clips can be made from two pieces of spring brass, 1 1-2 inches long and 1-2 inch wide. The brass is bent so that a half inch foot is formed, leaving an upright of 1 inch. The hole for mounting the clips on the shelf is drilled in the 1-2 inch foot of the clip, and a smaller hole to act as a receptacle for the grid leak tip is drilled 1 8 inch from the top of the 1 in. leg. Set the two clips thus made about 1 7-8 inch apart, with their tops bent toward each other to give the clips tension when the resistance unit is inserted. This little kink will often save you a lot of annoying noises later in the course of listening with the set.

In regard to the wiring, recent experiments show that it is highly advisable to keep the low tension wires rather bunched; that is, to keep them running together in as small, well defined path throughout the set.

Keep Wires Free

BY the low tension wires, the A battery leads and their respective connections and the B battery wires and connections are referred to. These wires are all at so called "ground potential" since they are not actually engaged in carrying radio frequency currents. The grid and plate wires as well as the antenna circuit connections should be kept free and open. They should run direct, and should not have right angle bends which tend to make them longer. In using the "right angle" bend system of wiring, one creates small loop antennas which have the property of absorbing and picking up small quantities of radio frequency currents, all of which are detrimental to the clarity of the received signals.

Incidentally, it is often a good plan to connect a high resistance across the G and F terminals (secondary) of the audio transformers, if one wishes further to help matters out with regard to clarity. These resistances may be of the standard type made for that purpose, or may be grid leaks of the tubular type with a resistance of about 3 megohms. However, this is entirely experimental, and is left to the judgment of the constructor.

Small fixed condensers of 0.00025 Mfds. capacity may be used in the same manner in conjunction with the grid leaks, but this decreases volume somewhat though they give exceptional freedom from noises when used.

[Next month Mr. Hopkins will tell you how to build a four-tube neutrodyne-reflex set, using a loop or outside aerial.—a real DX getter with volume and selectivity]

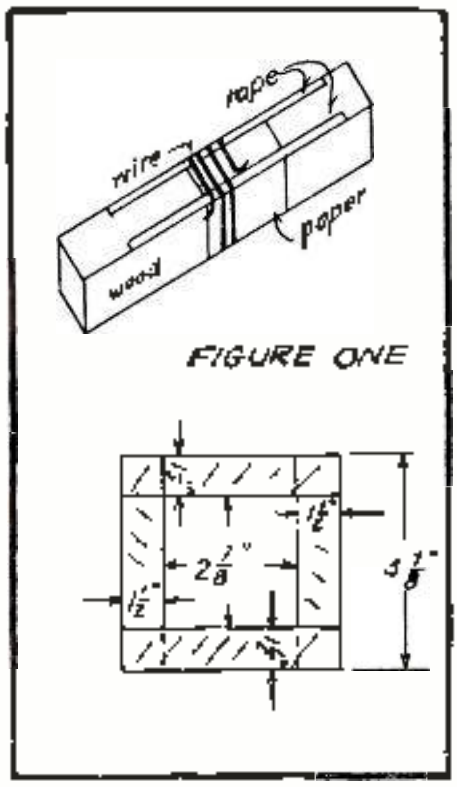


FIGURE ONE

Figure 1, showing how core should be put together and how to lay tape over paraffined paper.

End Your Pet Battery Troubles For All Time with a

Home-Built Battery Charger

A Reliable Rectifier

By C. WILLIAM RADOS

A STORAGE battery charger is an essential for all receiving sets using storage batteries, as it will keep them charged with a minimum of cost and bother. The tungar charger is probably the best and is easy to build. It is fool-proof and economical. Before attempting construction of a tungar charger, we should understand how it works.

The house current is reduced or stepped down through a small transformer and then passed through the tungar. As the tungar bulb is a one-way valve, it produces a pulsating direct current which is connected to the storage battery. The bulb works on the same principle as an audion tube, but it has no grid and is more sturdily built. The filament is heavy tungsten, the plate of graphite, and these elements are enclosed in a large strong glass bulb filled with argon, an inert gas.

When the filament is lighted, it throws off particles of negative electricity, which shoot off into the gaseous space. Negative electricity is attracted by positive electricity or a positively charged electrode. The plate is connected sixty times a second to a positive pulse of electricity. During these intervals the electrons are attracted to the plate and a steady stream from filament to plate occurs sixty times per second. When this occurs, the supply current flows from plate to filament, causing rectification. When the plate is negative, nothing occurs between plate and filament, and only the positive half of the alternating current gets through.

The Construction

THERE are two sizes of tungar bulbs available on the market, the two-ampere and the five ampere bulbs. Details for constructing rectifiers to use both bulbs will be given. The parts necessary are a transformer, a fuse block, switch and socket.

The transformer is the only part which has to be made, as the rest of the parts can be bought cheaply. The core is made of transformer iron No. 28 gauge. The electric light companies' service stations are the best places to get this and get it cheaply. About five pounds of iron will be sufficient. Have the iron cut by a tin shop and see that they cut all pieces exactly the same size. The dimensions are 1⅜x5⅜. All pieces are the same size. As the core is square, it is easy to build up. Fig. 1 shows how the core should be put together. In Fig. 2, the odd layers are sketched at "a," the even layers at "b." The core is carefully built up, making certain that the corners are square and even. When the core is assembled, put it in a vice and tighten it up. Carefully tape three sides with one layer of friction tape, being sure to draw the tape tightly. One side of the core is then pulled out after assembly to allow the windings to be slipped on.

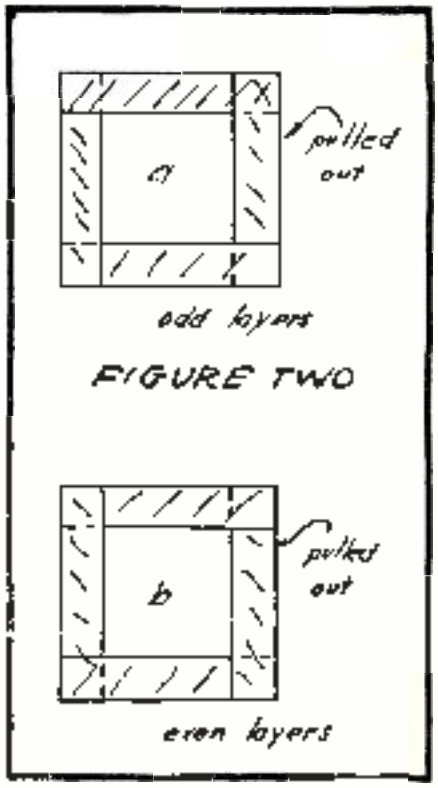


FIGURE TWO

Figure 2. Notice how the odd layers are sketched at "a" and the even layers at "b." Be sure the corners of the core are even.

Laying the Paraffin

Now obtain a piece of hard wood 1¾" square and at least 11" long. Lay over it carefully two sheets of paraffined paper 2¾" wide. Over this lay two pieces of tape about 12" long, as shown in sketch, Fig. 1. Now wind on carefully and evenly one layer of No. 18 dcc for a distance of 2¾ inches. Lay over with a piece of paraffined paper 2¾ inches wide. Start the second layer from the same end as the first layer was started. Continue this process until 550 turns are on, putting down a layer of paper for every other layer of wire. This is the primary. It connects to the 110 volt house current.

The filament winding is wound directly over

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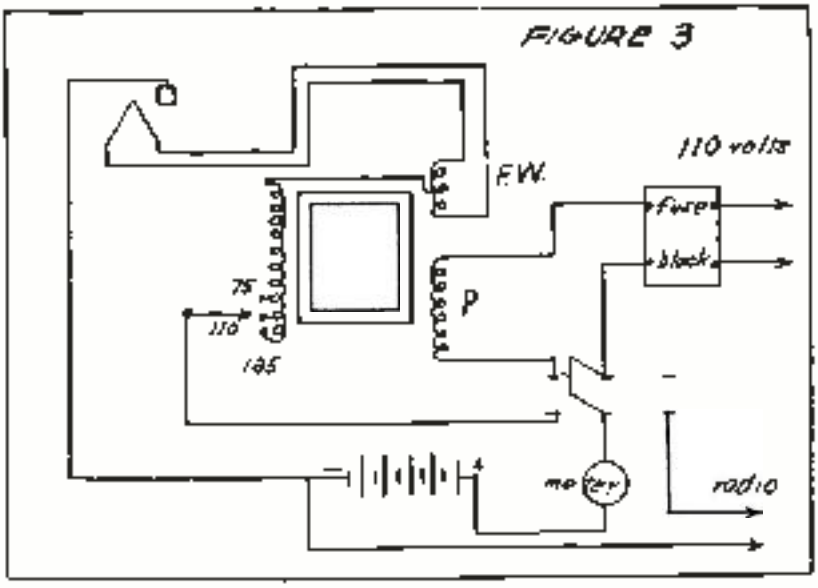

FIGURE 3

Figure 3. The wiring diagram of the home-built rectifier. Once wired in this fashion, it is only necessary to throw the switch from side to side to have the battery on charge or discharge. Quite simple, isn't it?

Some Suggestions for
Brushing Up TUNED R. F. STAGES

By BRAINARD FOOTE

Elimination of the Annoying Whistles in Neutrodynes Depends on Placing of Coils

THE Neutrodyne type of receiver, despite the inroad upon its fame being made by super-heterodynes, is surely the set of to-day. It is being built in far greater numbers than any other of equal number of tubes and its wide popularity is based upon its clear-cut performance in selectivity, sensitivity and clock-like precision in its dial adjustments.

We are beginning to realize that the tuned R. F. receiver can be worked successfully without neutralizing capacities and we are discovering that much depends upon the relative positions of the coils with respect to each other for the elimination of the annoying whistles often common to this form of R. F. amplifier.

Then, again, we are observing that the dimensions of the antenna system, its capacity and inductance, exercise no little effect upon the success with which the receiver may be operated in a given situation. To this end I am endeavoring to call attention to one or more details wherein the tuned R. F. receiver may be the recipient of a bit of "trouble-shooting."

Antenna Coupling

AS pointed out last month in my discussion of the three-circuit tuner there is a proper degree of coupling for every antenna and receiver, which does not necessarily hold true in another installation, where the antenna is of different length and height. Hence, some way of adjusting the antenna coupling after the set has been finished is most helpful in increasing signal volume, where this seems deficient.

In certain cases it is customary to provide a separate winding for the antenna coupling coil, although this is not essential and the same results may be had by tapping in the antenna lead at a point near the filament end of the first grid coil. In Fig. 3 this method is depicted. Four taps are taken when the coil is wound of approximately 5 6, 11 and 14 turns from the filament end of the coil. The antenna wire is first tried on each tap, on an evening when plenty of DX is available, and soldered permanently to the point at which the volume is satisfactory but where the selectivity is likewise acceptable. In the case of a separate antenna coupling coil, it's easy enough to wind 15 turns and take out five or six taps for the same method of coupling adjustment.

Coming now to inter-action between the R. F. transformers, we may entirely eliminate inductive coupling between coils of the various stages by placing them in such a position that the coupling between is zero or negligible. In the neutrodyne this is accomplished by fastening the coils to the tuning condensers at a certain definite angle and then spacing the condensers far enough apart to arrive at the condition of zero coupling between adjacent windings.

In Fig. 1 is shown a rear view of a receiving set in which a different scheme is used. Brass brackets bent to a wide "U" shape are employed to mount the three coils, secured by two nuts and bolts to their lower extremities. In this way, they may be swung to right or left as the occasion demands, and held permanently in the correct setting by tightening the mounting screws with a screw-driver. By adopting this arrangement, I found it possible to eliminate magnetic coupling between adjacent coils. There remains, of course, the coupling in the tubes themselves and between primary and secondary of the R. F. transformers to cause oscillation.

Were the primary windings too large, oscillation couldn't be overcome, and were they too small, sensitivity would be very low. Using 50 turn grid coils, tuned by .0005 mfds. variable condensers, I found that as many as nine primary turns could be employed without causing oscillation of the R. F. tubes on wavelengths above 200 meters. As the condenser capacity is decreased to tune for the shorter waves, oscillation becomes more and more easy, and it is therefore mainly on waves beneath 350 meters than most tuned R. F. receivers are apt to cause trouble of this sort.

Oscillation

With the coils adjustable in this manner, it is a simple thing to connect up the outfit and start to tune. When the three dials are in synchronism, or at the same wavelength setting, oscillation may occur. The positions of the coils are then altered slightly until the oscillation ceases. Then a lower wavelength is sought and the process repeated until the receiver tunes smoothly and without squeals or whistles throughout the range of broadcasting.

To allow of considerable latitude of motion, the connecting bus bar wires could not be run directly to the primary and secondary terminals of the R. F. windings. To simplify these connections, a little connector block of panel material was affixed to one of the mounting screws of each variable condenser, fitted out with several small machine screws and nuts and connections soldered to them. Flexible wires run thence to the coils.

Fig. 2 gives a different view of the R. F. windings and shows how the supporting bracket is fastened to the coil tubing from inside. Two small wood screws serve to hold the bracket to the baseboard.

A simple layout for the R. F. receiver of five tubes may be observed in Fig. 1. The five sockets are placed in a row near the rear of the baseboard, behind them a "binding post panel" held up by two angle pieces for all external connections. Behind each socket lies its respective transformer, whether audio or radio. They're the same in principle, the former being broadly tuned by the heavy iron core and the latter sharpened and tuned accurately.

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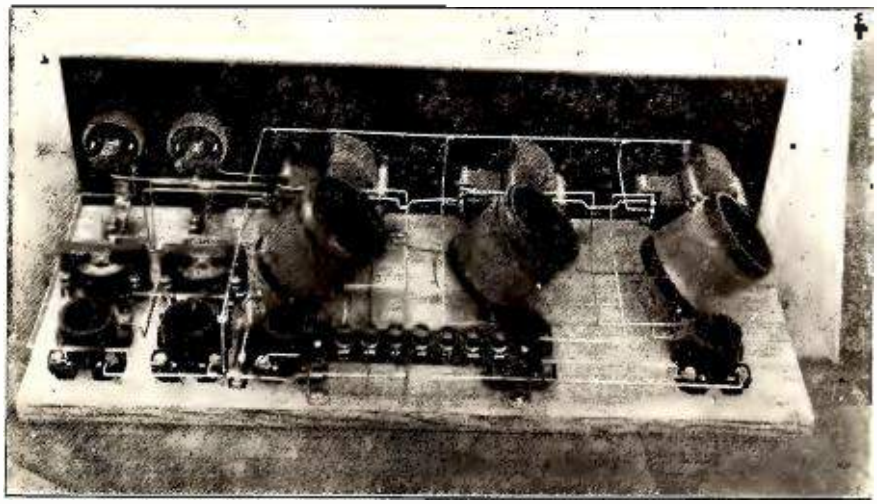


Fig. 1. A tuned R. F. receiver laid out simply and efficiently. Sockets are all in a line, with their respective transformers behind them. Connecting wires are at the rear and rheostats and jacks used to fill the space at the left.

MANY prefer the soft detector tube, but personally I don't care for them on account of the characteristic mushiness and sizzling sounds for which they are so famous. Of course, a little may be lost in sensitivity, perhaps, by the hard detector tube, but so much is gained in ease of tuning, in simplicity of rheostat control and in elimination of extra wiring that I prefer it in all cases with the possible exception of a single tube regenerator, where DX and lots of it is all I care for.

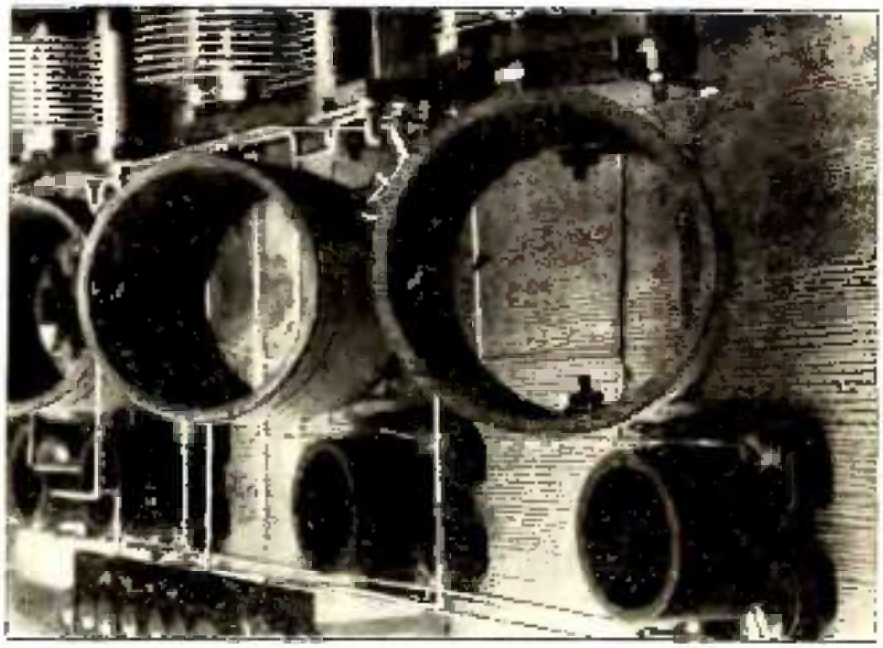


Fig. 2. How "squealing" is overcome. The tuned R. F. coils are placed on brass brackets, set to the point where howling stops, and fastened there with a machine screw and nut.

Choice of Tubes

Moreover, the quality of signal delivered by the hard tube is considerably superior to that of the soft tube, this phenomenon being due to the fact that its characteristic curve is almost a perfect straight line, whereas that of the soft tube resembles the letter "S." In the case of the hard tube, the fluctuations in plate current correspond very closely to those in the grid voltage, and consequently speech and music are more naturally reproduced than with a soft and gassy detector tube.

Now that this little argument is over, we find that we are using hard tubes all the way through. Hard tubes of the "A" kind aren't critical in their filament requirements, so that one rheostat may serve a number of tubes. With a 6 ohm rheostat controlling the two R. F. amplifier tubes and the detector, we have a three tube receiver for use with headphones. For the loudspeaker, however, two audio amplifier tubes are needed, and these may be controlled by a resistance of 10 to 15 ohms. No jack is provided for access to the first audio amplifier tube, since this isn't used for headphones and is not enough for the loudspeaker. That omission simplifies wiring and improves panel appearance, for there then are but two rheostat knobs and two jack "holes" underneath them.

There's a "C" battery in use also and all the grid return leads except that of the detector are connected to the "C minus" binding post. A "C" battery of three volts is employed. This makes a great reduction in "B" battery current and almost doubles the life of this expensive accessory, while somewhat improving the tonal quality at the same time.

While you are going over all these little things, don't forget to give the grid leak on the detector tube a little of the much-needed attention it requires for good results. A great deal depends upon the proper adjustment of this little unit in getting the best signal clearness. If your leak resistance is too high, (when using the hard tubes) the music and voice will sound tinny, and the receiver will be hard to control. On the other hand, if the leak resistance is too low (that is, if the value in ohms is smaller) your music will take on a mushy and dull aspect, and will not give the pleasing effect which is delivered by a properly adjusted detector tube.

The grid leak adjustment of the plate battery on the detector usually go hand in hand. Too high a plate voltage often renders the detector insensitive and finicky—it becomes hard to control, and the signal is very much distorted—a bad condition. When the plate voltage is decreased, it will be noticed that the tube gives the best results.

Remember that you have five tubes in the set, and each one of these five has its own characteristics. You can't try every possible combination that five tubes can give since by certain mathematical laws it runs up into an astounding figure, but you can at least endeavor to find out just which tubes make the best RF amplifiers, the best AF tubes and the one which is the best detector by a little changing around until the right one is found. Very often sets which refuse to work with tubes in certain order, break forth into life immediately upon changing the tubes around in the sockets.

If your dealer has a radio test set (a set used in determining the characteristics of the plate and grid of a tube) ask him to give you an idea as to which tube is the best for RF detector or AF. It is a good plan to have him do this when you purchase the tube.

Last of all, don't forget that the normal plate voltage for the A tubes is 45 volts, and if you use a higher voltage you should make corresponding increases in the grid bias circuit.

[Another Foote hook-up in January]

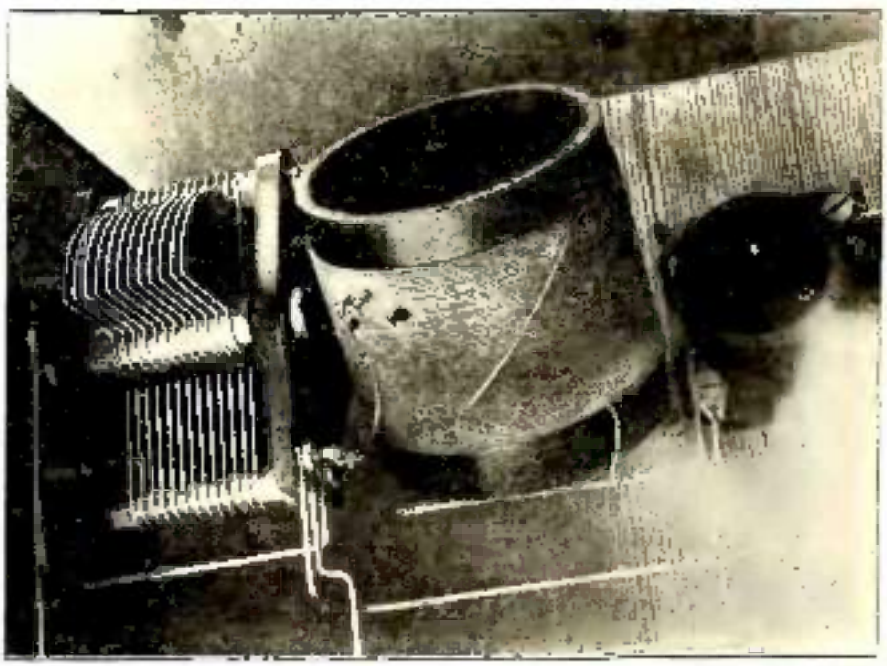


Fig 3. Here's a stunt for suiting your antenna coupling to your tuned R. F. unit to fit out your particular antenna. Several taps are taken out near the filament end of the grid coil and the antenna lead soldered to the one giving the best all-around results.

Mastering the Super-Het

This figure shows the panel arrangement for separate control of each of the fundamental circuits. Instead of complicating matters, this control system actually makes the operation of the set much simpler.

Tracing the CAUSE *of* SUPER *Troubles*

BEST RESULTS REACHED BY STUDYING FIVE CIRCUITS

By PAUL GREEN

IN THE October issue of RADIO AGE the writer had the pleasure of describing "An Easily Made Super-Het."

So many inquiries have been received from fans who have or are building Super-heterodynes that it seems best to answer these questions at one sitting, keeping in mind the relationships that exist between the various parts of the circuit. The best understanding can be secured by considering it as not one, but rather five circuits. These are, in the order of their arrangement on the baseboard, the oscillator circuit, the modulator or first detector circuit, the radio frequency or intermediate (long wave) circuit, the second detector circuit and the audio frequency circuit.

Curious and oftentimes baffling symptoms arise, which, owing to the relationship of each of these circuits to the others, may seem to have origin in a certain supposed cause, whereas perhaps only effect rather than cause has been considered. For this reason many fans ask questions which are little short of impossible to answer. By mentioning a few typical symptoms and telling how they have been overcome is in part a function of this article.

Experts Often Stumped

ODDLY enough, it is not always the perfectly "green" fan who encounters the most trouble with the super-heterodyne. In a number of conspicuous cases the greatest difficulties seem to have beset the path of the more seasoned fan. A partial explanation of this apparent paradox lies in the fact that the man of less experience who has the "nerve" to tackle the super will usually adhere closely to specifications.

Just recently two of the writer's friends began supers at about the same time. One is an experienced electrical engineer who deals in theory as well as the highly practical side of engineering. The other man admittedly lacks any ability along the lines of engineering and radio. In fact, the super was positively his first venture in radio. He had never handled tools of any kind, and scarcely knew a soldering iron from a buck-saw. The engineer has long since given up in disgust, saying: "It can't be did." The other man now has four supers in such successful operation that one must sit down and watch him operate his set to believe the yarns he tells. Does the above experience signify anything: is it typical? If so, what does it mean?

The engineer is a man who usually has learned that any specific instructions are for those who need guidance. Therefore, he says to himself: "Oh, well, that's all very nice, but I am going to substitute for this condenser one that I now have,' and, "I don't see the use of this little 'doo-dad' here, guess I'll leave it out. This condenser has altogether too much capacity for the oscillator circuit, I'll just change that little detail."

Who's to Blame?

WHAT'S the result? His set refuses to work. He condemns the diagram, the man that gave him the diagram, the transformers, the panel layout; in fact, everything but himself, for how could he make a mistake? The very idea!

Now, how does the other type of man go about it? He admits in the very beginning that he knows nothing. He is willing to be guided. He at least takes the diagram and specifications at their face value and fully expects failure if he deviates one infinitesimal iota from the specifications. Result: His set works.

While it does not fall within the province of this article, nor is it the policy of RADIO AGE to give trade names of parts used, yet enough cannot be said in favor of high grade parts, especially in the case of the super-heterodyne circuit. Each super-heterodyne circuit and each set of parts are or should be designed to operate best at a certain pre-determined frequency. It is obvious, then, that to use parts not specified will more than likely lead to trouble.

The governing factor is the frequency at which the intermediate transformer works best. The complete list of parts with values for each part will be furnished all who will get in touch with the writer, care of RADIO AGE.

Tubes to Use

In the set described in October issue, UV 199 tubes were used. Many have written asking whether the 201-A or 301-A tubes might be substituted. Yes, they may, but it must be remembered that probably very little extra volume will result and several times as much filament current will be used. However, as many fans already have the larger tubes and hesitate to buy smaller ones, it is thought best to provide a suitable circuit for these tubes. Incidentally, it might also be mentioned that in so doing, we also eliminate many of the previously mentioned puzzling characteristics of the set. This refers to providing five separate filament controls so that each circuit may be operated independently. In practice this is quite an advantage, in view of the economy of tubes and current, to say nothing of being able to compensate for changes in filament voltage.

So rapidly are conditions changing that since the October article appeared it has become (temporarily at least) difficult to procure well matched tubes

without almost getting "in bad" with the dealer. Without being able to procure tubes of fairly similar characteristics, it is at once seen that it may be very difficult at times to make all the five circuits work in harmony. This is especially true since part of the tubes are operated with a plate voltage of 90, whereas the balance operate at 45 volts. Variations in plate or filament voltage only serve to accentuate any lack of balance. It is the belief that this alone accounts for a very large number of the difficulties experienced by builders of the circuit. A set of tubes that have been matched may prove entirely satisfactory for the time being, but later give trouble due to their not ageing alike.

A Battery Voltage

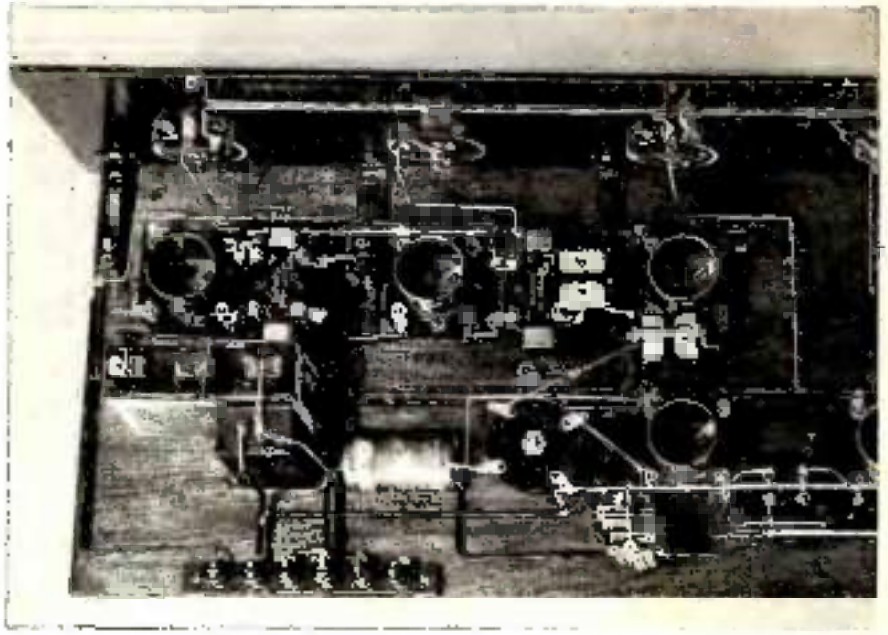
IN THE writer's experience it has been found imperative to keep the "A" battery fully charged at all times. Local stations may continue to come in with apparently their usual volume when the "A" battery gives a poor reading, while the more distant stations possibly are cut out altogether. Recharging this battery will usually correct this trouble. Of course, if one can provide himself with a voltmeter, he can watch the voltage and hence avoid many of the troubles which arise from improper voltage. In such cases the two filament control system with properly matched tubes will undoubtedly prove satisfactory.

Should trouble then later arise from this unequal ageing factor, re-location of the tubes will be necessary so that new ones of the proper characteristics may be purchased to replace the worn-out ones. Experience is proving that many fans not realizing to what an extent the "A" battery affects the operating of the set start turning the rheostats up just as soon as the set fails to respond as it should. The result is that within a short time the tubes have passed their useful life. With only two controls such a procedure subjects at least four of the tubes to dangerous filament voltage. With separate controls for each circuit only one or possibly two of the tubes feel any strain. What is more, the operator soon learns that it is useless to try to force certain parts of the circuit and hence comes to recognize the "battery too low" sign before matters have gone so far as to require crowding the filaments. As a matter of fact, the heterodyne is probably more exacting of "A" battery voltage than is true of most circuits. With "A" battery fully charged, the tuning will be rather broader, all other things being equal, than when it is low. This characteristic of the set undoubtedly covers more hard-to-account-for peculiarities than any other one factor. Volumes could be written on this one subject, but it is thought best to limit the discussion to important generalities rather than a host of smaller ones which would merely tend to confuse.

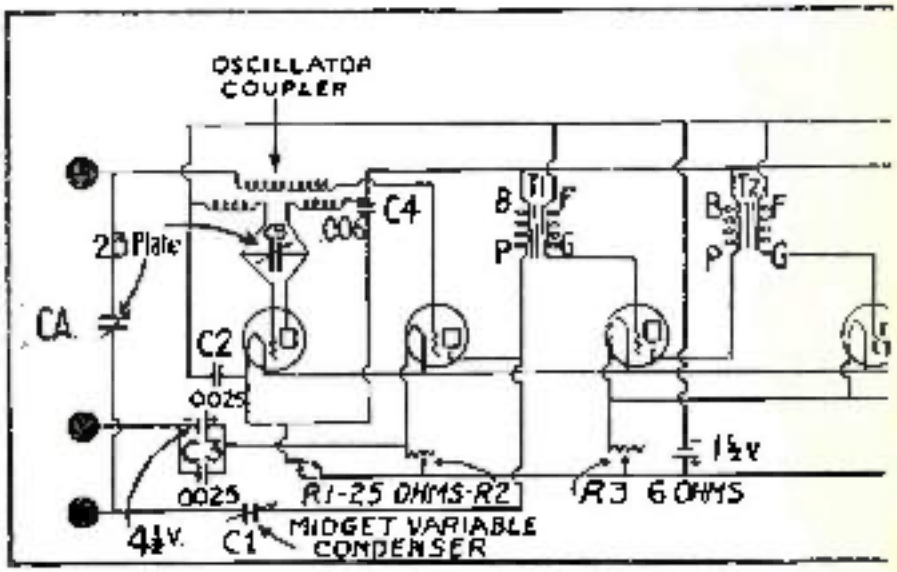
At the beginning it was pointed out that this circuit is virtually resolvable into five subsidiary circuits. That being true, and at the same time acknowledging the difficulty of procuring well matched tubes and the evident preference among fans for a circuit in which any of the standard tubes may be used, it becomes apparent that practically as many filament controls must be provided as there are subsidiary circuits. This system has the advantage of being very flexible and permitting of studying the peculiarities of each of these circuits. From this as a basis the builder can eventually consolidate certain of the filament circuits which have similar filament requirements. It is logical to assume that the separate control method will be the means of most quickly acquiring a working understanding of the circuit.

The set shown in this article was recently built, embodying this plan for separate control and serves to illustrate the several points involved. A panel and baseboard 18 inches long was used so that it would be possible to give each unit more space for purposes of observation. As a number of combinations of oscillator coils and condensers were tried, this circuit was changed a number of times. Hence no apology is due for what may appear as somewhat "sloppy" wiring.

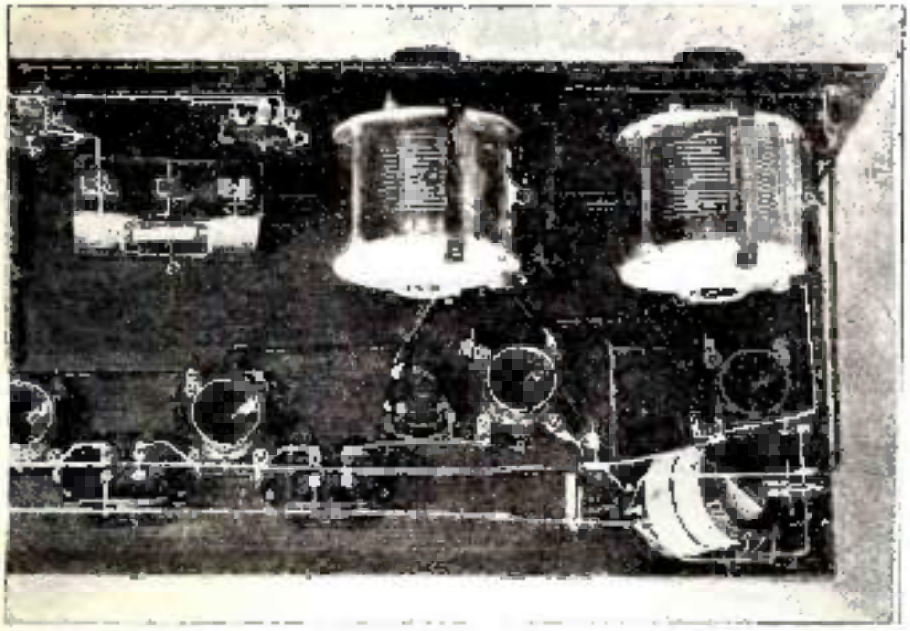
In operating the set it very soon became apparent that little was to be gained by turning up the filaments on the two detector tubes. In fact, with these rheostats barely on, full volume was secured. The intermediate circuit, however, required full voltage for full amplification. The audio circuit required less filament voltage than the intermediate circuit. The oscillator tube was probably the most critical, but even there the voltage could be lowered almost



The baseboard arrangement. This layout enables the builder to Green's super-heterodyne, which has



Above is the wiring diagram of Paul Green's super-heterodyne, this circuit report that little was to be gained by turning up the filaments volume was secured. The intermediate circuit, however, requires full the voltage was lowered almost to the vanishing point.



understand the operation of each of the fundamental circuits in Mr. —made quite a "hit" with the super fans.

to the vanishing point, once the circuit was oscillating. A change in condenser settings with such a chevatar setting usually caused the receiver to go out of oscillation.

Oscillator and Output Coil

THROUGH an oversight the detail drawings for these coils were omitted in the former article. Those described were designed to be made at home. In case you do not wish to "roll your own," here is what you can do. The oscillator coupler pictured in this article can be easily recognized as a type that can be bought in almost any radio store. The tuned output filter or output transformer can be replaced by two 1,000-turn honeycomb coils mounted in the conventional manner so that they can swing from 1-2 to 6 inches apart. This allows for loose or tight coupling with a corresponding variation in sharpness of tuning. Each of these coils is tuned by means of a .001 fixed condenser. When using these coils it should be understood that they replace the primary and secondary of the homemade output coil. The writer has found that the homemade coil operates best when tuned by means of .0255

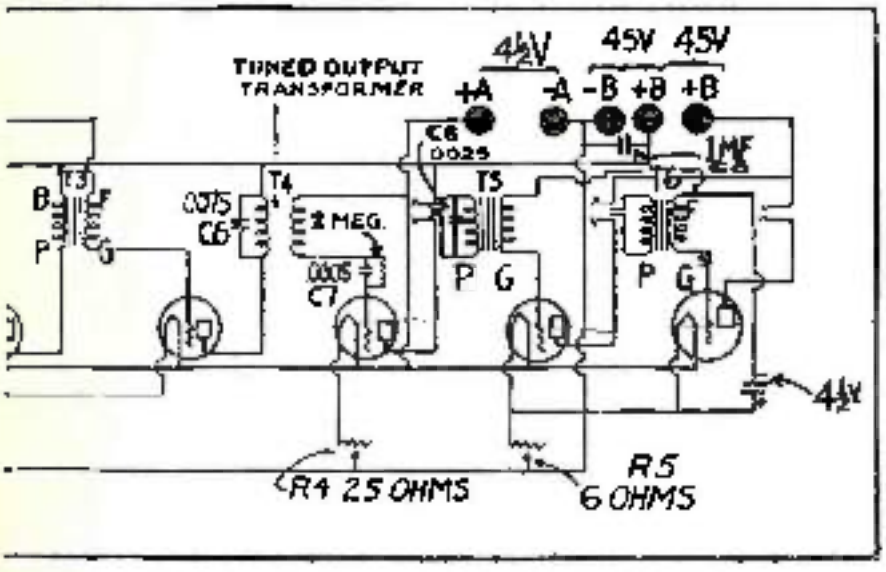
Owing to the nature of the circuit as a whole, it is common to hear of trouble in the audio stages. This usually but not always points to the fact that the audio transformers are not adapted to the circuit. Certain oscillations are set up in the first step, which are barely noticeable, but which are passed on to the second stage and may entirely obliterate the music or voice from the second stage, if the second stage is used. For this circuit the audio transformers must have very stable characteristics. Incidentally, it is of interest to note that rarely is the second stage of audio required. In Chicago it frequently has been possible during the last few months to receive the west coast stations on the first stage of audio with enough volume to give good loud speaker results. Probably the most ideal plan is to make the last stage of audio push pull.

There can be little question but that the super-heterodyne is by far the last word in quality of tone. This may seem a very strange statement to those who have repeatedly heard that the super is a noisy set. For one who has never heard a good super there is a treat in store. To say that it rivals the crystal in purity of tone may be an exaggeration, but at least it would be hard to amplify average crystal reception to the same degree, and still have quality that would compare to that of the super

Future of the Super-heterodyne

WITH the variables previously mentioned ironed out, by providing for separate filament control, there seems to be no reason why this circuit will not within a very short time be considered by fans who like to build their own, the last word in radio refinement. However, for the radio public at large there is a serious situation to be overcome. It is already apparent from the questions received that a large number of the "to-be super-het" fans desire to operate the set on an aerial. Though cannot be said right now by way of discouraging this purpose. If you have such a thought in your mind, get rid of it immediately. The oscillator circuit as used in any super-heterodyne set will, if connected to an aerial, give your neighbors more trouble than any single circuit regenerative set yet concocted. Other fans have inquired for means of coupling to aerial and ground through inductances. This, because of the comparatively tight coupling, will also give rise to more or less disturbance unless very carefully handled. The set herein described has been constructed solely for loop reception and should in no case be connected to an aerial.

Recently the writer had a letter from the editor of a radio publication who stated that he was going to publish an article bitterly attacking the super heterodyne. It was apparent that the editor had founded his conclusion either upon misinformation or had heard or seen sets operated improperly. Subsequent events proved that the editor had judged the super solely from the standpoint of its having been worked on an aerial. He claimed that in his home town life was made intolerable because of the super-heterodyne "maniacs" and their infernal noise machines. Let us not give others, perhaps less well informed than that editor, reason for jumping at the same conclusion. There is no reason why we should try to operate the super-heterodyne on an aerial. It brings in all of the volume that can be possibly used on all stations south and east of Chicago on the first stage of audio when working on a loop.

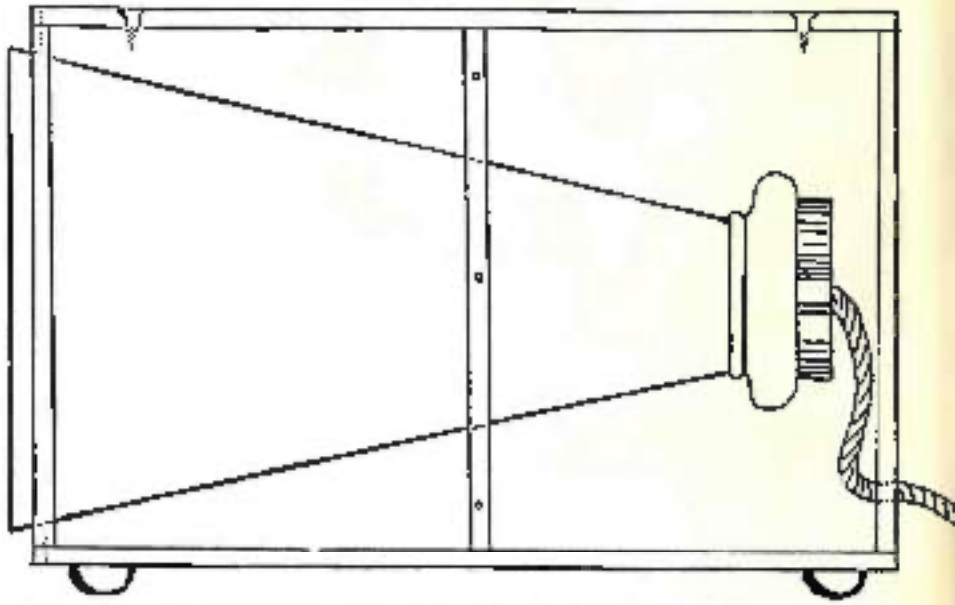


outlined in detail in the accompanying article. Fans who have tried on the two detector tubes. In fact, with these resistors barely on, full voltage for full amplification. A change in condenser settings often usually caused the receiver to go out of oscillation.

Are You Nearing the Loud-Speaker Stage?

Then Here Is a Clear-Tone Speaker for You to Build at a Low Cost

By PAUL THORNE



Above is a side view of the home-made loud speaker described by Mr. Thorne in the accompanying article, showing how the horn itself is placed in the cabinet, which likewise can be constructed by the builder at a small cost

EVERY radio enthusiast eventually reaches the loud speaker stage. While the DX scout will find it best to continue to use his headset on his occasional ether voyages, sitting night after night with the phones on your ears becomes tiresome.

Then, too, the knowledge that you are selfishly keeping the rest of the family from enjoying radio treats gradually disturbs your conscience.

The loud speaker affords the utmost in radio enjoyment. You may dance to the tunes of famous orchestras, join in the chorus with the radio songster, listen to tales of travel from your favorite easy-chair, and have a thousand and one nights of entertainment in many ways that would not be possible without the loud speaker. The whole family, as well as visitors, may listen in, and any one of the group is free to make comments on the program, or there may be a general conversation, which cannot comfortably be done with the phones clasped on one or more heads.

To Buy or Build?

THE acquiring of a loud speaker is easy for the man who has plenty of cash and prefers to buy his radio equipment ready-made. There are any number of good loud speakers on the market for those who can afford them. But there are thousands who feel that their present radio investment precludes any large additional outlay. Then there is the amateur radio builder; the man who gets his greatest kick out of his hobby by being able to say: "I made it!" He is not satisfied to tie a factory-built loud speaker to that skillfully home-built radio set.

Both the man who must count the dollars and the amateur builder have been frightened away from loud speakers. One has investigated the cheaper commercial types and decided to stick to his headphones. The other has gathered from numerous technical articles, full of intricate mathematical formulas, that building a super-heterodyne is child's play compared to correctly designing and building a loud speaker. So the real pleasure of radio is lost to many families.

It is true that the need for a loud speaker has been partly and economically met by a phone unit attached to the phonograph. As a rule, however, the radio set and the phonograph are neither designed nor placed in suitable locations to work together. And anyway, each has its individual place in entertaining the family.

As I am one of the radio bugs who will not have anything that is not largely home-made, I attacked the loud speaker problem and solved it satisfactorily. So many persons have asked for the construction details after listening to my loud speaker, that I am going to tell you here just how I built it. You will be both surprised and pleased to learn how simple and easy it proved to be (in spite of mathematical warnings), and I am sure that no home will longer be without the joys of a loud speaker after this number of RADIO AGE arrives.

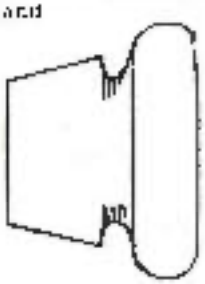
Two Vital Parts

WHEN you dissect the ordinary commercial type of loud speaker, you discover that there are really but two vital parts—the special phone unit and the horn. The horn is the big stumbling block in construction. Any kind of an effective horn is hard to build at home, and the articles which have appeared usually made it plain that unless certain scientific and mathematically calculated proportions were maintained the loud speaker would be a failure.

Perhaps you will recall how college boys on the campus or the athletic field place a megaphone to their mouths. If you happened to be opposite them at the time you heard a clear, strong voice issue from the megaphone, and carry to a considerable distance. Now, is there very much difference between a voice issuing from the human mouth or from a loud speaker phone unit?

I decided there was very little, except in volume. And if a boy's voice could carry across a football field by the aid of a simple little megaphone, why could not a phone voice carry across a room by the same means?

That settled the horn problem, and I went about securing the necessary material for my loud speaker.



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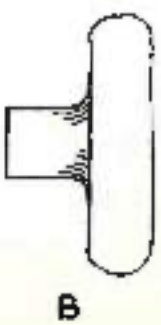

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I purchased a small, twenty-five-cent megaphone at a sporting goods store. This was of heavy, varnished fibre—a particularly inert composition, and therefore not sensitive to vibrations. It was eight inches in length, and the large opening was five and one-half inches in diameter. The mouthpiece was a nickeled metal ring, which gave added strength.

The next step was to buy a good loud speaking unit. I bought the Baldwin Type C, but you will find others that will serve just as well. *Do not expect, however, to get real loud speaker results from an ordinary phone unit.*

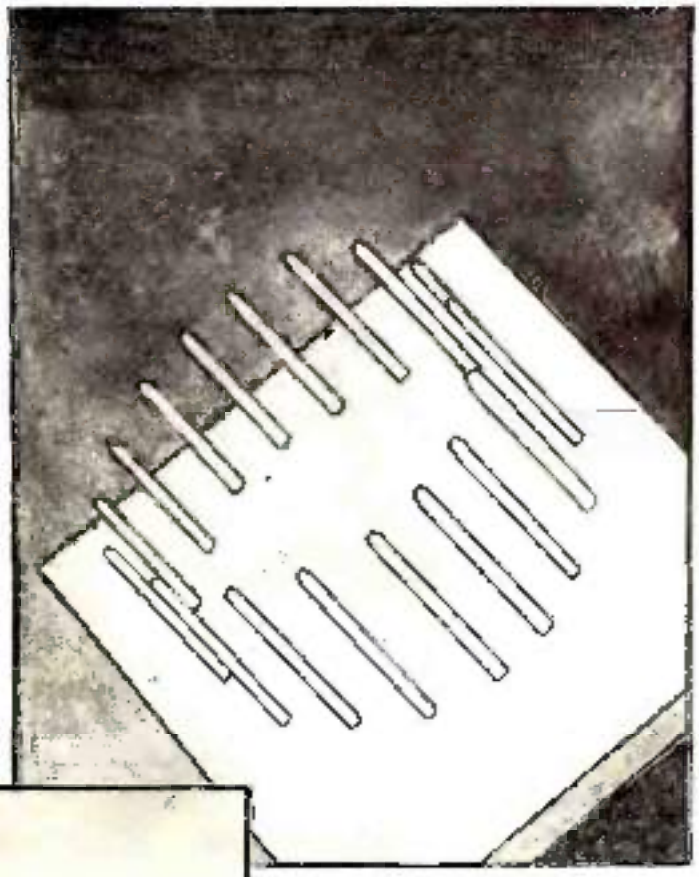
The next problem was to fasten the unit properly to the megaphone. For this purpose I obtained one of the rubber adapters for attaching

(Turn to page 57)

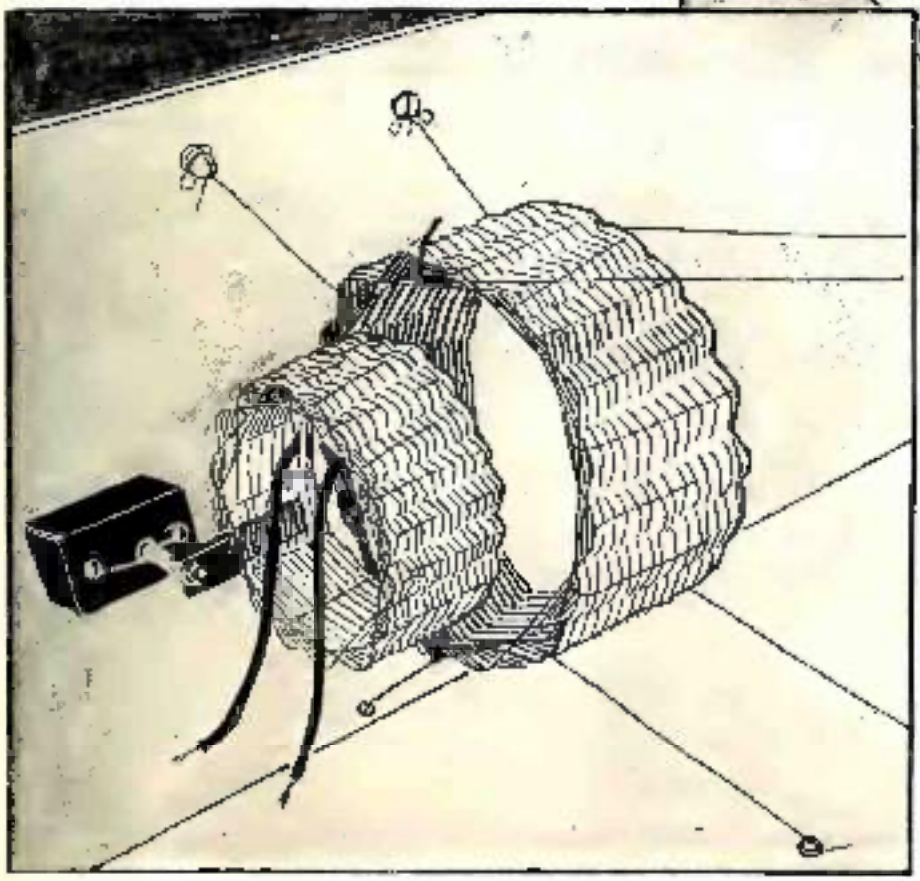
Angling for 'DX' Signals

Here's a Receiver That Has Proved To Be a Real Record-Breaker

By FELIX ANDERSON
Assistant Technical Editor



The winding form for the secondary and coupler coils. Seventeen pegs about 4 inches long are set into holes drilled in a pine board in a circle three and three quarters inches in diameter. The coils are wound by winding over one peg, skipping two, then winding over the third, and again skipping two until the desired number of turns is wound.



An illustration showing the assembly and mounting of the coupler and feedback coils. The feedback coil is variable with respect to inductive relation to the plate coil.

A Vital Summary of Experiments with England's 3-Tube Circuit Which Received Fifty American Stations

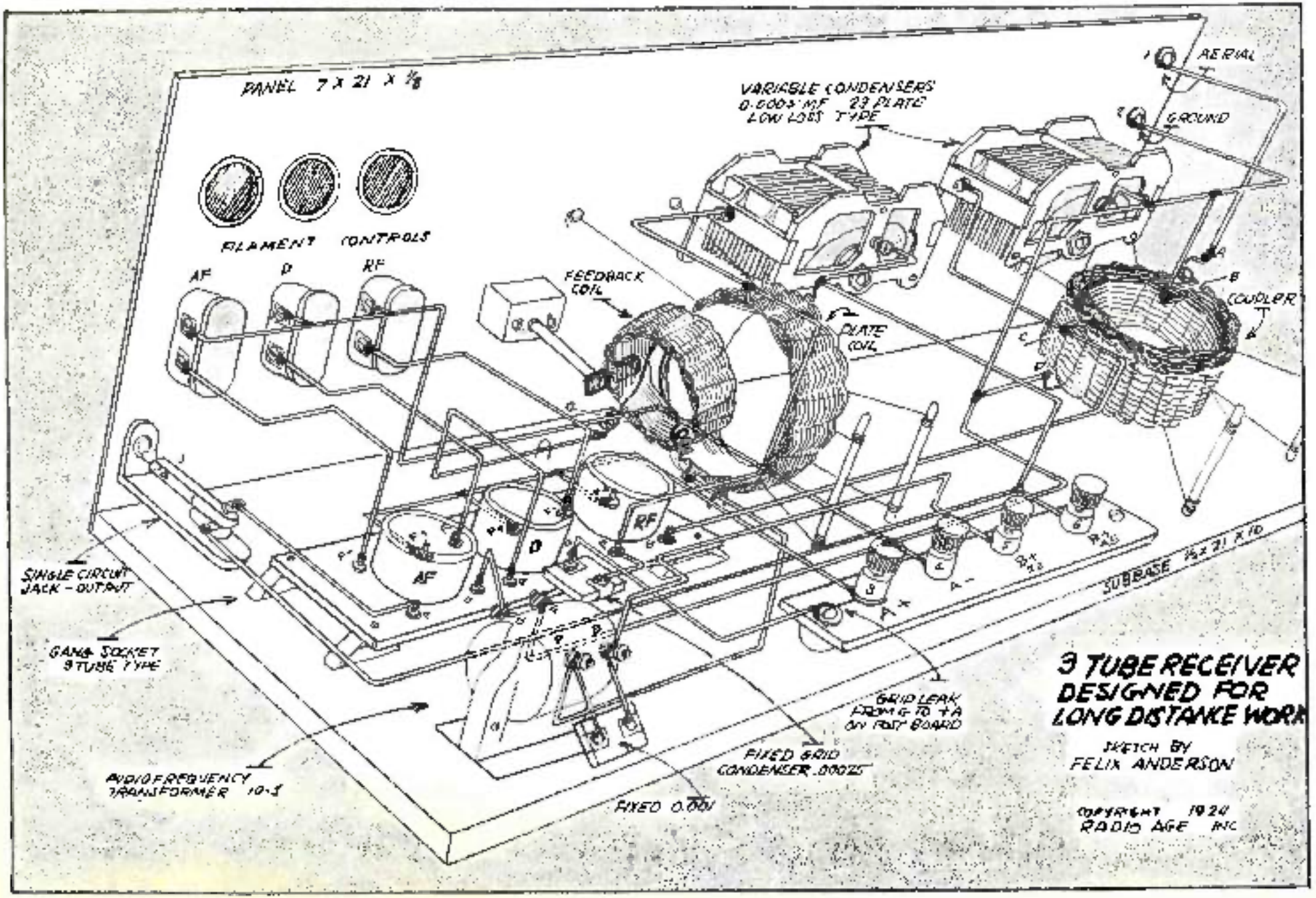
FISHING, whether it is for long distance stations or for fish, has two distinct types of adherents. In the grand old pastime with bait and rod, we have the type of fisherman who trolls along with a large bait, works hard, and when he gets results, he usually gets them to the extent of a nice big catch.

On the other hand, we have the fellow who goes out with a fly rod, and a little feathered hook, and if he is skillful, he gets a nice catch of sweet morsels.

In radio we have the same thing. We have the man who goes after the stations with a big receiver—a super-heterodyne or a neutrodyne, and when he gets the station he "baits" for, he gets him on the loudspeaker. Then we have the fellow who listens with his head set, with one to three tubes and he also gets them, and probably more than the other fellow, though they do not "weigh" so much.

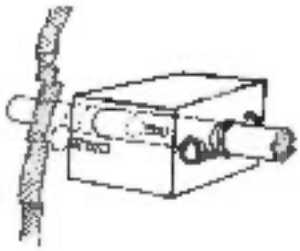
I am one of the latter type of radio bugs. I prefer to listen with the headset, and pick out stations at ease (just as I would rather fish for trout) because I get a much greater thrill out of the results. I'd rather get the East coast or West coast on the phones five or six times a week, than I would to listen to them probably once or twice a month on the loudspeaker.

You will be interested in hearing how this can be done. (Turn the page)


PANEL 7 X 21 X ⅛
VARIABLE CONDENSERS
0.0005 MF 23 PLATE
LOW LOSS TYPE
AERIAL
GROUND
FILAMENT CONTROLS
AF
D
RF
FEEDBACK COIL
PLATE COIL
COUPLER
SINGLE CIRCUIT JACK - OUTPUT
GANG SOCKET 9 TUBE TYPE
AUDIO FREQUENCY TRANSFORMER 10-1
FIXED 0.00?
FIXED GRID CONDENSER .0002?
GRID LEAK FROM G TO F A ON PANEL BOARD
SUBBASE ½ x 21 x 10
3 TUBE RECEIVER DESIGNED FOR LONG DISTANCE WORK
SKETCH BY FELIX ANDERSON
COPYRIGHT 1924 RADIO AGE INC

Choosing a Circuit

FIRST of all, I wanted a circuit that was not too complex, one that had only two or three controls which could be worked with two hands, and one that did not require a great many adjustments. Second, I was looking for a circuit that would give results, sharp tuning, and one that would allow me to log the dial readings once I got a station. Considerable scouting around was done before I lighted upon a circuit that would comply with these requirements.



Remembering that the English fellows were hearing American stations with regularity, I decided to try out one of these circuits, and suffice it to say that while their coils are not critical, they do give results. It might be well to add here that these results come from no little experimentation and painstaking care in design.

The circuit I chose to develop consisted of a stage of radio frequency, a detector, and one of audio. The radio gives DX, the detector—well, you know what that does, and the single stage of audio gives sufficient amplification to make the signals just loud enough to be comfortable with the headset, and not so loud that it will deafen you to other weaker signals. The original circuit had straight conductive coupling to the grid of the RF tube, which made the tuning too broad, so I changed this system to tuned antenna coupling by making a tuned coupler, wound low loss style. Otherwise, with the exception that the original circuit had coils wound on tubes, it is identical to the circuit I started out with. However, the few changes made no doubt contributed to the efficiency of the set, since coils wound on forms of hard rubber, bakelite, and other materials decreased the signal strength on some of the weaker stations. All in all, dry and slightly "doped" cardboard tubing, (very thin) was found to give the best results of all the tube forms.

How to Make the Set

TO make the set, procure the following materials:

- 1 Panel 7x21x¼ inches
- 1 Baseboard
- 1 pound No. 18 DCC or DSC wire.
- 2 0.0005 MFD (23 plate) Low Loss condensers.
  - Neat vernier, straight-line plates preferred.
- 1 tube gang (UV199) Socket stand.
- 6 Binding posts.
- 3 Filament controls.
- 1 Single Circuit jack (output).
- 3 0.0025 MFD Fixed Mica Condensers.
- 1 0.001 MFD Fixed Mica Condenser.
- 1 Set screw coupler shaft fittings. (Get these at 5¢ salvage radio shop).
- 3 UV199 tubes.
- 1 B battery 90 volt type capped.
- 1 set dry cells for A battery
- 1 strip bakelite 1x6½ inch for binding post mounting.
- 1 UV to 1 Audio Frequency transformer.
- 3 Panel Brackets (optional—you can drill a set of holes in channel formation).
- Strong, ¾ inch wooden rods (17 of 'em) about 9 to 4½ in. long and all the other necessary paraphernalia to put the numerous varieties of set together.
- 2 Vernier dials (anti-backlash type).

Winding the Coils

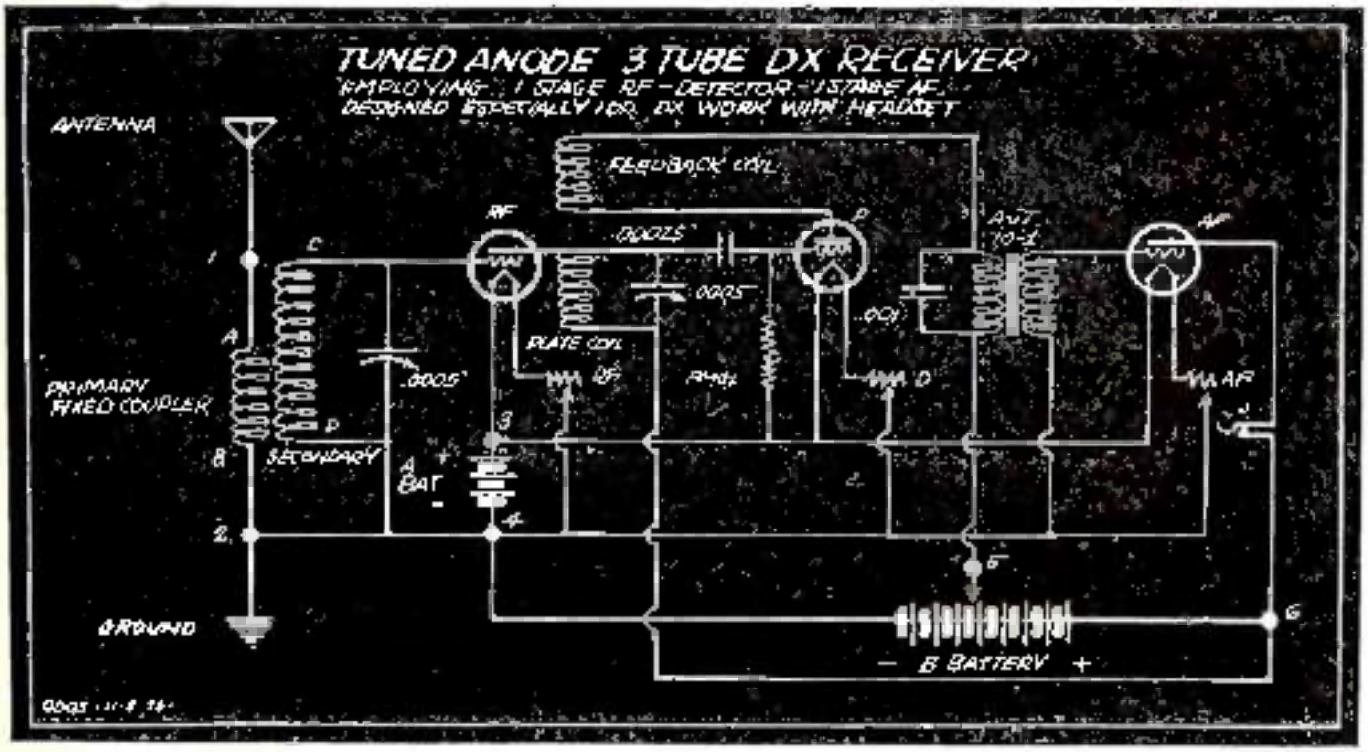
The first job (an easy one) is to wind the coils. If you desire, you can use honeycomb or pancake coils whose specifications come closely to the ones I am going to give, but if you possibly can, wind them yourself, since there is nothing like making your set to conform to the surroundings in which it is to be operated. Get a piece of board about 8 inches square and ½ inch thick, and with a compass describe a circle with a diameter of 3¾ inches. Then divide the circumference of this circle into 17 even divisions, and drill holes deep enough to permit the wooden dof rods to be set in. I put mine in with a little glue, and have a permanent form, and I get a nice coil out of the form since it makes it more rigid.

When you've finished the coil former, lay it aside to allow the glue to dry, and proceed to drill out the panel for the condensers and filament controls, as well as the feedback coil mounting arrangement. I found the arrangement shown (in the perspective sketch) to be very good, since it keeps the two condensers together, with the feedback coil control within easy reach of the right hand. The other detail is not important. We'll let you use your own judgment with respect to the other parts with the admonition that you use a large baseboard (plus varnished preferred). Give your units plenty of room on the baseboard, keep the coils clear by at least two or three inches.

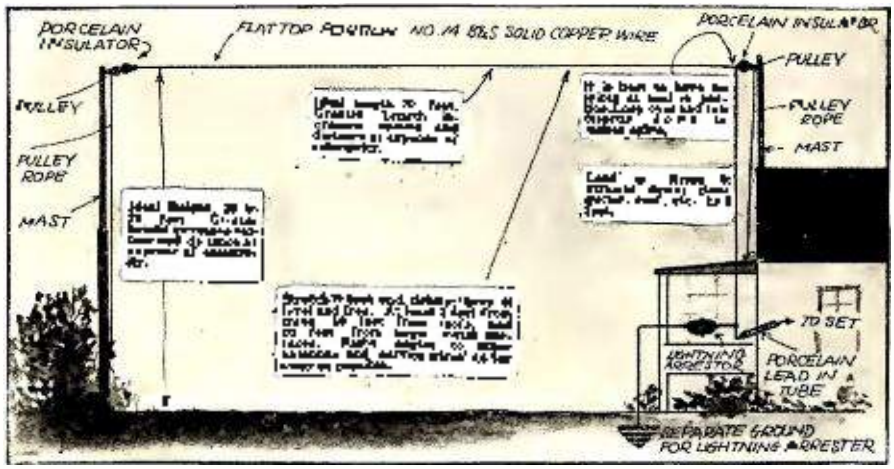
By this time, your coil former will have dried, and you are prepared to wind your coils. Start with the tuned coupler, by winding over one of the pegs (fasten the starting end with a little tack outside of the circle) then skip two of the wooden uprights, wind over the fourth, skip the fifth and sixth, and then wind on the outside of the seventh, the tenth, thirteenth, sixteenth, and start the second turn on the second peg (the one next to the one you started with). The third turn will bring you back to start winding the fourth turn beginning with peg No. 1.

For the coupler, wind 80 turns of No 18 DCC or DSC wire for the secondary in the foregoing fashion, and when you have finished the 80th. turn, give the wire a turn around the peg you

(Turn to page 77)



The circuit diagram of the Tuned Anode DX receiver can be traced down to nothing more than a good single circuit receiver with a stage of RF and one of AF. Since the merits of the straight single circuit with regard to results are so well known, it is no wonder that the circuit works.



A photo-diagram showing the ideal dimensions for the antenna to be used on any average broadcast receiving set. If the instructions printed on the diagram are followed religiously, the listener can expect very good results from practically any receiver he tries out.

The Best Way to Lies in Building

HOW To *Your* SIMPLE

By EDMUND

THE way to learn radio is to build a few receivers. No amount of study, no pouring over theories, will teach you adequately. It is interesting to hear a station a thousand miles away on some other man's receiver, and it seems marvelous enough. But it is ten times as thrilling and ten times as marvelous, when you pick that distant station up on a set you have built with your own hands!

Before attempting to construct any of the circuits recommended, you should know a few of the fundamental principles which must be adhered to in order to obtain maximum results.

Antenna and Ground

A CHAIN is no stronger than its weakest link, and radio reception, no matter how good the receiving set may be, cannot be satisfactory without a good antenna and ground system. The most efficient antenna is an outdoor aerial fully described in accompanying drawing of an "ideal antenna," into which pages of instruction have been compressed.

Be sure your "ground" conducts electricity deep into the ground. A water or radiator pipe (not gas pipe) serves the purpose well. File or sandpaper the pipe, tighten copper clamp tightly to it; solder clamp to your ground wire. If you are in doubt about the effectiveness of your "ground," use two grounds. One fan who has picked up 267 stations actually uses four different kinds of grounds.

Since it is a fact that the energy gathered by the antenna is generally but a trifling fraction of a fly-power, you want the set you build to be the last word in sensitiveness and efficiency. Otherwise you in effect move your station many miles farther away. A dollar saved through buying a cheap condenser, for example, may cost you 1000 miles of distance.

If we analyze any circuit, we find three fundamental factors which determine the efficiency of the particular circuit selected; namely, inductance, capacity, and a rectifying device.

The coil or coils constitute the inductance; the condensers (fixed or variable) the capacity; and a crystal or vacuum tube the rectifying device.

The Inductances

IN the selection of a really efficient coil or coils for inductance, several factors must be borne in mind.

First, Insulation. Since the flow of current in a coil occasions the sending out of "lines of force" (which constitute a "magnetic field"), you should have the least possible insulating or supporting material about it. Rubber, phenol compounds, compositions, fibre, etc., produce a loss of energy through absorption.

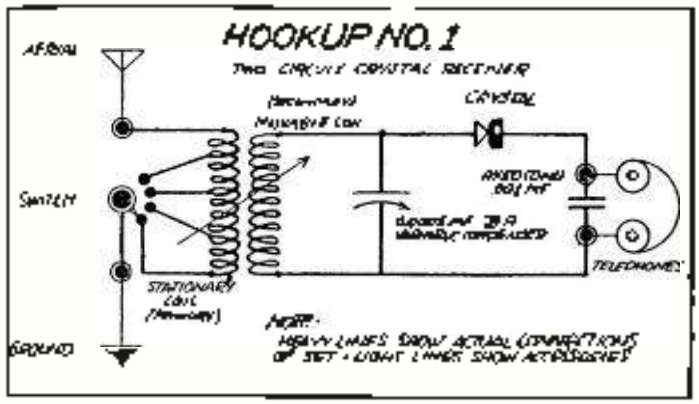
Second, the Method of Winding. Layer windings on a cylinder, because the adjacent turns of wire are close and parallel, give a wasteful condenser effect. This loss is called "distributed capacity" and it acts as a resistance to the incoming signal.

Third, Coupling. The method of coupling the "magnetic fields" when two coils are used, is important, as will be explained.

Carl Pfanstiehl, physicist and inventor, who has made a life-long study of electromagnetic forces including the electrical exploration of the "fields" about all types of windings, has found the stagger-wound form of inductance to be the most efficient for radio reception. The successful application of this form of inductance to the Reinartz circuit, led to the construction of new and perfected variometers, variocouplers and the recently developed three-circuit low-loss tuner.

In these tuning units, we find an absence of absorptive (or dielectric) material. Even the spiderweb or wooden frame is eliminated because it absorbs energy, and the coils are made self-supporting with a special low-capacitative cement. "Distributed capacity" between the windings has been eliminated.

The disc shape of the windings produces flat "magnetic fields" in which the lines of force are concentrated and do not reach out and interfere (i.e. generate disturbances, howls, etc.), with other parts of the set. As the coils are only a quarter of an inch thick, all turns of wire are included in the mutual "fields." This 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 coupled inductively (i. e. joined through the electromagnetic action of the "fields.")



Capacity

THERE is no use to use a low-loss inductance, however, if you hook it up to a high-loss condenser. All insulating material should be kept down to a minimum, and what little of it is used must be located as far outside the electrostatic field as possible, since any electrostatic lines of force which pass through insulating materials absorb energy from the circuit. (The loss takes place in the form of heat.)

The surface of insulating materials collects a little dust and sometimes a thin film of moisture. If this leakage path is short and wide, considerable energy will leak across, instead of being stored up in the condenser.

The fixed condensers, since they generally must be accurate and must be made of the best insulating material,

Master Radio
a Few Hookups

BUILD *First* RADIO

H. EITEL

A front panel view of the beginner's crystal receiver, showing the simplicity of the panel layout.

should be of the best quality and a reliable brand. In general, quality is just as necessary as in all other apparatus, such as in grid leaks, head sets, etc.

Other points to be regarded are:

1. A cheap condenser is no economy unless you prefer saving a little money, to getting a few stations!

2. A frictional contact is a poor and unreliable connection to the rotor as compared to a "pig-tail" connection.

3. For most circuits it is best to have both rotor and end-plates grounded to eliminate "body-capacity" effects.

4. "Shaped" plates are a sign of good design. They are superior to symmetrical plates since they give a "straight line" effect or regular change of capacity per degree turn of dial. Therefore they avoid the bunching of stations on the tuning dial.

5. The plates should be tightly wedged into their supports or soldered. Washers do not form an efficient path, but introduce resistance.

Rectifying Device

The purpose of a rectifying device is to suppress one-half of the "alternations" of the current and thus change the alternating current to direct current. The crystal accomplishes this purpose with a minimum of distortion. Sets using crystal detectors are notable for their purity of tone. Of course, a tube with its three "elements" has the advantage of acting like a valve and releasing a secondary current (from B battery). In this way, it greatly reinforces the weak signal.

There are many reliable crystals, both fixed and adjustable, on the market. If vacuum tubes are to be used, we suggest that you refer to a schedule of vacuum tube data for the characteristics of the various makes of tubes.

Other Parts

Nothing has been said of the other apparatus which is necessary for the construction of a good receiving set. We believe that if the builder has selected efficient coils, condensers and rectifying devices, he will naturally make the proper selection of his rheostats, fixed condensers, grid leaks, tube sockets, binding posts, jacks, dials, phones, panels and cabinet.

Having very briefly discussed the factors which make for efficiency in radio reception, we trust that the circuits which will follow, will prove interesting and most efficient in their operation.

Hookup Number One

A simple, efficient and selective crystal receiver that does not rest a fortune to construct.

IT IS the opinion of the writer that every radio beginner should commence his radio career with a crystal hookup. The reason lies in the fact that it embodies practically all the fundamental principles which are the basic laws of radio, and since there are so few parts (which are fortunately not expensive) it is an easy matter for the beginner to study and follow out the various functions of the set, as well as to gain a good general knowledge of radio principles.

It is with this idea in mind that the writer wishes to describe in a concise as possible manner the construction of one of these little "first grade receivers."

Building the Set

FIRST of all it will be necessary for you to appropriate about 25 dollars out of the weekly pay envelope. Your set will total close to this amount when all the accessories have been counted in. The second step is to pick out some reliable radio dealer, whom you can trust not to prey upon your lack of knowledge of the game. Then give him the following list, the bill comprising the necessary units and apparatus which will be needed in constructing the set:

BILL OF MATERIALS

1 Variocoupler, vernier-wound type as illustrated.
1 Variable Condenser, .0005 MFD, grounded rotor type, plates cut for straight-line effect in wave. Do not use one with bakelite end plates or one that uses a flexible bushing for adjusting.
1 Dioptite crystal detector. Silicon-bornite combination, or if desired, a galena.
1 Switch lever; you choose according to price.
1 Switch points (six contact shown. Otherwise, as many as there are taps on the coupler.)
4 Binding posts, two closed according to price.
1 fixed mica condenser, 0.001 MFD. (I'm not using one with paper insulation.
1 panel, bakelite, formica, hard rubber or other good insulating material. Size 7x10x1/4 in.
1 Cabinet (if desired.
1 Set headphones; get a diaphragm if you can stand the expense; otherwise spend about $4.00 for a good, standard pair. It pays in the long run.
1 coil of aerial wire (100 feet (metallic solid copper, enameled perfected.
1 coil of rubber covered No. 14 B & S copper cable long enough to be used for lead-in and ground connections. Your supply dominions.
1 set of insulators to suit type of antenna you build. The long, skinny glazed porcelain type is best (insulate the antenna well—the best is none too good. (See illustration for design of ideal DCL antenna).
1 lightning arrester (you can add this later).

If you intend to experiment in the radio game, it would be wise to supply yourself with a little soldering outfit, a pair of wire-cutting snips (used pliers), a hand drill and a screwdriver.

Put up your antenna first—do it the first nice day you have the chance, since your zeal later will no doubt drive you to get it up in minutes after you have finished the set, and the weather may not be just what it should be for climbing roofs. The illustration accompanying shows the construction, which should be adhered to as closely as possible.

Laying It Out

The rest is easy. Lay out the apparatus on the panel as the illustration shows, or if you prefer, use your own judgment. Keep the coils clear by at least two inches if possible, no matter what arrangement you use. Templates are furnished with nearly all of the units now on the market, and the actual

(Turn to page 63)

A Set for the Beginner
A SINGLE TUBE REFLEX

By FRANK D PEARNE

IT IS rather a hard proposition these days to select a receiving set for the beginner, because some care only for local reception, some care only for distant reception, while others want both.

Sets which will cover all three of these requirements may be constructed, but at an increased expense over those which are adaptable to local reception only. A set of this character must be selective and sensitive, or it will be of no practical value. As a matter of economy, the reflex type is the best, because in reflexing, the tube or tubes are made to do double duty; that is, the signal is first passed through the tube at radio frequency, is then rectified by the detector, after which it is again passed through the same tube at audio frequency, which causes double amplification with a single tube.

It is for this reason that the single tube reflex has earned the reputation of loud speaker reception. Accomplishing double amplification with a single tube naturally reduces the cost of apparatus and the clear, pure reception afforded by the crystal detector greatly improves the musical tone of the programs over those received on a tube detector.

In the simple reflex circuit, shown in the accompanying drawing, we have not only a good distance getter, but also one which will give loud speaker reception on local and many distant stations. It will be noticed that this circuit is slightly different from those before shown and the results obtained are exceptionally good.

Use Standard Parts

The materials and apparatus used are all of standard construction and one should have no difficulty in obtaining all the necessary parts from your local radio store. The antenna circuit is tuned by means of a .23 plate variable condenser and a variometer. These are of the ordinary standard type, although in the case of a variometer it is always advisable to use a large one in any kind of a set. The radio frequency transformer should be one having a wave band broad enough to cover all the broadcast waves. The audio frequency transformer in this case may be one of high ratio, as very little distortion will be noticed even if the ratio is as high as 10 to 1. The tube should be of the amplifier type. Either the UV-201-A, or the 301-A will work very nicely and probably the same results may be obtained with some of the other new tubes; the tube used in this test was a standard 201-A.

Short Wiring Needed

ALL wiring should be as short as possible to prevent interference and howling, and the wire used should not be smaller than No. 14. Tinned copper bus bar wire will make a very nice job and the soldering will be found to be a comparatively simple matter because of the tinned coating.

The set is wired as follows: from the aerial binding post to the rotary plates of the .23 plate condenser. The stationary plates of the condenser are connected to the grid of the tube and to one of the

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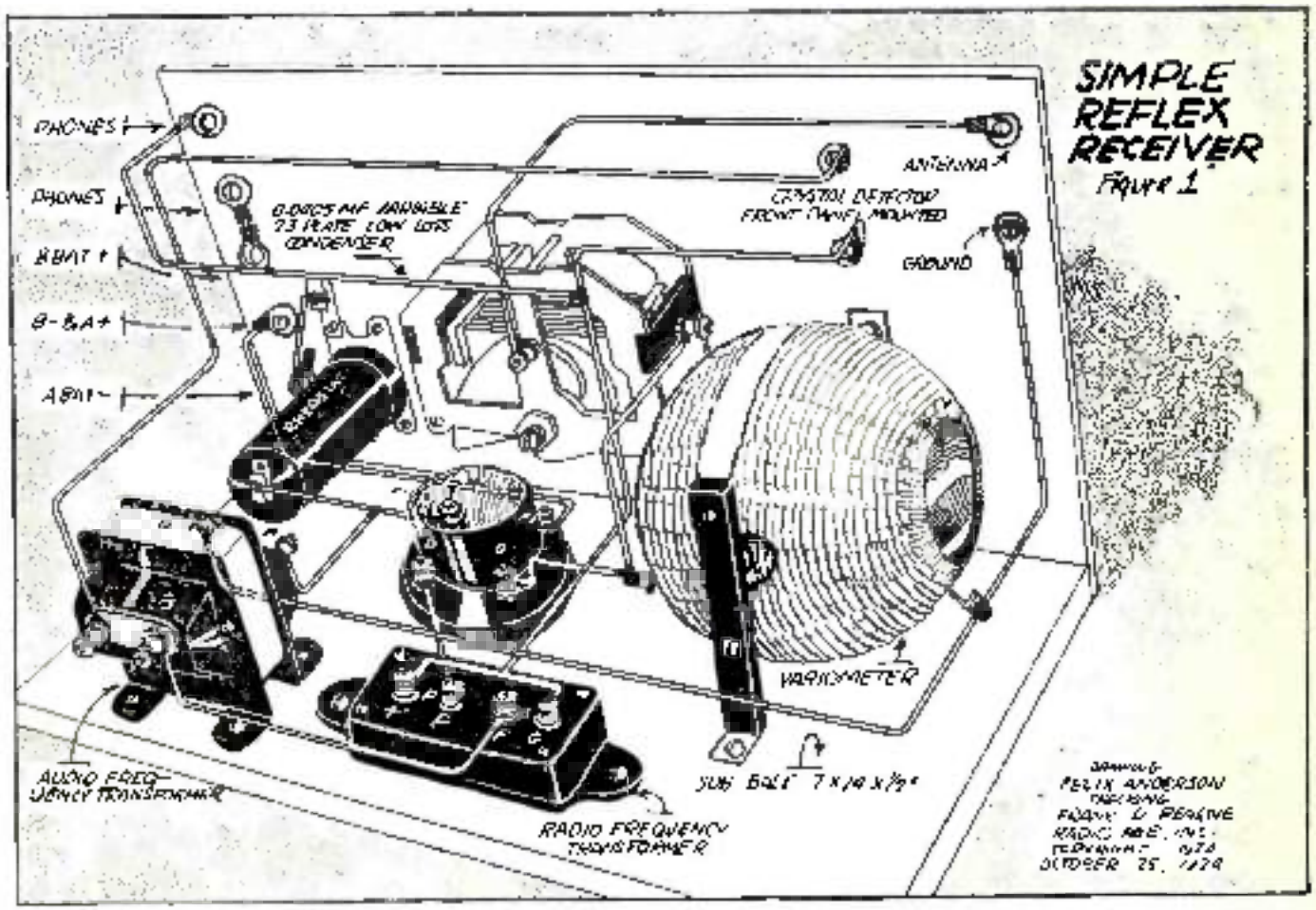
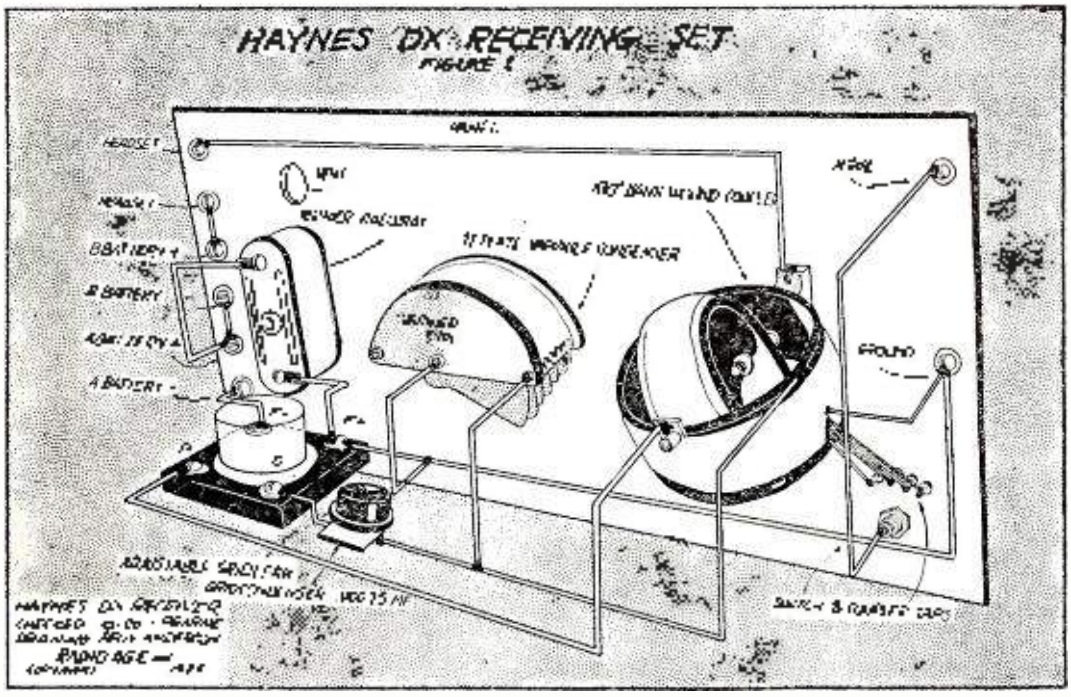


A perspective drawing of the simple single tube reflex, showing the simplicity and the lack of complication in its construction. The tube is made to do the work of both radio and audio frequency amplification, while the crystal detector gives exceptionally beautiful signal quality. The set is an ideal receiver for those "bugs" who wish to operate local stations on the loud-speaker.

An UNSELFISH Regenerative Set



Crime of Radio is to Cheat the Other Fellow of a Program by Allowing your Receiver to Radiate—Haynes Hook-up Gives Single Circuit Results Less "Canary Bird" Tuning

By *ALLISON BUDLONG*

IF YOU are the owner and operator of a good single circuit receiver, you will probably approach the reading of what follows in a rather hostile mood. So before we go any further, I'd like to suggest that the reader put himself in an unbiased and unprejudiced frame of mind in order to judge most fairly the gist of the statements which follow. I know as well as you do that the straight single circuit gives wonderful volume, incredible DX results, and general satisfaction all around, as a rule. But I also know what it does to the other fellow's share of a DX signal if it is not properly handled, and if you know anything at all about radio, I'll wager you have a rather guilty feeling while tuning DX signals when the set says WEEEEEEEEEE! Yet when another bug does the same thing after you have the station tuned in and the tickler coil just below the spillover point, you wax hot and furious—did you ever look at it that way?

This radio game has no room for selfish people and selfish acts. Unless we all take the attitude of making the game a better one, it will not grow—and without growth, nothing can continue.

Anti-Single Circuit

HOWEVER, let's not dwell on this phase of the problem. We all take it for granted that squeals are not intentional—that the fellow who operates his set does not know that he is doing the other fellow an injustice. If there are any fans who are still inclined to believe that the merits of the single circuit are great enough to warrant its general use, it is to be regretted, since the attitude of the radio public has only too plainly manifested itself in this respect. Since it is so simple a matter to prevent controversies in this regard, I am sure that it will be only a period of a few months before the effect of propaganda and sentiment will assert itself. Suffice it to say that the average radio enthusiast, with a fair knowledge of the art of radio, will not excuse the use of a circuit that is a violent offender and a menace to the peace and confidence of the broadcast listening pastime.

When you get this far, you will probably feel like turning over to the next page with the conviction that "it's the same old stall—duty to the public and all that rot. It gets into everybody's system more or less around election time."

Eliminating the Squeal

THAT Mr. Single Circuit Bug is a bad viewpoint to take on the subject. Remember that if you change your set over to something that is not so violent an offender, even to one that does not squeal, you not only set the example for coming BCL's, but for many of your other single circuit addicts as well.

Now don't get me wrong. I don't expect any average radio man to throw out a perfectly good set—that's impractical. What we can do is employ some circuit that gives us results without the bad feature ranked on. That's easy; there are a number of good hook-ups to follow.

The simplest way for the single circuit owner to get into the game right is to change the method of coupling the antenna circuit to the set. Get yourself a copy of the May, 1924, issue of RADIO AGE, read over the article on page 15, and then get busy and make yourself a considerate radio listener. There's nothing to it. A coil of wire used the right way, and the squeals of your receiver are cut down to a point where they can be of very little harm. Since the article covers many of the "bloopers" circuits now in use, you should have little or no trouble. As the article says, when you make the change, you not only become a good radio bug, but you make your set more selective, you inherently increase its range, and you get practically the same volume. Best of all, you get the satisfaction of knowing that you are not the one who is selfishly breaking up reception for probably five or six blocks around you.

It may be that you are interested enough in this movement to build a new receiver, so I will give you the details of the construction of a receiver that was designed with the object of keeping the

advantages of the single circuit receiver in its make-up. Its design is of a nature that it materially sharpens tuning, with correspondingly greater DX ranges made possible, and also keeps the set in a state of extreme stableness so that stations may be logged.

Specifically, this set, which is known as the Haynes DX Receiver, is a combination of all the good features of various circuits, so employed that all of them are at their best. Best of all, the system of antenna coupling, (called semi-aperiodic coupling) keeps the radiation factor of the set down, sharpens the tuning, and makes the set exceptionally stable

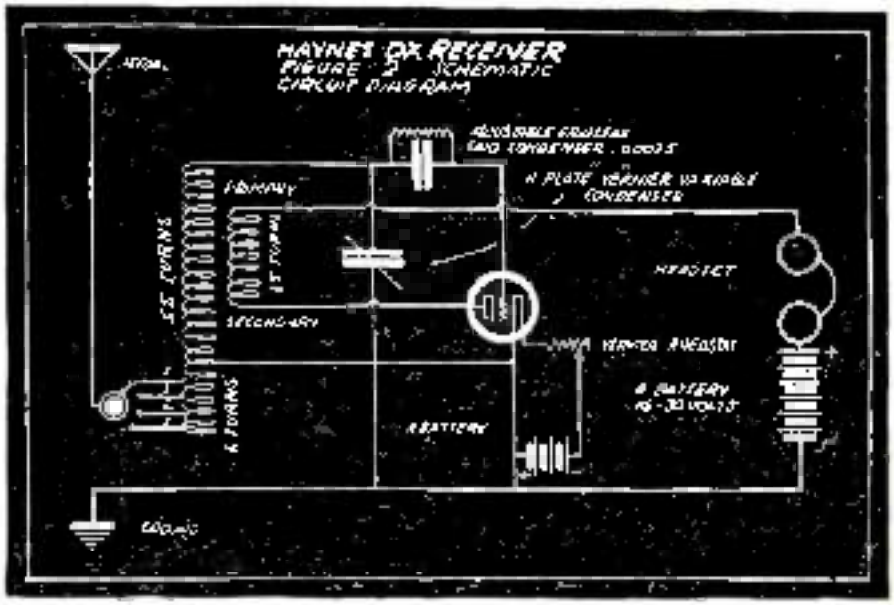


Figure 2. A circuit diagram showing the connections of the Haynes DX receiver. This set has the advantage of being a consistent DX-getter without the nuisance of creating squeals common to conductive coupling of regenerative circuits.

The operation is very simple. If the constructor so desires, the coupler may be purchased at practically any good supply house.

The condenser should be one of the low-loss, grounded rotor type having a low minimum capacity. An 11 plate type is recommended, it giving the greatest ease in tuning. If you have a 23 plate it may be used if some of the plates are removed to give the desired capacity. A condenser having a vernier moving all the plates of the rotor is advised, since logging is more certain and the losses are smaller than when a separate vernier plate is used.

Constructing the Set

THE construction of the set is as simple as that of any single circuit receiver and probably more so. First of all, we will need a specially wound coupler. The ordinary variocoupler will not do for the purpose, since the circuit requires the use of a low resistance bank wound secondary coil, and a rotary element set at an angle of 180°. The use of bank winding makes possible the employment of a smaller variable condenser to tune with, and as we all know the smaller condenser we use to cover a given band of waves, the less critical the tuning of the circuit will be. The coupler may be homemade if desired, so long as the 180° style is used. The coupler may be purchased unwound, and the winding put on as follows: 55 turns are wound in bank fashion after which a tap is brought out. Another turn is then wound and a second tap is made. Two more taps are then wound and another tap made, then two more and another tap. The 55th turn is connected to the ground and filament after which the 56th, 57th, 59th and 61st turn taps are brought out to switch points on the panel.

The tickler or rotor can be wound with about 35 turns to start. The final number of turns on this coil is determined by setting the condenser at maximum, and then stripping turns off the rotor until the set oscillates readily at that adjustment.

Other Accessories

THE rheostat should be one of the vernier type, the tube socket should be a good porcelain or bakelite or if desired a good hard rubber type (avoid the paper or composition sockets) and the grid leak must be variable. The choice of these parts is left to the judgment of the constructor.

The accessories are mounted on the panel as shown in Figure 1, and are wired as shown. The filament rheostat appears in the positive F lead on the isometric sketch and in the negative on the circuit diagram and while this is a little inconsistency in drawing, it makes no difference in the working or

(Continued on page 56)

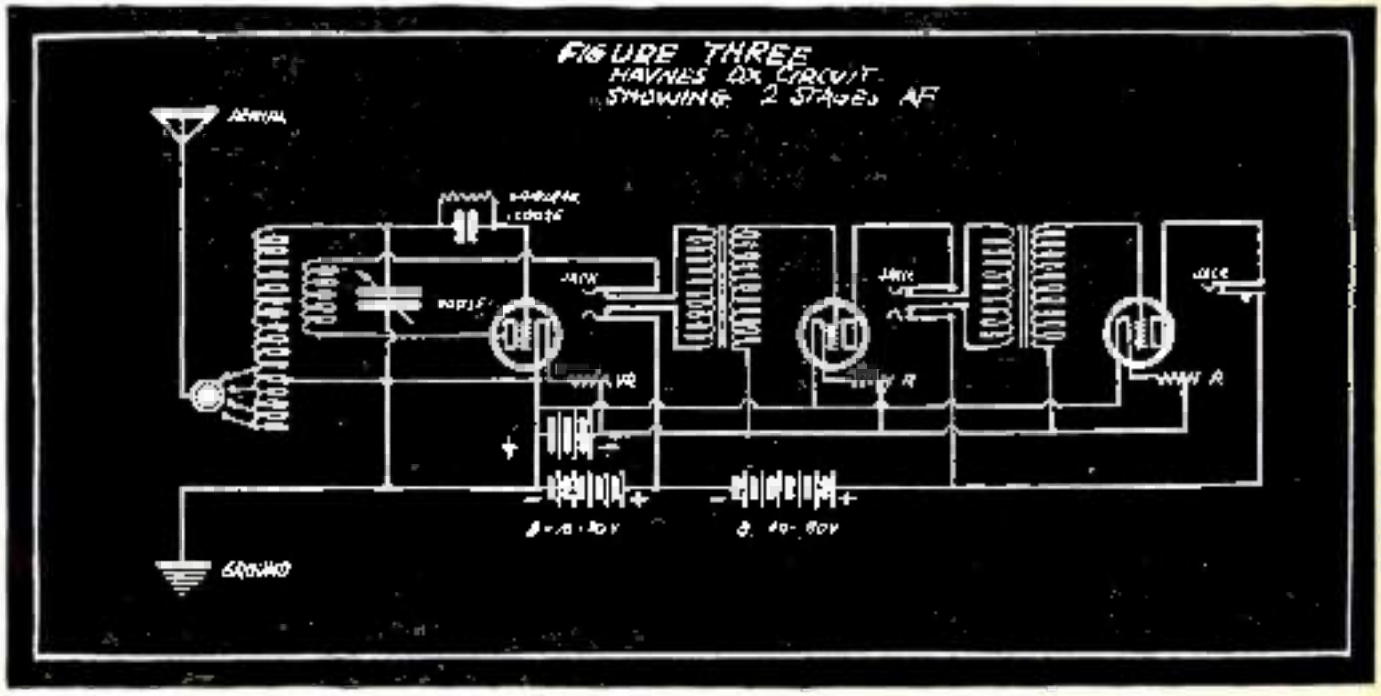


Figure 3. The DX receiver showing how two stages of audio frequency amplification may be added. The receiver as shown herewith is capable of accomplishing 1500 mile reception under average conditions.

The Fourth of This Interesting Series by a Veteran Commercial "Op," Proving That Life Surpasses Fiction

THRILLS *that go with* SOS

What Happened When the Merida was Rammed

By ARTHUR LEECH

Dark senoritas from Mexico, attired in the gay costumes of their country, were among the picturesque visitors from the doomed "Merida"

THOSE of you who, at a warning shout, have looked aloft just in time to see a five-ton safe about to make contact with the ole bean, will realize how I felt shortly after midnight on Friday, May 12, 1911, when, on hearing the ship's siren blow the emergency signal, I rushed out onto the starboard deck to see, through the darkness and heavy mist, a ship about forty times our size headed for a bull's-eye three feet forward of the radio shack.

That blast on the ship's whistle raised the curtain on as exciting a sixty-hour period of my life as I ever care to pass through. During this interval we calmly sailed from Philadelphia on time; drove into the side of a fat fog bank surrounded by dense darkness; with the same felt sweep stove in the side of a ship carrying four hundred people, rescued said four hundred people under difficulties and the stress of intense excitement; re-built a demolished antenna by the sense of touch alone to broadcast an "SOS" which started two ships scurrying to us through the fog bound darkness; limped into a New York dry-dock with our front end a mass of twisted beams and plates right up to the foot of the forward mast.

As I related last month, I had left Philly Thursday morning with a smouldering resentment that I had been forced to start another trip in a ship which, because of local conditions, had become distasteful to me. I also noted that I had thought some very wicked thoughts against the dear old "Admiral Farragut," wishing that she would have a little smash in the river and be obliged to turn back. Little did I know, however, that my mental malpractise would be visited upon us a hundred-fold, and when we passed out of the Delaware Capes at five o'clock Thursday afternoon I had become resigned to the belief that another voyage was safely under way.

In the early evening I had noticed that the weather was turning hazy, but up to 11:30 p. m. visibility had been good. At that time I could clearly see the lights of a vessel some five or six miles off the port bow.

Shortly past midnight, after copying press, I had closed the station and gone to my stateroom. Suddenly there came a jangle of bells in the engine room, followed by a series of short wails on the siren—the danger signal. Fortunately I rushed right out onto the starboard side, where the fireworks were being set up for a grand display. Bearing down on us from a few points ahead of the beam was a monster steamer, aglow with lights which showed a thousand little rainbows through the dripping fog.

AS a matter of fact, the "Merida"—as we four hours later learned it to be—was probably three times our tonnage and one and a half times our length, but under the harrowing circumstances she was distorted into a ghastly phantom of tremendous proportions.

In reality, it was not over two minutes from the time I sighted the oncoming ship until the moment we struck her, but time is as subject to distortion as space and it seemed that hours were crowded into the period. For about a week during the first minute the "Merida" was oblivious to the danger and bore straight on toward us with no effort to avoid the impending crash. Then her officers apparently sighted us and jammed the wheel hard over, as suddenly the ship swerved sharply—or as sharply as a 10,000-ton vessel can—to starboard (right). Our officers, exercising the prerogative of disregarding maritime rules in an emergency, swung our vessel's head to port (left), their idea being to minimize the force of the collision by making it a side-swipe rather than a head-on. But their efforts were futile.

However, the "Merida" swung to starboard and avoided what would have been a fatal crash for the "Farragut." Had she kept on as she was headed, she would have certainly cut us right in half. This would have meant a snappy three-minute tragedy with a score of survivors clinging to bits of wreckage. By chance or choice the "Merida" snorthood herself in the effort to save us. Her swing to starboard ran her directly across our bows and as I gazed straight forward at the rows of lights along the "Merida's" several decks, it seemed that an eternity was consumed by the weird procession. It appeared for a time as if the ship might get by and allow us to plow across her stern instead of ramming her.

The suspense was broken by a terrific, grinding, rumbling, ripping crash that lasted for several moments, accompanied by a quick rocking up and to of the "Farragut" which sent me reeling violently across the wet deck. It seemed as if everything above, on deck, and below was splashing to pieces. A minor crash close beside me proved to be the after spreader of the aerial, the six wires tangling, about my ears. Immediately pandemonium broke and everybody

(Turn to next page)

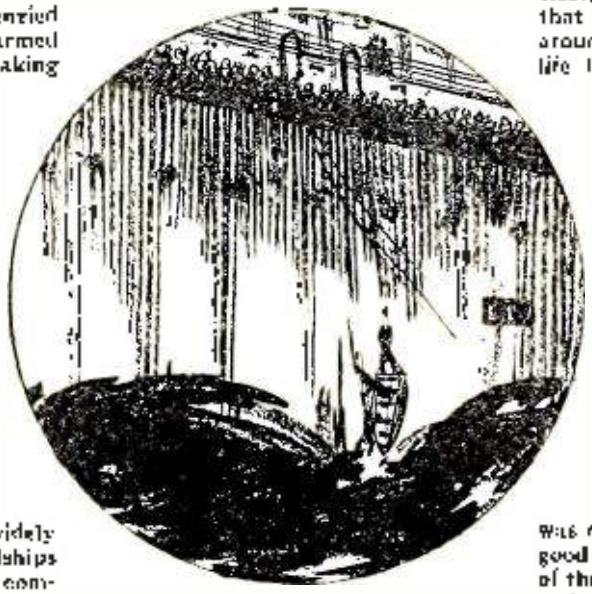
was on deck stirring up a beautiful panic.

The stricken "Merida" quickly drifted away into the darkness and fog off our port bow and was lost to sight, but her whistle at once took up the distress signal of four long blasts, sounded every few minutes, and we knew that she was disabled. We had, however, a houseful of trouble at home and at the moment could not concern ourselves with her possible fate.

SO many things happened in the next ten or twenty minutes that a complete impression would be difficult, if not impossible, to convey. Probably the most ridiculous and unimportant incident is always the one that comes to my mind first when I think of this interesting night. It was the sight of First Mate O'Neil, who had been off duty and asleep, rushing down the deck wrestling a refractory pair of trousers up over his pajamas, a revolver under his arm, cursing volubly at a frenzied mass of Spanish firemen who had swarmed up out of the forecastle and were making a sad mess of trying to launch several lifeboats. Severely handicapped by the personal problem of securing his pants, he was a pitifully impotent figure for a few seconds, although a powerful man physically and a valiant leader of his men. His galluses properly adjusted, however, matters took on a new aspect in his vicinity, and this flash from the film fades out in my memory with a comfortable majority of Spanish gentlemen falling cold to the deck from the impact of O'Neil's revolver butt.

For myself I cannot say that I was among the least excited of those present. Not being widely experienced in rationing vessels amidships on pitch dark foggy nights, I was completely sold with the idea that a young seaquake such as had just occurred meant but one thing—the prompt sinking of all the craft concerned. Not a little disturbed by this conclusion I wondered what port we would be rescued into and how uncomfortable I would be parading the streets of this unknown city minus shirt, collar and tie and with no hat. This small time worry was rudely banished by another group of the aforementioned Spaniards, who reeled from O'Neil's onslaughts and dashed toward a boat on the other side. Taking my cue from O'Neil's attitude, I gathered that the most expedient thing was to ward these eager gents away from the life boat before they gummed it up beyond recourse. My physical proportions counted for nothing, however, and an undershirt looked little like a uniform, so that I made scant headway against their frenzied efforts until reinforced by the First Mate, who had vanquished his pack of Spaniards and driven them below. Handing me a broken spar of some kind, he manfully jumped into my contingent and together we cleaned up the situation. A few random shots from the gun clinched matters and a few minutes later the firemen were herded together on the lower deck under guard of a husky seaman.

Free from matters of public policy for the moment, the question of personal safety loomed up again and I looked over the side fully expecting the shafts of light from our portholes to show the waves about ready to pour over the lower deck. Surprising to say, it still seemed a long jump to the water line and my hopes mounted immediately. Possibly, I thought, there was still time to patch up my wrecked aerial before the inevitable sinking. The intense blackness of the night made it impossible to tell the exact extent of the damage, but having been showered by the tangled wreckage of the after cross arm I knew that that end was a hopeless jumble. I figured the best thing to do was to report conditions to the Captain, ascertain how much



Passengers and crew were still wildly fighting to get life boats launched. One boat dropped overboard and capsized, and another we could see in the light of electric lanterns to be hanging by one davit . . . . the crew did wonders in saving those who dropped over the side.

time we had before the final chapter, and obtain instructions.

Fighting my way through the crazed rabble of passengers and crew, who were madly struggling amongst the wreckage, boat gear, etc., I shortly stood before Captain Mader on the bridge. Here was the first sign of calm I had encountered. The skipper was in possession of reports from all vital parts of the ship and even then was publishing reassuring advices. We had received a puke in the nose which had paralyzed our bow for twenty feet or so, but the collision bulkhead was holding and no water was entering the ship!

Feeling my way back to the radio shack through the soupy fog, I aided other officers in quelling the panic which was then the only feature offering immediate danger. Passengers and crew were still wildly fighting to get life boats launched. One boat had been dropped overboard and capsized and another we could see in the light of electric lanterns to be hanging by one davit, the forward tackle having been let go in the excitement. Working under these difficult conditions, the crew had done wonders in saving those who fell over the side.

Investigation showed the forward end of my aerial to be intact. This made it necessary to untangle the wires and rig up a substitute for the after-spreader. At first there was no help available, all hands being busy with their own work, and I spent many precious minutes falling around over debris of every description trying to straighten out the wires. I finally gave up the idea of trying to re-establish the full six-wire aerial, and bunching the ends of the wires together, attempted to pull them up on the after mast as a single cable. Three times I figured everything was clear, but found upon heaving away that one or more wires was wrapped around the smoke stack, or under a life boat, or afoul of the engine room gearing or some other such obstruction, making it necessary to unlash the wires and start all over.

A Display of Fireworks

AFTER an hour and a half of work, everything seemed to be clear finally, but at the first press of the key a grand pyrotechnical display around the after mast showed that one of the stays which had broken adrift was wound up in my leads. In addition to the shower of sparks, a chorus of lusty yells from a dozen men working at the foot of the mast advised me that all was not well. Twenty thousand volts of good transformer juice had sent a dozen of these gentlemen in as many directions, and as we were not over-supplied with able-bodied men, I desisted yet again lest I electrocute some of the available supply. My "SOS" was once more postponed until we could unscramble my leads from the rigging.

This meant more work in the darkness, but two seamen sent by the Captain rendered able assistance and were immediately aloft, shortly to report everything ready for another try. Pressing the key this time resulted only in a normal discharge at the spark gap and I plunged into a siege of wireless work which did not end until the following Saturday afternoon when we arrived at New York.

This being in the good old days when ships only carried one operator, repeated "SOS" calls were for a time of no avail. We were within easy range of many ships and at least two land stations, but all the operators were pounding their ears on the downy at two o'clock in the morning and might as well have been in the South Seas.

In the meantime we had begun to hear signs of life from the "Merida." By the diminished volume of the oft-repeated four dismal blasts of the

(Turn to page 67)

(Photo by Duke Reed)

SPEAKING OF VERSATILITY—

Hugh D. Marshall, whose pleasant voice may be heard nightly from WTAY, Oak Park, Ill., is a jack of all trades and master of several. Professionally he's a prosperous dentist, and artistically he's announcer and program director at WTAY. Not only that, but his tenor voice helps to enrich many of the interesting programs broadcast from this station. He is particularly adept at Scottish interpretations, as shown above.

Enter "The Premier Announcer"

Harold W. Arlin, KDKA, Leads in the Radio Age Popularity Contest

By Harry Aldyne

VOTES from the friends of Harold W. Arlin have awarded him a place of distinction for the month of October in the RADIO AGE Popularity Contest. During that month, the world's pioneer broadcaster received more votes than any of his contemporaries.

Since his debut at KDKA in February, 1921, Harold W. Arlin's voice has carried to listeners in all quarters of the world and votes received indicate that each day is increasing his universal popularity.

In observing the standing of candidates to October 15th, RADIO AGE readers will find several notable changes since the preceding month.

The order of the first four stands as before. E. L. Tyson moved from seventh to fifth place. Remington Welsch has jumped from eleventh to sixth position. Fred Smith has mounted the ladder from far down the scale to the ninth round, and the Duncan Sisters, who received the greatest number of votes during the first edition of this contest, and then had a brief slump, show a regain in favor by moving from 13th to 10th place.

THE WINNER FOR OCTOBER

H. W. Arlin . . Announcer . KDKA—Pittsburgh

WINNERS OF PRECEDING MONTHS

July.—Duncan Sisters
August.—Bill Hay
September.—Karl Bonawitz

STANDING TO OCTOBER 15th

Name	Classification	Where Heard
Karl Bonawitz	Organist	WIP—Philadelphia
H. W. Arlin	Announcer	KDKA—Pittsburgh
Bill Hay	Announcer	KFKX—Hastings
Lambdin Kay	Announcer	WSB—Atlanta
E. L. Tyson	Announcer	WWJ—Detroit
J. Remington Welsch	Organist	KYW—Chicago
John S. Dagget	Announcer	KHJ—Los Angeles
Jack Nelson	Announcer	WJJD—Mooseheart
Harry M. Studebaker	Entertainer, Director	WOS—Jefferson City
Fred Smith	Announcer	WLW—Cincinnati
Duncan Sisters	Entertainers	KYW—Chicago
Hired Hand	Announcer	WBAP Fort Worth
Edw. H. Smith	Director-Player	WGY—Schenectady
Bert Davis	Entertainer	WGN—Chicago
Kirk. H. Harris	Entertainer	KFI—Los Angeles
Jerry Sullivan	Director-Entertainer	WQJ—Chicago
Wendell Hall	Entertainer	WDAF—Kansas City

Radiocast fans who listen in on KDKA regularly will be pleased to know that Harold W. Arlin—the KDKA announcer—received more votes in the RADIO AGE Popularity Contest for October than any of the other contestants.

Not Over Yet

THE contest has several months to go. Probably the name of the candidate who will receive the greatest number of votes does not appear in the above list, for there are any number of radio favorites who have not received the recognition to which they are entitled.

In the spirit of Christmas giving, why not see that your radio favorite receives your votes? Your vote might be the deciding ballot in electing the monthly winner, if not the final victor. And while the matter is on your mind, what is your suggestion for a unique and appropriate gift for the final winner of the contest? The contest editor would like to know.

Mr. Arlin was born in La Hayse, Illinois, December 8, 1895, and was raised on a farm in the Southwestern part of Missouri. After completing his studies at the Carthage High School, Carthage, Missouri, in 1913, he entered the University of Kansas, electing to take the course in electrical engineering. He was graduated from the University of Kansas with the degree of Bachelor of Science in Electrical Engineering in 1917 and received his professional degree of Electrical Engineer in 1921.

Mr. Arlin was first employed by the Westinghouse Company in 1917, but it was not until February, 1921, a few months after the establishment of station KDKA on regular broadcasting schedules, that he was engaged to make the announcements from the Pittsburgh station.

In his capacity of announcer from the various studios and pick-up stations of the Westinghouse Station, the premier broadcaster has met many famous personages and world celebrities from foreign diplomats and statesmen to renowned performers in the athletic world.

Included among the famous personages received while appearing before the Westinghouse Station are: Theodore Roosevelt, Former President of the United States; Marshall Foch of France; David Lloyd George, Ex-Prime Minister of Great Britain; Roger Ward Babson, well known statistician; Governor Pinchot of the State of Pennsylvania; Jimmie Murphy, late Champion Automobile Racer; Hughey Jennings, ex-Manager of the Detroit Tigers and present Assistant to Manager McGraw of the New York Giants and Will Rogers, well known Comedian of Vaudeville and Motion Picture fame.

Appears at Four Studios

MR. ARLIN has made the announcements from the four studios of the Westinghouse Station KDKA located at the Main Works of the Company at East Pittsburgh, the Pittsburgh Post Westinghouse Studio in the Pittsburgh Post Building, the University of Pittsburgh Studio located in the Pittsburgh University and the Stockman and Farmer Studio at the offices of the National Stockman and Farmer.

In addition to appearing at these studios, Mr. Arlin has also appeared at the forty or more pick-up stations of KDKA located in the Pittsburgh District. He has appeared before the microphone as announcer from the Alvin, Davis, Ritz, Schenley, Cameo, Grand and Rowland Theaters; The Wm. Penn, Fort Pitt and Schenley Hotels; Kaufman's, Horne's and McCreery's Department Stores; and from the Point Breeze Presbyterian, Shadyside Presbyterian, E. E. Christian, Calvary Episcopal, Smithfield M. E., Sixth Avenue U. P., Trinity, and South Avenue Churches.

The world's pioneer broadcast announcer has also appeared at many other points where pick-up stations have been installed for various events.

Old Time Radio Stars Regain Favor as Contest Hits Stride

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).....

What the Broadcasters are Doing

KDKA Celebrates Its Fourth Birthday

FOUR years ago, on November 2nd 1920, Westinghouse station KDKA of East Pittsburgh, broadcast voice and music for the first time in history.

This pioneer station of the world went on the ether for the first time when it broadcast the election returns that resulted in the election of the late Warren G. Harding to the Presidency of the United States. November 2nd goes down in the annals of history as an anniversary date for Radio. This has resulted in an expansion in radio activity, whereby today there are over 500 broadcasting stations in the United States, and a radio audience which is estimated at from 12,000,000 to 50,000,000 people and a business of more than $300,000,000 per year. It has resulted in the establishment and operation of broadcasting stations in Canada, Mexico, South America Great Britain, Germany, France, Czecho-Slovakia, Australia and China. November 2nd, 1920, started a world wide movement which is still reaching out and evidently knows no limitations.

KDKA today broadcasts news, time signals, sporting events, church services, vocal and instrumental selections, farm programs, etc.

KDKA is the first station to install portable pick ups, whereby programs are picked up and transmitted to the broadcasting station by means of special telephone wires.

Soon came the search for radio receivers—the manufacturers were swamped, they had not gauged the demand correctly. The popularity of radio was manifest. Others took it up. The *Pittsburgh Post* was the first newspaper to acquire a broadcasting station.

A wave whereby one station could broadcast and another pick up for rebroadcast was next developed. The Westinghouse company installed equipment at KDKA, in addition to their regular station, whereby programs could be broadcast on a special frequency wave of about fifty meters. On this short wave, H. P. Davis, vice president of the Westinghouse company, broadcast greetings to the people of Great Britain, which were picked up by the Metropolitan Vickers Company at Manchester, England. This station was linked by land lines with the stations operated by the British Broadcasting Company and on January 1st, 1924, for the first time in history, an event of this kind was carried out. Since that time KDKA'S programs have been picked up in England, Scotland, Spain and even Africa.

WBCN Makes Bow

The Englewood section of Chicago is to have a broadcasting station of its own, to be known as WBCN. The *Southtown Economist*, the leading south side community newspaper, has under construction at 728-34 W. 65th St., a 500 watt set of the very latest type and expects to be on the air the latter part of November.

The staff of seven is already functioning and a number of important bookings have been made.

The staff of the new station includes the following popular radio men: Director, Robert Northrop, late of WCAY, Milwaukee, KYW and WLS, Chicago; assistant director, Harry A. Zook, Jr., formerly with KYW; John Ralph Foster, ex-chief engineer of CGCK, Winnipeg; musical director, Guy Shrigley.

"Bob" Northrop's picture shown above.

(Photo by Doris Ulmann)

Above is pretty Martha Bjorn, youthful singer who has just established herself as a soprano from Chicago, Pittsburgh and Davenport radiocast stations. She is just out of high school, but she sings like a veteran, according to the most critical listeners.

Another N. Y. Station on the Air

NEW YORK'S newest radio broadcasting station was inaugurated last month when Station WGBS, operated by Gimbel Brothers, went on the air for the first time. An unusually entertaining program was presented for the benefit of millions listening in at their radios as well as several hundred guests who were present—prominent people from all fields of endeavor, theatre, music, journalism, motion pictures and public life.

During the week preceding its opening WGBS had been sending out test programs nightly after other programs were over and the ether clear. Letters, telegrams and long distance calls from many parts of the country were received daily, as far west as Ohio and from many Pennsylvania towns, saying that the programs were being heard with perfect clarity and had a high degree of modulation. Because of these tests thousands stood by expectantly last night, awaiting the official opening of WGBS.

The opening program was also relayed by special ground wires to station WIP, operated by Gimbel Brothers in Philadelphia, and from there sent out over the large radius of that section. WIP has a record-breaking radius, its programs being received in the far corners of this country as well as in Europe. WIP has been heard at Danzig, Poland, and, in the other direction, at Pearl Harbor, Hawaii.

Many of the numbers of the program were given on a specially constructed stage, as completely equipped as the stage of any theatre. The broadcasting was done through microphones on the stage.

A unique feature of the station is that it is entirely enclosed by glass and that broadcasting is visible and open to the public at all times. This is the first time in the history of radio that the public has been able to see the various phases of broadcasting at all hours.

"The Miracle," Morris Gest's play, was broadcast in its entirety from the Century Theatre. Five microphones, with a special remote control station, were installed in the theatre to send the symphony orchestra and organ music, the singing of the choir and the story of the pantomime, told by the actor, Fred Eric, over the ether.

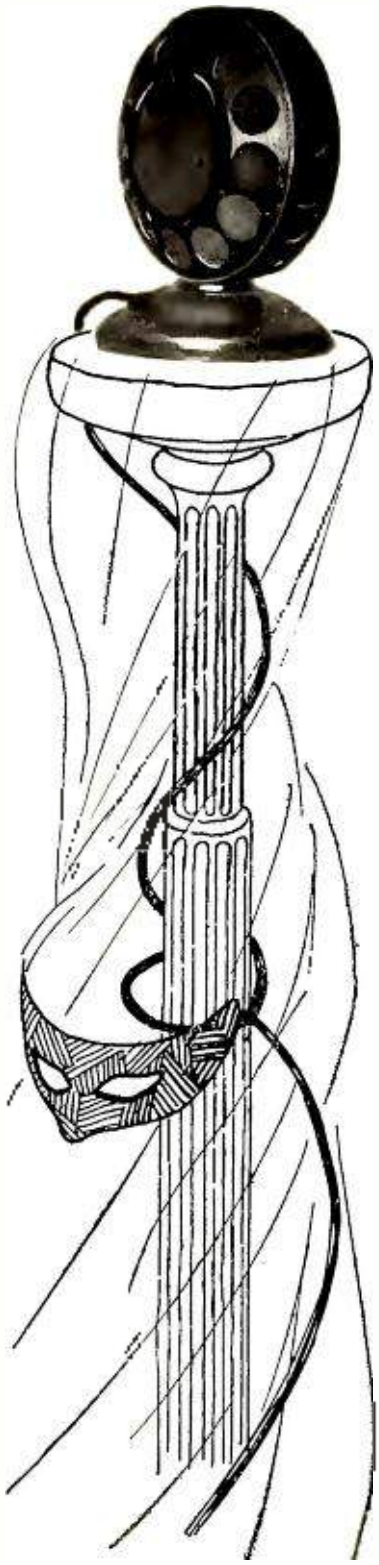
TUNE IN!

Don't forget to listen to RADIO AGE'S Congress Hotel Jazz Carnival from KYW, 536 meters, Saturday, December 6, at midnight!

It's Funny How the "*Veiled Lady*" SCARES *'Em*

What's the Ideal Voice for Radio?

By William Cunningham



THE world's best little eavesdropper. The universal record holder for distance demolition. The greatest fo'-el hunk ever known to man. The only device which, with no pain at all and practically no cost, can stretch a human ear from an Iowa parlor to Madison Square Garden.

That's the Mike.

The radio microphone, if you please. Or, if you are romantically inclined and relish a dash of poetry now and then, the Veiled Lady.

There are no set rules anywhere in radio as yet. Staffs vary in size and functions. Programs vary in length and in composition. Studios vary in tactics and policies. Wavelengths vary. Mechanical equipment varies. Everything varies except—except the Veiled Lady. She is absolute queen of the studio, ruling her minute dominion from a movable mahogany pedestal that lifts her to the height of a singer's face.

A broadcasting station consists of a very simple room or studio, where entertainers perform, and a very complicated power plant on top of the building from which the radio's message is hurled through the heavens and the earth. A staff of announcers, a station secretary, a director of broadcast, and a stenographic force hide herd on the studio, its programs and fan mail, while a staff of operators, licensed by the government, handles the switches and dials upstairs.

And the Veiled Lady is the center of it all. Her throne-room is really a padded cell with ceiling, floor, and walls heavily upholstered to kill all echoes and overtones.

This padding is a vital feature and marks the major cleavage between broadcasting and ordinary concertizing. Acoustics are pre-requisite in the concert hall; lack of acoustics pre-requisite in the studio.

The Lady Frightens 'Em

THE Veiled Lady always shares her snug apartment with a resourceful and subservient grand piano, but never once does she lose her dignity nor cease to be the dominating personage even after the performers enter. It isn't the actual Lady, herself, that is commanding. At best she is only a small circular affair of gun metal and concealed coils standing like a blackened soup plate on edge atop the pedestal. It's the almost sinister suggestion of thousands of silent listeners out beyond her somewhere, ready and able to hear the very breath you draw, that chills the feet and shackles the speech of the broadcasting neophyte no matter how facile or voluble he may be from the lecture platform.

Radio stage fright is a strange and ever present phenomenon. Even the best of them get it. Roy Chapman Andrews, lecturer and naturalist, recently in international print for his discovery of the dinosaur eggs in China, is famous as an extemporaneous speaker. He frequently addresses audiences for an hour and a half without notes or previous preparation.

In Detroit recently Mr. Andrews was asked to speak for five minutes over the radio. It was his first experience, but, true to custom, he faced the Veiled Lady without notes or manuscript. Halfway through his five minutes he suddenly found himself in trouble. The inspiration and guidance of a visible audience were missing for the first time. The Lady, dumb and smugly self-satisfied, grinned at him with tantalizing indifference. She neither smiled approval nor curled her lips in scorn. Her hard-boiled attitude totally wrecked his aplomb. He later characterized those last two minutes as the stiffest assignment of his career.

A metropolitan station was temporarily nonplused one night when an orchestra due to go on the air missed a train. Its director of broadcast never allows a performer to face his microphone without having first investigated what the performer has previously done and where he has done it. But in this emergency all bets were off and an urgent call for talent was sounded. A man responded who highly recommended himself as an experienced monologist. He had never faced the Veiled Lady but was sure he wouldn't have the slightest difficulty if he were only allowed to do his own announcing, to gesticulate freely, and just be himself, as he expressed it.

Assured that he could stand on his head if he wanted to, he reported to the studio in full evening dress, stepped up to the microphone, and announced that his first number would be a reading of Gunga Din.

Then he backed off about ten feet and made a low, sweeping bow. Waving his arms and weaving from side to side, he thundered the opening cadences. Suddenly, he looked at the Lady. Next at the deadened walls. Then he straightened up, choked, and started over again.

Reaching the identical point, he stumbled, stuttered, and hauled up again.

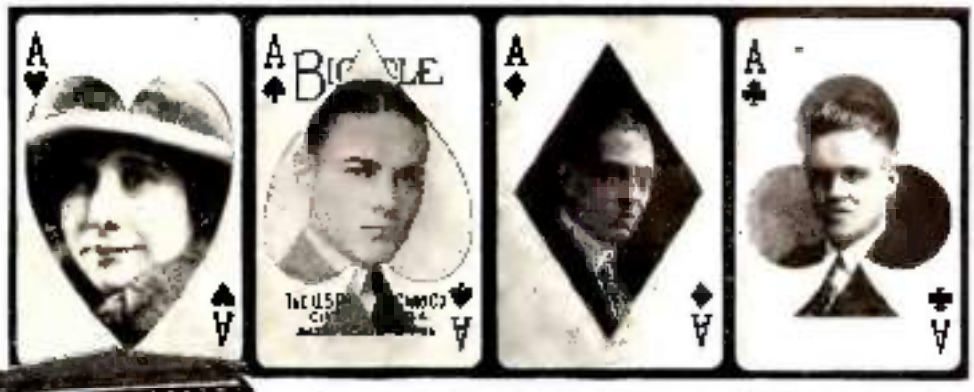
The third time he made his start. Perspiration beaded his brow by this time (the Veiled Lady won't stand for any fans in her apartment) and his back feathers were rapidly rising. For the third time he collided with the line he had recited in public no less than two thousand times, according to his own admission, and again he went ox-eyed and limp-lipped.

"Hey, yank this thing off and let me out. *I'm licked,*" he yelled before the operator could pull the plug. That was the gentleman's farewell to his audience and his tribute to the confounding personality of the Veiled Lady.

(Continued on page 62)

WITH "FOUR ACES" WSAI IS ALWAYS A WINNER

Led by An Able "Queen of Hearts," This Famous Station Has Proved to be One of the Most Versatile in the Middle West: Every Kind of Musical Taste Appeased in One Evening's Broadcasting.

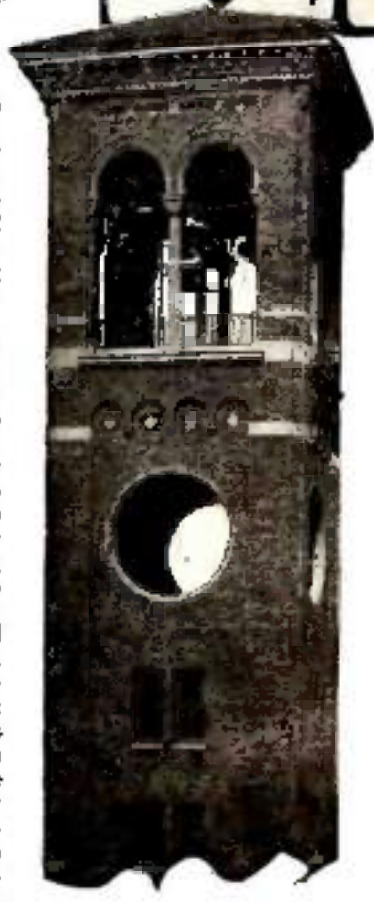


Here are the "Four Aces" who constitute WSAI's winning hand throughout the year. Left to right, Frances Jones, musical directress and Queen of Hearts. Paul Greene, chief announcer and Ace of Spades; E. S. Mittendorf, announcer and Ace of Diamonds; and Evans Cooper, chief "op" and Ace of Clubs.

CINCINNATI—A radio station that can furnish every conceivable kind of program on a moment's notice is a real radio station; and WSAI, owned and operated by the U. S. Playing Card Company in Cincinnati, is just that.

It is only recently that the other fans have begun to notice the high caliber and versatility of programs sent out from this unusual station. And the more one studies it, the more he is convinced that Cincinnatians have no need to tune for DX—for everything they could desire to hear is usually broadcast from WSAI during the course of an evening's entertainment.

The owners of the station modestly admit that the prime reason for this station's success lies with the "Four Aces" who guide its destiny. The "Four Aces," so nicknamed because of their affiliation with the playing card concern, are Frances Jones, musical directress; Paul Greene, chief announcer; E. S. Mittendorf, another announcer and R. Evans Cooper, the chief operator who keeps the waves on their best behavior when they leave WSAI's antenna.



Above is the WSAI chime tower which broadcasts musical chime concerts on Sundays. The microphone is suspended in the air 300 feet away

Passing the Buck

FACED with the accusation that they are responsible for the station's phenomenal popularity, the "Four Aces" pass the buck with typical modesty by saying that Cincinnati as a city is so versatile that any kind of a program can be had by appealing to the galaxy of talent residing in the city. So that's that.

Plenty of talent is supplied by the faculty and students of the Cincinnati Conservatory of Music and the Cincinnati College of Music. Their programs are a regular part of WSAI's daily broadcasts.

WSAI consists of two studios one for regular concert work and singing, and the other for bands, orchestras and glee clubs. The station studios are about the most pretentious in the broadcasting world, and every effort is made to make visitors and artists feel "at home."

WSAI's chime concerts are known from coast to coast. They are broadcast every Sunday afternoon and for fifteen minutes on Tuesdays and Saturdays. The chimes are composed of twelve bells built especially for broadcasting. The chimes are located in a nine-story bell tower on the U. S. Playing Card Company's grounds. Music from the chimes is caught by a hidden microphone three hundred feet from the tower itself.

They're All Experts

"Texas" Green, the Ace of Spades on the playing card station, has done engineering work on nearly all the big broadcasting stations in the Middle West before settling down at WSAI. Miss Jones, who arranges the musical programs and who accompanies nearly every artist at the piano, is the "Queen of Hearts" in more ways than one; E. S. Mittendorf, whose signature "W-S-A-I, Cin-Cy-Natty" is a byword among Middle Western fans, is the Ace of Diamonds; and R. Evans Cooper, the operator, enjoys the cryptic title of Ace of Clubs, which may mean much or little.

Ever Tune In?

WSAI is comparatively easy to get because it enjoys a fairly low wavelength—400 meters. It is far enough below the big ones to be heard without interference, and far enough above KFKX, WTAS, WJJD, WSIAR and WEAN to be likewise free from disturbances. On the upper band, right near WSAI, such stations as KDKA, WGR and others are hovering, but WSAI usually comes in with sufficient volume to be heard alone. That is another broadcasting accomplishment in these days of crowded ether lanes.

WSAI also enjoys the reputation of being a well-modulated station. The fault with scores of stations today is their tendency to fade in and out during the course of an evening's program. This causes much exasperation on the part of well-meaning listeners, and sometimes these offending stations lose many of their adherents because their modulation is inconsistent.

Not so with WSAI. Clear, unadulterated volume is its outstanding feature, and cites as far East as the Atlantic Coast and as far West as the Dakotas report receiving this Cincinnati broadcaster with all the clarity and consistency of a local station. That's a record—but then, everything one mentions about WSAI is a record.

Another thing—all young folks are in charge of this station. Their buoyant enthusiasm keeps WSAI alive and full of pep, and just because they're young doesn't mean they have to play up jazz all the time. They know the desires of every class of listener—which means they're psychologists as well. No fun!

How America is Turning to RADIO AND THE DRAMA

By WINDERMERE HUNGERFORD

HAVE you ever heard a radio play? It left quite a lot to be imagined, didn't it? WGY, the Schenectady broadcasting station, realizes that radio listeners cannot see accordingly it is producing radio plays that leave nothing to be imagined and keep the interest alive in every act. Miss Hungerford tells all about it in this article.

WGY Leads All Stations in Producing Plays that Are Suited To Radio

SEVERAL months ago the wiseacres said a legitimate play (or any other kind) could not be broadcast by radio for the very simple reason that the army of theater-goers must see a play before they can enjoy it. In fact, these critics pointed to the movies in an attempt to prove that a play doesn't even have to be *heard*, vision is enough, they averred.

The first few plays broadcast by radio stations seemed to bear out this pessimistic belief. They were flat failures for the reason they were not picked out for broadcasting purposes. There would be several moments of mysterious silence, in which the vast radio audience would wonder what was going on on the stage; what could be going on, that seemed to hold the theater audience in such rapt attention and of which the radio audience had no idea?

The plays broadcast from WGY are as varied as those that attract the crowds along Broadway. Above is the "cast of characters" from a rural production recently broadcast from WGY. The actors dress their parts and accordingly "put over" the spirit of the play just as if they were facing their audience

The first radio plays were just like that. They did not take account of the fact that something must be said or done *audibly* every minute of the play in order to keep an absent audience from tuning off that wave length.

It took quite a few failures to realize this, and it was only by bitter experience that these pioneer play-broadcasting stations hit upon the ideal radio play; the kind that is slowly re-establishing radio plays to their rightful popularity in the Great American Radio Heart.

WGY the Pioneer

Without a doubt WGY, the General Electric Station at Schenectady, is the leader in the radio drama field. Untiringly this station has kept up its broadcasting of plays and acts—musical, melodramatic and plain comedy. When this station found that it was too hard to search New York's White Way for suitable radio plays, it decided to form a theatrical company of its own and to write plays that would be suitable to radio broadcasting.

The experiment has been a success. The plays to be heard weekly from WGY are perfect from a radio standpoint. Perhaps they would fall down if put on a regular stage before a critical audience of visible first-nighters; but the listeners who "see" these plays through their ears have "eaten them up and cried for more."

"Radarios" on WGY

Other stations are following the lead of WGY, but very few have developed the radio drama art to such a state where they can afford or desire to form their own company. A new class of writers has sprung up, however, and if more stations adopt theatrical broadcasting, we will have a new profession in our midst; a profession of psychologists well versed in the art of turning out "radarios," the name recently coined for "radio scenarios."

Two of the most typical "radioly perfect" plays ever put on the air are "Abie's Irish Rose" and "Applesauce." Although these plays are interesting to look at in the theater itself, they are equally easy and pleasant to hear for a running fire of side-splitting conversation fills every minute of every act. And that's what makes a real radio play; and if such plays appeal to the imagination through the ear instead of through the eye, the radio-drama has unlimited possibilities.

How They Do It

Perhaps the most interesting and thrilling play broadcast from WGY was the melodramatic success, "Pierre of the Plains," by Edgar Selwyn. The actors grouped themselves around the microphone, and in order to make a fight in woodland leaves seem realistic, onion-skin paper was sprinkled on the floor. A microphone was placed next to the leaves on the floor, and two of the "actors" grappled in a life and death struggle on the leaves. Their deep breathing and muscular motions were picked up by the "mike" and transmitted to a thrilled audience.

Above is one of the jolly musical units at W.O.W. and incidentally, one of the reasons why the Woodmen are so popular

At the right is Lester Palmer, program director "Radio is fast and funny in Rite really how one of W.O.W.'s amateurs says"

Are You One of the Order of WOWLS?

If You're Not, Then Station WOAW Can Help You

Says Milton Lieberman

BY being the home of the "radio Billy Sunday," the "WOWLs," and above all, Eugene Kennedy, the poet laureate, Station WOAW (pronounced "wow" by the light-headed) of the Woodmen of the World, Omaha, Nebraska, deserves the fame it has achieved recently.

Religion is a big thing in WOAW, and it claims to have the largest congregation in the world, estimating the number as high as a quarter of a million. Although the Woodmen of the World is a benevolent and insurance organization, there is no truth whatever to the statement that it preaches religion to save fees and thereby save insurance money.

Not at all, for they are not so mercenary.

The only reason that the Honorable W. A. ("Big Bill") Frazer, president of the Woodmen, started the station was because he believed that an insurance society must keep abreast of the times, must discharge its civil duties, and must deliver the goods by serving and educating the members in addition to paying claims.

"Fellowship of the Air"

BIG BILL FRAZER is a fraternalist. It is no coincidence that he carried his fraternalism into the radio field. In fact, he visioned a great fellowship of the air, a fraternity of men, women and children connected with one another by means of the latest scientific marvel of the century.

So he organized the Radio Church of the World, giving morning, evening and Sunday sermons. And he obtained the Rev. R. R. Brown, the "Billy Sunday of the air" to hold the microphone pulpit. Nobody could have done the job better, either, for the Rev. Brown has so reached the hearts of his children that they would do anything for him. He is constantly receiving gifts from them as a means of expressing their appreciation. Crates of country eggs, honey in the comb, angel cake, pie, candy, ham and bacon are many of the articles which the mail man delivers to his home.

Rev. Brown says of his congregation: "I see 'em all, in the steel-framed glass circles of my microphone. There's the hard boiled husband who won't go to church with his wife. There's the gang at Biffy's billiard hall. There's that little constantive girl who is taking the fresh air cure. There's an old couple out on the farm who wrote me: 'You brought Sunday back to us.' There's that little lad at the school

(Turn to page 71)

KYW—*The Only Station with* 24-HOUR RADIO Service

Mr. Wm. H. Wilbur E. Gross, Manager of KYW.

KYW, the Westinghouse station at Chicago, is the only broadcasting unit in the world on duty twenty-four hours each day. Over this daily period the station is actually in operation eight hours and thirty-six minutes, but its mighty transmitter is in readiness at all hours of the day and night to go on the air.

From a station requiring a personnel of five, KYW has expanded to its present proportions, with a force numbering almost thirty people. KYW today has studios in the Edison Building, Hearst Square, the Congress Hotel and Garrick Theater Building, and also has private wires to other places from whence entertainment is put on the ether.

All Tastes Satisfied

With the varied class of entertainment, radio fans can meet all their desires by tuning in this station. The programs from the Edison studio are classic in nature and only the most select artistry is accepted. The Congress Hotel Saturday evening concerts include only the foremost and highest class entertainment obtainable.

The World Crier broadcasts its material in the form of world news, stock reports and sporting news, every hour and half hour, consuming an average time of five minutes on each occasion.

The World Crier has also served on several occasions by request, when heavy snowstorms crippled telegraph and telephone wires. On these occasions the World Crier added laurels to the value of radio, in broadcasting train dispatches and seeking information of lost trains, also acting as the official news herald. Always ready for service.

Mail Piles Up Fast

The continued increase in the daily receipt of an already vast number of letters and postal cards, clearly indicates the rapidly growing popularity of KYW with its invisible audience.

KYW's endeavor always has been to please its silent audience with interesting news, entertainment and announcements, and the station enjoys the confidence of its uncountable fans. KYW is often called upon by radio listeners-in to render personal services.

Wilson J. Wetherlee is general manager of the station and Eddie Borod assistant director and announcer.

The Chief Operator

Walter Evans is the man behind the apparatus at KYW. He is one of Chicago's pioneer chief operators, and accordingly he knows whereof he speaks when he gives advice to aspiring radio operators. The following information was obtained from Walter in an effort to enlighten those readers who think operating a radio station is a "snap":

"There are two general classes that make good operators," he began. "First is the graduate electrical engineer who has learned enough about radio to obtain a government license. The other is the old time radio operator who has passed the experimental or bug stage and with whom radio is a serious means of earning a living.

"The work in each particular radio station is vastly different from any other, so it is more desirable to start a new man, green as far as broadcasting is concerned, and to train him to specialize on a particular equipment in the station in which he is to operate. The ex-amateur operator is too inclined to experiment and change the equipment

(Turn to page 70)

Here we have "Coon" Sanders' original Kansas City Night Hawks of Radio Fame, who are now furnishing jazz regularly from KYW, Chicago. They earned their reputation at WDAF in days gone by.

Photo by Carbone

Edythe Sackett, pianist-accompanist who is appearing on the Chicago Concert Company's classical programs from KYW.

Entire Country Hears "Radio Age" Programs from Chicago Stations

By RUSSELL H. HOPKINS

Able Radio Artists Give Fine Programs

HAVE you tuned in on one of RADIO AGE'S broadcast programs lately? Every month classical and popular programs may be heard from well known Chicago broadcasting stations, under the auspices of "The Magazine of the Hour."

RADIO AGE was the first radio publication to demonstrate belief in the importance of promoting good radio programs, when, last July, it arranged to present varied selections from local stations. WTAY was the first to broadcast RADIO AGE programs, and, encouraged by the success of this first attempt, dates at other stations were obtained.

Since the first presentation last summer, RADIO AGE artists have appeared at Chicago's biggest stations, including WEBH, on the Edgewater Beach Hotel, WLS, the Sears-Roebuck station, KYW, the Westinghouse radiophone, and from WTAY, on the Oak Park Arms Hotel.

Programs in Demand

Gradually, through appearing at these various stations, RADIO AGE has built up a staff of artists that can compete with the best to be heard on any station in the country. Vocalists, instrumental musicians and others have been obtained to present their best numbers, and as a result "RADIO AGE nights" have been in demand.

Nor has RADIO AGE'S effort to promote the best in broadcast programs been confined to Chicago alone. WSAI, the U. S. Playing Card Station at Cincinnati, has put RADIO AGE on the air for its efforts in promote quality broadcasting, and Nick Harris, of Station KFI, Los Angeles, keeps the Coast fans informed of this magazine's doings.

Splendid co-operation has been offered by such well known radio figures as Edgar L. Bill, Ford Rush and Glenn Rowel, of WLS; Bob Boniel of WEBH, Telfer MacArthur of WTAY and Wilson J. Wetherbee, Eddie Bacroff and E. E. Mattson from Westinghouse KYW.

RADIO AGE'S most recent program was on Saturday, November 8, when a "RADIO AGE Carnival" was put on the air from the Congress Hotel studio of KYW, (536 meters) from 12 midnight to 4 a. m. This midnight program is one of the most popular in the country, drawing requests from coast to coast and from gulf to Canadian frontier.

Standing at the top oval, from left to right are some of RADIO AGE'S broadcast artists: Arthur W. Hickman, baritone; Elizabeth Berry, soprano; Tillie Thorpe, soprano; Hugh Marshall, WTAY singer and director; Anna Leeb, soprano; Maurine Marseilles, character soprano of jazz selections. In the centre lower is Blanks Kennedy, popular piano monologist who appears exclusively for RADIO AGE. (Picture of Miss Berry, Miss Thorpe and Mr. Marshall by Fowler Studios; of Miss Marseilles by Gregory; of Miss Leeb by Brown.)

Now, a word about the artists who are making this reputation for RADIO AGE. Misses Elizabeth Berry, Tillie Thorpe, Anna Leeb and Maurine Marseilles have built up a following, each in her own line. Miss Leeb and Miss Thorpe have elicited valuable praise for their efforts in classical and semi-classical numbers, while Miss Berry and Miss Marseilles have won the hearts of the jazz fans.

Two Peerless Baritones

Arthur W. Hickman has built up a radio reputation solely because of his splendid baritone singing of semi-classical numbers. Carroll Kearns is another baritone and newcomer to the ranks of RADIO AGE artists. He, too, is winning deserved comment.

Blanks Kennedy, former organist at the Tivoli Theater, Chicago, appeared for the first time at RADIO AGE'S classical program over KYW and later at the jazz frolic, proving proficient in both lines with his piano monologues. Eddie Bacroff of KYW asserts Mr. Kennedy has an ideal radio voice. More than two score telegrams in one evening corroborated Ed's opinion.

Then there are "Jack and Jill," a new pair who are specializing in popular numbers. They will be heard again within a few weeks on another of RADIO AGE'S midnight KYW carnivals. Jill presides at the piano, while "Jack" does the vocal exercising.

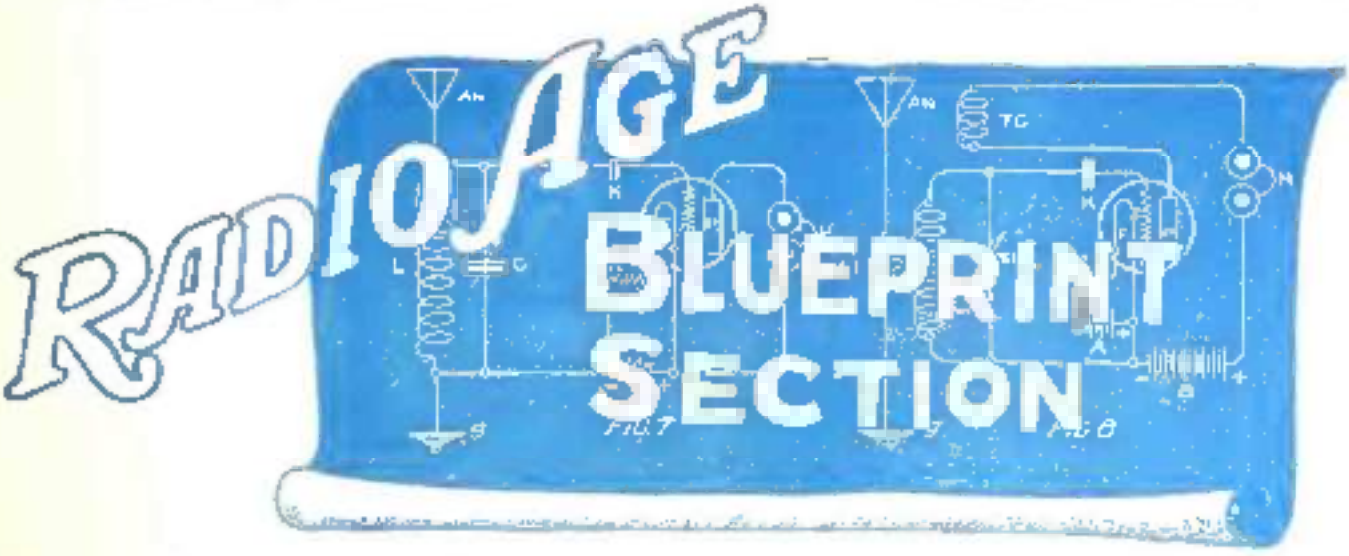
George W. Jatho and his instrumental soloists help break up the vocal numbers with pleasing selections. All in all, RADIO AGE presentations have been regarded as examples of "balanced programs."

Here Are Two New Programs

As we go to press, it is learned that RADIO AGE'S artists will be on the air once again in November and on December 6.

Thursday evening, November 20, RADIO AGE may be heard from WEBH (370 meters) between 9 and 10 p. m., with a popular and semi-classical program. Tune in on this station if you want to pass a pleasant hour.

Jazz fans will be pleased to hear that RADIO AGE may be heard hereafter the first Saturday in every month from KYW, Chicago, on its Saturday night Congress Hotel Carnival. This program begins at midnight and runs till 2 a. m.



At Last! A Master Receiver

A New 8-Tube Super-Heterodyne

By JOHN B. RATHBUN

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A Super That Gives Distance and Tone

SO much has been printed in RADIO AGE upon the elementary principles of the super-heterodyne that it seems hardly necessary to enter again into the theory in much detail.

Briefly, the super-heterodyne is a special form of radio frequency circuit in which radio frequency amplification takes place at a much longer wavelength than that of the incoming radio waves, thus reducing the losses in the tubes and R. F. transformers and adding to the efficiency of the set. Broadcasting wavelengths ranging from 200 to 600 meters are converted into wavelengths approximating 15,000 meters before the waves enter the radio frequency stages. After amplification, the waves then are rectified by the usual detector tube producing audible signals which can be further amplified by one or more audio stages.

A typical eight tube super-heterodyne of the type to be described consists of the following principal unit divisions of tubes:

(1) The first detector tube.

(2) Three radio frequency amplifying tubes.

(3) One oscillator tube used as a frequency changer of the heterodyne type.

(4) One second detector for rectifying the output of the radio frequency stages and thus producing audible signals.

(5) Two audio frequency stages for increasing the volume of the audio component so that a loud speaker can be used.

The Detector Tube

IN a certain respect, the first detector tube (1) can be considered as a radio frequency amplifying stage, and in some circuits is used exclusively for this purpose without the conventional grid condenser and leak, but when iron core radio frequency transformers are used the detector tube is of advantage in providing an audio component to the first stages of the circuit. It should be noted that the R. F. tubes and transformers work normally at a frequency which is not very much greater than the higher audio or voice frequencies, and therefore a certain amount of audio amplification is also possible in the radio stages, when iron core transformers are used at this point. With air core transformers the audio component receives little if any amplification in the radio stages, and hence under these conditions the rectification of the first tube (1) is not of importance and can be considered and used as a strictly radio frequency stage. The advantages and disadvantages of either system are still a matter of some dispute.

We now come to the oscillator tube (3) by which the wavelength or frequency of the incoming waves is converted into the desired value for use in the radio frequency stages. Really this tube is an independent unit as far as the rest of the circuit is concerned, for it does not enter directly into the amplification or rectification of the waves. It simply produces a series of independent, continuous oscillations, which are combined with the incoming radio waves to form a third series of oscillations having a greater wavelength or lower frequency than either of the original series. This method of changing frequencies is known as heterodyning. The third wave is amplified by the succeeding radio stages. The frequency of the oscillations set up by the oscillator tube is determined by an inductance coil and a variable condenser in such a way that a constant frequency is maintained in the R. F. stages, regardless of the incoming radio frequency. The oscillator condenser forms one of the two tuning controls of the circuit.

The R. F. Transformers

ALL of the radio frequency transformers operate at a constant fixed wavelength or frequency at which maximum amplification takes place, regardless of the frequency of the broadcasting station which may then be tuned in. This optimum frequency is determined by the windings of the transformers and more particularly by the fixed condensers placed across the first or last R. F. transformers. The transformers are therefore sharply tuned to a single definite wavelength or frequency to which the heterodyned waves must be adjusted by means of the oscillator variable condenser. As the transformers will not respond to any other frequency than that determined by the fixed, the oscillator condenser becomes an effective tuning control, which in connection with the aerial or loop condenser insures a high degree of selectivity.

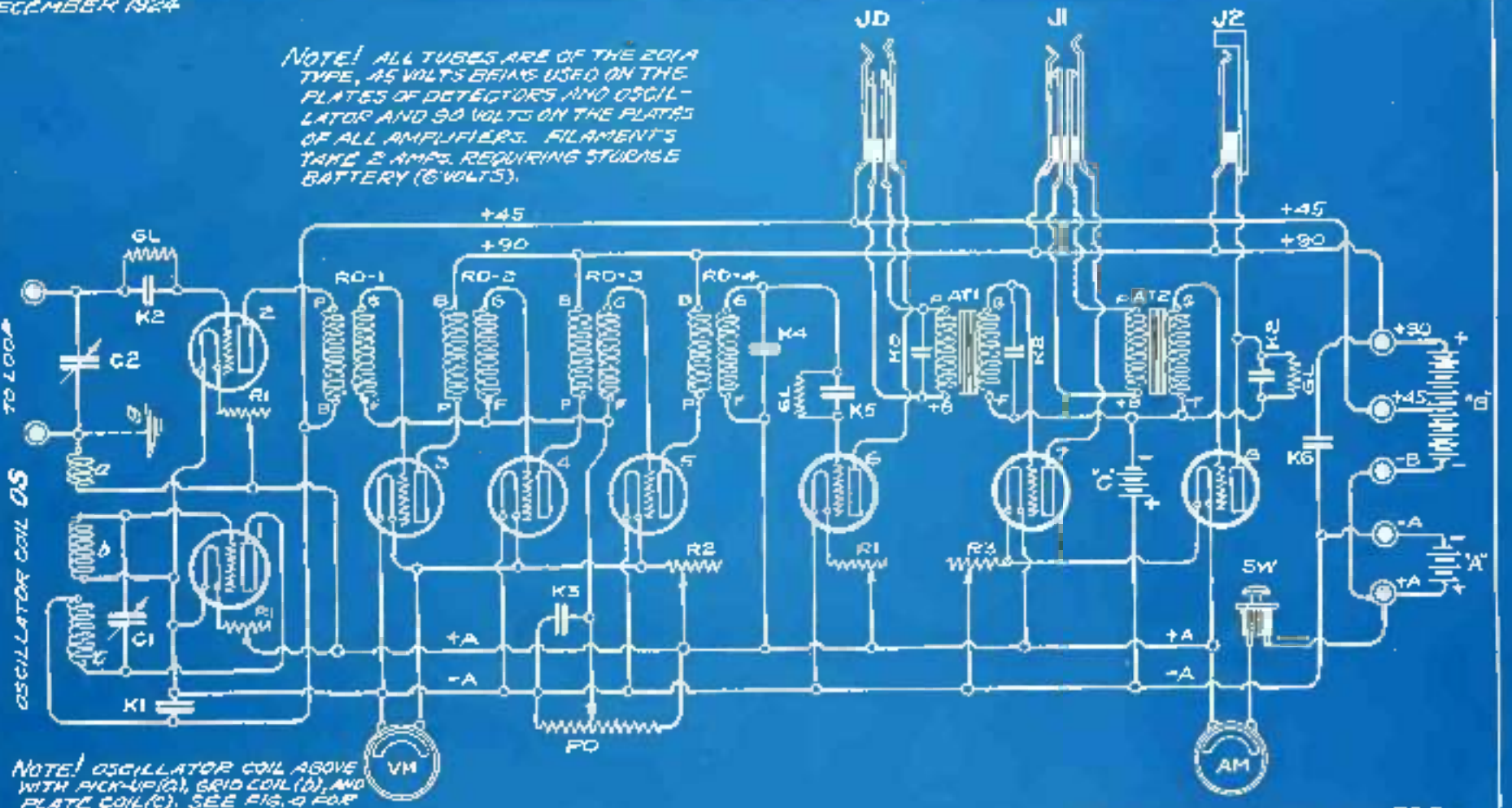
All the radio frequency transformers, whether of the air core or iron core types, are of the "long wave" design especially designed for the super heterodyne circuit. In the circuit illustrated, the transformers are designed for operation on approximately 15 kilocycles (15,000 cycles frequency) which corresponds to a wavelength of 6,000 meters. This is not a fixed standard frequency which must be maintained strictly in all cases, but has been found in practice as the most effective compromise for the circuit at hand. Actually, the wavelength may extend from 1,200 to 25,000 meters in many circuits, but at either extreme certain objectionable features appear which make the 6,000 meter type the logical compromise for use with iron core transformers.

(Turn to page 43)

Blueprints for the New Super-Heterodyne on Pages 42, 44, 45 and 47

RADIO AGE
DECEMBER 1924

NOTE! ALL TUBES ARE OF THE 201A TYPE, 45 VOLTS BEING USED ON THE PLATES OF DETECTORS AND OSCILLATOR AND 90 VOLTS ON THE PLATES OF ALL AMPLIFIERS. FILAMENTS TAKE 2 AMPS. REQUIRING STORAGE BATTERY (6 VOLTS).



NOTE! OSCILLATOR COIL ABOVE WITH PICK-UP(a), GRID COIL(b), AND PLATE COIL(c). SEE FIG. 4 FOR GENERAL DESIGN AND ARRANGEMENT OF OSCILLATOR.

COUPLING BETWEEN (a) AND (b) MUST BE VERY "LOOSE" WITH ONLY FOUR TURNS OF WIRE ON COIL (a).

TUBES AND TRANSFORMERS MUST BE MATCHED IN RADIO 57.

PAT. PENDING

FIG. 1

EIGHT TUBE SUPER-HETERODYNE

OSCILLATOR, THREE STAGES OF RADIO FREQUENCY, TWO STAGES OF AUDIO AND TWO DETECTOR TUBES. WORKS ON STANDARD 200-600 METER LOOP AERIAL, 24"-30" SQUARE.

ANY GOOD MAKE OF AUDIO FREQUENCY TRANSFORMERS (AT1) AND (AT2) CAN BE EMPLOYED AND WITH ANY PRACTICABLE RATIOS. A RATIO OF 5 TO 1 FOR BOTH TRANSFORMERS PROBABLY BEING BEST.

USE A 4.5 VOLT "C" BATTERY FOR PUTTING A NEGATIVE BIAS ON THE GRIDS OF BOTH TUBES. FILTERING IS ACCOMPLISHED BY K2-GL.

U. B. RATHBUN
SH-55A

Uniformity of Tubes Vital in "Super"

(Continued from page 41)

Circuit Diagrams

Fig. 1 is the schematic circuit drawing of the super-heterodyne developed by Mr. Posth of the Radio Doctors, Inc., Chicago, and which has been built by a number of amateurs with excellent results. It is not a radical departure from conventional practice, but is a simple, compact layout which is easily constructed by the novice in "dyne" circuits with an excellent chance of getting results immediately after the completion of the set. It is the result of nearly a year's continual experimenting by one who has alternately added and then eliminated various experimental features which have been brought up from time to time in heterodyne development until the present circuit was arrived at.

Fig. 2 is a picture diagram of the hook-up which will be of service to those who have not yet delved into the mysteries of conventional diagrams. Here each part is drawn out as it actually appears in the proper proportion, with the wiring runs located at the most advantageous points. The letters and figures on Fig. 1 correspond to those marked on Fig. 2, so that the relation between the two drawings can be easily traced out. For convenience, Fig. 2 is divided into two parts. The lower half of the drawing represents a plan view of the baseboard and apparatus as it appears to the observer on looking straight down on the set. The upper half is the rear view of the panel as seen from the rear of the assembly. Between the upper and lower views we see the connecting wiring drawn in heavy lines, which connect the apparatus mounted on the baseboard to that attached to the rear of the panel. Arranged in this way, the connections are easily followed.

Fig. 3 is a front elevation of the panel which shows the controls and the center to center dimensions between the various units mounted on the panel. As will be seen from the blueprints, the panel is 8"x32"x1/4", a reasonable size for a super-heterodyne and a panel not much longer than that used with many tuned radio frequency outfits. The circuit is arranged exclusively for use with a loop aerial, and with this arrangement the loop plays no small part in gaining absolute selectivity in districts where there are a number of broadcasting stations located within a short distance of the receiver.

Starting in with either Fig. 1 or Fig. 2, depending upon the experience of the reader, we note the two variable condensers (C1) and (C2) mounted on the panel at the right. Both are of the low loss type with external vernier adjustments, and both have a maximum capacity of 0.0005 microfarad or the capacity of the standard 23 plate. Condenser (C1) controls the oscillation frequency of the oscillator tube (1) and the oscillator coil (OS). Condenser (C2) tunes the loop and the grid circuit of the first detector tube (2). These are the only tuning controls used and therefore the actual operation of tuning is much simpler than with the usual tuned radio frequency set.

Further along the panel we have four filament control rheostats (R1-R2-R3) with resistances varying according to the number of tubes that they control. Rheostats are based on the use of 201A tubes throughout both for the amplifiers and detectors. The three rheostats marked (R1) have a resistance of 20 ohms and control respectively the oscillator tube (1), the first detector tube (2) and the second detector tube (6). Rheostat (R2) controls the three radio frequency tubes (3-4-5), and because of the greater current has a resistance of only six ohms. Rheostat (R3) has a resistance of 15 ohms for the control of the two audio tubes (7-8).

Watching Potentiometer

AT (PO) is a 400 ohm potentiometer or stabilizer which controls the grid potential of the radio frequency stages. In actual operation the potentiometer has a marked influence on the volume and selectivity but is not frequently used after the set is set into operation in the same sense that the condensers are used. A potentiometer of lower resistance is not recommended, as it does not give sufficiently accurate control of the grid potential. A voltmeter (VM) is desirable for indicating the potential across the filaments of the radio tubes, but it is not absolutely essential. By means of this voltmeter (0-10 volt scale), the tubes can be kept accurately to the point of greatest sensitivity. An ammeter, shown by (AM) gives the total current consumed by all tubes in the circuit. A battery switch as at (SW) is very convenient and is an insurance against the accidental burning of the tubes after leaving the set for the night. It makes the complete readjustment of the rheostats unnecessary when the set is used the second time. All of the above apparatus is mounted on the panel as shown by the upper view of Fig. 2.

Three output jacks are provided. Inserting the plug into jack (JD) gives reception from the tubes up to and including the first detector tube (6) and this corresponds to the detector tube circuit of the ordinary regenerative circuit. Plugging into jack (JI) gives the addition of one stage of audio amplification, while jack (J2) includes all of the tubes or two stages of audio. Experience has shown that one stage of audio is all that is required for loud speaker operation on all but the faintest and most distant stations.

An oscillator coil (OS) of the fixed winding type is located between the first detector tube (2) and the oscillator tube (1). The functions of this inductance coil have been described before. This coil is very compact and requires no adjustment. The inside bakelite tube is 1.5 inch in diameter and carries about four turns of wire near its center which corresponds to the "pick-up coil" of the usual heterodyne oscillator coil. The outer tube is 2.5 inches in diameter and carries both the grid and plate coils of the oscillator circuit. The grid coil carries 20 turns of No. 26 D. S. C. wire and the plate coil consists of 40 turns of the same size wire. The latter is spaced about one half inch from the grid coil. A detail of the oscillator coil is shown in Fig. 4 where the external plate and grid coils are clearly seen. The inner and outer tubes are mechanically connected by short pieces of small fiber tubing through which brass screws are run. When tuned by the 0.0005 mf condenser (C1), this oscillator will fully cover the ordinary range of broadcasting wavelengths.

At (2) we have the first detector tube with the grid condenser (K2) of 0.00025 mf capacity and the grid leak (GL) with a resistance of two megohms. As will be seen from the plan view in Fig. 2, the oscillator coil and the two tubes (1) and (2) are located well back on the baseboard, so as to clear the variable condensers (C1-C2) indicated by the dotted lines. The outline of the baseboard is indicated by (F). A bypass condenser (K1) has a capacity of 0.005 mf.

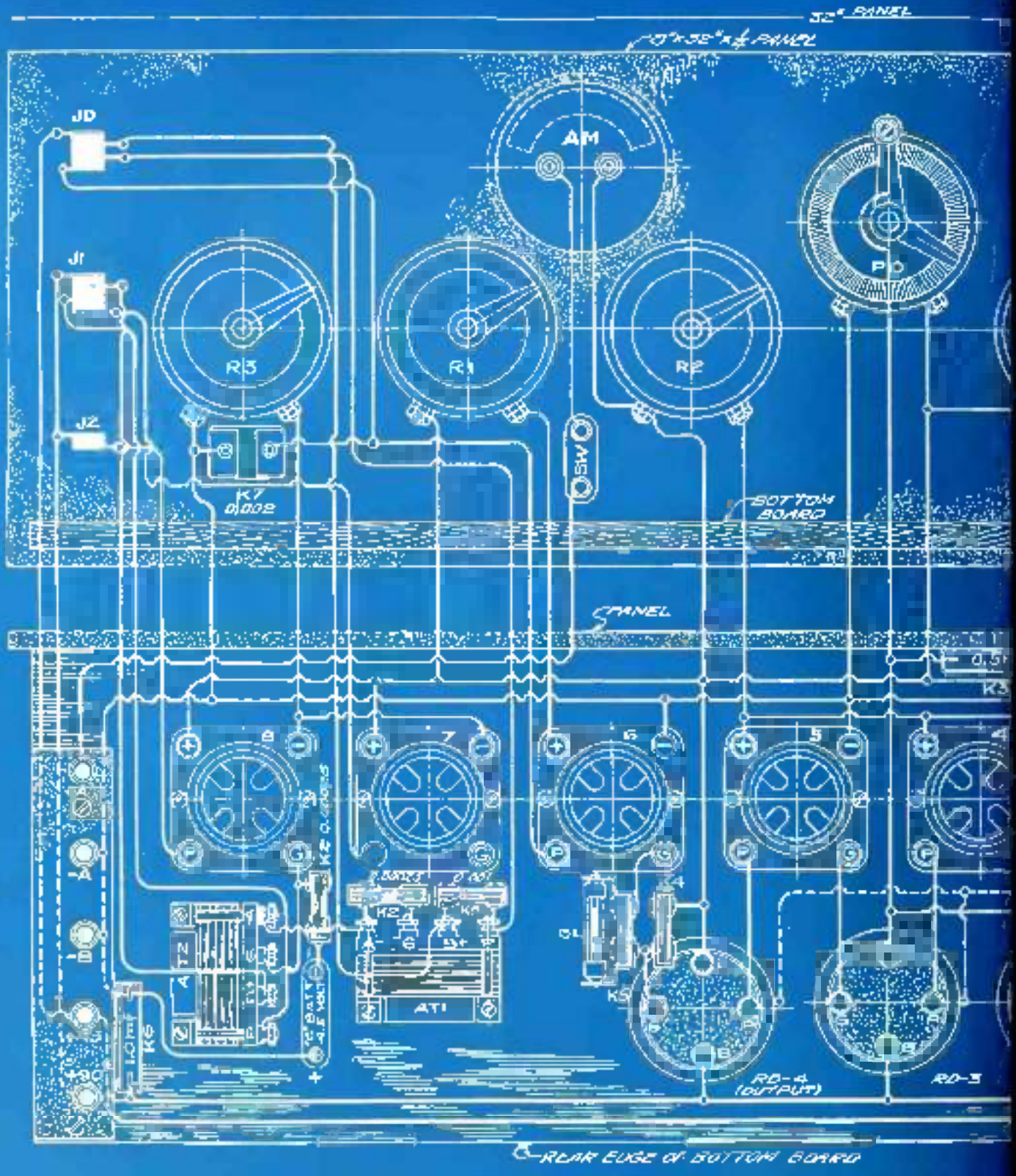
Next in order come the radio frequency stages consisting of the tubes (3), (4), (5) and the long wave radio transformers (RD1-RD2-RD3-RD4). All of the transformers are of the iron core 45 kilocycle type and are tuned to work in agreement with the oscillator by means of the fixed condensers (K1-K4). (RD1) is the input and (RD4) is the output transformer. Any iron core of 45 kilocycle type can be employed. Condenser (K4) has a capacity of 0.00025 mf. Owing to the body capacity which is sometimes in evidence, it is frequently desirable to ground the metal cases of the transformers as indicated by the dotted line (g).

With the particular transformers shown in Fig. 2, the tube sockets and transformers can be set very close together, about 2 7/8 inch centers. The transformers are of the metal shielded upright cylindrical type, which lend themselves nicely to compact formation. The grid post (G) of the output transformer (RD4) goes to the grid condenser (K5) and grid leak (GL) of the second detector tube (6). The grid condenser (K5) has a capacity of 0.0005 mf, while the grid leak has a resistance of 2 megohms.

201A Tubes Used

BY using 201A tubes throughout with a current consumption of 0.25 ampere per tube, the total current is only 8x0.25 = 2 amperes, the exact amount of current taken by a five tube neutrodyne when a soft detector tube is used. As a soft detector of the "200" type takes about one ampere and introduces a certain amount of hissing tube noise, its use is not recommended in this set. Owing to the high potentials on the grids of the tubes, it is necessary to use the highest grade of sockets to insure against leakage and internal capacity effects. For the same reason, the bottoms of the sockets should be raised well above the

(Turn to page 46)



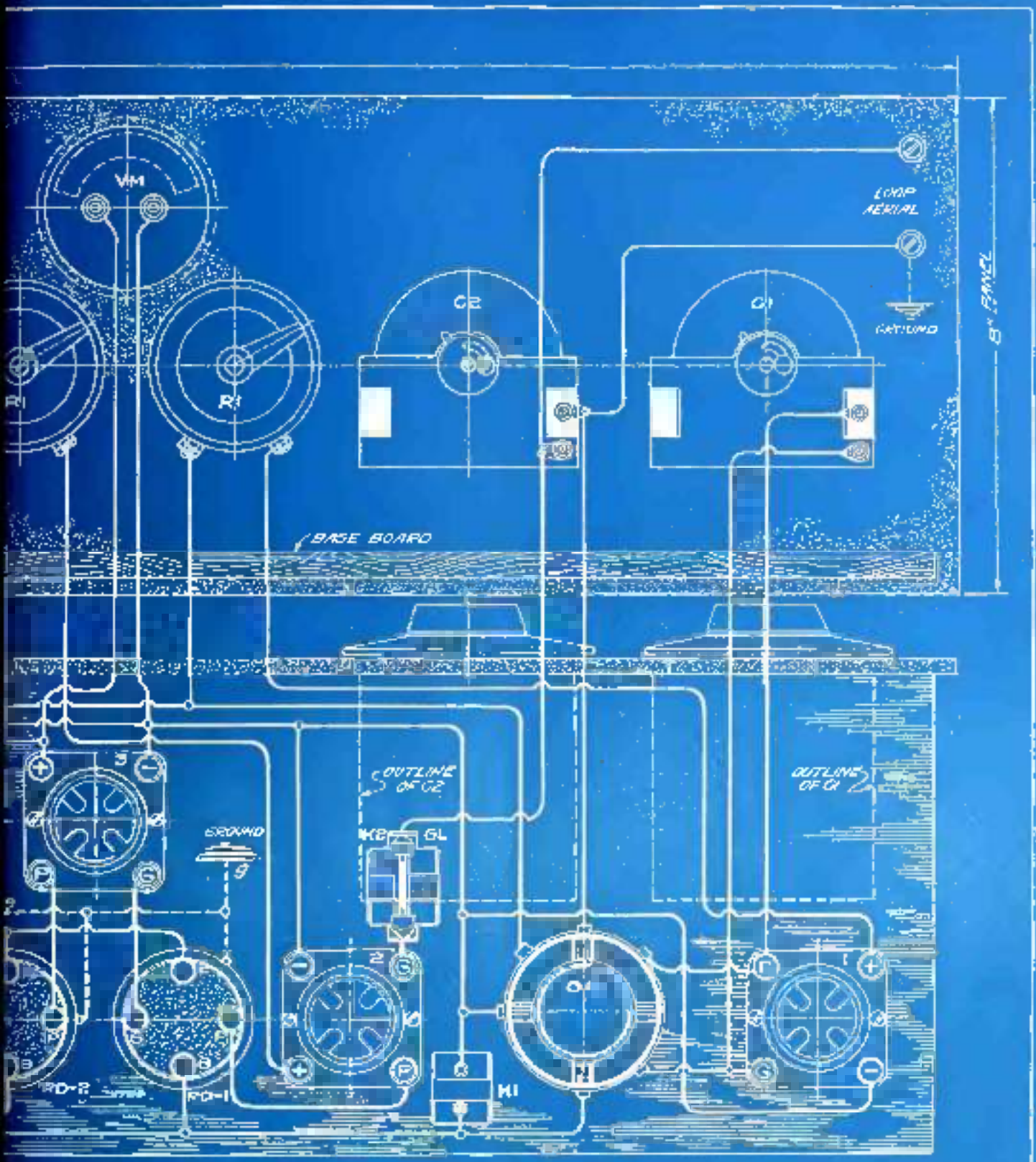


FIG. 2

THE EIGHT TUBE "A-4" SUPER-HETERODYNE

OSCILLATOR, THREE STAGES RADIO, TWO STAGES AUDIO AND TWO DETECTOR TUBES. ALL TUBES TO BE UV-201A, C-301A, OR OTHER "A" TYPES.

U.S. KATHBUN
SM-55A

CONDENSERS	
K1	0.005 MF
K2	0.00025 "
K3	0.5 "
K4	0.0002 "
K5	0.0005 "
K6	1.00 "
K7	0.00E "
K8	0.001 "

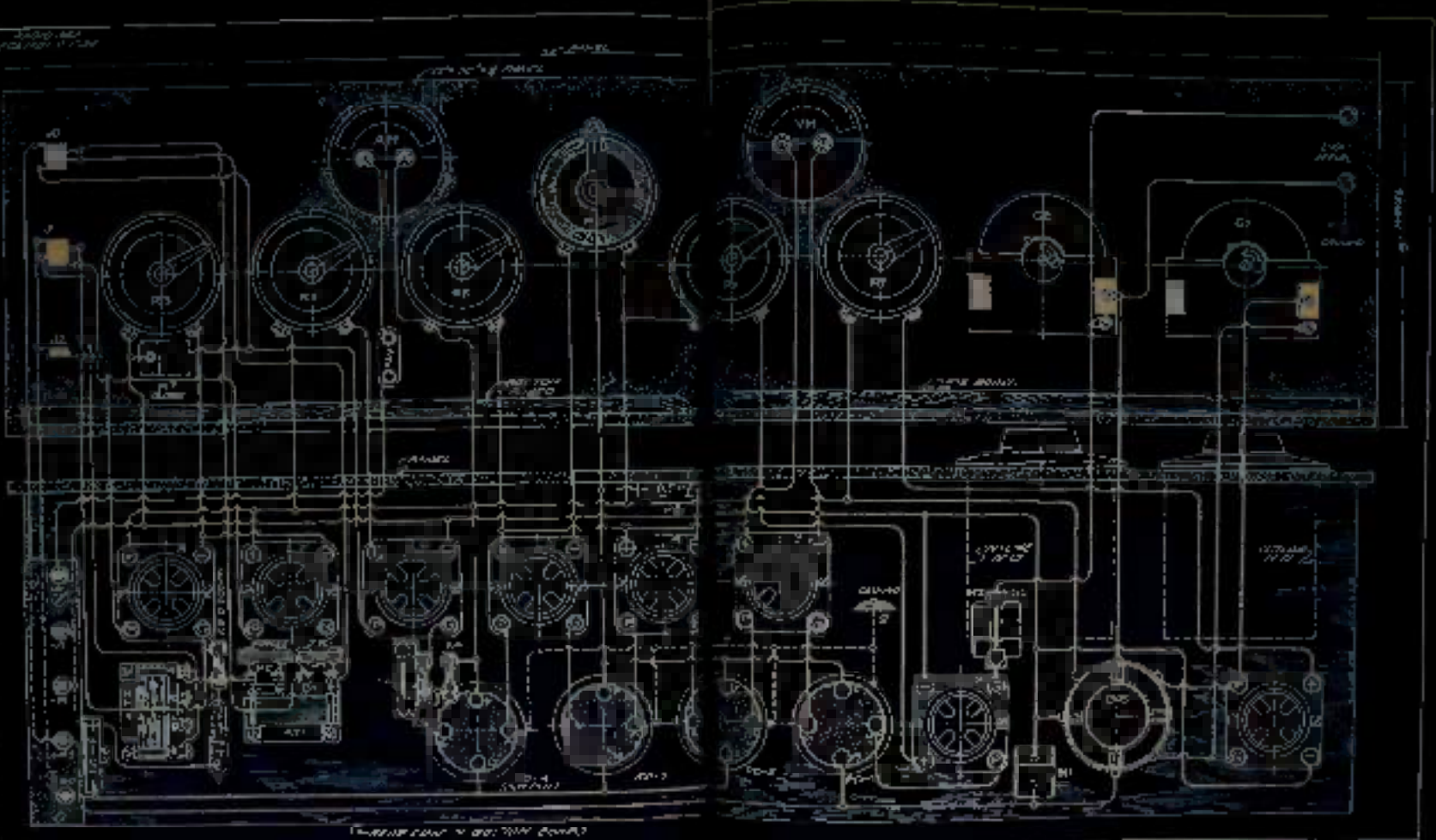


Fig 2

THE EIGHT TUBE "A-4"
SUPER-HETERODYNE

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RADIO ARE INC
CHICAGO ILL.

(Continued from page 43)

face of the baseboard by means of spacers or liners, say about 1/4 to 3/8 inch above the board.

For the best results all tubes should be carefully matched by the dealer before delivery, for all of the tubes in the radio frequency stages at least must have exactly the same electrical characteristics. When so many radio frequency tubes are connected up in cascade (series), and when the transformers are exactly matched as they should be, any small difference in the tube characteristics will cut down the output to an alarming extent. Matched tubes may cost slightly more than tubes taken out of stock at random, but they are well worth the money. Any one who has constructed a neutrodyne set knows how greatly tubes of the same make and type vary among each other, and how difficult it is to get dissimilar tubes to act together.

Large bypass fixed condensers must be used to shunt the radio frequency currents around the windings of the potentiometer and across the resistance of the "B" batteries. This is even of more importance with long wavelengths than at broadcasting frequencies and the capacities of the condensers must be correspondingly greater. Condenser (K3) has a capacity of 0.5 microfarad and is used to shunt the R.F. current around the potentiometer windings. Fixed condenser (K6) has a capacity of 1.0 microfarad and shunts the "B" battery. Smaller condensers should not be used.

Last are the two audio frequency stages at the extreme left of the board. Tubes (7) and (8) are the first and second audio tubes respectively, while the audio frequency transformers will be seen at (AT). In general, these two audio stages are the same as any audio stages but owing to the nature of the super-heterodyne, it is necessary to filter the output by means of certain fixed condensers so that the second stage can be worked without noise and distortion. To use these stages "straight" without filters means trouble as soon as the output is taken from the second stage through the jack (J2). Any high grade audio frequency transformer can be used for this purpose. The ratio of the first stage should preferably be from 3/1 to 4/1 while the ratio of the second stage transformer can be 5/1 to 6/1. Higher ratios are general not advisable.

Grid biasing by means of the "C" battery is most essential to the proper operation of the set. It at once promotes clarity of tone and effects a saving of "B" battery current in the audio frequency tubes. For a plate potential of 90 volts, a three cell 4.5 volt "C" battery will give the best results with the 201A tubes. There is no current drain to speak of on this battery and it can be the smallest type of three cell battery procurable. While most high grade audio transformers are well shielded, yet it is safest to place them at right angles to one another as shown in Fig. 2. This eliminates any danger of noise or interference.

Two fixed condensers are connected across the primary and secondary of the first stage audio transformer (AT1). Condenser (K4) has a capacity of 0.00025 mf. while (K8) is a 0.001 mf. size. Another filter fixed condenser (K4) is connected between the grid (G) and the (−) post of the "C" battery at (K4) and has a capacity of 0.00025 mf. This completes the audio frequency stages except for the three jacks (JD-J1-J2) which are interconnected with the stages as shown.

The Loop Connections

At the extreme upper right hand corner of the panel in Fig. 2 are the two binding posts for the loop connection. It is best to use binding posts and to avoid the use of a jack at this point as a jack introduces objectionable capacity into the circuit and also permits of some leakage of the already weak radio impulses. As explained, the set is somewhat more sensitive and selective if the lower binding post is grounded, or if the (+A) line is grounded. This ground can be made directly from the post or from some more convenient point in the circuit as at the (+A) binding post. This effect is particularly noticeable in cities where the radio traffic is congested and where the utmost in selectivity is necessary.

In regard to the "B" batteries it must be noted that the demand for plate current is very heavy and that for the best service a storage "B" battery is highly desirable. If a storage "B" is out of the question with the user, then only the largest size of dry batteries are advisable. The eight tubes will run down a small or medium size "B" battery in a very short time and in the end, the smaller dry cell batteries will prove much more expensive than storage batteries or large dry batteries. A full 90 volts should be maintained at all times for the maximum output, and much of the trouble experienced with super-heterodynes can be traced to exhausted "B" batteries which have been allowed to outlive their usefulness.

At the left of the baseboard will be seen the terminal strip of bakelite on which the battery binding posts are mounted. This is 1 1/4 inch wide and 6 inches long with a thickness of 3/16 inch. Wires to the connections run off through the side or back of the cabinet, and this makes a much neater arrangement than with the binding posts mounted on the front of the panel as we sometimes see such sets. Spacers are placed beneath the terminal strip to raise it well above the bottom board and so that the screw heads will not make contact with the wooden bottom board. Wood is not a perfect insulator and therefore we should avoid placing any current carrying parts in contact with it.

While spaghetti can be used with profit on all "A" battery and ground wires, its use is not advised on wiring which carries radio frequency currents, except at points where a short length is necessary to prevent actual short circuits. Spaghetti has a high dielectric value and increases the capacity of the circuits with attending losses.

IT GOES without saying that all joints must be soldered and that particular care must be taken where soldered connections are made to the jacks. Rosin flux must be used exclusively (no acid) and in using the rosin one must take care that the parts are actually soldered and not simply stuck together with the non-conducting rosin flux. After soldering, shake the wire vigorously to make certain that the parts are soldered. In such a complicated set, it is exceeding difficult to trace trouble when due to open joints, hence we must be vigilant during the wiring operations.

Tubes should be matched by the dealer so that all of the radio frequency tubes are electrically identical. If this is not done, then it will be impossible to secure maximum amplification in the radio stages. Much of the success with a super-heterodyne circuit depends upon the accuracy with which the transformers are matched and their agreement with the tubes. When the transformers are successively numbered from the input through to the output transformer, they must then be arranged in numerical order as shown by RD-1, RD-2, RD-3 and RD-4.

For the convenience of the builder, the "A" and "B" battery connections are made according to two different systems. In Fig. 1 the negative "B" (−B) is connected to the positive "A" (+A), and in general this will give the best results. The connections can be seen at the extreme right of Fig. 1 at the terminals. However, under certain conditions it is better to connect (−A) to (−B) as in Fig. 2. Either connection is easily had without labor by changing the cross connection or "jumper wire" at the terminal board. In the first case, the jumper in Fig. 1 runs from the (−B) terminal to the (+A) terminal. In Fig. 2 this is switched from (+A) so that the (−B) terminal is connected to the (−A) terminal. This is simple, and we should try out to find which is best.

In connecting the ammeter and voltmeter, we must observe the polarity marked on these instruments; that is, the wire from the positive bus must go to the positive terminal of the instruments. If these connections are reversed, then the instruments will have the needle come to rest on the zero stop and will not indicate the current or voltage. In connecting up the transformers, the marks on the transformer posts should be observed, the grid (G) on the transformer being connected to the grid (G) of the socket as shown in both Figs. 1-2.

Particular care should be taken to connect up the variable condensers so that the connections between the grid of the tube and the stator (stationary plates) are always observed. If the grid is connected to the rotor or movable plates, then we will have trouble from body capacity effect, as the full grid potential is then carried out to the hands through the condenser shaft. The proper connections are clearly shown in Fig. 2.

In order to absorb undesirable vibrations from the radio stages, a grid leak (1 megohm) is connected across between the negative of "C" and the grid of the last audio tube so that the leak (GL) and the condenser (K2) form the conventional grid leak and condenser. This has a notable effect in reducing noise when the second stage of audio is thrown in. The negative of the "C" battery must go to the grid (G) as shown.

RADIO AGE, INC.
DECEMBER 1924

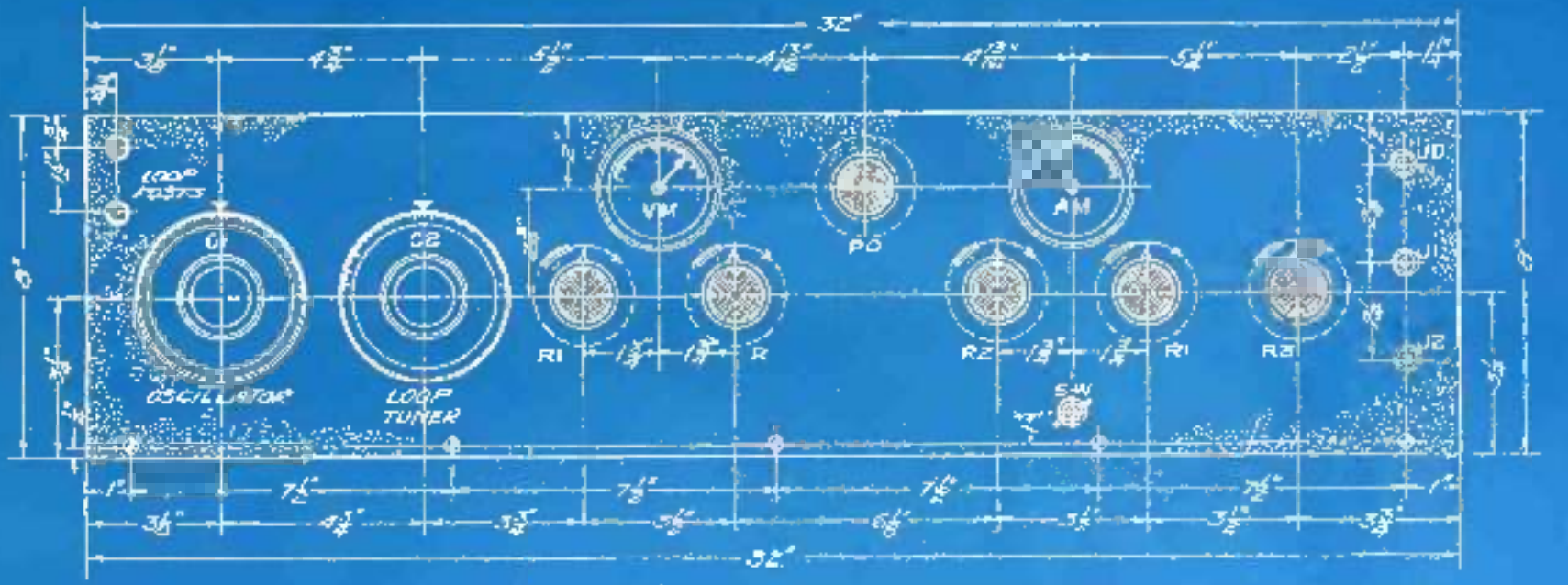


FIG. 3.

EIGHT TUBE SUPER-HETERODYNE

THE DRAWING ABOVE IS A DIMENSIONED PANEL LAYOUT (FRONT ELEVATION) SHOWING ARRANGEMENT OF APPARATUS ON FRONT FACE. USE ONLY HIGH GRADE PANELS, BAKELITE, HARD RUBBER, ETC. NO WOOD PANELS.

PAT. PENDING.

J. B. RATHBUN
SH-5-5-A

Pride of the *Chicago* Radio *Show*

One hundred and eighty of America's leading radio manufacturers and twenty of the most famous wireless concerns of Europe were among the exhibitors when the Third Annual Chicago Radio Show opened at the Coliseum November 18. The exhibits, which were all of the "de luxe" variety, filled the entire massive structure, and thousands of radio fans were on hand to view the latest additions to the radio world. The show was managed by H. J. Herrmann and James F. Kerr, and some of the typical sets on display are shown below.

The New "Super-Zenith" Model X. This is one of the latest developments of the Zenith Radio Corporation, Chicago, and attracted widespread attention at both the New York and Chicago shows.

The new Howard Neutrodyne. The console cabinet effect is one of the latest prizes to the Howard Radio Company's fame. In addition to this elaborate type of set, the Howard Company are showing all their other models in actual operation.

The popular Ffansteel "Model 7" with its system of non-oscillating reception. The Model 7 is a portable receiver of the radio frequency type, and its particular feature is a station finder on the panel which enables one novice to obtain any station he desires, so long as the wavelength is known.

A Silver super-heterodyne made entirely of parts on display in the exhibit of the Silver Marshall Company, Chicago. Silver-Marshall, Inc., do not produce finished sets, but actual sections in building sets from specified parts were given at the show.

The new Brunner-Tully "Nonelux" Low-Loss receiver, one of the features of recent radio shows. This hookup consists of five tubes and its success is said to have given added impetus to the "low loss" craze now spreading among American and European radio fans. Note the simplicity and clear cut method of construction.

Here is the "Thermiodyne," the new six-tube wonder set manufactured by the Shepard-Potter Company of Plattsburg, N. Y. The feature of the Thermiodyne is its simplicity of control, all tuning on the entire six tubes being manipulated by the one control in the center. Great demand for the Thermiodyne is reported by the manufacturer.

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.

EVEN if we do say so ourselves, we've got to admit that we've compiled a keen Pickups Section this month. As usual, we are swamped with contributions. Again we're sorry to have to tell you that we can't possibly print all of them—and it is an awful job trying to decide just which ones to print; they're all so full of interest.

This month we have several contributions of interest. Mr. Pearne, our technical editor, contributes a circuit that has been giving unusual results. In our columns we have the word of a broadcasting station which has done a good bit of DX work. In addition, a couple of foreign fans contribute items of interest, and last but not least, we have a nice assortment of choice DX lists. Probably the prime one (pretty close to our prediction that some bug would tear out the BC list and indicate stations he had not heard) is the contribution of a radio engineer, operating a superhet, who did tear out the list and indicate thereon the stations he had heard. While checking over the list, we had a hard time finding open spaces on stations not heard and most of the open spaces came in the foreign list of broadcasting stations.

Yessir, it looks like the Dial Twisters are all steamin' up and rarin' to go. We've got a hunch that the mail that's coming our way is going to make Sears Roebuck & Co., and Montgomery Ward look like a country postoffice when it comes to comparing incoming mail.

—THE PICKUPS EDITOR

CONTRIBUTORS

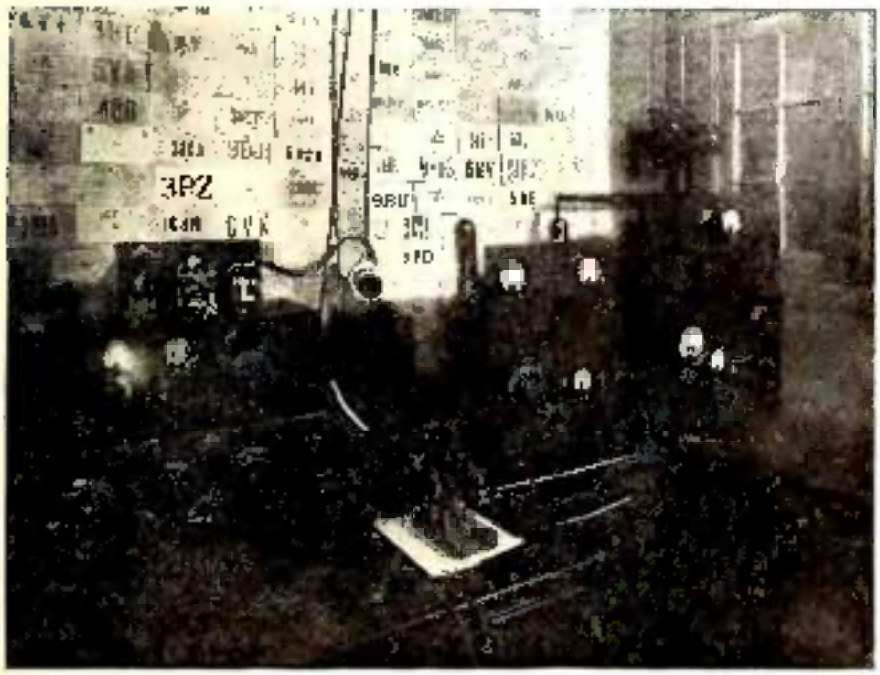
W. J. POTTER, British BCL — REGINALD A. GARRATT, British BCL

L. S. LANE — FRANK D. PEARNE, E. E. — H. E. WRIGHT

A. W. TERTER, Asso. I. R. E. — L. V. DAVENPORT, Opr. XDIV

C. W. KLENK, Radio 9AAU

Note—The usual list of Dial Twisters for this month has been omitted due to lack of space. But hosings are being sent out to those whose letters merit them nevertheless. If your letter deserves a hosing, it will be forwarded, even though your name does not appear in the usual list.—EDITOR.



A PEEP INTO A REAL DX STATION.

Mr. Carl W. Klenk let us peep into his amateur radio station which operates under the call letters 9AAU. He is located at 3748 Holliday Ave., St. Louis, Mo., and is known by many amateurs on the country for his consistent DX work on both receiving and transmitting. To the right are two short wave transmitters used on code work. The receivers at the left are designed for both broadcast and amateur code work. Note all the acknowledgment cards from other amateurs tacked on the wall. They show that 9AAU has been heard in every district in the United States.

STAND BY

Since we started this International phase of the Pickups Section last month, we expect to keep it up. Hence we print the following from two of our British friends:

15, Auriol Road,
London, W. 14.
England.

RADIO AGE:
Gentlemen:

Being a keen reader of your very excellent journal, I am responding to the request on page 48 of your September issue with a complete and up-to-date list of British broadcasting stations, and am sending under separate cover a copy of the official programmes for all our stations for the present week, which I trust may be of interest to you. Should you desire it, I will keep you posted with all alterations, and would also send you from time to time any interesting information regarding radio happenings on this side.

I am very surprised not to have seen any mention in American radio papers of our new high-power broadcasting station 5XX at Chelmsford. This broadcasts on a wave length of 1600 meters and puts 40 amps in the aerial, so you should have no difficulty in receiving it "over there."

I am afraid I cannot send a list of stations received sufficiently imposing to qualify me for your "Dial Twisters." There is a growing number of broadcasting stations in Europe, but they do not yet exceed 35, and my DX (over 500 miles) record for consistent reception on one-valve, tuny—tube, at present (Summer) is:

Berlin (Germany). . . . . 535 miles

Breslau (Germany).....700 miles
Madrid (Spain).....805 miles

This on an aerial 20 feet high and 50 feet long on the coast where Morse is—well, you know. Straight circuit; home designed and home made. Needless to say, I hope to get some of your stations this Winter.

By the way, I should be very grateful if you would indicate on your list of American and Canadian broadcasting stations the power used. The list is quite useless to us here, as I understand many of the stations listed work on as low as 25, 50, and 100 watts. If you cannot print this, perhaps you would be good enough to send me a list with those of 1 kw. marked thereon.

With best wishes and sincere appreciation of all the American has done to further the finest of all hobbies—radio.

Very sincerely,
W. J. POTTER.

There is no need to apologize for your small amount of stations heard, Mr. Potter, because even though they are not so distant, they do show that you are getting results. We have had letter after letter from lugs who consistently report NO miles at all. And in the U. S. A. that's inexcusable.

SPARKS SAY

And here we have another excellent and generous contribution from an English Twister. These English fans may not be so good on the DX stuff—but they write clever letters. Just look at this one:

17, Lorne Road,
Stroud Green, N. 4.
London, England.

RADIO AGE,
Gentlemen:

I am obliged to you for your letter of the 19th of September, thanking me for my appreciation of your paper and also I am very grateful to you for having made me a D. T. member, which I consider is something very fine for a mere foreigner.

You have asked me very nicely if I wouldn't give you a write-up, and so am enclosing a brief one herewith, and sincerely trust that it will not bore you.

The only thing to be secured over here is a license at 10s. when you are going to have a radio set; otherwise everything is very cheap; in fact much cheaper than some of your goods over in the states.

Let me name a few: first of all there are tubes, which are selling over here at 4 to 12 shillings, that's cheap isn't it? Antenna wire at 2 shillings for 100 feet, condensers (variable) at 3 to 15 shillings, and best of all phones and loud speakers, phones can be secured for 11 to 15 shillings, and table talkers from 35s to £6.

Now for a few hints for your readers; that is, if you would like them. These have come in very handy for us on this side of the water.

1. *Cutting out the local Broadcasting Station.*

The sure way to cut out any one station is to add to the valve, a crystal set. This simple crystal receiver is connected to the aerial and earth as well as the valve set. The crystal set is tuned to the *unwanted station*, when it will be found that the other station can be selected and tuned in without the least trace of the unwanted one. If a complete crystal set is not available, a coil with a variable condenser in parallel can be placed across the aerial and earth, and the local station tuned out by trial in conjunction with the valve set.

2. *Losses of Emission in Dull Filament Valves.*

Some people find that after some use of the above valves, they will not function properly unless 1.5 volts are applied to the filament whereas originally the voltage of 1.1 specified by the makers was quite satisfactory. The remedy is to run the valve for about half an hour with the normal filament voltage supplied by the makers and with the *high voltage battery disconnected.*

3. *Improving Your Phones*

When you have finished listening, hang your phones on a nail driven in a DRY wall. Also rub the diaphragms with emery paper, thus making them slightly thinner, so that they will be more responsive to weak signals.

I also enclose what I call "A bought components set." Many people do not want to go to the trouble of winding coils, etc., so I devised a quite simple hookup. (I do not pretend that this is anything elaborate) but this will receive broadcasting stations at some considerable distance with good volume of sound, and trust that this may be of some use.

We shall be listening to some of your high power stations this Winter, all being well, and hope to have some very enjoyable times in "getting over." The only disadvantage is that we have to sit up in the early hours of the morning.

Wishing your fine paper all the best that can be desired,

I remain,

Yours faithfully,
REGINALD A. GARRATT.

SPARKS SAY

A Good Regenerative Set

By Frank D. Pearne

The set shown is so constructed that it is a very poor radiator of carrier waves, yet it has all and more good points than the ordinary regenerative sets. The name sounds rather formidable, but this is the only complicated thing about it, and, as the builder has nothing to do with this part of it, he will find it a very simple set to construct.

Being loosely coupled, and having an aperiodic primary circuit, as shown, it will be seen that such an arrangement will not cause much interference with other receiving sets.

In the first place, the length of the aerial on which it is to be operated is not at all critical, as almost any length, from 50 to 200 feet, will be satisfactory.

It is exceedingly selective and will bring in distant stations very nicely.

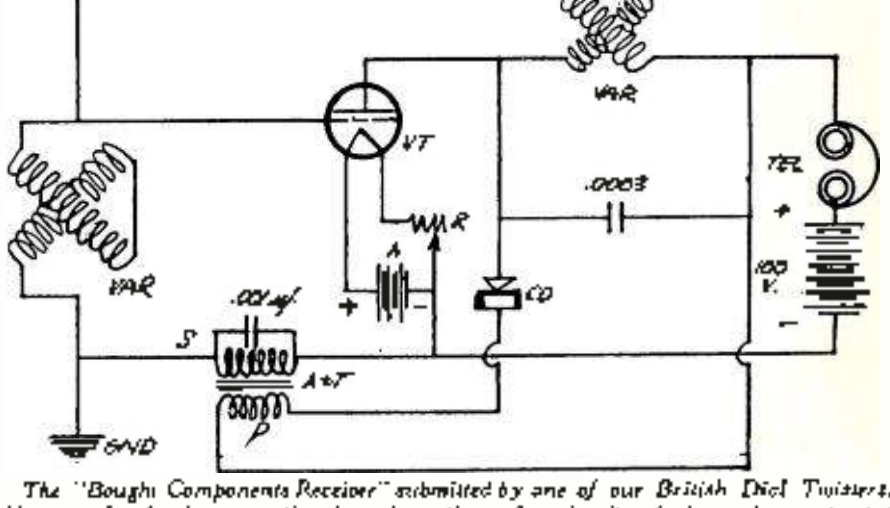
As will be noticed on the drawing, the only unusual part called for is the special coil shown at the left. All other parts are standard and may be obtained at any radio store.

Almost any standard tube may be used as a detector.

One must be careful, however, when selecting the type of tube to be used, to see that the proper rheostat is obtained. For the UV-201-A, the 25, or 30 ohm rheostat should be used, but if a standard detector tube, such as the UV-200, or the C-300 is desired, then the rheostat should have a resistance of from 6 to 8 ohms.

The tube used will also determine the voltage of the plate battery. For the UV-201-A, the plate battery should have a voltage of 45, while the UV-200 only will require 22 1-2 volts on the plate.

It will also be noted that a by-pass condenser is bridged across the phones and plate battery. This condenser should have a capacity of approximately .002 M. F., and, to be sure that no trouble will occur from overheating when soldering it to the leads, it should be of the mica insulated type. The grid leak and condenser should be of the ordinary



The "Bought Components Receiver" submitted by one of our British Dial Twisters. He says she he does exceptional work on this reflex circuit, which can be constructed from parts available at any radio store. The circuit is designed with the idea of not requiring any special parts.

values, that of the leak being 1½ megohms, while the capacity of the condenser is .00025 M. F. This should also be of the mica insulated type.

To construct the special coil shown, first procure a heavy cardboard tube four inches in diameter and three inches long. This is to be wound with forty-five turns of No. 22 double cotton or silk insulated wire. About half an inch from one end of the tube punch two small holes about a quarter of an inch apart and just large enough for the wire to pass through. These holes are used to anchor the ends of the coil.

First put the end of the wire down through one of the holes and bring it up through the other, leaving about eight inches projecting, to make connections. Now begin the winding, keeping the turns close together, so as to make a good appearance. After ten turns have been wound, bring out a tap, by making a loop of the wire and twisting it up to the tube, so that it will not pull loose when the winding is continued.

Thirty-five more turns are now wound in the same direction, the final end being anchored in the same way as the starting end. This completes the coil, which is mounted as shown in the drawing.

A panel of bakelite, 12x7x1-8 inches, will do very well for this set. A baseboard one-half inch thick and of the right size to fit into the cabinet used should be attached to the bottom of the panel as shown. This is used to mount such apparatus as cannot be mounted on the panel.

Do not mount the grid leak and condenser on the panel, but rather locate them just as close as possible to the grid binding post on the socket. The closer they are to the socket the better will be the results, as a long lead between these points will often cause the set to howl and squeal.

STAND BY

We thought superheterodyne operators were either all too proud to holinob with us or else were "dead" spots when it came to disseminating information.

However, the following letter proves that that is not so: these fans are only modest and don't want to make people think they're lying when they tell the story of the stations they hear. Here's the letter from the fellow who tore out the BC list and indicated his stations thereon. And oscillating Santa Clauses—there sure were a mob.

RADIO AGE Pickups Section Broadcasting—Stand by our musical please.

81 Maiden Lane, New York City.

RADIO AGE

In view of your repeated requests for records with superheterodynes, I have taken from your last issue the corrected list of broadcasting stations and have checked those which I have heard within the last thirty days. Those marked with a line before them represent stations I have heard using a loop; those with a cross before them are stations received with neither loop, aerial nor ground—simply the batteries connected to the machine and no collective agency. This may sound rather far-fetched; however, anyone who might be interested as to whether or not the machine is as sensitive and as powerful as I claim, is cordially invited to inspect it any time by appointment.

Regarding the Station 5IT Birmingham, England, this is the only station I did not receive within the last 30 days. This station was received last fall at 10:12 Sunday evening, during the time of the trans-Atlantic test; I have a confirmation from them. My length of time for holding KGO was a couple of weeks ago when I held them between 11:36 and 11:56, having full program confirmed.

Everything marked received, either on the loop or without any collective agency, was in all instances received on seven tubes, using a loud speaker in each instance.

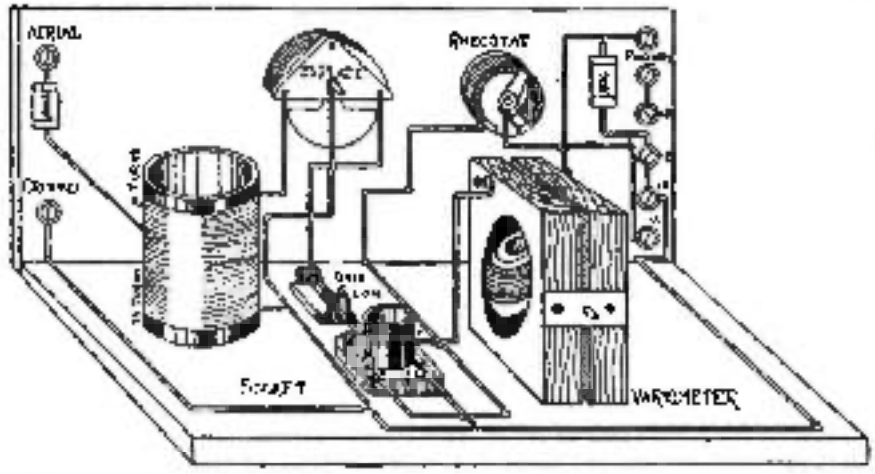
This particular circuit is a super-heterodyne of my own design, and has been pronounced by one of the leading research engineers on super-heterodynes as being the most sensitive and powerful that he has ever seen.

Very truly yours,
A. W. TEETER.
Associate, I. R. E.

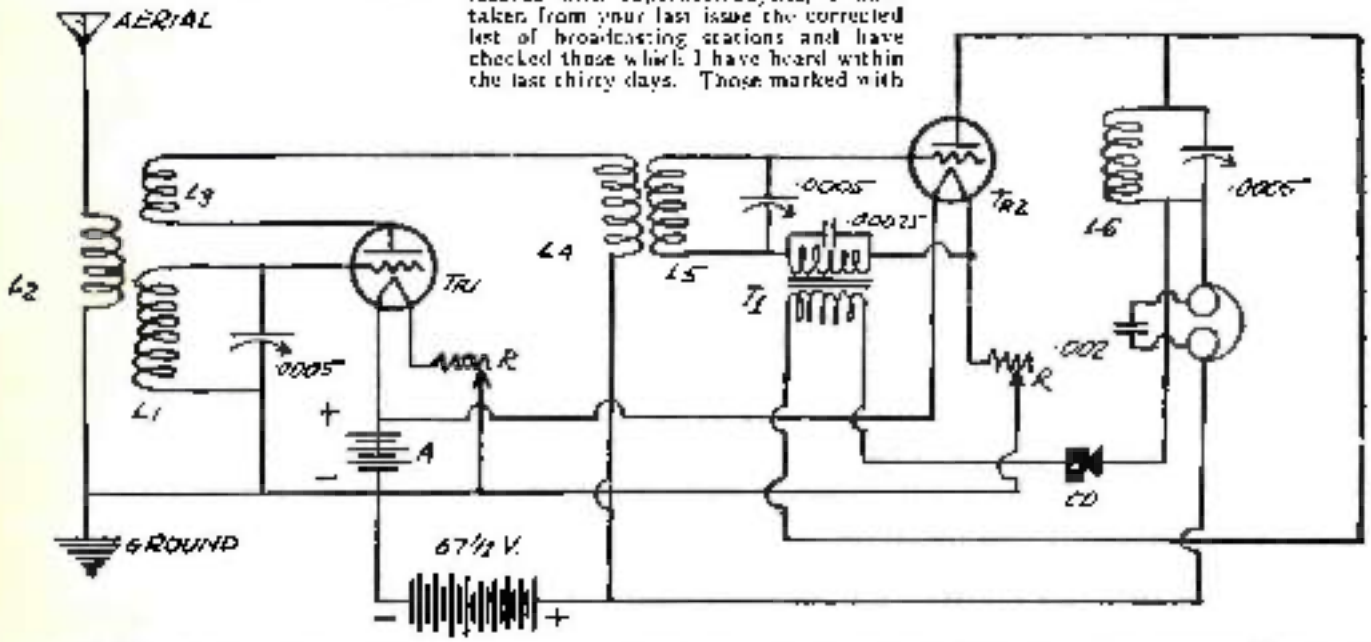
STAND BY

Now, the list is so long that we'd rather not use the space to print it, and our eyesight started to fail at 125 when

(Turn to page 53)



A perspective sketch and wiring diagram of the regenerative receiver contributed by our technical editor, Mr. Frank D. Pearne. This set, with the exception of the coupler, uses standard parts, and can be easily assembled. From reports on this circuit, we are led to believe that it is exceptionally efficient.



With the receiver shown in the circuit diagram above, one of the group has succeeded in doing some phenomenal DX listening. The set is a combination of reflex and reverse feedback, the latter as acting the control of oscillations in the tube TR_2. Specifications for the coils are given in the accompanying text.

we counted the marks, so we'll let it go with the mention that the list contained 3 foreign (non-Canadian) Stations.

STAND BY

One of the big broadcasting stations wants to tell us about some of their DX work which they feel warrants their becoming Dial Twisters of the other kind—not the ones who listen—but transmit. Here's a piece of choice DX:

Westinghouse station KYW received a letter dated October 17, 1924, from Tacoma, Washington, and signed by L. S. Lane, Radio Operator of the Motor Ship "Hauraki" in which he has logged the following reception of KYW programs:

"On Wednesday night, or rather Thursday morning the 16th instant, I had the pleasure of listening to part of your program. Commencing at midnight, Pacific Time, I heard.

12:00 Lady singing
12:03 Man solo
12:06 Announcement KYW etc., then remarks about the visiting celebrities from other stations

12:08 Song "Stumbling"
12:12 "I'm Smiling Through"
12:17 "——— Blues"
12:20 Screaming broke the microphone, the announcer said "This noise was caused by someone kicking the radio"
12:23 "Because they all love you"
12:25 Faded out

This vessel was then rounding Tatoosh Island, and I was troubled by several commercial stations and nearby shipping.

The following is a log kept by L. S. Lane during a recent trip in Australian waters: All times shown are Pacific times.

We were then within 400 miles of Auckland, New Zealand. Was using detector, 2 step and loud speaker up to 4,000 miles, then head phones—am now using detector and phones only, left amplifier in Australia.

Yours faithfully,
L. S. Lane, Radio Operator,
Motor ship "Hauraki."

STAND BY

Now if you ask us, we think that is a very creditable piece of long distance transmission and reception, and certainly deserves mention. Keep up the good work, KYW, and here's our "congrats" to the fellow who heard you.

STAND BY

H. E. Wright, of 142 E. North Ave., Baltimore, Md., wants to hand out a

(Turn to page 54)

Pickups by Our Readers

(Continued from page 52)

circuit that he thinks is pretty good. He says:

RADIO AGE,
Gentlemen:

I thought perhaps your readers might be interested in the enclosed circuit, which is the result of several months experimenting.

I find it an exceptionally good circuit, the secret of its remarkable sensitivity being in the method of stabilization, which is of the reverse feedback type. The potentiometer used in the older systems gives rise to too high losses; the reverse feedback accomplishes the same thing without the losses. Some idea of the sensitivity of this circuit may be had from the following:

From my home in Baltimore I have repeatedly heard KGO at Oakland, California with perfect clarity.

I find that the most important part of the whole circuit is the crystal, which should be very stable.

I shall be pleased to hear from any one so constructing this circuit and will gladly answer any question providing a stamped, self-addressed envelope accompanies the request.

The constants of the circuit (shown elsewhere in this department) are as follows:

L1—40 turns 24 DCC on 4 inch tube
L2—10 turns 24 DCC on same tube eight inch coupling
L3—30 turns—rotor
L4—15 turns on spider web | No. 24
L5—50 turns on spider web | or 22
L6—40 turns on 4 in. tube | DCC wire

In order to get the maximum results, all coils should be kept a good distance apart.

STAND BY

To the Pickups Editor the circuit submitted looks like it had possibilities. We have always liked the reverse feedback system of neutralization. We hope some of the fans will try it out, and report their results. Mr. Wright is to be thanked for his idea.

STAND BY

Before we print more DX records, we want to have a little talk with you Dial Twisters. You know that we've been giving you the best circuits, information and tips on radio that any book can give, and from the letters we get from all of you, we know you appreciate them. We're going to keep giving you as much good stuff as we can possibly scrape together—there's no stopping to us. We're going over big, and there won't be any QSS (fading).

The point is this. Every magazine depends largely upon its advertisers for support: we really sell you a magazine that costs more than 25c to print. You see, the advertiser makes up for the difference.

Now then. If every one of you fellows will mention RADIO AGE when you buy from one of the advertisers, it'll do us both a world of good, and you'll make the advertiser just as strong for the RADIO AGE, as you are for the Pickups Section. If the fellow you are buying your stuff from does not advertise in RADIO AGE, tell him "please send me one of your (name of part) which *I DID NOT* see advertised in RADIO AGE."

Remember, DT's, this is your book just as much as it is ours, and whatever you care to make of it you can.

STAND BY

We have a correction to make. Through an error in drawing, one of the draftsmen on the staff incorrectly indicated the connections on a diagram. We are grateful to L. V. Davenport, a keen eyed radio operator on the SS Olympic (Call letters KDIV) San Pedro, California for calling this to our attention. His correction is as follows:

SS Olympic, San Pedro, Calif.
RADIO AGE,
Gentlemen:

I purchased my first copy of RADIO AGE a few days ago and like it very well. Your blue prints are splendid. Also some of the other data contained in your magazine.

I would like to call your attention to your regenerative set published in the October issue on pages 15, 16 and 17. There are some corrections that should be made in the diagrams on pages 16 and 17. On page 16, if you will trace your F plus from the tube sockets you will find that it goes exactly nowhere. On page 17 you have left out the connection of the A minus to the rheostats. These connections while very apparent to the average might cause the novice some difficulty in getting his tubes to light.

I have had some experience with beginners in radio, teaching a "ham" school, and I find that a great majority will not even take the lead and think with their own head enough to know that the plus side of a "B" must always go to the plates. In this case they would in all probability leave both A minus and A plus leads out because both diagrams didn't agree and then condemn you because they couldn't get the tubes to light.

Sincerely yours,
L. V. DAVENPORT.
Opr. KDIV.

STAND BY

Well DT, there's another little thing we want to broadcast before we sign off. In looking through this issue, we fail to find any mention of a wish for the Merry Radio Christmas that you are going to have.

The only semblance of Christmas is on the cover; but the season is a good one—we want to get so much good *live* stuff in the book, that space is scarce—so here's a wish for a Merry Radio Christmas to you from the Pickups Editor and the rest of the bunch.

STAND BY

By the way—have any of our DT friends heard any of the RADIO AGE musicial programs over the air? Our Editor is anxious to know how you like them. We are also interested in knowing how you are getting the Wednesday night technical talks (broadcast at about 9:15 p. m.) and how you like them. If you hear any of our talent over the air, or if any of the talks are received, drop us a card and tell us all about it. Please—thank you!

U. S. Manufacturers Get German Patents

ONE of the outstanding historical events in the radio patent field took place October 30th, when the Navy Department decided to issue licenses to approximately sixty independent radio manufacturers under 129 German patents seized by the Alien Property Custodian during the World War.

Early in 1923 application for the patents had been filed, but no decisive action was taken by the Washington authorities. About a week ago the cooperation of Congressman Fred Britten of Chicago, the National Association of Broadcasters, and the Radio Manufacturers Association was enlisted. Through the joint efforts of these what had grown to be considered a hopeless cause was quickly matured into a successful issue of wide-reaching importance.

The majority of the patents and applications involved were originally owned by the Telefunken Company, a German corporation, among which patents is the controlling patent covering tuned radio frequency—the well-known Wilhelm Schloemilch and Otto Van Bronk patent. Under a series of contracts, the first dated February 21, 1913, substantial rights in these patents and applications were assigned by the Telefunken Company to the Atlantic Communication Company, a German corporation organized under the laws of the State of New York.

The theory on which the independent manufacturers requested grant of license was that such grant would tend to advance the welfare of the people of the United States, and would promote a healthy competition in the manufacture and sale of radio apparatus; that to withhold such license would tend to injure the public welfare by tending to promote monopoly contrary to the policy declared by the Sherman Act; that the denial of the license to the applicants would make the International Radio Telegraph Company, the only licensee, which would be inconsistent with Governmental policy as to monopoly, or the principle of equality of opportunity on which this Nation is founded.

As a part consideration for granting the said license, the independent radio manufacturers agreed to grant to the United States of America, represented by the Secretary of the Navy, a non-transferable, non-exclusive license under United States letters patent which they now own or may hereafter own during the term of the agreement, to make or have made for it and use for governmental purposes, apparatus utilizing or embodying the inventions of their patents but not for sale.

One of the chief obstacles to the greatest development of the radio industry is thus removed. The complexities of the radio patent situation are now much minimized. The difficulties incident to the government sharing the use of these patents with only one American manufacturer are permanently obviated. In fact, the monopolization effected by one exclusive license amounted to unwarranted discrimination and manifestly did injury to the radio industry.

An Unselfish Regenerative Receiver

(Continued from page 38)

operation of the set. As a rule, it is customary to place this rheostat in the A— lead.

For those who prefer a circuit diagram to work from, Figure 2 is shown, which clearly gives the connections of the set. The mounting shown requires no baseboard. A 11x7x1-8" panel makes up nicely, and allows plenty of room around all the parts.

Operation

THE operation is exceedingly simple, probably more so than the average single circuit where changes in antenna resistance and wavelength must be compensated for by tickler and antenna condenser adjustments. After the batteries and other wires have been connected, the filament is turned on and the condenser manipulated in conjunction with the tickler coil until the set hits the oscillating point. Then, keeping the tickler value just below the spill-over point, turn the condenser with different settings on the switchpoints, until a station is heard. In doing so, it is necessary to change the tickler adjustment quite frequently.

Figure 3 shows the proper connections for the addition of a two stage amplifier. It is advisable for the builder to use good low ratio transformers if clear signals are wanted.

In general, the receiver is about as efficient a receiver as one can get, when one looks at the problem from a standpoint of selectivity, sensitivity, volume and lack of radiation.

(The writer wishes to acknowledge the works of the inventor of the circuit, A. J. Haynes of 41 W. 43rd St., New York City, N. Y., as the source of his information relative to the foregoing description.)

New Charger for "B" Batteries

The Radio Rabat Company of Cleveland, Ohio, has brought out two new electrical chargers for "B" batteries. They are known as the Senior Charger and the Junior Charger.

The Senior Charger is assembled in a glass jar 4 inches in diameter and 5 inches high with the aluminum rod placed horizontally at the bottom of the jar, bringing it at the coolest point of the charging solution. This reduces incrustation. The lead rod is also placed in a horizontal position but it is attached to the rubber cork. With this manner of construction they have accomplished a unique automatic cut out feature which insures against damage to either charger or battery.

See RADIO AGE'S special Christmas offer on page 80.

* Tested and Approved by RADIO AGE *

How to Build a Real Loud Speaker

(Continued from page 20)

a phone or loud speaking unit to the phonograph reproducer arm. The one I purchased looked like the illustration at "A," and is the best for the purpose. If you are unable to secure this type, the one shown at "B" will do. The small end of an adapter of this style is intended to slip over the arm after the reproducer has been removed, and the large pocket or recess holds the unit. In constructing the loud speaker, however, the small end of the adapter should be forced *inside* the mouthpiece of the megaphone, so that a small compression chamber is projecting inside the horn. The adapter at "A" fits nicely, and needs no further adjustment. But the small end of the one at "B" should be built up with layers of paper and glue until it fits the megaphone mouthpiece snugly. After putting style "B" in the megaphone, it will be wise to pour some melted sealing wax around the outside edge to hold the adapter in place.

I now had the vital parts of my loud speaker—the phone unit, the small chamber (the rubber adapter) for compressing and giving force to the sound waves, and the horn for throwing them across the room.

A Cabinet for Looks

THE equipment, of course, needed a cabinet—for the sake of appearance, to make the speaker convenient to handle, and to prevent any *vibration* of the horn. I secured two small soft wood boxes. The one used for the cabinet measured seven and one-half inches wide, six and one-half inches high, and ten inches deep. It had originally contained a celebrated brand of eating chocolate. May a tip to the wise be sufficient.

If you are handy with tools, and wish to take the time, you can, of course, build your cabinet complete from special wood, using the proportions given above.

I carefully removed the top of the box and knocked out the nails. The rest of the box I reinforced with fine wire brads. Then the top was fastened in place with four small brass screws.

With fine sand-paper I smoothed all the surfaces, and rounded the edges and corners. Then I removed the top to complete the cabinet.

A circle five inches in diameter (a half-inch less than the diameter of the horn opening) was marked in the center of one end, which was to be the front of the cabinet. A series of drill holes just inside the line of this circle enabled me to cut out the circular piece of wood, and the edge of the opening was sand-papered round and smooth. Then an end piece from the second box was used to make a snug-fitting partition, with a small hole (see directions above) in the center. This hole was of a size that would fit the megaphone near the center. Reference to the diagram will show location of the partition in the cabinet. After fitting the partition to the horn,

(Turn to next page)

* Tested and Approved by RADIO ACE *

and establishing its exact location, it was secured in place by wire brads driven through sides of cabinet. A small hole, large enough to pass the phone cord, was drilled in the center of the back of cabinet, about one inch above the bottom.

A Beautiful Job

THE complete cabinet was then stained. When dry, I rubbed the outside with powdered pumice and water. After cleaning off the pumice, one coat of white shellac was applied. This was repeated twice, allowing time for each coat to dry thoroughly, and I had a beautifully finished cabinet that anyone could be proud to own. If you prefer a dull finish, either wax the surface or rub down with oil and a little pumice after the final coat of shellac. Rubber headed tacks, such as plumbers use for bumpers, were placed at the four corners to serve as rubber feet on the cabinet and so protect any surface it might be placed upon. It also helps to kill any vibrations caused by the sounding board effect of a table top.

The megaphone or horn was now forced securely into place by turning or twisting it through the two circular openings—the one in front of the cabinet, and the one in the partition. The seam which most megaphones of this kind have can be placed at top and thus kept out of sight. To prevent loosening, and consequent vibration, I put a wire brad through top and bottom of cabinet (see dotted lines in diagram) until the point just rested in the fibre. Then I cut off the exposed part of the brads with a wire cutter.

The rubber adapter was forced into the mouthpiece of the horn, the loud speaker unit inserted in the pocket, and the phone cord passed through the hole in back. After screwing on the cover, my loud speaker was complete. See sketch.

For volume, tone quality, range of reproduction, and freedom from harsh or metallic sounds, I have never heard a loud speaker that could excell it. When connected to the Co-Gerter circuit (described in RADIO ACE for September), with one step of audio amplification, the music from local stations can be heard all over a large house.

Another word of advice regarding your grid leak. It might seem a far cry from loud speakers to grid leaks, but it is a fact that the grid leak has an important bearing upon loud speaker reproduction. Many of the poor results obtained from loud speakers can be traced directly to improper adjustment of the grid leak. You should have either a variable grid leak in your set, or an assortment of fixed grid leaks. By proper adjustment of the grid leak you can increase your loud speaker volume and clarity, often as much as fifty per cent.

A Reliable Home Built Battery Charger

(Continued from page 14.)

the primary. It consists of ten turns of a conductor, consisting of two No. 12 dcc wires together. A tap is taken out at five turns in the middle. Make sure a good joint is made here, also using No 12 dcc wires.

After a piece of paraffined paper has been laid over the winding, the ends of the two pieces of tape (previously mentioned) are brought up around to the top, pulled tightly and made secure. This keeps the wires in place. Put spaghetti over the primary and secondary leads and tape them down. Now slip the entire coil off the wooden form and tape, starting inside. A single layer is enough, as we must leave room for the iron core inside. Now give the entire coil a good coat of electrical black paint and place in an oven to dry. The other coil, called the secondary, will be wound in a similar fashion over the wooden form again.

It consists of 135 turns of No. 12 dcc tapped at 15, and 110 turns. The leads from both ends are brought out. These taps give respectively 15, 22, and 27 volts.

This coil is slipped off the wooden form, caped, painted, and dried. Then when both coils are thoroughly dry, they are slipped on the core. The secondary goes on one core leg, and the other coil, consisting of primary and filament windings, goes on the opposite leg. Then the fourth side of the core is added and the whole transformer is fastened securely by means of angle irons to a base.

A MOGUL socket, obtainable at any electrician's, is necessary for the tungar bulb to screw into. A piece of brass rod or stiff busbar is placed vertically alongside the bulb to make connection at the top with the plate terminal.

Figure 3 shows the wiring diagram. Once wired up in this fashion, it is only necessary to throw the switch from side to side to have the battery on charge or discharge. The rectifier is started and stopped automatically. The ammeter is an automobile type of 0-15 charge and discharge. As they are very cheap, they are almost a necessity. The fuses are six ampere; smaller will do if they can be obtained. The small three-point switch is to vary the charging current and voltage when different batteries are put on charge. Thus two batteries may be put on charge when the switch is on the tap connected to the whole secondary winding (Marked 135 in diagram.)

If the bulb does not start to rectify at once when first tried, it may be necessary to open and close the circuit several times. Once it is started, it will always function properly. When properly operating, the bulb just glows, there is a blue appearance in the bulb, and the plate may redden a bit. The filament dims down when the battery is connected. The glass is usually discolored as in the UV-201 A tube, but this does not affect operation. The transformer will hum and warm a little.

Jones Socket Now Has Bracket Mountings

Howard B. Jones, 616 S. Canal St., Chicago, manufacturer of the Jones Multi-Plug Cable for instantly and simultaneously connecting or disconnecting the ground, antenna, A and B batteries to or from a set, announces that Jones sockets may now be had with bracket mountings. The bracket mountings permits the plug to be placed inside the set on the sides or bottom of the cabinet as convenient.

It is in addition to both the Jones Multi Plug panel mounting type, and the Jones Multi-Plug binding post type, extensively used as standard equipment on sets, and is provided with seven color coded leads for attaching to the binding posts of any set. Any Jones Multi Plug Cable, it is stated, will fit any of the Jones sockets of the three types mentioned.

The Multi Plug Cable now regularly supplied is eight feet long. All leads in it are coded by color to insure being properly connected to the ground, antenna, and A and B battery terminals. The ground and antenna wires are separate leads.

RADIO AGE'S BROADCASTING SCHEDULE

Every Wednesday night, 9.45, from WTAY (283) meters) -10 minute technical talk by a staff member of RADIO AGE.

Thursday evening, November 30, 9 to 10 o'clock, popular and semi-classical program from WEBH (370 meters) by RADIO AGE artists.

Saturday, December 6, and first Saturday of the month thereafter, from KYW (536 meters) Congress Hotel Radio Age Jazz Carnival, by RADIO AGE artists. Beginning at midnight.

A Single Tube Reflex for the Novice

(Continued from page 26)

variometer terminals, from the other variometer terminal to the ground binding post and to the post marked "G" on the audio frequency transformer. The audio transformer terminal marked "F-" is connected to one of the filament binding posts on the socket and to the connection on the rheostat. One resistance terminal of the rheostat is connected directly to the negative side of the filament battery, or rather to the negative filament battery binding post. The other filament binding post on the socket is connected to the positive filament battery binding post. The plate binding post on the socket is connected directly to the post marked "P" on the radio frequency transformer and the post marked "B" on the transformer is connected to one side of the crystal and to the post marked "G" on the same transformer, also to one of the phone binding posts.

The remaining binding post on the radio frequency transformer, the one which is marked "F" is connected to the post marked "B" on the audio frequency transformer and the post marked "P" on the audio frequency transformer is connected to the remaining side of the crystal detector. The other phone binding post is connected to the positive binding post of the plate battery, the negative post of this battery being connected to the positive binding post of the filament battery, as shown.

The material required consists of one 7x12x3/16 inch panel with cabinet and baseboard to suit, one 25 plate variable low loss condenser, one standard variometer, one audio frequency transformer having a ratio of 10 to 1, one standard socket, one amplifier tube, one 25 ohm rheostat, one radio frequency transformer which will operate over a wave band of from 250 to 550 meters, two 3-inch dials, one good adjustable crystal detector with mounting, eight binding posts, four No. 6 dry cell batteries, one 90 volt plate battery and enough tinned copper bus bar wire to connect up all the parts as shown.

It is suggested that the use of "low loss" parts, such as the condenser and variometer, be used if possible, as apparatus of this kind will greatly improve the reception, although they are not necessary unless one feels that he can afford the extra expense occasioned by their use.

Any type of aerial will be satisfactory, providing that it be as high as possible and a single wire about 75 feet in length is recommended. This should be carefully insulated and the lead-in should be kept as far away from the side of the building as possible and brought in through a porcelain insulator or tube.

An arrangement of this kind may be made permanent by raising a window and inserting a one inch board between the window and the sill, and mounting the insulator in this board. This it will not be necessary to bore any unsightly holes in the window casing.

Audio Frequency Amplification and Audibility, a Topic of Interest to the Average Radio Builder, will be the subject of an unusual article by Armstrong Perry in January RADIO AGE—on the stands about December 15.

How the VEILED *Lady* SCARES *'Em*

(Continued from page 34)

Radio stage fright, unlike the ordinary variety, is something not easily outgrown. Perhaps it's because a speaker's mind is not monopolized by a visible audience. It's there. He sees it. His mind is free to concentrate upon what he is saying. Over the radio, however, his audience isn't there. He can't see it. His only contact with it is thinking of it—wondering where it is located, what it looks like and how it is reacting to him. Thus, before he realizes it, his mind is miles from his message, and he suddenly goes blooey.

Experienced radio speakers know this and even the cleverest of them nowadays face the Lady with their remarks written out word for word—not merely notes—but the entire scroll complete with spare parts. Then they merely read the paper, deliberately interposing occasional ers and ahs to make it seem as if they are speaking extemporaneously.

Musicians rarely have any difficulty. Their music sheets are equivalent to the speaker's manuscript.

Broadcasting, as a matter of fact, is the singer's paradise. Corsets and tight collars can be parked in the anteroom and vocal joy thus be unconfined. The operatic tenor with the build of a pouter pigeon would scandalize his audience if he shed his vest and loosened his belt buckle on the concert platform.

In the studio, however, he can sing in a bathing suit if he wants to. One of the most magnificent concerts ever hurled into the ether was given by a famous baritone, who stripped down to his undershirt and sang with an ecstatic abandon that no formal audience has ever heard him display.

The Ideal Radio Voice

THE baritone voice registers best on the radio. Step-ladder tenor and subcellar bass are likely to run into wolf tones. Male voices register better than female. The saxophone is the perfection of wind instruments so far as broadcasting is concerned, and the violin is king of the strings.

No other detector known to science, not even the marvelous human ear, so quickly recognizes and so instantly glorifies a natural sweetness or pleasing resonance in the human voice. The ideal radio voice isn't necessarily one of power. The operator on the roof can supply the power.

What the operator can't supply is life, color, vivacity, and tone. These are the things the microphone demands. There must be purity and quality with no pushing or pressing, no labored breathing or furry enunciation. The Veiled Lady is fastidious to a fault.

President Coolidge has an excellent radio voice. It isn't the ideal voice because of its nasal Yankee twang, but it has timbre and tone and sincerity that registers well with the microphone. Douglas Fairbanks and Charles Evans Hughes more nearly approach the ideal. Owen D. Young, of the Dawes Commission, is considered a splendid subject and William Jennings Bryan is microphonic perfection when anchored some three feet back from the instrument.

Herbert Hoover's voice is a total loss over the radio, as is General Pershing's. Some baffling element in their tonal equipment makes registration flat and lifeless, although their speaking voices are pleasant enough.

Mrs. Izetta Jewell Brown of West Virginia, who seconded the nomination of John W. Davis with a ringing speech, is said by experts to possess the most satisfactory feminine voice that has ever yet been broadcast.

Major J. Andrew White, perhaps the best known of all the professional announcers, has a voice that is broadcastingly perfect, and the significant fact is that Major White has never once spoken above a low conversational tone when addressing a radio audience.

Must Be Grammatical

THE ideal professional announcer must have several things more than wood-wind vocal timbre and perfect diction. For one thing, he must be able to handle such names as Rachmaninoff, Tchernigov, and Carpentier without having to shout for help. For another, he must be naturally grammatical in his conversation. The slightest bungling of a syntax or the unfortunate omission of an adverbial "ly" is sufficient to blacklist him and his station in certain homes.

All of which shows that while the man of the street must mind his p's and q's, the man of the mike must mind the entire alphabet and all its possible combinations.

When a program is on the air the studio telephone is usually constantly ringing with requests for some favorite entertainer to render some favorite selection. Sometimes there is praise for the program, sometimes better abuse.

Freak broadcasting has been successfully attempted. The roar of a lion, the croak of a frog, the thunder of the Atlantic City surf have all been on the air. They broadcast the song of a nightingale in England and the beat of a heart in Pittsburgh, Station KDKA performing the last-named feat.

Where will it end? Ask somebody else.

A thing that can come from nowhere in four years to pick up the squeak of a mouse or the beat of a heart and hurl it ten thousand miles is entirely too potent to tamper with.

If you'll accept a guess, here's one that in four more years some station will be broadcasting the harmony of the spheres on Tuesday and Friday nights, the original Æsop will be whispering bedtime stories, and Helen of Troy will be on the air with her personal beauty secrets each Wednesday morning at ten o'clock.

[Reprinted through courtesy of Collier's Weekly.

How to Make Your First Crystal Set

(Continued from page 25.)

assembly is only a matter of exercising a little brain work with regard to mechanical ability. If you scratch the panel during the drilling of the mounting holes, grain it by sand-papering in one direction only and then wipe off the dust with alcohol.

PROCEED to wire the set as follows: From the binding post for the aerial to the outside turn of the stationary coil (beginning end). Then wire all the remaining leads from this coil to the switch points. The switch lever is connected to the ground binding post. Connect the two flexible leads of the movable coil to the two connections provided on the variable condenser. Then from the stator plate connection on the condenser, run a wire to the one terminal of the crystal detector, and from the other crystal detector terminal to one of the phone-posts. The other phone-post should be connected to the rotary plate connection on the condenser, and after making this connection, the fixed condenser should be connected right across the two phone binding posts. You can use some of your No. 14 aerial wire to connect the set up with. Solder all connections if possible. When you have finished this, connect up the antenna, ground and phones to their respective binding posts, and prepare to listen.

Don the phones, and set the dial of the condenser at about 35. Set the switch lever on the second tap, and then give your attention to the crystal detector. Scratch the cat-whisker or movable element of the crystal rectifier around at various places on the surface of the stationary mineral: one or two settings will tell which is the loudest and best.

RADIO AGE ON THE AIR!

Don't forget to tune in on RADIO AGE'S Congress Hotel Jazz Carnival from KYW, Chicago, Saturday night, December 6, beginning at Midnight. Lots of fun.

WITH THE MANUFACTURERS

New Operadio Unique

The Operadio Corporation of Chicago are now marketing their 1925 model, which while embodying the fundamental principles of the 1924 series has many new and unique features.

The instrument is a complete, self-contained radio set, with the six tubes, loud-speaker and all connections within a compact case. No aerial or ground is required. The side and top of the carrying case take the place of the usual antenna. This makes it possible to use

The New Operadio

the set anywhere—in any part of the house, or when traveling or camping.

So compactly designed is the new Operadio that there is actually space for four of the largest "B" dry cells, as well as six "A" batteries. This means unusual power and long battery life.

The circuit employed is cascaded radio frequency, so developed that reception is remarkably efficient over the entire wave band. Unit construction is employed, in which the three stages of radio frequency (capacity compensated) together with the detector portion, are moulded into the solid unit. Likewise the two stage audio frequency amplifier is moulded into a solid unit.

There are many other improvements in the set such as a safety fuse on the "B" battery circuit and a voltmeter which registers the voltage on either the "A" or "B" batteries separately.

New Anti-Capacity Panel

U. S. Anti-capacity Radio Panel is a panel of high grade hard rubber, to the back of which is attached by a vulcanizing process a thin sheet of perforated metal which serves as a shield against the effects of body capacity. In working the panel, any part of the shielding can be easily removed with a penknife. The anti-capacity shielding is furnished with panels of any size, or with full size sheets, in black or mahogany finish, and in 1-8 inch, 3-16inch, or 1-4inch thickness. Manufactured by United States Rubber Company, 1790 Broadway, New York City.

The Story of the Microdyne Radio Receiver

By E. K. Oxner, M. I. R. E.

This radio receiver is one of the more recent developments in seven-tube superheterodynes.

The usefulness to the home user of such a receiver depends on several fundamentals, such as: simplicity of control, stability of operation, saving in space, its adaptability to perform with either the large storage battery type of tube and the so-called "peanut" tube.

Tuning is accomplished by two dials, both of which can be accurately logged. Master rheostat is provided to compensate for changes of battery voltage only.

This stability of operation is secured by the use of the Microdyne Transformers, namely long wave, filter and audio, of Apex Electric Mfg. Company's design and manufacture. The long wave Microdyne Transformers, in particular, are of special design, brought out as the result of several years' work in the attempt to produce an entirely satisfactory Transformer for this type of receiver i. e. a Transformer which provides a high degree of amplification, such as is otherwise secured only with the use of specially constructed tuned circuits, without the many difficulties and the extreme bulk inseparable from the latter. This design as the present Microdyne long wave transformer has been perfected to the point where the maximum amplification per tube is attained, so that the two stages used in the Microdyne receiver are sufficient to provide more than enough radio frequency amplification under any broadcast receiving condition encountered.

The price of the Microdyne 7 tube radio receiver complete with battery and loop cables, without tubes, batteries, loop or loud speaker, is $160.00. The receiver is also furnished in knock down form at a price of $97.50.

The new Apex Vernier Dial embodies some unusual and original ideas in its design. It consists of two plates, a stationary one and a calibrated rotary element, which rotate with a ten to one ratio.

New Marshall Rheostat

The Marshall Electric Company, 3225 Locust Boulevard, St. Louis, have recently put on the market a new type of rheostat for filament control. The device is called the Marshall-stat and can be used with any tube or combination of tubes

This rheostat is very compact in design. It requires only one hole in the panel of a radio set, and can be inserted in the hole from which an old rheostat has been removed. The space taken up on the back of the panel is a circle of 3-4 inch in diameter.

The chief advantage claimed for the Marshall-stat is the absolute smoothness of adjustment which may be obtained through its use. Although there is only one knob to turn and a single adjustment to make, the Marshall-stat gives vernier precision throughout its entire range, varying the resistance not step-by-step but smoothly, continuously and uninterruptedly from zero to maximum.

New Storage "B" Battery

Builders of radio sets will no doubt be interested in knowing that there is a storage "B" Battery on the market now which occupies only about one third of the space used by wet cell "B" Batteries of like capacity.

It is a 24 volt battery of 4500 milliamperes capacity and is assembled in an indestructible container. The cells are sealed absolutely tight with a special compound to prevent the leakage of acid. Vents are of hard rubber to permit their removal for refilling with distilled water.

This battery is manufactured by the National Lead Battery Company of St. Paul, Minnesota.

The National "B" Battery is only slightly more expensive than the dry battery. It is estimated that this new battery will last at least five years and as it can be recharged for less than ten cents with a very moderately priced charging outfit put out by this company, it should prove very economical.

National Transformer Unique in Design

The National Transformer Mfg. Co., 154 Whiting St., Chicago, has made several additions to its line of radio transformers. Now there is a National Transformer to meet different radio requirements. A distinctive departure from the common practice has been followed in naming the new transformers. Each is called after some type of battleship because of some characteristic of the transformer and the type of battleship after which it is named.

What all the fans are asking for! A Four-Tube Neutrodyne Receiver—Reflexed! Embodying all the features of the popular neutrodyne circuit, with a couple of additional improvements! In the January RADIO AGE.

WIRE TABLES (C-15-20)

PROPERTIES OF MAGNET WIRE

MAGNET WIRE TABLES. In the following table will be found the dimensions of covered magnet wire which will be found of use in calculating the dimensions of coils and other windings. The diameters (O. D.) taken over the insulation. As a convenience the number of turns per inch of length (N. T.) are also given. The four most common insulations are shown. Single cotton covered (S. C. C.); double cotton covered (D. C. C.); single silk covered (S. S. C.); double silk covered (D. S. C.) and enameled wire (E. W.)

MAGNET WIRE TABLE

O. D.—Outside diameter in inches. N. T.—Number of turns per inch of core.

B. & S. Gauge Number	S. C. C. Wire		D. C. C. Wire		S. S. C. Wire		D. S. C. Wire		Enam. Wire	
	O. D.	N. T.	O. D.	N. T.	O. D.	N. T.	O. D.	N. T.	O. D.	N. T.
10	0.1115	9.25	0.1183	8.85					0.1104	9.6
11	0.099	10.8	0.102	9.80					0.0927	10.8
12	0.091	11.5	0.092	10.5					0.0828	12.1
13	0.078	12.8	0.082	12.2					0.0740	13.5
14	0.070	14.3	0.074	13.9					0.0661	15.1
15	0.063	15.9	0.067	14.9					0.0591	16.9
16	0.056	17.9	0.060	16.7	0.0528	18.9	0.0546	18.3	0.0528	18.9
17	0.050	20.0	0.054	18.5	0.0475	21.1	0.0491	20.3	0.0470	21.3
18	0.045	22.2	0.049	20.4	0.0424	23.6	0.0441	22.7	0.0473	23.8
19	0.041	24.4	0.045	22.2	0.0379	26.4	0.0397	25.2	0.0372	26.5
20	0.037	27.0	0.041	24.4	0.0340	29.4	0.0358	28.0	0.0337	29.7
21	0.033	29.0	0.038	26.3	0.0305	32.8	0.0323	31.0	0.0302	33.1
22	0.0295	33.9	0.0333	30.0	0.0273	36.6	0.0291	34.4	0.0279	35.2
23	0.0266	37.6	0.0306	32.7	0.0246	40.7	0.0264	37.9	0.0241	41.5
24	0.0243	41.5	0.0281	35.6	0.0221	45.3	0.0239	41.8	0.0215	46.5
25	0.0219	45.7	0.0259	38.6	0.0199	50.3	0.0217	45.8	0.0192	52.1
26	0.0199	50.2	0.0239	41.8	0.0179	55.9	0.0197	50.8	0.0171	58.5
27	0.0182	55.0	0.0222	45.1	0.0162	61.8	0.0180	55.6	0.0153	65.4
28	0.0166	61.0	0.0206	48.6	0.0146	68.5	0.0164	61.0	0.0136	73.5
29	0.0153	65.4	0.0193	51.9	0.0133	75.2	0.0151	66.2	0.0122	82.0
30	0.0140	71.4	0.0180	55.6	0.0120	83.3	0.0138	72.5	0.0109	91.7
31	0.0129	77.5	0.0169	59.2	0.0109	91.7	0.0127	78.7	0.0097	103.0
32	0.0120	83.4	0.0160	62.5	0.0099	101.0	0.0118	84.8	0.0087	115.0
33	0.0111	90.0	0.0151	66.2	0.0091	110.0	0.0109	91.3	0.0077	130.0
34	0.0105	97.1	0.0145	70.0	0.0085	121.0	0.0101	99.0	0.0069	145.0
35	0.0096	104.0	0.0136	73.5	0.0076	132.0	0.0094	106.0	0.0062	161.0
36	0.0090	111.0	0.0130	77.0	0.0070	143.0	0.0088	114.0	0.0055	180.0
37	0.0085	118.0	0.0125	80.0	0.0065	154.0	0.0083	121.0	0.0049	204.0
38	0.0080	125.0	0.0120	83.3	0.0060	167.0	0.0078	128.0	0.0044	227.0
39	0.0074	135.0	0.0115	87.0	0.0055	180.0	0.0073	137.0	0.0039	256.0
40	0.0071	141.0	0.0111	90.0	0.0051	195.0	0.0069	145.0	0.0035	286.0

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J. B. RATHBUN

VACUUM TUBES (VT-9-35)

OPERATING CHARACTERISTICS

GRID TO PLATE CAPACITY. In any triode vacuum tube the grid and the plate act like the two plates of a condenser and as a result there is a considerable capacity between these two elements. The larger the elements and the closer together these parts are installed the greater will be the internal capacitance. In addition to the true grid to plate capacity there is a second capacity due to the close proximity of the lead-in wires in the base of the tube. In the majority of tubes all four connection wires pass out at one end of the tube and being close together introduce a condenser effect. This is greatly reduced in the tubes, such as the Moyers tubes, where the connections are made at both ends of the tube and where the wires can be more widely separated.

One of the most important effects of the grid to plate capacity is the feed-back that takes place from the plate or output circuit to the grid, a portion of the plate energy in this way being transferred back to the grid circuit producing a certain degree of regeneration and tending to set up self-oscillations. For this reason, all circuits are essentially regenerative circuits even though no external inductances, capacities or tickler's are used to obtain the effect. This regeneration is small yet it raises to sufficient magnitude to cause trouble in radio frequency circuits where regeneration is not desired.

When the tubes are being used for radio frequency amplification the full amplification of the input is never possible at ordinary broadcasting frequencies because of the capacity effect. A part of the incoming radio impulses are fed directly through the capacity from grid to plate without effecting the electron stream and therefore without producing amplification, this transfer reducing the grid potential and control over the electron stream. Secondly a second transfer or feed-back takes place from the plate to the grid, thus setting up oscillations which again interfere with the amplification. The only reason for such arrangements as the Neutrodyne, Superdyne and Super-Heterodyne is to eliminate or greatly reduce the internal capacity effect of the tubes in the radio frequency stages.

In the Neutrodyne circuit a small condenser known as the "Neutro-don" is connected to the grids of the R. F. tubes in such a way that is directly opposes the internal capacity of the tube, thus effectively reducing the internal capacity to zero. In the Super-Heterodyne the frequency in the radio frequency tubes is reduced thus reducing the internal capacity effects. The capacity is less at low frequencies than at high, and when we get down to about 45,000 cycles per second this capacity is practically negligible. The feed-back at the conventional 45,000 cycles used in the Super-Heterodyne is very much less than at the average broadcasting frequency of 800,000 cycles per second.

At ordinary broadcasting frequencies the grid-plate capacity varies among different tubes, owing to the varying sizes of the plates and grids and their separation. Roughly this is about as follows:

Western Electric "J," VT2, and 216A	10-12 micromicrofarads
UV-201-A, C-301A Tubes	5- 6 micromicrofarads
UV-199, C-299 Tubes	4- 5 micromicrofarads
Moyers Tubes	3- 4 micromicrofarads

In general, the lower the internal capacity, the better is the tube adapted to radio frequency amplification when no external control is provided as in the Neutrodyne. As the audio frequency currents are of very low frequency the grid-plate capacity has very little effect on audio amplification, and the tubes that show up best on R. F. are not generally as good at audio frequency. The UV-199, the Moyers tubes, and the UV-201A are the best.

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THRILLS that Go with "SOS"

(Continued from page 39)

stricken vessel, we deduced that the ship had drifted on about a mile into the inky black fog before coming to a final stop. This made a long row for the boats, groping their way toward us. The single blast we were blowing on our whistle, served to show them we were not sinking and also guided them in finding us. About two hours after the crash we began to hear a sploshing of oars, mingled with shouts and the murmur of voices coming to us out of the Stygian blackness.

Shortly faint "hellos" and "ahoys" rose above the commingled sounds and showed that the survivors were within hailing distance. We immediately answered, and in response to their harassed inquiries assured them we could take all their company aboard. It was then we learned that we had captured and sunk the steamer "Merida," back from Mexico with a capacity passenger list.

Soon after the first survivors were aboard, we also were advised that the "Merida" had a cargo consisting in part of several million dollars in gold and silver bars. Those of my readers who follow the daily press will note the latest revival of the sporadic interest frequently being shown in this cargo, now resting three hundred feet below the surface. The promoters of the expedition now being fitted out believe they have solved the problem of working under the tremendous pressures existing at such a depth.

The "Merida's" people, clambering over the ship's side, presented a sorry spectacle. They ranged from babes in arms to be-whiskered grandees of old Mexico, and of garbs running the gamut from breeches and undershirts and no shoes to gay dressing gowns and ornamented slippers of different colors. Each person carried with him exactly what he wore and no more. As our bow had torn from the "Merida's" engineroom, all machinery, including the dynamo, was immediately submerged, plunging the ship into darkness inside and out. This, by the way, rendered their wireless hors de combat, which completes the explanation of why neither of us was able to do any snappy work on the radio.

Misery Loves Company

AS THE "Farragut" could accommodate less than one hundred passengers with any degree of comfort, the "Merida's" four hundred gentle deal people were soon piled right and ren in a stateroom, Mexican greaser sharing space with New York cake eater, dark senoritas sleeping in the arms of fair American damsels and in some cases sharing the common comfort of one bath robe. Many heads were in curlers, some were loose or in braids, while dishevelled boudoir and night caps were present in large numbers. Bobbed hair would have been a blessing in such circum-

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stances, but not a shingle was to be seen. Altogether it was not a dress rehearsal. And when the outfit was landed at "Norfolk" that afternoon they must have felt in holiday spirits making a tour of the shops in search of new rigs.

Our "SOS" calls were sent repeatedly with one minute intervals of listening. Had we been sinking, as was the "Merida," there would have been two shiploads of survivors waiting on the great waters for the chance passing of some ship. Yet the obvious lesson—that a continuous watch should be kept on all ocean vessels—was ignored until the "Titanic's" operator found himself in a similar predicament several years later, with direful results known to all.

About 4:30 a. m. I was gladdened by the sound of the S. S. "Hamilton," call "OA," lazily calling the "OC" of the same line and giving routine directions for passing each other in the fog so as to avoid possibilities of collision. Any spark was like news from Heaven as it showed that the set was working. "OA's" op was usually a snappy sender, but disturbed at this time of the morning for such drab duty found him rather dull on the key. The minute he stopped sending I slammed the switch and called him briskly, sticking in a couple of "SOS" to bring him to life. He had been too numb to catch my calls but the "SOS" shocked him into shape instantly, and despite the tenseness of the situation I had to chuckle to note the change in his manner of sending. "Zip! Zip!" he flashed into action. "WHO CALLED 'SOS' —WHO CALLED 'SOS'—WHO —CALLED 'SOS'—GO AHEAD AGAIN," he snapped. The story was soon told and five minutes later I handed our Captain a message from the "Hamilton's" Commander saying that he would be at our position about 9 a. m.

We had just finished this satisfactory communication when the U. S. S. "Iowa" came in, saying he had overheard the talk and that his Commanding Officer had headed his vessel toward us. The combined good news was distributed among the survivors and served to lighten the gloom a little. But the general morale was still very low. Sitting in the comfort of your library, with loud speaker at elbow, it is hard to conceive of one-tenth of one per cent of the misery hanging over the heads of several hundred refugees brooding about the decks of a ship about a third large enough to hold them, the clammy, dank fog sticking closely over all.

When Cape Hatteras "HA" shot a leisurely "GM" onto the air, I briefly informed him of the tragic happenings which had been going on a short hundred miles off his front door while he had been pawing the hay, and like the "OA's" op, he snapped into a different style pronto. As the ship operators began to come on the job and learned of the night's doings, we were flooded with offers of assistance. Many of the ships had passed almost within sight of us, being obscured by the fog, and had their operators been on duty, rescue

would have been a matter of minutes after our first "SOS."

However, we felt that we were well taken care of and broadcast the information that all offers were declined with thanks. This did not suffice to quiet some of them, however, and all morning the "UG" was being called by somebody bursting with the desire to render us succor. With the motor generator red hot from a run of many hours, and a constant stream of messages still passing between our captains and their offices ashore, I was forced to ignore these calls and tend strictly to my knitting. I recall especially the "Santa Maria," of our own line, call "UBV," calling furiously all morning. Every time I threw the switch he was on, but I simply could not take the time to get into a chewing match with him, and I did not answer him until nearly noon. Then I told him briefly that we had no use for his services, at which he was one sore op. Sitting snugly in his room away from such scenes as were going on around us he could not appreciate the situation and I certainly had no time to offer any apologies. With a brief "nothing doing; much obliged" I returned to working "AX," Atlantic City, who had another long dispatch for our Captain. "UFY" operator would not speak to me for several months.

"The Hamilton" arrived on time, performing a beautiful bit of navigation by laying out a course, when we worked him at 4:30 a. m., which brought him directly on our beam at the estimated moment without the deviation of a hair.

Transfer of survivors began at once and continued until about 1 p. m., when the last sad-eyed member of the "Meridy's" company was safely aboard the "Hamilton" and she continued her voyage to Norfolk. About the time the "Hamilton" left us, the "Iowa" appeared and offered to convoy us to shallow water. Our bow being practically non-existent, the open sea was pressing against a comparatively frail bulkhead. We had not moved an inch since the collision, fearing that any forward movement would add to this pressure and bring disaster. However, as we were about four hundred miles from New York or Philadelphia something had to be done and with the "Iowa" standing by we started slowly ahead, then as nothing untoward happened we increased to about one-third speed toward New York.

At 3 p. m. Saturday we arrived at Erie Basin drydock, Brooklyn, and I removed the phones from a set of aching ears and turned in. Not having turned an eye since Thursday morning, I was practically out of the habit and it was some hours before I was able to make satisfactory arrangements with the Sand Man. But once in work—oh, boy! The next thing I knew it was Sunday night.

AN IDEAL GIFT.

Give that radio-bug friend of yours a year's subscription to RADIO ACE—at a special price of $2.00. See page 80, this issue, for Christmas offer!

A Real Go-Getter Among Stations

(Continued from page 38)

according to his own ideas and obviously this does not work out well in a station which operates 24 hours a day. The dyed-in-the-wool telegraph operator seldom ever becomes sufficiently interested in the electrical or mechanical end to be very valuable.

"First of all, a prospective operator must hold a government license—this is required by law. In addition to this, he must have a good working knowledge of the electrical trade, so that he may be able to overcome difficulties which may arise within the equipment. He must be ingenious, able to think fast in emergencies and segregate and overcome troubles. He must have a good personal appearance and pleasant personality, so he may successfully meet people when outside pick-ups are used. It is desirable that the applicant also be a good Morse wire operator because most of the better stations use land line telegraph for orders between the point of pick-up and the radio station. Commercial telegraph wires are now looped through the broadcasting station so that the artists may have their applause first hand and it is a convenience if the radio operators are able to handle these messages.

"In brief, the applicant should be a diplomat, technician, telegraph operator, steeple jack, public contact man and on top of that, husky enough to carry storage batteries. In fact, a successful radio man must be nearly everything but a cook.

"The present supply of radio operators does not nearly meet the demand of the large number of new broadcasting stations. The field for radio operators and kindred pursuits is especially attractive with its rapid increase in popularity, and those young men whose ambitions follow that channel should give first thought to the requirements as set forth in the preceding paragraphs."

KYW Three Years Old

KYW entered upon its fourth year of activity on November 11th. On Armistice Day in 1921, KYW broadcast its first program from the stage of the Auditorium theater, when Mary Garden addressed the comparatively few who at that time owned receiving sets. On this same occasion Edith Mason sang a solo.

This was the birth of a broadcasting station which during the three years since has enjoyed amazing changes and wonderful growth.

On November 13, 1922, KYW commenced broadcasting grand opera, the first station to put opera on the ether. With the limited equipment then available, KYW broadcast every opera of that season from Chicago.

From this point KYW rapidly grew. In June, 1924, the present up-to-date aerial and station equipment were installed. The operating crew also grew in numbers, until today thirty-five are required to attend to the detail that only a couple men handled in the station's infancy.

Are You a WOWL? —Well, You Should Be

(Continued from page 37)

for the blind, who says I'm making a good boy out of him.

"The preacher who has his audience where they can't get away, can use subtle methods, and build up a climax. But the radio preacher must say something in every sentence."

This station feels that it must give the public what it wants. As judged from his experience with the Radio Bulletin, a season publication which was sent to listeners, Mr. Frazer knew that the public wanted something from WOAW more tangible than songs, stories, speeches and instrumental selections. So every person who had listened to at least three church services and who wished to become a member of the radio Church of the World, writing to the Woodmen of the World, received a certificate of membership. This certificate was a genuine work of art designed and drawn by an expert artist so that it would be suitable for framing and hanging in any home. And it proved popular. Over 21,000 of these certificates have been presented.

Weekly Dance Night

BUT affiliation with the radio church was not adequate in many ways. There were thousands of fans who did not belong to the church who wanted to affiliate with the station in appreciation of its nightly programs, especially its dance affairs, for every Friday evening is official dance night for station WOAW. For these dance hounds and just pony-gerlate, the "WOWL" club was organized. The WOWL club signified a "Woodmen of (the) World Listener." The entire country is divided into antennas. Each antenna has a regular set of officers, on a descending scale from Grand Oscillators, Galens, Generators, Crystals, Mikerophones, to ordinary WOWLS. Membership cards signed by W. A. Frazer, the Great Grand Generator of the International Order of WOWLS, were sent to each individual who expressed a desire to become a WOWL. It was the duty of a WOWL to report each week as to how conscientiously he had listened to the programs.

Radio broadcasting always involves the human element, often in an amusing manner. One letter asks that the Woodmen of the World broadcast a request that search be made for a young man and woman who had rented a Ford for their honeymoon and failed to return it. In another instance a fierce fire was raging in the business section of Omaha, WOAW announced the particulars and one of the listeners was surprised to learn it was his store on fire. He rushed downtown and arrived at the scene almost as soon as the fire department.

I mentioned that, if for no other reason, WOAW deserve fame because it possessed a poet laureate, Eugene Konecky. He is not only well known for his own verses, but for his exceptional talent in reading the verses of other poets.

Mr. Konecky is the author of a volume of poems, "Trail of Spring" and is recognized as one of the leading writers of poetry in the Middle West, which was

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shown when he was recently appointed as judge in the poetry contest by the Omaha Women's club, acting as an associate judge to John G. Neihardt, Nebraska's epic poet, who was the winner of the Columbia University prize for the best volume of poetry in 1920.

WOAW has a number of literary geniuses. C. R., known to fans as "the voice of the Woodmen of the World" in his capacity as announcer, is really Gene Rouse, who has written a play, "The Scoop." I am not informed the play might be about journalism or the coal pile.

"Early to Bed"

L. P., another initial man to the radio-listening public, is Lester Palmer, program director. He says that he gets along by following the proverb, "early to bed and early to rise makes a man healthy, wealthy and wise." He goes to bed early in the morning and gets up early in the evening. He was a University of Illinois man and won the captaincy of the football team. As a pianist he is unequaled. He can play the most difficult scores of Rachmaninoff with his right hand while his left is busy with jazz, at the same time keeping one hand in ignorance of what the other is doing. Some trick!

Lou W. Chanskey, chief operator, finds his pleasures in the operating room where he can dissect a tube or a coil, removing an oscillation from the esophagus of a grid and spanking a recalcitrant other wave from the stomach of a generator. He's another literary inventer, having written a radio drama. They're all that way at WOAW!

Who's Who In Radio

Over 200,000 persons depend upon radio for a living. How many have made their work a profession? How many a job? E. E. Yaxley has succeeded because he has devoted himself to his profession.

By Robert Archer

IT HAS been my pleasure to talk to many men who have won a high place for themselves in business and professional life. If I were to try to sum up in one short sentence the advice of these leaders to the man on the first rungs of the ladder of success, the composite sentence would read something like this: "Choose your favorite calling, stick to it and work." And good advice it is.

When RADIO AGE asked me to speak to one of the leaders in this new industry of radio, I expected to listen to a different kind of story. The industry is young. It has had a remarkable growth, so remarkable that there can be few real pioneers in the field—or putting it another way, most everybody is a pioneer. I am one of the *pioneers* myself.

I sought out E. E. Yaxley, President of the company bearing his name. The visit was a real pleasure, which is one measure of a man's greatness. Mr.

Yaxley was very gracious in his welcome. He discussed radio with all the enthusiasm of a man who has made a hobby of his work. But he was equally as reticent when it came to speaking about himself and giving advice.

As we talked, however, I gathered many interesting sidelights on a life devoted to the study of transmitting sound. Truly Mr. Yaxley is a professional man. His whole lifetime has been a study course, divided between the laboratory, developing ideas, and the shop carrying out these ideas in a practical way.

E. E. Yaxley

As with so many of our radio and telephone engineers, Mr. Yaxley received his early telephone training with the Western Electric Company.

In 1892, Mr. Yaxley designed the first automatic switchboard apparatus which was installed on a trial exchange at LaPorte, Ind. Through the following years, Mr. Yaxley was ever at work in the telephone field. In 1901, he organized the Monarch Telephone Co. and for eleven years personally designed Monarch apparatus. The reputation of the old Monarch Telephone Company for the correct design and superior construction of its equipment is due in no small way to the efforts of Mr. Yaxley.

The name Yaxley is familiar to old time telephone men who remember the patent claims advanced in favor of Gray Clashing and Bell. Mr. Yaxley's work was so closely related to the development and improvement of telephone design and construction that he was an authority frequently consulted by telephone engineers from all over the country.

Naturally enough, when radio broadcasting first came into popular favor some three or four years ago, Mr. Yaxley turned to radio as a new field for his inventive faculties. The Yaxley Mfg. Co. started the manufacture of radio devices. The shop facilities were excellent for precise workmanship and it was not long until production on radio jacks, jack switches and other parts was under full headway.

I marveled that a man, known principally for originating and developing radio and telephone apparatus could keep such a close watch on production and could plan so well. But to Mr. Yaxley, system is synonymous with designing. He seeks the practical. It is not enough to design a piece of apparatus, it must be so designed that it can be manufactured to pass on the benefits of it to the world.

Corrected List of Broadcasting Stations

KDKA	Westinghouse Electric & Mfg. Co.	East Pittsburgh	326
KDPM	Westinghouse Electric & Mfg. Co.	Cleveland, Ohio	339
KDPT	Southern Electrical Co.	San Diego, Calif.	244
KDYL	Mormon Church	Salt Lake City, Utah	360
KDYM	Savoy Theatre	San Diego, Calif.	360
KDYO	Oregon Institute of Technology	Portland, Ore.	360
KDZB	Frank E. Siefert	Bakersfield, Calif.	246
KDZE	Rhodes Department Store	Seattle, Wash.	370
KDZI	Electric Supply Co.	Pasadena, Wash.	360
KDZR	Bellingham Publishing Co.	Bellingham, Wash.	261
KFAD	Adolphus Busch Sons Brewing Co.	Phoenix, Ariz.	360
KFAE	State College of Washington	Pullman, Wash.	330
KFAF	Western Radio Corporation	Denver, Colo.	350
KFAJ	University of Colorado	Boulder, Colo.	360
KFAR	Radio Listening Service Co. (C. E. Mason,	Hollywood, Calif.	360
KFAU	Boise High School	Boise, Idaho	360
KFAV	The Radio Log (W. R. Ashcroft)	Santa Ana, Calif.	360
KFAY	Myers Radio Service	Medford, Ore.	220
KFBB	F. A. Buttrey & Co.	Havre, Mont.	360
KFBC	W. E. McNeil	San Diego, Calif.	278
KFBE	Bertha H. Hays	Bay Lake Grove, Calif.	360
KFBG	First Presbyterian Church	Ogden, Utah	360
KFBK	Kimball-Upson Co.	Sacramento, Calif.	283
KFBL	Leese Bros.	Everett, Wash.	278
KFBS	Trinidad Gas & Electric Service Co. and the Chronicle News	Trinidad, Colo.	360
KFDU	The Cathedral	Laramie, Wyo.	360
KFDB	Nielsen Radio Supply Co.	Phoenix, Ariz.	278
KFDF	Frank A. Hart	Walla Walla, Wash.	360
KFDL	Apple F. Lee	Los Angeles, Cal.	275
KFDP	Ralph W. Hayes	Ogden, Utah	360
KFDY	Fred Hagedey, Jr.	Brookings, Texas	360
KFEA	Omaha Central High School	Omaha, Nebr.	258
KFDD	St. Michaels Cathedral	Boise, Idaho	258
KFDM	University of Arizona	Tucson, Ariz.	360
KFDJ	Oregon Agricultural College	Corvallis, Ore.	360
KFDX	First Baptist Church	Shreveport, La.	360
KFDY	South Dakota State College	Brookings, S. Dak.	360
KFDZ	Harry O. Iverson	Minneapolis, Minn.	250
KFEC	Meier & Frank Co.	Portland, Ore.	360
KFEK	Anderson Hardware	Minneapolis, Minn.	360
KFEL	Mission Radio Corp.	Denver, Colo.	254
KFEQ	J. L. Brownlee	Oak, Nebr.	360
KFER	Leon Electric Service Co.	Port Dodge, Iowa	360
KFEV	Bunker Hill & Sullivan Mining and Concentrating Co.	Kellogg, Idaho	360
KFFB	Jenkins Furniture Co.	Boise, Idaho	360
KFFE	E. H. Smith	Hillsboro, Oreg.	220
KFFF	First Baptist Church	Nashville, Tenn.	360
KFFR	Kansas State Journal (Jim Kirk)	Topeka, Kans.	360
KFFV	Cleveland College	Leonard, Iowa	360
KFFY	Pierce & Stephens Music House	Alexandria, La.	360
KFGB	Hastings Radio Supply Co.	Utica, Nebr.	360
KFGC	Louisiana State University	Baton Rouge, La.	360
KFGD	Oklahoma Radio & Electric Co.	Chickasha, Okla.	360
KFGH	Leland Stanford University	Stanford University, Calif.	360
KFGI	Rose & Orr	Arkansas, Dress.	360
KFGQ	Geary Hardware Co.	Boone, Iowa	360
KFGX	First Presbyterian Church	Orange, Tex.	360
KFGZ	Bennington Missionary College	Bennington, Mich.	360
KFHA	Western Radio Callers of Colorado	Guernsey, Colo.	360
KFHB	Utz Electric Shop Co.	St. Joseph, Mo.	360
KFHH	Ambrose A. McCue	North Bay, Wash.	360
KFHJ	Fallon & Co.	Santa Barbara, Calif.	360
KFHR	Star Electric & Radio Co.	Seattle, Wash.	360
KFI	E. C. Anderson, Inc.	Los Angeles, Calif.	468
KFIF	Oregon Polytechnic Institute	Portland, Oregon	360
KFIO	North Central High School	Spokane, Wash.	360
KFIQ	First Methodist Church	Yakima, Wash.	360
KFIU	Alaska Electric Light & Power Co.	Juneau, Alaska	360
KFIX	Reorganized Church of Jesus Christ of Latter Day Saints	Independence, Mo.	360
KFIZ	Daily Commonwealth and Grand Junction	Fruita, Colo.	360
KFJB	Marshall Electrical Co.	Marshalltown, Iowa	360
KFJC	Bertha Pat. Institutes	Bertha, Wash.	278
KFJF	Megaphone Radio Manufacturing Co.	Oklahoma City, Okla.	360
KFJI	District Theatre (E. E. Kenyon)	Astoria, Oreg.	360
KFJK	Nelson Radio and Supply Co.	Nelson, Ore.	360
KFJL	Hardware Manufacturing Co.	Ottumwa, Iowa	360
KFJM	University of North Dakota	Grand Forks, N. Dak.	360
KFJQ	Valley Radio, Div. of Elec. Constr. Co.	Grand Forks, N. D.	360
KFJR	Astley C. Ulmer & Son	Stockyards, Manc. (mail)	360
KFJX	Iowa State Teacher's College	Cedar Falls, Iowa	360
KFJY	Tarkio Radio Co.	Fort Dodge, Iowa	360
KFJZ	Texas National Guard (Two hundred and twelfth Cavalry,	Fort Worth, Texas	360
KFKA	Colorado State Teachers College	Greeley, Colo.	360
KFKB	Brubaker-Sloan Hospital Association	Milford, Kans.	360
KFKV	F. J. Olof	Butte, Mont.	360
KFKQ	Conway Radio Laboratories (Ben N. Woodall)	Conway, Ark.	360
KFKX	Westinghouse Electric & Manufacturing Co.	Hastings, Nebr.	360
KFKZ	Hampton Roads Radio Co.	Colorado Springs, Colo.	360
KFLA	Alger R. Wilson	Butte, Mont.	360
KFLB	Liberal Electric Manufacturing Co.	Wisconsin, Minn.	360
KFLD	Paul E. Quigley	Philadelphia, La.	360
KFLE	National Educational Service	Denver, Colo.	360
KFLG	Russell Radio Shop	Little Rock, Ark.	360
KFUM	University of New Mexico	Albuquerque, New Mexico	360
KFUO	Rio Grande Radio Service Shop	San Benito, Texas	360
KFUV	Hay A. T. Fishback	Rockford, Ill.	360
KFUW	Nemora Electric Repair Co.	Missoula, Mont.	360
KFUX	George Roy Cloud	Galveston, Tex.	360
KFVE	Atlantic Automobile Co.	Atlantic, Ia.	360
KFVM	Christian Church	Little Rock, Ark.	360
KFWB	University of Arkansas	Fayetteville, Ark.	360
KFWF	Marysville College	Iowa City, Iowa	360
KFWI	Ry Chester W. Vance	Minneapolis, Minn.	360
KFWM	M. C. Rikerd	Hamilton, Mich.	360
KFWO	Carlton Ballard	Northfield, Minn.	360
KFWP	Hearst Field Aeronautics	Shenandoah, Iowa	360
KFWQ	Western Radio Shop	Coldwater, Miss.	360
KFWJ	Watertown Service Shop	Watertown, Mo.	360
KFWL	Radio Broadcast Artists	Pasa Robles, Calif.	360
KFWP	C. A. Brooks Hatchery and Radio Supply Shop	Santa Rosa, Calif.	360
KFNY	Morgan Photograph Co.	Helena, Montana	360
KFNZ	Hazel Radio Company	Barbarosa, Calif.	360
KFOA	Rhodes Department Store	Seattle, Wash.	360
KFOC	Fort Christmas Church	Whittier, Calif.	360
KFOD	Radio Shop	Walnut, Idaho	360
KFOJ	Moberly High School Radio Club	Moberly, Missouri	360
KFOR	Lester W. Schofield	Sigourney, Iowa	360
KFOX	Schoolcraft Radio Shop	Long Beach, Calif.	360
KFPU	Latter Day Saints University	Salt Lake City, Utah	360
KFQF	Hamer Bros. Co.	Stanfield, Ore.	360
KFQD	Rev. William Councilor	Galveston, Texas	360
KFQR	Buick City Tire & Electric Co.	Buick City, Nebraska	360
KFQT	Colleen Hill Radio Club	Wichita, Kansas	360
KFQU	Memorial Hall, Pa.	Richmond, Calif.	360
KFQX	Board of Education, Technical High School	Omaha, Nebraska	360
KFUT	Hanson Radio Service	St. Paul, Minn.	360
KFUZ	Lewis Hudson Real Estate Co.	Fort Smith, Ark.	360
KFVB	Edwin J. Brown	Seattle, Wash.	360
KFVC	Carrington and Daniels	Los Angeles, Calif.	360
KFVE	Harold Chas. Watanabe	Salt Lake City, Utah	360
KFVL	C. C. Bearer	Dublin, Texas	360
KFVM	The New Hamburg Co.	Greenville, Texas	360
KFVN	Missouri National Guard	Jefferson City, Mo.	360
KFVO	Colorado National Guard	Denver, Colo.	360
KFVP	C. & C. Radio & Electric Shop	Olympia, Washington	360
KFVR	Los Angeles Co. Forestry Dept.	Los Angeles, Calif.	360
KFVT	Carr & Johnson	Salt Lake City, Utah	360
KFVV	Tolmie & Robinson, Inc.	San Francisco, Calif.	360
KFPW	St. Johns M. E. Church	Carterville, Mo.	360
KFPX	First Presbyterian Church	Pine Bluff, Ark.	360
KFPY	Spokane Investment Co.	Spokane, Wash.	360
KFQA	The Telegram	St. Louis, Mo.	360
KFQB	The Searchlight Publishing Co.	Fort Worth, Tex.	360
KFQC	Reed Brothers Radio Shop	Taft, Calif.	360
KFQD	Chena Power Co.	Anchorage, Alaska	360
KFQE	Johnson-Hoyt Radio Laboratories	Colorado Springs, Colo.	360
KFQF	D. A. Doyle	Minneapolis, Minn.	360
KFQG	Southern Calif. Radio Ass'n.	Los Angeles, Calif.	360
KFQH	Radio Service Co.	Burlingame, Calif.	360
KFQI	The Times, El Paso Co.	Colorado City, Colo.	360
KFQJ	Hudson Lodging Company	Oklahoma City, Okla.	360
KFQK	Democrat Leader	Tacoma, Wash.	360
KFQL	Oklahoma Fire Hose Fair Ass'n.	Muskogee, Okla.	360
KFQM	Texas Shabbuy Bulletin	Austin, Tex.	360
KFQN	First Baptist Church	Portland, Ore.	360
KFQO	Minor Radio Shop	Inwood, Kans.	360
KFQP	G. E. Carter, Jr.	Iowa City, Ia.	360
KFQR	Delmar La Fayette Ellis	Chickasha City, Okla.	360
KFQS	Livingston-Hearst Radio Laboratories	Madison, Colo.	360
KFQT	Texas National Guard	Denison, Texas	360
KFQU	W. Tuttar	Hollister, Calif.	360
KFQV	Omaha Grain Exchange (Donaldson)	Omaha, Nebr.	360
KFQW	C. Y. Knudsen	North Bend, Wash.	360
KFQX	Alfred M. Gilchrist	Seattle, Wash.	360
KFQY	Farmers State Bank	Tobias, Neb.	360
KFQZ	Taft Radio Co.	Hollywood, Calif.	360
KFRI	The Reynolds Radio Co. Inc. Reynolds Radios	Denver, Col.	360
KFRJ	Our Paperman, Jr.	Conway, Ark.	360
KFSG	Aeolian Temple	Los Angeles, Calif.	360
KFSY	The Van Blarcom Co.	Tucson, New Mex.	360
KGB	Tacoma Daily Ledger	Tacoma, Wash.	360
KGG	Hallock & Watson Radio Service	Portland, Ore.	360
KGO	General Electric Co.	Oakland, Calif.	360
KGU	Marion A. Mylrock	Honolulu, Hawaii, Waikiki	360
KGW	Portland Morning Oregonian	Portland, Oreg.	491
KGY	St. Martins College (Rev. Sebastian Wulf)	Lacey, Wash.	258
KHJ	Times-Mirror Co.	Los Angeles, Calif.	395
KHQ	Louis Wasmer	Seattle, Wash.	360
KJQ	C. D. Field	Modesto, Calif.	231
KJR	Northwest Radio Service Co.	Seattle, Wash.	283
KJS	Ryle Institute of Los Angeles	Los Angeles, Calif.	360
KLS	Warner Brothers Radio Supplies Co.	Oakland, Calif.	360
KLX	Tribune Publishing Co.	Oakland, Calif.	509
KLZ	Reynolds Radio Co.	Denver, Colo.	283
KMJ	San Joaquin Light & Power Corp.	Fresno, Calif.	248
KMO	Leon E. Starks Co.	Tacoma, Wash.	360
KNT	Walter Heinrich	Nelson Bar, Alaska	263
KNX	Los Angeles Examiner Express	Los Angeles, Calif.	337
KOB	New Mexico College of Agriculture & Mechanic Arts	State College, N. Mex.	360
KOF	Detroit Police Department	Detroit, Mich.	286
KPO	Don Lee	San Francisco, Calif.	423
KQP	Apple Gate Radio Club	Wood River, Oreg.	360
KQW	Doubleday-Hill Electric Co.	Pemberton, Pa.	270
KRE	Charles D. Hayes	San Jose, Calif.	360
KRE	W. C. Bellamy & Electric Co.	Berkeley, Calif.	217
KSD	Post-Dispatch (Pulitzer Pub. Co.)	St. Louis, Mo.	545
KTW	First Presbyterian Church	Seattle, Wash.	360
KUO	Examiner Printing Co.	San Francisco, Calif.	360
KUY	Coast Radio Co.	El Monte, Calif.	258
KWC	Pacific Wireless Telephone Co.	Berkeley, Calif.	360
KWH	Los Angeles Examiner	Los Angeles, Calif.	360
KYO	Electric Shop	Honolulu, Hawaii	270
KYW	Westinghouse Electric & Mfg. Co.	Chicago, Ill.	536
KZM	Preston D. Allen	Oakland, Calif.	360
WAAB	Valdemar Jensen	New Orleans, La.	268
WAAC	Tulane University	New Orleans, La.	360
WAAD	Ohio Mechanics Institute	Cincinnati, Ohio	360
WAAF	Chicago Daily Drovers Journal	Chicago, Ill.	286
WAAM	1. E. Nelson Co.	Newark, N. J.	263
WAAN	University of Missouri	Columbia, Mo.	254
WAAW	Omaha Grain Exchange	Omaha, Nebr.	286
WABB	Harrisburg Sporting Goods Co.	Harrisburg, Pa.	268
WABD	Parker High School	Dayton, Ohio	283
WABE	Young Men's Christian Association	Washington, D. C.	283
WABH	Lake Shore Tire Co.	Sandusky, Ohio	240
WABI	Bangor Railway & Electric Co.	Bangor, Me.	240
WABL	Connecticut Agricultural College	Storrs, Conn.	360
WABM	F. A. Doherty Automobile and Radio Equipment Co.	Superior, Wis.	254
WABN	Cat Radio, Inc.	LaCrosse, Wis.	248
WABO	Lake Avenue Baptist Church	Rochester, N. Y.	283
WABP	Robert F. Weyer	Clear, Ohio	266
WABQ	Haverford College Radio Club	Haverford, Pa.	261
WABR	Rural Hill School, N. W. B. Rowe	Toledo, Ohio	270
WABU	Victor Talking Machine Co.	Camden, N. J.	226
WABW	College of Wooster	Wooster, Ohio	234
WABX	Jerry D. Jeff	Mt. Clemens, Mich.	270
WABY	John Magrath, Jr.	Philadelphia, Pa.	242
WABZ	College Place Baptist Church	New Orleans, La.	263
WAHG	A. H. Grebe & Co.	Richmond Hill, N. Y.	314
WBAA	Purdue University	W. Lafayette, Ind.	283
WBAH	The Harmon Co.	Minneapolis, Minn.	417
WBAN	Wireless Phone Corp.	Paterson, N. J.	244
WBAO	James Millikin University	Decatur, Ill.	360
WBAP	Westinghouse-Carter Publishing Co. (Star Telegram)	Fort Worth, Tex.	476
WBAV	Ernst & Hastler Co.	Columbus, Ohio	413
WBAX	John H. Stenger, Jr.	Wilkes-Barre, Pa.	256
WBAY	Warners Electric Co.	New York, N. Y.	492
WBBB	Barbour Belgard Service	Pasadena, Pa.	294
WBBG	Irvine Venaffra	Metuchen, N. Mex.	248
WBBH	J. Fraise Bell	Port Huron, Mich.	346
WBBL	Grace Covenant Presbyterian Church	Richmond, Va.	283
WBBM	Eagle Optic Products Co.	Lincoln, Ill.	226
WBBN	Rishr, A. R.	Binghamton, N. Y.	275
WBBP	Bibleday High School	Pingsbury, Mich.	246
WBBR	Peoples Pulpit Assn.	Rossville, N. Y.	273
WBBS	First Baptist Church	New Orleans, La.	252
WBDS	Lloyd Brothers	Philadelphia, Pa.	234
WBBU	Rock River Radio Co.	Monmouth, Ill.	224
WBBY	Johnstown Radio Co.	Johnstown, Pa.	245
WBBX	Ryttan Ferrer High School	Norfolk, Va.	222
WBBY	Washington Light Infantry Co. "B" 118th Inf.	Charleston, S. C.	248
WBBZ	Ralph R. Watson	Indianapolis, Ind.	337
WBL	T. & T. Radio Co.	Antigo, Wisc.	360
WBR	Pennsylvania Gas Pulse	Butler, Pa.	254
WBS	In W. Mfg. Inc.	Newark, N. J.	260
WBT	Southern Radio Corp.	Charlotte, N. C.	360
WBZ	Westinghouse E. & M. Co.	Springfield, Mass.	337
WCAD	St. Lawrence University	Canton, N. Y.	236
WCAE	Kaufmann & Baer Co.	Pittsburgh, Pa.	462
WCAG	Clyde E. Randall	New Orleans, La.	360
WCAH	Reynolds Electric Co.	Columbus, Ohio	288
WCAJ	Nebraska Wesleyan University	University Place, Nebr.	283
WCAK	Alfred F. Daniel	Decatur, Texas	263
WCAL	St. Olaf College	Northfield, Minn.	360
WCAO	Baldwin & Brunson Co.	Baltimore, Md.	360
WCAP	Chesapeake & Potomac Telephone Co.	Washington, D. C.	469
WCAR	Alamo Radio Electric Co.	San Antonio, Tex.	360
WCAS	W. H. Hammonds Industrial Institute	Minneapolis, Minn.	360
WCAT	State College of Mines	Rapid City, S. Dak.	360
WCAU	Durham & Co.	Philadelphia, Pa.	399
WCAV	J. C. Blue Electric Co.	Little Rock, Ark.	360
WCAX	University of Vermont	Burlington, Vt.	360
WCAZ	Carthage College	Carthage, Ill.	360
WCBA	Charles W. Heinlein	Allentown, Pa.	360
WCBC	University of Michigan	Ann Arbor, Mich.	360

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 $1000 weekly selling standard well advertised radio sets and parts. No investment required. Write for free outfit. Dept. 31, WAVELAND RADIO CORPORATION, 6001 N. State St., Chicago.

FOR SALE

Litzer Wire. Most perfect Conductor known. No Loss of Current. Easy to Solder. In Joint Coils. Per Coil $1.25. Aragon Radio Co., 327 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 DECEMBER

The Roberts Radio Booklet, by Frank D. Perrine, fully illustrated, and RADIO AGE, for $1.50. Price of booklet alone is 50c. Send check, currency or money order to RADIO AGE, 500 N. Dearborn St., Chicago.

MISCELLANEOUS

150 Genuine Foreign Stamps, Mexico War Issues, Venezuela, Salvador and Iced a Service, Guatemala, China, etc., only 5c. Besson approval sheets, 50 to 60 percent. Agents Wanted. Big 32-p. Lists Free. We Buy Stamps. Established 28 Years. Hussman Stamp Co., Dept. 452, St. Louis, Mo.

AGENTS

Do you want to earn money in your spare time? We have a wonderful offer to make ambitious men and women. No previous experience necessary, no money required; write today for plans. American Products Co., 2121 American Bldg., Cincinnati, Ohio.

CASH IN ON RADIO! Build and sell sets for us. We furnish 50 watt $5 an hour in spare time at home. Auburn Radio Co., Dept. N, Cincinnati, O.

AGENTS

$5 an hour in advertising and distributing samples to consumers. Write quick for territory and particulars. American Products Co., 1328 American Building, Cincinnati, Ohio.

Men wanted for this territory to sell wonderful value magazine, woman's, Children's shoes direct, spare or consumer over 40%. Experience unnecessary. Samples supplied. Big weekly permanent income. Write today. Tanners Mfg. Co., 3356 C. St., Boston, Mass.

BUSINESS OPPORTUNITIES

DEALERS—Write for our illustrated catalog of reliable Radio Merchandise. Rogers Manufacturing Corporation, Dept. D, 1328 Wilson Ave., Chicago, Ill.

WANTED.—A Chicago Organization desires radio proposition of merit from manufacturers, that can make more profitable returns direct to the consumer or from jobbing standpoint. Merchandise of established trade name considered, but propositions considered for the use of our own trade name preferred. Give full details first letter. Address Box 112, RADIO AGE, 500 N. Dearborn St., Chicago, Ill.

FOR SALE

BLUE PRINTS—Make your own set from newest original and up-to-the minute blueprints. The following are merely titles of a choice of fifteen one hundred different types:

HT-1-1—Five tube neutrodyne—60c.
FD-5—Three-hookup combination—35c.
DI0-4—Diode single circuit—25c.
All three of above, for $1.00.

These tested blueprints are all made up on ready to read circuit drawings. MIDLAND PRODUCTS COMPANY, 1612 Grand Ave., Chicago, Ill. Ask for our complete list, No. R11.

500 VOLT EDISON TYPE "B" BATTERY, Sacrificed down. Parts and plans—complete, $12.50. Lamb Mfg., 3017 W. Lake, Chicago.

Classified closed for the January issue must reach RADIO AGE not later than November 25

Marv-O-Dyne R. F. Circuit

The Marv-O-Dyne incorporates two special unique features, one known as the Fil-A-Meter, which permits keeping under control through the use of a Weston Meter, the amount of filament voltage required.

There are but three tuning dials on the receiver, and because of the accurate design of the radio frequency coupling coils, these dials can be calibrated, and are so marked that all three dial settings correspond in setting for a given wavelength. This is of value to the layman, who need know nothing of tuning to enable him to obtain distance reception practically the first night he operates the set.

The very fine selectivity obtained with the set is due in a large part to the design of the inter-tube coupling coils. These are especially wound by machine in the familiar spider web form, said to be the most efficient type of winding, with a capacity far below other winding methods.

WCBD	Wilmer G. Voliva	Zion, Ill. 345
WCBF	Main Radio Co	West Orange, N. J. 280
WCBH	Neil J. Stiller	Pittsburgh, Pa. 238
WCCO	Howard S. Williams (Westinghouse)	Minneapolis, Minn. 416
WCDH	University of Illinois	Oxford, Miss. 345
WCBI	Wall, Dunnet & Hunt	Bryan, Tennessee 360
WCJJ	J. C. Pizzo	Jackson, Louisiana 261
WCJK	E. Richard Hall	St. Petersburg, Fla. 361
WCOL	Columbus Radio Mfg. Co.	Hamilton, Ohio 360
WCRM	Charles Rosen	Baltimore, Md. 329
WCRW	Joseph P. Wright	Ft. Wayne, Ind. 266
WCRO	The Radio Shop, Inc.	Memphis, Tenn. 250
WCSO	First Baptist Church	Nashville, Tenn. 394
WCUK	C. H. Mercer	Henderson, N. C. 294
WCOT	Clark University, Summer Dept.	Worcester, Mass. 238
WCOU	Arnold Winston Rapidy Co	Arnold, Pa. 254
WCRV	Williamson Radio Club	Williamson, W. Va. 252
WCRW	George P. Keeton, Jr., and Maitland Simpson	Macon, Ga. 286
WCSX	Hyde Hour of Detroit Observer Laboratories	Detroit, Mich. 516
WCSY	The Tribune Electrical Store	Rock Hill Falls, Pa. 360
WCSZ	Cromwell Bros. Music House	Chicago Heights, Ill. 248
WCCO	Washburn-Crosby Co.	Twin Cities, Minn. 417
WCK	Stix-Baer-Fuller D. G. Dept.	St. Louis, Mo. 545
WCX	Free Press	Detroit, Mich. 517
WDAE	Tampa Daily Times	Tampa, Fla. 486
WDAF	Kansas City Star	Kansas City, Mo. 411
WDAG	J. Lawrence Matlock	Amarillo, Tex. 361
WDAH	Trinity Methodist Church (South)	El Paso, Tex. 254
WDAR	J. H. Bruning	Philadelphia, Pa. 395
WDAS	Arnold A. Weiss	Worcester, Mass. 268
WDAU	Alarm Kitten	New Bedford, Mass. 360
WDAY	Radio Equipment Corp.	Fargo, N. Dak. 261
WDBA	Fred Bair	Columbus, Ga. 236
WDBO	A. E. Wells & Co., Inc.	Taunton, Mass. 220
WDBC	Kirk, Johnson & Co.	Lancaster, Pa. 256
WDBD	Arcadia Radio Parts	Martinsburg, W. Va. 360
WDBF	Robert G. Phillips	Youngstown, Ohio 246
WDBH	D. T. Belcher Co.	Worcester, Mass. 268
WDBI	Radio Specialty Co.	St. Petersburg, Fla. 256
WDBJ	Richardson Wayland Electric Corp.	Roanoke, Va. 256
WDBL	Mac. Dept. of Markets	Bowman Point, Wis. 270
WDUN	Electric Light & Power Co.	Bangor, Me. 359
WDBO	Rollins College Inc.	Winter Park, Fla. 340
WDHP	Superior Page Journal Agency	Superior, Wis. 231
WDRG	Alerton Radio Supply Co.	Salem, N. J. 234
WDSR	Treasure Temple Baptist Church	Revere, Mass. 256
WDOS	S. M. K. Radio Corp.	Peyton, Ohio 360
WDUT	Taylor's Book Store	Hazlehurst, Miss. 256
WDOU	Beacon Radio Co.	Stevenson, Mass. 275
WDBV	The Rivoli Theatre	Fort Wayne, Ind. 231
WDRM	The Radio Den	Columbia, Tenn. 209
WDRX	Tele Rex	New York, N. Y. 233
WDBJ	North Shore Congregational Church	Chicago, Ill. 258
WDBZ	Bar Street, Elm Hill	Kingston, R. I. 233
WDOF	Church of the Covenant	Washington, D. C. 234
WDZ	J. L. Bulk	Tuscola, Ill. 218
WEAA	P. H. Fuller	Flint, Mich. 270
WEAF	American Telephone & Telegraph Co.	New York, N. Y. 492
WEAH	Wichita Board of Trade	Wichita, Kans. 290
WEAI	Cornell University	Ithaca, N. Y. 286
WEAJ	University of South Dakota	Vermillion, S. Dak. 143
WEAM	Bernards of North Plainfield (W. Gilbert Plainfield)	North Plainfield, N. J. 306
WEAN	Shepard Co.	Providence, R. I. 277
WEAO	Ohio State University	Columbus, Ohio 500
WEAP	Mobile Radio Co.	Mobile, Ala. 500
WEAR	The Evening News Publishing Co.	Baltimore, Md. 286
WEAU	Davidson Bros. Co.	Sioux City, Iowa 235
WEAT	Jim Thorpe (Will Rogers) Prod.	Houston, Texas 360
WEB	Brunswick Co.	St. Louis, Mo. 203
WEBA	Electric Shop	Highland Park, N. J. 222
WEBC	Wahpe Grill Building	Superior, Wis. 242
WEBD	Electrical Equipment and Service Co.	Anderson, Ind. 246
WEBE	Roy W. Walker	Cambridge, Ohio 246
WEBH	Edgewater Beach Broadcasting Station	Chicago, Ill. 370
WEBI	Walter K. Gibbons	Salisbury, Md. 242
WEBJ	Third Avenue Railway Co.	New York, N. Y. 455
WEBT	C. B. Peterson	New Orleans, La. 360
WEBZ	The Dept. of Com. Industrial Radio School	Dayton, Ohio 330
WEBV	Detroit Piano & Music Co., 2 to Boulevard St.	Detroit, Mich. 270
WEBW	Beloit College	Beloit, Wis. 252
WEBX	John B. Cox, Jr.	Nashville, Tenn. 252
WEBT	Wilson Radio Co.	Reidsville, N. Car. 238
WEEI	The Edison Electric Illuminating Co.	Boston, Mass. 360
WEV	Student Aid Rec. Co.	Houston, Tex. 243
WEW	St. Louis University	St. Louis, Mo. 280
WFAA	Dallas News & Dallas Journal	Dallas, Texas 476
WFAB	Carl T. Wood	Syracuse, N. Y. 234
WFAM	Times Publishing Co.	St. Cloud, Minn. 370
WFAN	Eastman Electric Service Co.	Eastman, Minn. 288
WFAV	University of Nebraska, Department of Electrical Engineering	Lincoln, Nebr. 278
WFAB	Farmer Cabinet	Fargo, Ill. 260
WFBG	The Wm. F. Gable Co.	Altoona, Pa. 288
WFBH	Crescent Radio Corporation	New York, N. Y. 273
WFBJ	St. John's University	Collegeville, Minn. 238
WFBM	Circuit-Gate Radio Co.	Indianapolis, Ohio 360
WFBT	Shawnee and Uncas	Philadelphia, Pa. 395
WGAL	Lancaster Electric Supply & Construction Co.	Lancaster, Pa. 252
WGAN	Cecil E. Lloyd	Portland, Me. 280
WGAQ	Louise Hand	Shreveport, La. 258
WGAZ	South Bend Tribune	South Bend, Ind. 286
WGI	American R. & T. Co.	Medford Hillside, Mass. 360
WGL	Theo. F. J. Bankert	Philadelphia, Pa. 396
WGN	The Tribune Co.	Chicago, Ill. 370
WGR	Federal T. and T. Co.	Buffalo, N. Y. 319
WGY	General Elec. Co.	Schenectady, N. Y. 380
WHA	University of Wisconsin	Madison, Wis. 275
WHAA	State University of Iowa	Iowa City, Iowa 484
WHAD	Marquette University	Milwaukee, Wis. 280
WHAC	University of Cincinnati	Cincinnati, Ohio 222
WHAH	Main Barrie Co.	Joplin, Mo. 261
WHAK	Roberts Hardware Co.	Clarksburg, W. Va. 258
WHAM	University of Rochester (Business Board of Study)	Rochester, N. Y. 278
WHAR	Seidel-Town	Atlantic City, N. J. 316
WHAS	Courier-Journal & Louisville Times	Louisville, Ky. 400
WHAV	Wilmington Electric Specialty Co.	Wilmington, Del. 260
WHAZ	Rensselaer Polytechnic Institute	Troy, N. Y. 360
WHB	Sweeney School Co.	Kansas City, Mo. 411
WHK	Hollywood Company	Cleveland, Ohio 293
WHN	George Schubel	New York, N. Y. 360
WHO	Bankers Life Co.	Des Moines, Ia. 526
WIAR	Indus Automobile Co.	Rockford, Ill. 252
WIAC	Interstate Theatres	Galveston, Texas 396
WIAD	Howard R. Miller	Philadelphia, Pa. 254
WIAK	Journal-Stockman Co.	Omaha, Nebr. 278
WIAQ	Chronicle Publishing Co.	Muncie, Ind. 228
WIAS	Home Electric Co.	Burlington, Iowa 293
WIK	K & B Co.	McKeesport, Pa. 234
WIL	Continental Electric Supply Co.	Washington, D. C. 360
WIP	Gimbel Bros.	Philadelphia, Pa. 509
WJAG	Norfolk Daily News	Norfolk, Nebr. 229
WJAD	Modern Radio Institution Laboratories	Waco, Texas 360
WJAG	Norfolk Daily News	Norfolk, Nebr. 263
WJAK	Clifford L. White	Owensboro, Ky. 254
WJAM	D. M. Perkins	Cedar Rapids, Iowa 248
WJAN	Peoria Star	Peoria, Ill. 360
WJAR	The Outlet Co. (J. Harris & Bros.)	Providence, R. I. 360
WJAS	Pittsburgh Radio Supply House	Pittsburgh, Pa. 360
WJAX	City of Jacksonville	Jacksonville, Fla. 360
WJAZ	Chicago Radio Laboratory	Chicago, Ill. 240

WJD	Denver University	Omaha, Nebr. 229
WJJD	Supreme Lodge, Loyal Order of Moose	Mooseheart, Ill. 370
WJY	Radio Corp. of America	New York, N. Y. 405
WJZ	Radio Dept. of Amer.	New York, N. Y. 454
WKAA	E. F. Pace	Cedar Rapids, Iowa 278
WKAD	Univ. Head (Crescent Park)	East Providence, R. I. 240
WKAF	W. M. Radio Supply Co.	Wichita Falls, Texas 360
WKAN	United Brewery Service Co.	Montgomery, Ala. 226
WKAP	Dexter W. Tiller	Cranford, N. J. 360
WKAQ	Radio Corp. of Porto Rico	San Juan, P. R. 360
WKAR	Michigan Agriculture College	East Lansing, Mich. 288
WKAV	Laconia Radio Club	Laconia, N. H. 254
WKHF	Hotel Village Plaza	Syracuse, Third Island 286
WKY	Wm. Radio Supply Co.	Okla. City, Okla. 360
WLAG	Cutting & Washington Radio Corp.	Minneapolis, Minn. 417
WLAH	Russell Wentworth	Syracuse, N. Y. 234
WLAL	Tupler Electrical Co.	Tulsa, Okla. 360
WLAP	Wm. V. Jordan	Louisville, Ky. 286
WLAQ	Arthur R. Mullins	Kalamazoo, Mich. 283
WLAW	Police Dept., City of New York	New York, N. Y. 360
WLBX	Eastern Electric Co.	Greencastle, Ind. 231
WLB	University of Minnesota	Minneapolis, Minn. 360
WLBL	Wisconsin State Dept. of Markets	Stevens Point, Wis. 278
WLS	Sears Roebuck & Co.	Chicago, Ill. 345
WLW	Crosley Mfg. Co.	Cincinnati, Ohio 423
WMAC	J. Edw. Page (Geo. B. Murphy)	Cazenovia, N. Y. 261
WMAF	Knox Hill Radio Club	Dartmouth, Mass. 360
WMAG	General Supply Co.	Lucas, Iowa 284
WMAK	Morton Laboratories	Lockport, N. Y. 233
WMAL	Treston Hardware Co.	Trenton, N. J. 246
WMAN	First Baptist Church	Columbus, Ohio 286
WMAQ	Chicago Daily News	Chicago, Ill. 448
WMAV	Alabama Polytechnic Institute	Auburn, Ala. 250
WMAY	Kingshighway Presbyterian Church	St. Louis, Mo. 280
WMAZ	Mercer University	Macon, Ga. 261
WMC	Commercial Appeal	Memphis, Tenn. 500
WMU	Doubleday-Hill Elec. Co.	Washington, D. C. 261
WNAC	Shepard Stores	Boston, Mass. 278
WNAD	University of Oklahoma	Norman, Okla. 286
WNAL	Omaha Central High School	Omaha, Nebr. 286
WNAP	Wittenberg College	Springfield, Ohio 275
WNAH	First Christian Church	Butler, Mo. 231
WNAT	Lewis Brothers Co. (Frederick Lewis)	Philadelphia, Pa. 380
WNAV	Peninsular Radio Club (Henry Kenwood)	Fort Monroe, Va. 348
WNAX	Dakota Radio Association Co.	Yankton, S. Dak. 244
WNYC	Dept. of Plant and Structures	New York, N. Y. 526
WOAC	Pure Oxygen Co.	Lima, Ohio 266
WOAE	Wolfburg College	Fremont, Nebr. 280
WOAI	Tyler Commercial College	Tyler, Texas 360
WOAO	Apollo Theater (Belvidere Amusement Co.)	Belvidere, Ill. 273
WOAI	Southern Equitable Co.	San Antonio, Texas 385
WOAN	Vernon Conservatory of Music (Jesse O. Vaughn)	Lawrenceville, Texas 360
WOAO	Lyradise Refr. Co.	Shelbyville, Ind. 360
WOAK	Lockwood, Mary P.	Kokomo, Ind. 229
WOAR	Bond of Mercy	Washington, Del. 360
WOAV	Pennsylvania National Guard, 28 Battalion, 112th Infantry	Erie, Pa. 242
WOAW	Woodmen of the World	Omaha, Nebr. 526
WOAX	Franklin J. Wold	Trenton, N. J. 240
WOC	Palmer School of Chiropractic	Davenport, Ia. 484
WOI	Iowa State College	Ames, Ia. 360
WOQ	John Wanamaker	Philadelphia, Pa. 509
WOQ	Western Radio Co.	Kansas City, Mo. 360
WON	L. Bamberger and Co.	Newark, N. J. 405
WOS	State Marketing Bureau	Jefferson City, Mo. 441
WPAB	Pennsylvania State College	State College, Pa. 285
WPAC	Donaldson Radio Co.	Donaldson, Minn. 360
WPAJ	Tennessee Radio Co.	New Haven, Conn. 268
WPAK	North Dakota Agricultural College	Agricultural College, N. D. 283
WPAL	Superior Radio & Telephone Equipment Co.	Columbus, Ohio 288
WPAM	Apartment and Quarter	Pittsburg, Kan. 273
WPAR	Ward Battery and Radio Co.	Parkersburg, W. Va. 238
WPAU	Concordia College	Moorhead, Minn. 286
WPAZ	John R. Rock (Dr.)	Charlottesville, W. Va. 273
WQAA	Horace A. Beale, Jr.	Parkersburg, Pa. 360
WQAC	T. H. Daly	Amarillo, Texas 231
WQAE	Moore Radio News Station (Richard P. Moore)	Springfield, Vt. 278
WQAF	Eastside Refiner	Lindsay, Ohio 240
WQAM	Electrical Equipment Co.	Miami, Fla. 283
WQAN	Scranton Times	Scranton, Pa. 286
WQAO	Calvary Baptist Church	New York, N. Y. 360
WQAQ	Abilene Daily Reporter (West Texas Radio Co.)	Abilene, Texas 360
WQAS	Pilcher-Weiser Co.	Lowell, Mass. 268
WQAX	Radio Equipment Co.	Peoria, Ill. 248
WQJ	Calumet Radio Broadcasting Co.	Chicago, Ill. 448
WRAF	The Radio Club (Inc.)	Laporte, Ind. 224
WRAL	Northern States Power Co.	St. Croix Falls, Wis. 248
WRAM	Lombard College	Galesburg, Ill. 244
WRAN	Black Hawk Electrical Co.	Waterloo, Iowa 238
WRAO	Radio Besides Co.	St. Louis, Mo. 360
WRAY	Joseph Conger	Silver Springs, Ohio 242
WRAW	Arnold Radio Shop (Richard D. Goodfellow)	Reading, Pa. 238
WRAK	Pierce's Pianos	Tennessee City, N. J. 268
WRBC	Immanuel Lutheran Church	Valparaiso, Ind. 278
WRC	Radio Corp. of Amer.	Washington, D. C. 469
WRK	Doran Bros.	Hamilton, Ohio 340
WRL	Union College	Schenectady, N. Y. 360
WRM	University of Illinois	Urbana, Ill. 360
WRR	Police and Fire Signal Department	Dallas, Tex. 360
WRW	Tarrytown Radio Res. Lab.	Tarrytown, N. Y. 273
WSAB	Southeast Missouri State Teachers College	Cape Girardeau, Mo. 360
WSAC	Clemson Agricultural College	Clemson College, S. C. 360
WSAD	J. A. Reiter Co.	Providence, R. I. 261
WSAI	United States Playing Cards Co.	Cincinnati, Ohio 309
WSAN	Penn City Collieries	Penn City, Pa. 258
WSAP	Seventh Day Adventist Church	New York, N. Y. 263
WSAR	Doherty & Wash Electric Co.	Fall River, Mass. 254
WSAU	Camp Marshall	Cleburne, N. H. 229
WSAY	C. W. Rich Radio Construction Co.	Houston, Tex. 360
WSAY	Irving Aumon (Fort Clinton Chamber of Commerce)	Fort Clinton, N. Y. 278
WSAZ	Chas. Electric Store	Toronto, Ohio 278
WSB	Atlanta Journal	Atlanta, Ga. 429
WSI	S. and M. Elec. Co.	Utica, N. Y. 273
WSUE	School of Engineering	Milwaukee, Wis. 248
WSYI	Alabama Power Co.	Birmingham, Ala. 360
WTAB	Fall River Daily Herald Publishing Co.	Fall River, Mass. 248
WTAC	Penn Traffic Co.	Johnstown, Pa. 360
WTAF	Joseph A. Gomez	New Orleans, La. 242
WTAG	The Telegram	Portland, Me. 230
WTAL	Toledo Radio & Electric Co.	Toledo, Ohio 252
WTAM	Willard Storage Battery Co.	Cleveland, Ohio 389
WTAP	Cambridge Radio & Electric Co.	Cambridge, Ill. 242
WTAQ	S. B. Van Gordon & Son	Osseo, Wis. 220
WTAS	Reliance Electric Co.	Norfolk, Va. 280
WTAT	Charles E. Erbstein	Elgin, Ill. 286
WTAT	Edison Electric Illuminating Co.	Boston, Mass. (portable) 244
WTAU	Tonne Battery & Electric Co.	Tecumseh, Nebr. 242
WTAW	Agricultural & Mechanical College of Texas	College Station, Tex. 280
WTAX	William Hasbrouck Co.	Streator, Ill. 234
WTAY	Oak Leaves Broadcasting Station	Oak Park, Ill. 283
WTAZ	Thomas J. McGuire	Lambertville, N. J. 283
WTC	Kansas State Agricultural College	Manhattan, Kans. 273
WTX	D. G. Seal Co.	Chicago, Ill. 268
WWAD	Wilgus & Wilgus (Geo.)	Philadelphia, Pa. 360
WWAE	The Aimee Ball Room	Joliet, Ill. 242
WWI	Ford Motor Co.	Dearborn, Mich. 278
WWJ	Detroit News (Detroit News Assn.)	Detroit, Mich. 517
WWL	Loyola University	New Orleans, La. 280
WWOA	Mortlake College of Music	Houghton, Mich. 344

Angling for Long Distance with a DX-Catcher

(Continued from page 23)

finish on that it, leaving an end of about six inches. Then start another coil of the same type, winding 10 turns. The 50 turn coil is the secondary while the 10 turn coil is the antenna coupling inductance. The ends of these coils are shown at A and B (primary terminals) and C and D (secondary terminals). Their connection can be easily traced in both perspective and circuit diagrams.

Now we want these coils to be absolutely perfect, so get one of the condensers out (the variable ones,) and put a dial on the shaft. Connect the ends of the 10 turn coil to the antenna and ground, and the secondary wires to the terminals of the variable condenser. Now connect a crystal detector and a pair of phones in series, and shunt them across the variable condenser. Tune in a signal, and look up the wave-length. Then remove turns from the secondary coil until a 500 meter station comes in at about 70 on the condenser dial (which should be set at zero when all the plates are out of engagement). A 360 meter station should come in at about 35 on the dial and if you hear about a 400 meter station, it should come in from 48 to 52. This applies to a dial that has readings from 0 to 100. Other dials are proportionate with regard to the setting. By this method you can make your condenser dial to cover the reading of from 220 meters up to 550 without the trouble of not being able to hear the low or high wave fellows. The secret lies in juggling the number of turns on the secondary coil until it suits your condenser. Remember, it is always best to not use the last first or last five degrees on the dial, for logging purposes.

When you have found the right number of turns, tie up the coils firmly but not too tightly. I find that tieing it in about 5 places keeps it together until I can weave it. The weaving consists of threading the string in and out of the bumps formed by the wire bent around the rods, and tying the ends. You can get an idea of what is meant by referring to the perspective sketch, where you will notice the zig-zag effect the string has on the coil appearance. The primary (shown in darker lines) is tied together with the secondary.

USING the same system and same size wire as the coupler, you next wind the plate coil, and proportion the size by the same procedure. If you do this, you can make the anode condenser and secondary condenser read alike.

The feedback coil is wound on a similar form, which can be made easily. I drove 17 finishing nails through a 1-inch board in a circle having a 2¾ inch in diameter, the 17 nails being set at even intervals along the circumference of the circle. This feedback coil should have about 35 turns of number 20 DCC or DSC wire to start with. Its final number of turns is determined by actual trial and it varies greatly with different tubes. I found that using one tube as detector

(Continued on page 79)

RADIO AGE FOR XMAS

There's Not a Better Gift. See Page 80.

RADIO AGE AT WEBH

RADIO AGE will broadcast a special program from WEBH, at the Edgewater Beach Hotel, Chicago, from 9 to 10 p. m. Thursday, November 20. Tune in on 370 meters for an Ideal Program!

End your Radio Troubles for 30c in Stamps

We have laid aside a limited number of back issues of RADIO AGE for your use. Below are listed lookups to be found in these issues. Select the ones you want and enclose 30c in stamps for each desired. The supply is getting low, so enrich your store of radio knowledge by laying in an ample stock of copies NOW!

May, 1922
—How to make a simple Crystal Set for $5.

September, 1922
—How to make a Refrigerator Set at a low cost.

October, 1922
—How to make a Tube Unit for $12 to $22.
—How to make an Audio Frequency Amplifier; Power Ampli.

November, 1922
—Details of a portable short wave radio receiver

May, 1923
—How to make a portable transmitting set for amateur use

June, 1923
—How to build the new Neutrodyne receiver.
—What about your antenna?

December, 1923
—Building the Electron Receiver.
—Complete Amplifier and Loud Speaker
—A detailed Crystal Receiver

January, 1924
—Tuning Out Interference—Three Tube—Elimination Filters.
—A Jack-Knife Electrolyte.
—Push-Pull Amplifier.
—Homemade Crystal.

February, 1924
—How to make a Battery charger
—Audio Tube Relationships.
—Adding the radio amplifier to enhance receiver when listening to a broadcast
—Superheterodyne receiver.

March, 1924
—An Eight-Tube Super-Heterodyne.
—A simple low frequency
—A Tuned Radio Frequency Amplifier.
—Simple Wave Set

April, 1924
—An Efficient Super-Heterodyne Radio Instrument.
—A Two-Tube Receiver.
—Unbreakable Crystal Detector.
—Details of the Three Circuit Tuner.
—Index and how two installments of Radio Age Data Sheets.

May, 1924
—Construction of a Simple Portable Set
—Index Issues.
—Third Installment of Radio Age Data Sheets.

June, 1924
—Important Factors in Construction of a Super-Heterodyne
—A Universal Amplifier.
—A Two-Tube Radio Set
—Audion Radio and Audio to Make Homemade
—Radio Age Data Sheets.

July, 1924
A Portable Tuned Impedance Tuner
—Operating Details of Tube by Dial Reg.
—A Three-Tube Wiring Circuit
—Data Sheets

August, 1924
—Armchair Into Radio Without a Diagram.
The Sandrik-Klemmer Tube
—Filament Rheostat for Audio Amplifier
—An Audio Amplifier Without an "A" Battery
—Data Sheets.

September, 1924
—How Crystal Monitors Will Improve Reception
—One Tuned Coupler for Three Broadcast Receivers.
—Four Pages of Real Blueprints of a New Radio Receiver and an Accurate Variometer Set.
—Data Sheets.

October, 1924
An Easily Made Super-Het.
—Two Radio and Two Audio-Tube Three Tuner
—A Simple Inductance Switch
—The Outside Aerial for Best Results Explained Diagrams of a 3 Tube Neutrodyne and a Midget Coffee Set

November, 1924
—Blueprints of a Simple Dust Loop Set and a reasonably Efficient Loop set
—A 5-Tube Low Loss Receiver.
—Operating the 3-Circuit Tuner.

RADIO AGE, Inc. 500 N. Dearborn St., Chicago

THE 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. Enter the number of the article you would like to know more about in the spaces provided in the coupon

1 "A" Batteries
2 Aerial equipment
3 Aerial lightning
4 Aerials
5 Aerials, loop
6 Amplifiers
7 Amplifying units
8 Annunciators

9 "B" batteries
10 Batteries, dry cell
11 Batteries, storage
12 Battery chargers
13 Battery clips
14 Battery plates
15 Battery substitutes
17 Bezels
18 Binding posts
19 Binding posts, insulated
20 Books
21 Buzzer, battery
22 Buzzer, vibrator
23 Brackets, wall
24 Broadcasting equipment
25 Buildings
26 Buzzers

27 Cabinets
28 Cabinets, battery
29 Cabinets, loud speaker
30 Carbons, battery
31 Cat whiskers
32 Code practicers
33 Coils
34 Coils, choke
35 Coils, coupling
36 Coils, filter
37 Coils, grid
38 Coils, honeycomb
39 Coils, inductance
40 Coils, Reinartz
41 Coils, stabilizer
42 Coils, tuning
43 Condenser parts
44 Condenser plates
45 Condensers, antenna type
46 Condensers, bypass
47 Condensers, coupling
48 Condensers, fixed
49 Condensers, fixed (panel-end, or phone)
50 Condensers, variable grid
51 Condensers, variable mica
52 Condensers, variable
53 Contact points
54 Contacts, switch
55 Cord tips
56 Cords, for head sets

57 Couplers, loose
58 Couplers, molded
59 Couplers, vario
60 Crystal silky
61 Crystal holders
62 Crystals, rough
63 Crystals, mineral
64 Crystals, synthetic
65 Crystals, unmounted
66 Crystals, mounted
67 Dials, radio
68 Detector units
69 Detectors, crystal
70 Detectors, mixed crystal
71 Dial, adjusters
72 Dials, composition
73 Dials, hard rubber
74 Dials, thermal
75 Dials, metal
76 Dials, vernier
77 Dials with knobs
78 Dies
79 Drills, electric
80 Dry cells
81 Earth grounds
82 Electrolyte
83 Enamels, battery
84 Enamels, metal
85 End stops
86 Eyelets
87 Experimental work
88 Fiber sheets, vulcanized
89 Filter switches
90 Fixtures
91 Fuse set outs
92 Fuses, tube
93 Generators, high frequency
94 Grid choppers, rotary
95 Grid leak holders
96 Grid, variometer type
97 Grid leaks, tube
98 Grid leaks, variable
99 Grinders, electric
100 Ground clamps
101 Ground rods
102 Handles, switch
103 Head bands
104 Head phones
105 Head sets
106 Honeycomb coil adjusters
107 Hook ups
108 Horns, reproducers
109 Hours, libre
110 Hooks, metal
111 Hooks, metal
112 Horns, wooden
113 Hydrometers

114 Indicators, polarity
115 Inductometers, C. W.
116 Insulators, molded
117 Insulator, material
118 Insulators, panel
119 Insulators, composition
120 Insulators, fiber
121 Insulators, high voltage
122 Insulators, cloth
123 Insulators, glass
124 Insulators, hard rubber
125 Insulators, porcelain
126 Irons soldering
127 Jacks
128 Filament control
129 Jars, battery
130 Keys, transmitting
131 Knobs
132 Knock-down panel units
133 Laboratories, testing
134 Levers, switch
135 Lightning arresters
136 Loop complete
137 Loud speakers
138 Loud speaker units
139 Loops, battery
140 Lugs, terminal
141 Measuring instruments
142 Megohmmeters
143 Meters, A. C.
144 Meters, D. C.
145 Mica
146 Mica sheets
147 Mi Instruments
148 Minerals
149 Molded insulation
150 Motor-generators
151 Mountings, coil
152 Mountings, condenser lock
153 Mountings, dial
154 Mountings, grid leak
155 Mountings, honeycomb coil
156 Mountings, inductance coils
157 Name plates
158 Neutrodyne set parts
159 Nuts
160 Ohmmeters
161 Oscillators
162 Panel cutting and drilling
163 Panels, drilled and undrilled
164 Panels, fiber
165 Panels, hard rubber
166 Paints
167 Paste, soldering

168 Patent attorneys
169 Phone connectors, multiple
170 Phonograph adapters
171 Plates, condenser
172 Plugs, coil
173 Plugs, telephone
174 Potentiometer, dial and knob
175 Potentiometers
176 Potentiometers
177 Punching machines
178 Reinartz set parts
179 Repairing of set parts
180 Receiver caps
181 Rectifiers, battery
182 Resistance blocks
183 Resistance units
184 Rheostat knobs
185 Rheostat strips
186 Rheostats, antimeter
187 Rheostats, battery
188 Rheostats, dial
189 Rheostats, filament
190 Rheostats, potentiometer
191 Rheostats, panel
192 Rheostats, vernier
193 Rods, ground
194 Rotors
195 Screwers, wire
196 Screw drivers
197 Sockets
198 Sockets, tube
199 Sets, receiving—cabinet
200 Sets, receiving—crystal
201 Sets, receiving—knock-down
202 Sets, receiving — Neutrodyne
203 Sets, receiving—portable
204 Sets, receiving—radio frequency
205 Sets, receiving—reflex
206 Sets, receiving—regenerative
207 Sets, receiving—Reinartz
208 Sets, receiving—regional
209 Sets, receiving—short wave
210 Sets, receiving—super-regenerative
211 Sets, transmitting
212 Slate
213 Shellac
214 Sliders
215 Sockets, adapters
216 Sockets
217 Solder
218 Soldering irons, electric
219 Soldering paste
220 Solder flux

221 Solder wire
222 Solder solution
223 Spaghetti tubing
224 Spark coils
225 Spark gaps
226 Stampings
227 Stators
228 Stop posts
229 Switch arms
230 Switch levers
231 Switch points
232 Switch stops
233 Switches, aerial
234 Switches, battery
235 Switches, filament
236 Switches, grid
237 Switch, inductance
238 Switches, panel
239 Switches, single and double throw
240 Tone wheels
241 Towers, aerial
242 Transformers, audio frequency
243 Transformers, dynamic
244 Transformers, modulation
245 Transformers, power
246 Transformers, push-pull
247 Transformers, radio frequency
248 Transformers, variable
249 Transmitters
250 Tubes, vacuum—peanut
251 Tubes, vacuum—receiving
252 Tubes, vacuum—transmitting
253 Tuners
254 Vernier plates, hard rubber
255 Variocouplers, molded
256 Variocouplers, wooden
257 Variometers, molded
258 Variometers, wooden
259 Vernier, dial
260 Voltmeters
261 Voltmeters
262 Washers
263 Wave meters
264 Wave traps
265 Wire, aerial
266 Wire, braided and stranded
267 Wire, copper
268 Wire, insulated
269 Wire, Litz
270 Wire, magnet
271 Wire, platinum
272 Wire, tungsten

RADIO AGE BUYERS' SERVICE, 500 N. Dearborn St., Chicago, Ill.
Please see that I am supplied with buying specifications and prices of the articles numbered herewith

150 [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

I am a— ☐ Dealer ☐ Jobber ☐ Mfgrs' Rep. ☐ Manufacturer

Firm (If identified with Radio industry) .....

My Occupation ..... My Name .....

Address ..... City ..... State .....

The Stars Are Your Radio Pilot

WHEN the mariner or the forest ranger loses all other means of directing his way, he may always turn to the stars as a never-failing guide.

The stars included in many of the advertisements in this issue of RADIO AGE may just as certainly be followed by the buyer of radio products. Sometimes he has been confused by the variety of sets and parts offered, and it is regrettable that he has often been misled into purchasing inferior apparatus.

Whenever an asterisk is used the reader may accept it as evidence that experts associated with the RADIO AGE Institute have tested the merchandise offered and found it to be good. *Apparatus not passing these tests will not be approved and advertising exploiting such apparatus will not be accepted by RADIO AGE.*

In those instances where the asterisk does not appear in advertisements, it is to be understood by the reader that the products therein described have not as yet been submitted for laboratory tests, or that such tests have not been completed.

The presence of any advertisement is evidence of the fact that RADIO AGE has confidence in the maker of the goods.

Wherever the asterisk appears, it means that the manufacturer is entitled to use our official approval seal and that his goods have been

"Tested and Approved by RADIO AGE."

the set would oscillate nicely with only 25 turns as a feedback coil, while again another tube of the same make requires 34 turns on the same form.

All coils are wound in a clockwise direction.

The feedback coil mounting is accomplished by using a standard vario-coupler shaft in connection with a hard rubber block drilled to fit the shaft. The little illustration on the accompanying sheet shows the mechanical detail of the arrangement. The block with the shaft hole drilled through it is screwed to the panel.

After determining just how far the shaft is to protrude outside of the panel, it is marked with a file at the point where it comes out of the rubber block. A groove, deep enough to accommodate a turn of stiff brass wire is filed in the shaft, and after the wire is firmly single turned in the groove, it is made fast to the rubber block with screws. This keeps the shaft at the right distance.

The other coils are mounted with pegs and strings, as shown, and are virtually hung in air. And it certainly makes them low loss.

The remainder of the circuit is standard. All you have to do is to follow the circuit, exercise a little ingenuity if need be, and then get results.

I did. The first week I had it up, I heard Oakland, California (KGO) four consecutive nights, while WSAI was going full blast just 5 meters away. And I live in Chicago.

KYW, RADIO AGE, JAZZ!

All three will collaborate on Radio Age's Congress Hotel Carnival from KYW December 6 at midnight. Tune in on 536 meters for this Frolicsome Jazz Party.

DEVICES

displaying this seal have been tested and approved by the RADIO AGE INSTITUTE

The apparatus illustrated and described below have successfully passed our tests for December, 1924.

Radio Age Institute

Manufacturers' Testing Service

MEMBERS of the staff of RADIO AGE will be pleased to test devices and materials for radio manufacturers with the object of determining their efficiency and worth. All apparatus which meets with the approval of various tests imposed by members of the technical staff of RADIO AGE will be awarded our endorsement, and the seal shown to the left will be furnished free of charge. Materials for testing should be sent to

RADIO AGE INSTITUTE
504 N. Dearborn Street, Chicago, Ill.

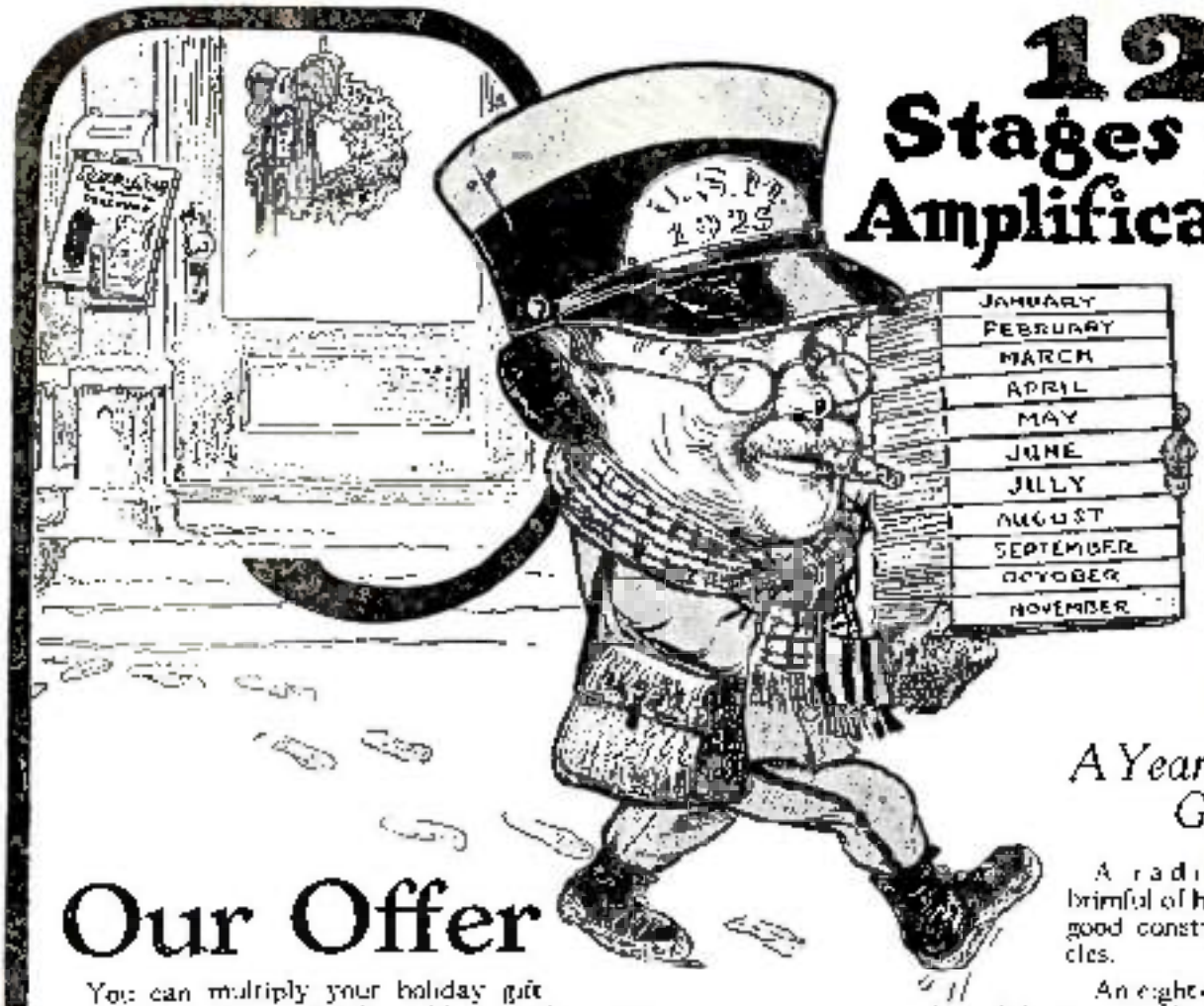
Test No. 23. ANTENNA RIBBON. Made by the Cortland Brass Company of Middleton, Mass. It is plated with a non-corrosive agent that is specially developed to withstand corrosion and grime. The product is known as the Silver-Tone Antenna, and is sold in 50, 75 and 100 foot lengths. Was received in good condition and satisfactorily passed the tests of the RADIO AGE Institute.

Test No. 24. REGENERATIVE RECEIVING SET. Made by the South Radio Corporation, 311 S. Michigan Blvd., Dept. RA, Chicago, Ill. The receiver is a three-circuit regenerative receiver, employing three tubes, one as a detector and two as low frequency amplifiers. The receiver has an adjustable semi-aperiodic primary tuning control, variable with taps. The secondary circuit is capacity tuned, and reaction is accomplished by the employment of a rotary stator. The receiver itself is one of beautiful workmanship, the panel being of the silver-gray moleskin composition, and the cabinet of mahogany with especially pleasing engraving. Wave-length range quite covers the broadcast allocations. Arrived in excellent condition and packing. Tested and approved by RADIO AGE Institute.

Test No. 25. STORAGE PLATE BATTERY. Made by the Main Electric Company of Cleveland, Ohio. A large size of rechargeable B battery having 24 volts as a rating. The battery is well designed, having celluloid guard rubber caps, so designed as to eliminate the necessity of electrolyte splashing on the tops of the cells. The plates are sturdily made, and the glass containers are exceptionally heavy. Built in 24 and 48 volt units and rugged with a strong and durable black tray. Arrived in good condition and excellent packing. Tested and approved by RADIO AGE Institute.

Test No. 26. DI-KINK-GRAPHIC REPLAYING DEVICE. Better known as the Dukes - Tone Phonographic Lead Stealing Device. Made by the Teagle Company of Cleveland, Ohio. The Model X tested by the laboratory was found to be a good one for transforming the electrical energy to sound energy at the same time reducing to a minimum the scratching noise of the phonograph. Made a few adjustments was satisfactorily reproduced. Tested and approved by RADIO AGE Institute.

* *Tested and Approved by* RADIO AGE *



12 Stages of Amplification!

A Year-Round Gift

A radio magazine brimful of hook-ups and good construction articles.

An eight-page section in each issue containing actual blue-prints showing how to make the best and latest circuits at home.

Many pages of pictures and interesting stories about the world's favorite broadcast entertainers and about the stations and studios.

A department for radio beginners.

A department for readers who want to tell other radio fans about the sets they have made, how they're made and what results they have had with them.

All the best news of the radio world and its magic progress.

A magazine your friend would treasure as a gift.

Our Offer

You can multiply your holiday gift by twelve in a very simple and inexpensive manner.

You probably know of one or more friends to whom you wish to make a present. We want to make it easy for you to select the gift, and we want to take care of all the work connected with delivering it safely, twelve times.

Of course, your friend, relation or whoever is to be remembered is a radio lover. RADIO AGE is a quality publication for the entire family; for experimenters and broadcast listeners.

Its blueprint section in each issue is a delight to the home constructor of radio sets and its illustrated features on what is going on in the broadcast studios have a large following. A perfect gift, particularly for men and boys.

For a special thirty day rate of $2.00, (regular rate is $2.50) we will have the mail carrier deliver a copy of RADIO AGE each month for twelve months. Fill in the coupon on this page with the name and address to which you wish the magazine mailed; we will do the rest.

If you wish to order subscriptions for more than one person, you may do so by writing the additional names and addresses on a slip of paper attached to the coupon. Start it with any issue you desire, *but send the coupon now!*

Radio Age,
INC.
500 N. Dearborn St.,
CHICAGO, ILL.

Gift Subscription Coupon

RADIO AGE, Inc., 500 N. Dearborn St., Chicago, Ill.

Please send RADIO AGE, the Magazine of the Hour, to the following for one year as your special holiday gift, beginning with the ..... issue.

Name .....

Address .....

City .....

I enclose $2.00 (in currency, check or money order). With the first magazine delivered send me at once a notice informing the recipient that RADIO AGE is sent to him by the undersigned with Christmas greetings and Best Wishes for the New Year.

Sender's Name .....

Street .....

12-24 City .....

This Offer Not Good After December 22, 1924

ZENITH RADIO

—it tunes through everything

Super-Zenith VII

The New SUPER-ZENITH

for people who take pride in their homes

ONE glance at the new Super-Zenith and you are instantly impressed with the sheer artistry of its design, the excellence of its craftsmanship, the superb beauty of its finish—you know that within its case is a receiving set capable of the most extraordinary performance—a receiving set entitled to the place of distinction in the finest home.

Radio enthusiasts: Note that the new Super-Zenith is NOT regenerative. It is a six-tube set in four different models ranging from $230 to $550, with a new, unique and really different patented circuit controlled exclusively by the Zenith Radio Corporation. Amplification is always at a maximum in each stage for any wave-length. *The Super-Zenith line is not affected by moisture.* For the first time, you have here a set that—

1—tunes through *everything* and selects the station you really want.
2—requires *only two* bands—*not three*—to operate.
3—brings in each station *at only one point* on the dial.
4—affords such mathematical precision and simplicity that you can run over the entire dial in 3½ minutes and pick up more stations with greater clarity and volume than any other set on the market. Direct comparisons invited.

Write for the name of the nearest dealer from whom you can obtain a demonstration of this outstanding marvel of the radio world.

Dealers and Jobbers: Write or wire for our exclusive territorial franchise.

Zenith Radio Corporation

332 South Michigan Ave., Chicago

ZENITH—the exclusive choice of Stefansson for his North Pole Expedition—Builder of the Electrophonic Receiver

Super-Zenith VII (Not regenerative)—6 tubes—2 stages tuned frequency amplification—detector and 3 stages audio frequency amplification. Installed in a beautifully finished cabinet of solid mahogany—40½ inches long, 26½ inches wide, 10¼ inches high. Door panels inlaid. Slanting panel of sheet bronze, mahogany finish, with scales and indicators in metallic relief. Gold plated pointers, to prevent tarnish. Compartments at either end for dry batteries. Can be operated on either wet or dry batteries. Either inside or outside aerial or antenna. Price (exclusive of tubes and batteries) **$230**

Super-Zenith VIII Same as VII except—built with mahogany legs of well-proportioned appropriate design, convertible model into console type
Price (exclusive of tubes and batteries)..... **$250**

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) **$350**

Super-Zenith X Containing two new features unprecedented in all previous sets. 1st—Built-in, patented, Super-Zenith Duo-Tone Speakers, (thermonically synchronized twin speakers and horns) designed to reproduce both high and low pitch tones otherwise impossible with single-unit speakers. 2nd—Zenith Battery Eliminator, positively a Zenith achievement. Requires no A or B batteries or charger. Price (exclusive of tubes)..... **$550**
Price (without battery eliminator) $450

Zenith Radio Corporation
Dept. 12C
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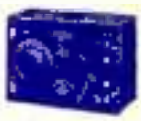

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