

On the Air

A Magazine of Radio

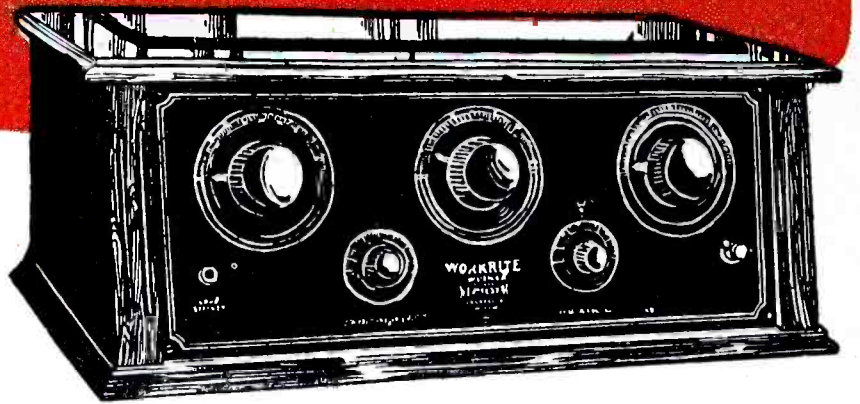
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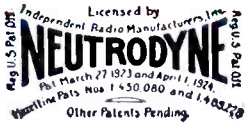
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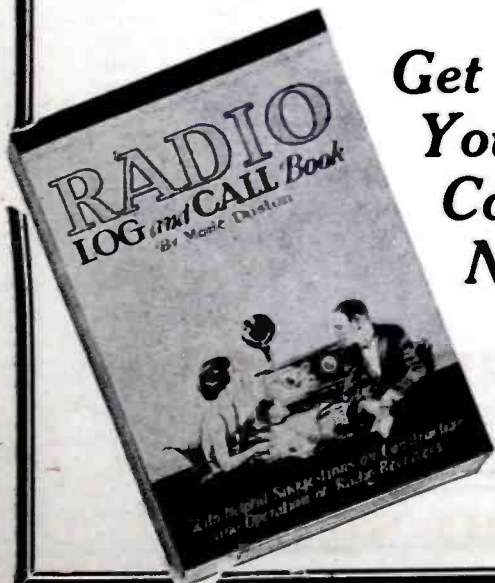
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On the Air

A Magazine of Radio

VOLUME II

NUMBER VII

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SCANNING THE CONTENTS PAGE

Tramp, tramp, tramp the trusts are marching . . . or are they? Read what Armstrong Perry says about the alleged radio monopoly in his story "The March Toward Monopoly" written exclusively for ON THE AIR.

John B. Rathbun has written us a story on "Stabilization Systems for Radio Frequency Sets" which gives us the opportunity to suggest a subtle remedy for the malignant, raucous squeals that your neighbor's radio emits. It's just this . . . buy an extra copy of ON THE AIR and present it to him. We'll bet he'll try to stop the radiation, and we are also willing to wager that he'll come back and thank you for acquainting him with a really good radio magazine.

In the "Quest for the Ideal Radio Set," our editor sets down some basic requirements of the present day radio . . . and incidentally recounts a specific case as an illustration that is tremendously newsy and interesting. In contrast to this we have a description of a simple crystal set of improved design that the beginner will find intriguing.

That a little nonsense now and then is relished by the best of men is well portrayed in the story of WOAW's Blah Club. . . This is one of the unusual features that we promised in our last issue. Read it and laugh with Izzy, the dizzy comedian.

C. Clyde Cook, our Western correspondent offers some interesting information on what radio has done to the movie industry. . . not in a business way but rather what the movies are doing with radio. We just had a letter from him . . . he tells us that he has some unusual features planned for you . . . just wait and see.

MORAL: If you think ON THE AIR is a hide and tallow men's journal write your name backward on the margin of this page with the eraser end of your pen. If you think it's a pretty good radio magazine turn the pen around and write out a check for a year's subscription, and shoot it in.

H. J. MEISTER,
Publisher.

Publication Office 404 N. Wesley Ave., Mount. Morris, Ill.

Published Monthly by

On The Air Publishing Co., Kimball Hall, Chicago, Ill.

Henry J Meister.....Publisher
Felix Anderson.....Editor
Howard I. Shaw.....Advertising Manager
Frank O. Balch.....Circulation Manager

Advertising Representatives
RHODES & LEISENRING
Bell Building, Chicago

ON THE AIR is published monthly by ON THE AIR PUBLISHING CO., 1322 Kimball Hall Building, Chicago, Ill. Application made for transfer as second class matter from the Post Office at Chicago, Ill., to the Post Office at Mount Morris, Ill., under the act of March 3, 1879. Originally entered at the Chicago Post Office April 25, 1925.

ISSUED MONTHLY 25 cents the copy, \$1.50 a year in the United States and Possessions. Elsewhere \$2.00. When remitting do so by check, money order, or by registered mail if cash is enclosed.

Advertising forms close on the 15th of the month preceding date of issue. That is, forms for the February issue close January 15th. Issued on or about the 25th.

Change of address. Instructions for the change of address should be sent to the publisher at least two weeks before the date of effect. Address all mail to ON THE AIR, 1322 Kimball Hall Building, 306 S. Wabash Ave., Chicago, Ill.

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EDITORIALS



THE day of the helter skelter throwing together of various units comprising the radio installation is a thing of the past. Two or three years ago the accepted procedure was to collect an assortment of various devices and wire them into any one of the fashionable circuits then being talked about.

Now the citizen radio enthusiast has been educated through his own experiences and by virtue of radio publications such as ON THE AIR, into a finer appreciation of the necessity in observing with great caution basic electrical laws that govern radio reception and acoustics. Because the consumer of radio has acquired sufficient knowledge of radio theory to prevent his becoming "ham-strung," necessary changes have taken place in the engineering department of radio activities.

There has been a noticeable effort toward the laboratory matching of tubes, transformers, inductances and condensers, and the matching of loudspeakers to tubes in order to effect better reproduction. This trend in radio design is to be welcomed heartily by radio fans. It is always evident that a 'fussy' attitude implying meticulous attention toward the details of any work attempted, results in a finer finished product. Undoubtedly we will find the standardization of radio parts an outgrowth of this "matching" craze, because the dissimilarity of the equipment now on the market will necessitate steps toward designing equipment that will more effectively work in unison.

Many big manufacturers have banded into merchandising committees in order to accomplish this. Their efforts are thoroughly appreciated, and it is hoped that more such combines will make their appearance, eventually ending the present limitations imposed on home construction of radio sets.

FROM the cold interior of northern Saskatchewan, in Canada, comes word that another convert has been won over to radio. She was a skeptic of long standing who doubted that music and voices are transmitted through the sky. The letter from Mrs. E. W. Jamieson of Barford, Sask., says:

"Until seeing our one-tube receiver and listening with our ear phones, this person thought a radio was a strange code listening device that required interpretations to understand.

"We turned on the tubes and tuned in a church service from KOA at Denver, and handed the skeptical lady the phones. Donning them, a strange look of wonderment and awe spread over her countenance as she joyously exclaimed, 'Oh! I hear voices.'

"We all stood in more or less rapt awe of the event,

for I believe everyone present suddenly came to the realization what this wonderful radio means to us . . . way out in the loneliness and cold. None of us have seen a store, school, town or church for eighteen months, and radio had so effectively kept us in touch with the world, that we had lost sight of its incalculable value until this incident occurred."

The letter above should be of interest to the self-pitying city "Johnny" who growls and cusses because he can't find a station that suits his finicky "I don't-know-what-I-want-my-self" taste.

THE average citizen radioist may not know it, but it's true. He manufactures a great deal of static and artificial interference himself and then complains that reception is poor.

One of the most common causes of this static making (which we think is quite unintentional) is that radio batteries of sets are charged while the set is connected to the antenna.

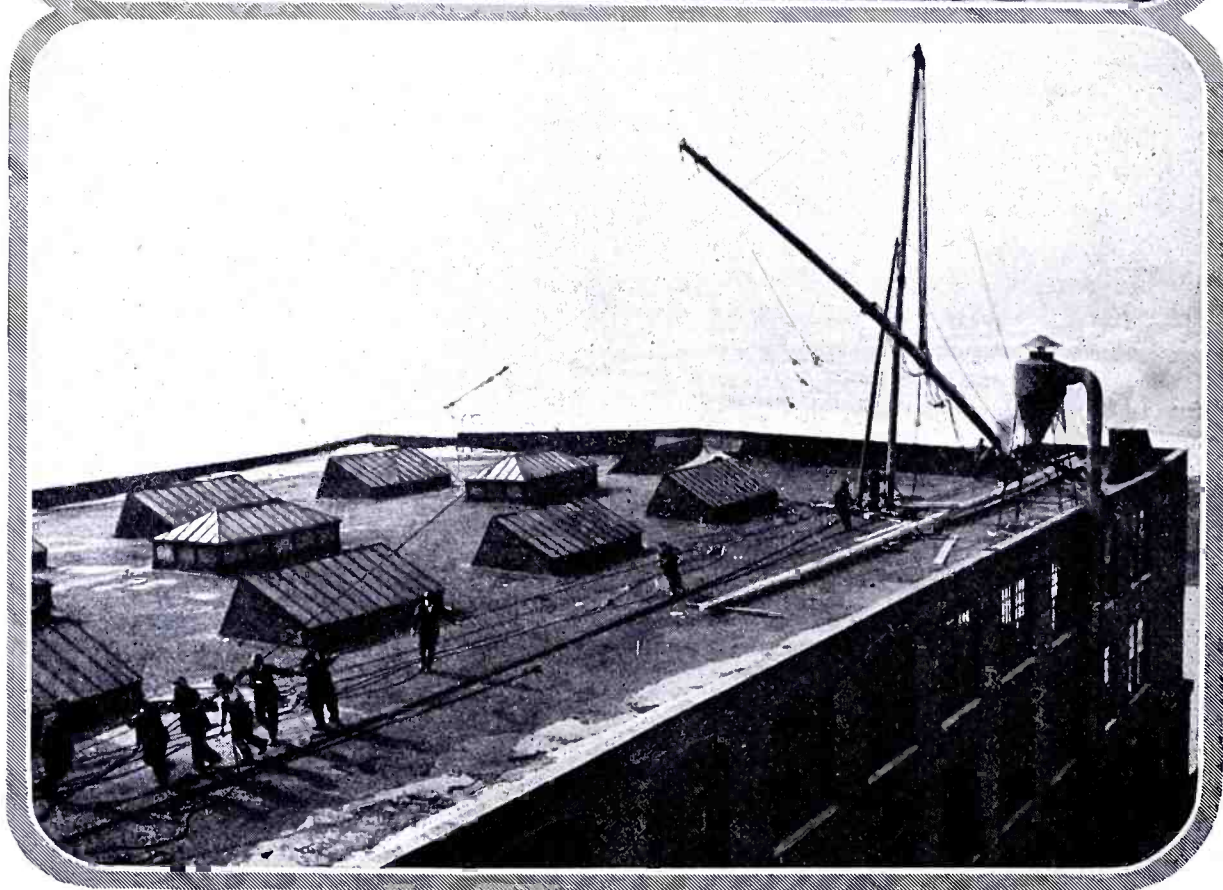
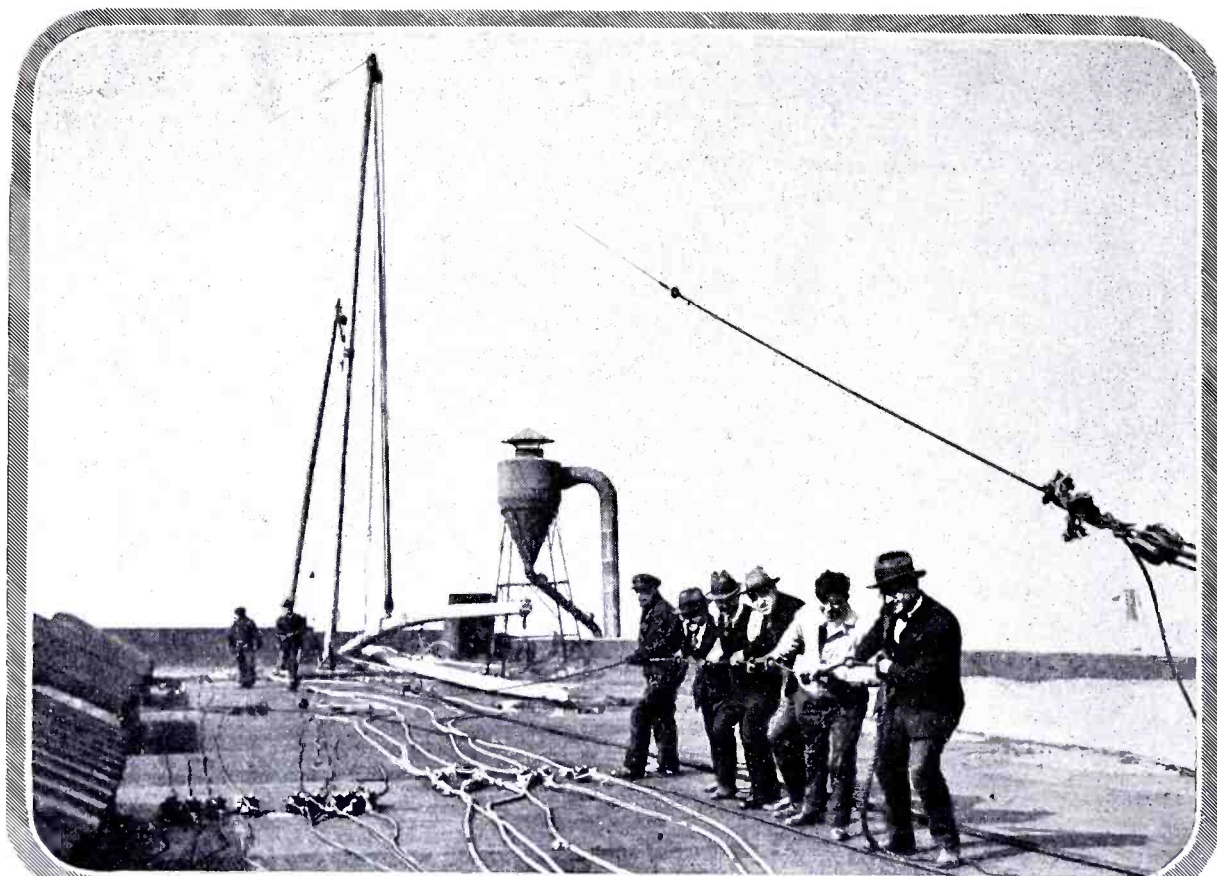
Battery chargers of the vibrating valve type are particularly bad. The strong spark across the vibrator arm contacts charges the antenna with minute but irritating surges of radio frequency electricity that causes much interference to neighboring reception. Likewise, tests tend to show that bulb chargers manufacture a peculiar type of crash static when the A battery is charged while connected to the set.

The considerate thing to do is to disconnect the A battery when you charge it or else take the aerial off the set. Don't leave it on and contribute to conditions in reception that at present are certainly none too good.

WE DON'T like to remind you of summer static because the average radio addict is more or less inclined to balk, and usually shuts up his set till the fall because someone started the idea that you couldn't receive DX in summertime. But this is the reason we mention it. . . .

Summer brings violent electrical storms, and we remind you with the best of intentions, to look over your protectors and lightning arresters. If you don't happen to have one, by all means get one. They are inexpensive, and are quite effective, and when installed you comply with the Underwriters' rules regarding fire and electrical discharges. A well protected, well grounded antenna acts very much in the manner of a good lightning rod. Instead of "attracting" lightning it dissipates charges in the neighboring atmosphere, and reduces the hazard of a stroke greatly.

That Antenna on the Roof



DID you think you had a hard job when you put up your antenna? If you think so take a look at these men hauling up one of the 160 foot poles for the aerial of the new WGBS transmitter at Astoria, Long Island. The photos illustrate very plainly the use of "gin" poles, one of the simple laws of physics for raising high masts and flagpoles. When you compare this with your ten foot, two by four mast on the roof you shouldn't sympathize with yourself for working so hard.

APRIL, 1926

The March Toward Monopoly

☞ If Radio Corporations Are Aiming at a Monopoly of the Manufacture of Apparatus, They Must Be Having a Hard Time Says

ARMSTRONG PERRY

PPOINTING out to us Americans that some other fellow is securing a monopoly is like waving a red rag in the face of a bull. We figuratively paw the earth, snort, and if sufficiently brave and belligerent try to gore the monopolist. Not infrequently we find that he, like the trained toreador, has a trick of stepping aside and letting us butt our brains out against a wall.

Showing us an opportunity to secure a monopoly for ourselves is more like waving a piece of red flannel before a bullfrog. We grab the opportunity, all unmindful of the hook that may be concealed by the attractive bait.

The statement that certain corporations are trying to secure a monopoly of radio in this country, if not throughout the world, is made frequently. Anyone in a position to know the plans of the larger radio concerns would probably deny this for, like a man on trial for murder, he would be considered insane if he pleaded guilty, but anyone who can read and think must realize that any business concern would certainly obtain a monopoly if it were possible to do so without arousing popular antagonism that would wreck the business. There is no use of seeing red even if it can be proven that certain radio corporations seek a monopoly. The thing to do is to sit down calmly and figure out whether it is possible for them to secure it and, if so, what the American people can do to bring about a condition that will be agreeable to all concerned.

Business corporations are organized for the purpose of making money. At the beginning of the radio era the men who put their money into radio took a chance. They could have bought Government bonds, or the securities of concerns that were making profits consistently, and they would have had

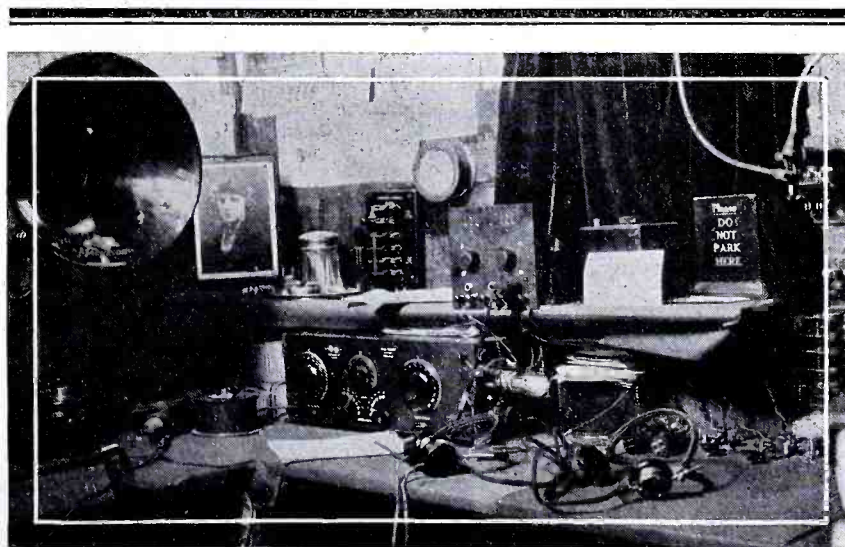
a good income from their money without a large element of risk. They put their money into radio because they believed it had a future, but without any definite evidence that their belief was correct. A good deal of the money has never yet yielded returns. Some of it was lost. But certain concerns, either through good judgment or good luck, eventually found themselves in a commanding position in the radio business.

As soon as radio became a paying proposition there were plenty of men who were not only willing but anxious to invest their money in it. Some of them found opportunities of buying into the big concerns. Others started, or went into, younger and smaller concerns. None of them questioned his own right to reap the benefit of the popularity that had been won for radio by the pioneers. But the suggestion of monopoly immediately arouses antagonism except on the part of those who hope to share in its benefits.

How a Monopoly is Possible

THERE are two ways in which a monopoly on radio might become possible. One way is through the control of the manufacture of apparatus and the other is through the control of the use of apparatus. If radio corporations are aiming at a monopoly of the manu-

facture of apparatus, they must be having a hard time. With a few feet of copper wire, a piece of galena and a single phone I can pick up broadcasts and code messages all day long in the city where I live. I can hear fine music, instructive lectures, traffic from government, commercial and amateur stations, and addresses by the President of the United States and lesser public officials. Not all of these originate in my home city. Some are brought in from many



One of the 30,000 amateur stations in the United States where new ideas are constantly tried out, patent or no patent.

miles away but broadcast here. I am not asked to pay for having them put on the air. My copper wire costs me about a dollar, my galena from a dime to a quarter per chunk, my phone from two to twelve dollars according to the degree of sensitiveness I want to pay for. All of this apparatus will last for years. I doubt if any part of it is controlled by a monopolistic corporation. Even if it is, and even if I paid that corporation one thousand or five thousand per cent profit, it has not taken much of my money and I sure do get my money's worth every week I listen in.

When I go farther from the radio stations it is necessary for me to have more apparatus. I must have some sort of a tuner. I can make that from efficient designs published in government pamphlets or in radio magazines or books. There is no radio monopoly on the oatmeal boxes on which I can wind my coils, so far as I know. Probably I pay a profit on the box along with the oats, but as I can get a month's supply of oatmeal along with the box for a total of twenty-one cents I refuse to worry about that. The other parts may be priced too high but the total amount of money required is not prohibitive.

Is There a Tube Monopoly?

IF I am very far from the nearest radio station I must use an electron tube. Now I've touched a sore spot. Everybody says there is a monopoly on tubes. Well, the Fleming patent expired a while ago, and as I understand it anyone can make a two-element tube without infringing an active patent. I have seen a number of them advertised at half the prices of the three-element tubes. A two-element tube is not as efficient as a three-element tube, but it is more sensitive than a crystal detector and better than the detector Marconi used in receiving the first transatlantic signals. It will bring in broadcasts from a considerable distance. It would probably be difficult to find a spot in the United States where it would be impossible to hear interesting programs through two-element tubes.

It is doubtful if even the trade in three-element tubes is completely controlled by any corporation. One patent expired January 15th, 1924. The corporation that owned that patent immediately announced that it owned another patent, still in force, that covered the tube, but that will expire sometime. Moreover, I learned on good authority some time ago that one manufacturer of "bootleg" or illegal tubes had discovered a way to stave off for two years the day

when the legal proceedings instituted against him would close his factory. If I felt that a corporation had secured control of all the legitimate tubes by immoral methods I might find some satisfaction in purchasing and using illegally-manufactured tubes. But although the present prices of legal tubes is said to be several times as high as the prices at which they were sold in large quantities on war-time contracts, the fact remains

that the same concerns that make them, give me free entertainment day after day that is worth much more during the life of the tube than the cost of that piece of apparatus. There is no justice in kicking about an alleged overcharge and then accepting free service, from the concern that is said to have overcharged, that is worth more than the overcharge.

The alleged attempt at a monopoly of radio has extended even to the patenting of circuits. Maj. E. H. Armstrong is said to have received a million dollars for his regenerative circuits. But just

how is a corporation to prevent a radio user from disconnecting a wire from one binding post and connecting it to another binding post, even though the new connection means infringement on a patented circuit? If all the infringers were brought into court, the Chicago Coliseum and the New York Polo Grounds together would not hold them. Mr. Armstrong and the corporation that bought his patent have tried to prevent unauthorized manufacturers from making and selling apparatus using the patented circuits, but amateurs from the Atlantic to the Pacific have infringed to their hearts' content and Mr. Armstrong has given many a lecture, telling them how to construct and operate their regenerative sets, without even selling admission tickets.

A monopoly of apparatus might be obtained if the apparatus in question were used only by large business concerns that could be made to pay enough to cover the cost of proceeding against them. Alexander Eise- mann says that eventually 95 per cent of the business will be done by six companies, but there seems to be no present possibility of any one corporation's securing a monopoly that will compel the public to buy its apparatus. Manufacturers who could not secure the privilege of using the regenerative circuits combined and encouraged the invention of the neutrodyne. Radio-frequency amplification is successfully used without regeneration. The corporation that owns the regenerative circuit patent is up against real competition all the time.

(Turn to page 30)

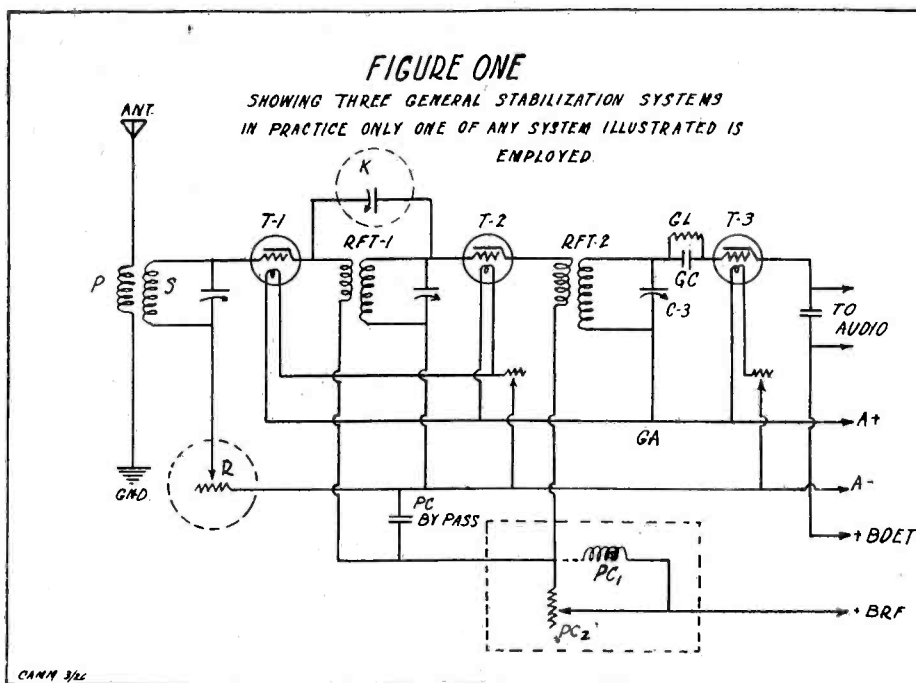


Would a radio monopoly stop the 600,000 Boy Scouts from building and operating radio sets? The photo is one of the author of this article who holds the rank of Seascout Radio Commodore, discussing the construction details of a twenty-one cent receiver with one of his army of Boy Scout radio enthusiasts.



This Canadian boy came home from the war with his heart so weak that he will never be able to do a man's work. Would a radio monopoly deprive him of his one source of pleasure and income—that of making radio sets?

John B. Rathbun is a radio engineer of considerable fame and experience, and his papers on various radio problems have been read by hundreds of thousands of radio fans.



The accompanying paper originally came to our office headed "Tube Oscillation Control Methods." But we, taking the layman's attitude toward radio, prefer to label it "A Treatise on Squeal Controls."

There Are "SQUEAL CONTROLS" For Every Set

That Will Save Your Neighbor's Ears and Disposition

By JOHN B. RATHBUN

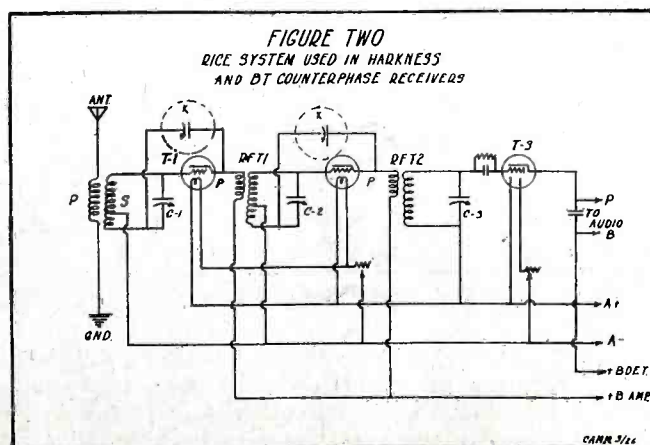
PROPER control of the tube oscillations on both long and short wave lengths usually proves a matter of great difficulty for the beginner unless he has purchased a complete kit-set of parts or has had the good fortune to purchase parts which accidentally happened to match up with one another. Oscillation control has been the bugbear of radio frequency and reflex receivers and has been the subject for a multitude of patents. If his luck is against him, then the builder of a radio frequency or reflex set will experience a wide variety of disorders ranging from wild howling and squealing to absolutely dumb dead silence. As an incentive to his inventional ability, the set may squeal and howl on wavelength, function perfectly a single station and then give up the ghost and the remaining wavelengths.

It is considered quite the thing to blame the hook-up for all these disorders but as a matter of fact the trouble is most frequently due to the apparatus or the manner in which it is assembled. If all makes of radio parts on the market were made exactly according to some fixed standard and carefully calibrated, then this difficulty would not occur so often, but unfortunately the infant radio industry has not yet been developed to the point where

perfect standardization is possible. There is no doubt but what two different makes of the same type of coil will give widely different results in the same hook-up due to differences in their electrical characteristics or to the arrangement of the coils and wires. It therefore remains to devise some system of control whereby different coils can be made to function properly in different constructions by a simple adjustment conveniently at the operator's hands, or better still, to make this control automatic.

The Cause of Squeals

All tubes must oscillate in step with the incoming waves and in effect are miniature broadcasting stations whose frequency of oscillation is controlled by the joint effects of an inductance and a variable condenser. If the tubes do not oscillate then amplification is impossible. If they oscillate freely without control on some particular frequency of their own without regard to the frequency of the incoming signals, then we may have squealing or howling or else dead silence. It is possible to so strongly excite the tubes that they are no longer under the dominion of the tuning controls and in this state reception is impaired or entirely prevented. Further, the imped-



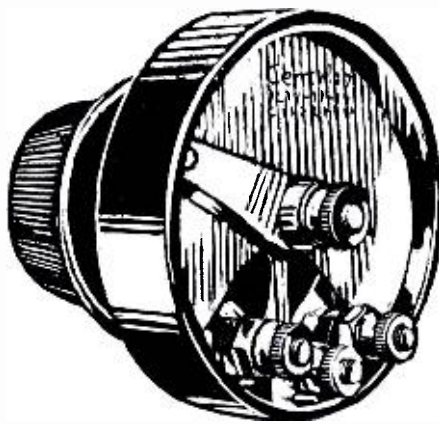
ance of the tubes at different wavelengths is not constant and adds further to the complications.

To begin with, all operative circuits of the present day are always regenerative to a certain extent, although the source of the regeneration may not be immediately obvious. With regeneration some of the amplified output of the tube is fed back to the input for a second amplification and in this way the regeneration adds to the distance and volume if it is not excessive. It makes no difference whether the output of the tubes is fed back to the input through the capacity of the apparatus or by magnetic coupling between the various stages just so long as some of the plate current is so bypassed that it passes through the tubes for amplification for a second time. Excessive regeneration causes squealing and howling up to a certain point, or else the tube may "flop" off sharply so that neither noise nor signals are heard. If the amplification or the regeneration is deficient then the signals will not be audible.

Tube Capacity Feed-back

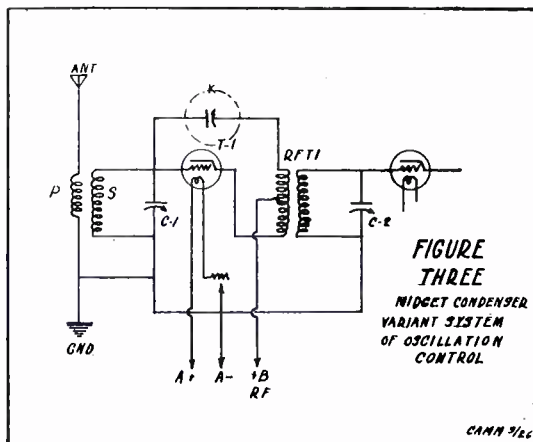
Even in the so-called non-regenerative receivers there is a certain amount of regeneration due to the feed-back of plate energy through the grid and plate capacity. These two elements of the tubes act just like the two plates of a miniature fixed condenser so that the charge on the plate is communicated directly to the grid and is therefore reamplified by a second trip through the tube. A second cause of accidental regeneration is due to the magnetic coupling between stages caused by the stray magnetic fields issuing from the tuning inductances or to the electrostatic fields set up between parts of the circuit. The regeneration may not be intentional but it certainly exists in all types of circuits using the present day type of tube and inductance.

It is therefore evident that the performance of the set depends largely upon whether the regeneration is deficient, normal or excessive. If the source of regeneration itself is not under direct control, as is the case with the tube capacity or fixed coupling between coils, then some sort of a control device must be installed by which the regeneration can be handled independently and without disturbing the wavelength controls. In the case of tube capacity, the capacity is a fixed quantity in which regeneration is greater on short wavelengths (High frequency) than at long wavelengths as the grid-plate condenser feeds back more current at high frequencies. With the long waves the capacity may be so small that there is practically no feed-back and hence a serious diminution in the distance and strength of sig-



There are several types of variable resistance units used in the "frictional" stabilization arrangements that are now on the market. The type above, is a typical example, and is the product of the Central Radio Laboratories.

nals. The magnetic feed-back between coils due to the strays also increases at high frequencies or the lower wave-



lengths, thus adding to the short wave amplification but causing a rapid falling off on long waves.

As most of you know, the Neutrodyne is supposed to be absolutely non-regenerative, but it is a well known fact

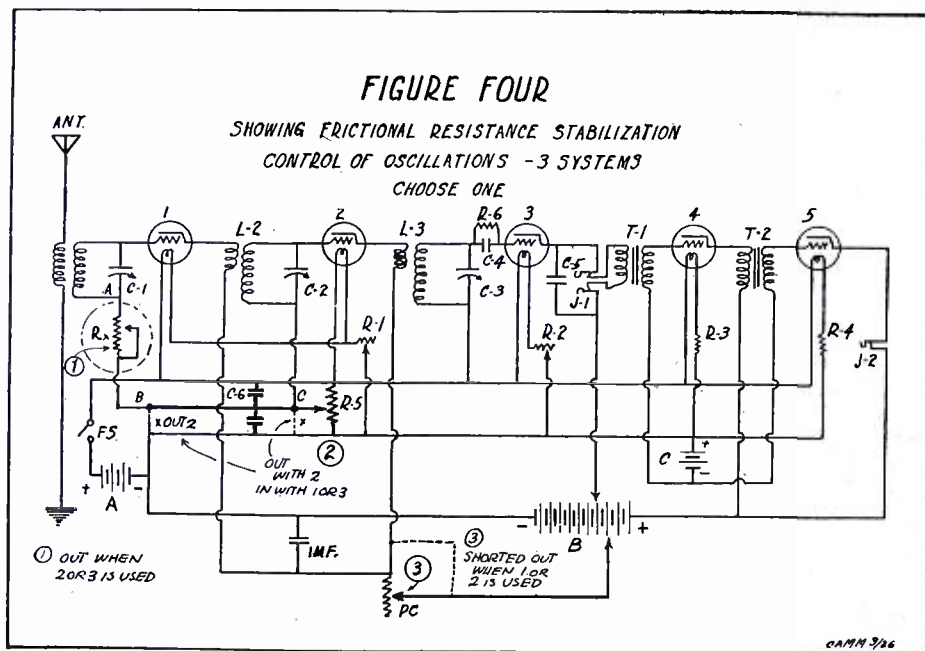
frequencies and it is at those frequencies that the best performance is noted. In several of the new bridge circuits regeneration is supposed to be entirely cancelled out, and so it is theoretically, but in actual practice you will generally find evidence of accidental or incidental regeneration due to radiations not considered in the theory.

Magnetic Coupling

REGENERATION and the tendency toward self-oscillation can be increased by placing the coils in the proper relation to one another so that the magnetic coupling is increased, or by either reducing the negative bias on the grids of the tubes or causing a positive tube bias. With ordinary solenoid type coils the regenerative effect is generally so strong that some means must be found by which regeneration can be reduced to suppress the squealing or sharp critical tube flopping on certain wavelengths. The oscillations can be suppressed in a number of ways and if these methods are made variable then control can be had at all wavelengths.

One of the oldest methods is the potentiometer scheme by which the charge on the grids of the tubes can be made positive or negative at will. With a negative bias the oscillations are reduced or entirely suppressed according to the degree of the potential. This is also known as variable grid "biasing." However, certain mechanical difficulties make the potentiometer an undesirable form of control and other methods have been largely substituted for it. A second method, and a much better method from many standpoints, is to include a variable resistance or rheostat into the grid return line by which the oscillations can be damped down frictionally to the required degree. The size or resistance of the rheostat depends largely upon the circuit constants and may range from 30 to 200 ohms. It is generally placed in the circuit of the first radio frequency stage.

A somewhat similar method of damping down free oscillations, and one that needs no adjustment with varying wavelengths, is the fixed resistance of from 10,000 to 25,000 ohms placed in the plate circuit of the tubes. If placed in the wire from the positive "B" line, the resistance will then be effective for all of the tubes. A small air-core choke coil placed in the plate circuit in the same way is even more effective than the resistance and consists of from 500 to 1,000 turns of fine wire on a small spool. This choke must of course be "aperiodic" so that it will not vary



that when the Neutrodyne is perfectly neutralized so that no regeneration exists it is dead and sluggish. Because of the fixed neutralizing condensers it cannot be absolutely non-regenerative at all

the results on different wavelengths.

Reversed feed-back really produces negative regeneration and may be performed in a number of different ways. (Continued on page 42)

Discussing the **BROADCAST TRANSMITTER** *in Simple Terms* By C. William Rados A. M. I. R. E.

From Microphone to Antenna—How it is Done



EVERYONE knows more or less, but mostly less, about how a broadcast station works. However, a photograph of a studio or operating room does not tell us much about what makes it go. The theory can be found scattered about here and there in text books, in operating experience, in lectures, and in interviews with radio men. But the average amateur or broadcast listener thus never gets the idea logically and in sequence. So the author hopes that this story will cover the broadcasting from before the microphone to your loudspeaker in a logical fashion.

The music or speech which you hear in your home, always starts in front of a microphone. This we may say is the beginning of the whole process. It is well for us to know what this microphone is.

In general appearance it is nothing very radical and is quite similar to your telephone transmitter. Its size is about the size of a small cigar box. The difference however, between the telephone and the "mike" is in the electrical construction. The ordinary microphone used in broadcasting is the carbon granule type. Two others that are being experimented with, are the condenser and the glow type. Another type is the liquid jet type, but this is not very practical. These radio microphones have a low resistance, some only five or ten ohms, and are of fifty to five hundred watts capacity.

Construction and Operation

THE carbon "mike" has a diaphragm which is rigidly stretched. The idea is to keep the metal disk from resonating at an audible frequency. By "resonating" is meant that the vibration back and forth of sound may happen to be the same vibration speed as the natural vibration of the disk. When a tuning fork is struck it oscillates or vibrates at a certain frequency and this

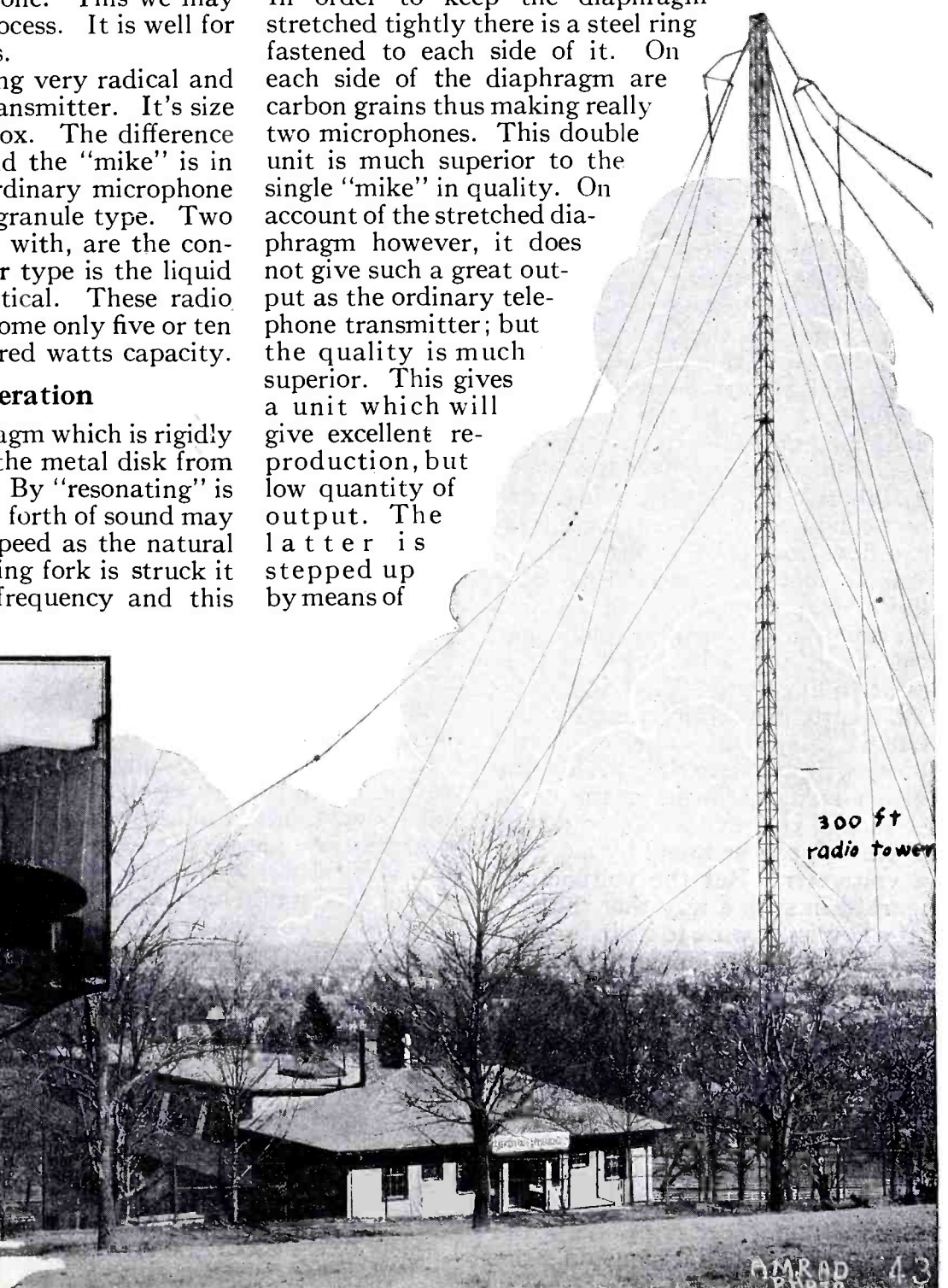
determines the pitch of the tone which it sounds. In the same way, the diaphragm will oscillate or vibrate back and forth at a certain pitch. If the sound in the studio of voice or instrument happens to be the same frequency as that of the metal disk, the amount of vibration will be very large. This of course causes certain notes to come out louder than others. It is very noticeable with ordinary loudspeakers.

All rigid substances have a natural period of vibration of their own. This cannot be eliminated. But we can change the period of vibration by putting tension on the substance. This is what is done with the microphone.

In order to keep the diaphragm stretched tightly there is a steel ring fastened to each side of it. On each side of the diaphragm are carbon grains thus making really two microphones. This double unit is much superior to the single "mike" in quality. On account of the stretched diaphragm however, it does not give such a great output as the ordinary telephone transmitter; but the quality is much superior. This gives a unit which will give excellent reproduction, but low quantity of output. The latter is stepped up by means of



VERY few know what takes place in the process of a radio program's existence between the microphone and the end of the transmitting antenna. This article delves into the mysterious journey from the piano to the aerial. It contains valuable information on vacuum tube theory, and anyone the least bit interested in getting a general idea of how it is done should read the article closely.



AMRAD 43

a carefully designed amplifier. (Fig. 1).

Vacuum Tube Theory

BEFORE explaining the speech amplifier it will be necessary to have fresh in our minds the elements of simple vacuum tube action. So a brief outline of how a tube oscillates and amplifies will first be given.

When a piece of metal, such as a filament, is heated, it throws off electrons or very minute particles of negative electricity. The higher the temperature the more electrons thrown off. These electrons or negative particles of electricity, are attracted by a positively charged electrode or piece of metal. This in a vacuum tube, is furnished by the plate. The positive end of the B battery is connected to the plate. When an electron leaves the filament, it strikes the charged electric field between the electrodes (filament and plate) and moves to the plate. As long as the filament is lighted and the B battery connected, steady flow of electrons occurs. (Fig. 2). As this flow or stream is carried by a conductor, the B battery current can flow from plate to filament.

Note that there are two opposite flows or paths; one, the electron stream from filament to plate, and the other, the B battery flow from plate to filament. That is to say; if the current is flowing from right to left we know that the electrons are flowing from left to right. This condition holds throughout the entire science of electricity. The direction of current can be found by means of a voltmeter. But the voltmeter is marked in such a way that the electron flow is opposite to its indication.

In most discussions of electricity, this condition need not be considered at all, but, when dealing with vacuum tubes it needs to be brought out quite strongly.

How To Control The Flow

When the electron flow has been started as in Fig. 2, it will continue steadily if nothing is done to alter its condition. It may be stopped or regulated by two methods only one of which we will present, however.

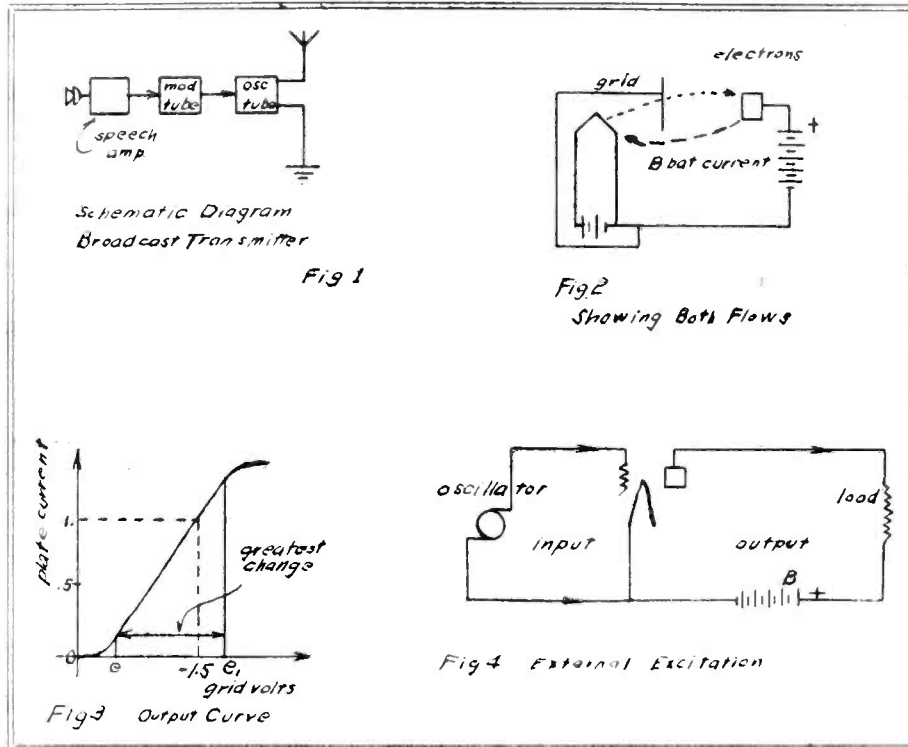
There will be no electron flow if there is no B battery connected to the plate, and there will be a large flow if a large B battery potential is on the plate. Now by placing a third piece of metal between the plate and

E and E_i , we see that a small change in grid voltage cause a large change in plate current. In other words we have amplification. This is the basic property of the vacuum tube.

Why A Tube Oscillates

SUPPOSE we use a set up as in Figure 4 and with one watt input to the grid, we get eight watts output from the plate. We can then feed back one watt from the plate to the grid and do away with the oscillator. We will get eight watts output as before. Do not make the mistake of thinking that we are getting something for nothing. The extra wattage comes from the B battery which is supplying energy to the tube.

Figure 5 shows the self oscillator as it is termed. It can



be seen that once the system is started it will continue to oscillate. To keep up the energy fed back must be in phase with the original input and also the feedback coupling must be great enough to return to the grid a voltage greater than the initial input voltage. If it is less than this, the circuit will amplify but not oscillate. This theory is the same for transmitting and for receiving. So now you know what happens in your tube.

The Grid As A Throttle

This is one of the reasons why negative "C" batteries are connected to the grids of receiving tubes. It reduces the drain on the B battery. Thus the grid acts as a throttle on the electron stream.

In Figure 3 the plate current-grid voltage curve is very easy to read and shows this action very clearly. When the grid pressure is -1.5 volts (the vertical dotted line) the plate current (horizontal line) is $+1.0$ milliampere. These values are for ordinary receiving tubes. Between the

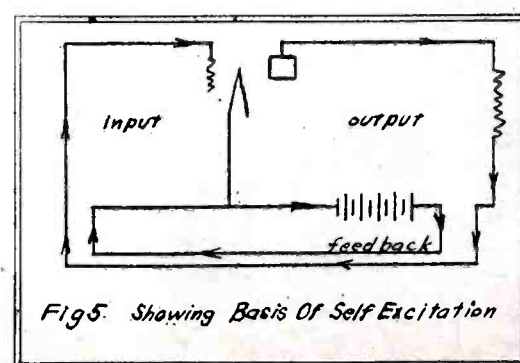
oscillator input and the load output, a B battery is connected to the plate circuit.

To start an oscillatory circuit, simply close switches in the plate and filament circuits of the tube. This is what you do when you start your receiver. Oscillation is possible therefore because of the amplifying properties of the tube. We may have an amplification without oscillation but not oscillation without amplification.

Signals Amplified First

The basis of amplification is that the plate current of the first tube varies the grid voltage of the second tube, and due to the properties of the vacuum tube, not only is the power applied to the grid of the second tube greater, but the voltage variation will be many times as large as in the first tube.

The several amplifiers circuits in use are as follows: Transformer coupled, Push pull, Resistance, Retard condenser, and Resistance condenser. The circuit used in broadcasting is the retard condenser



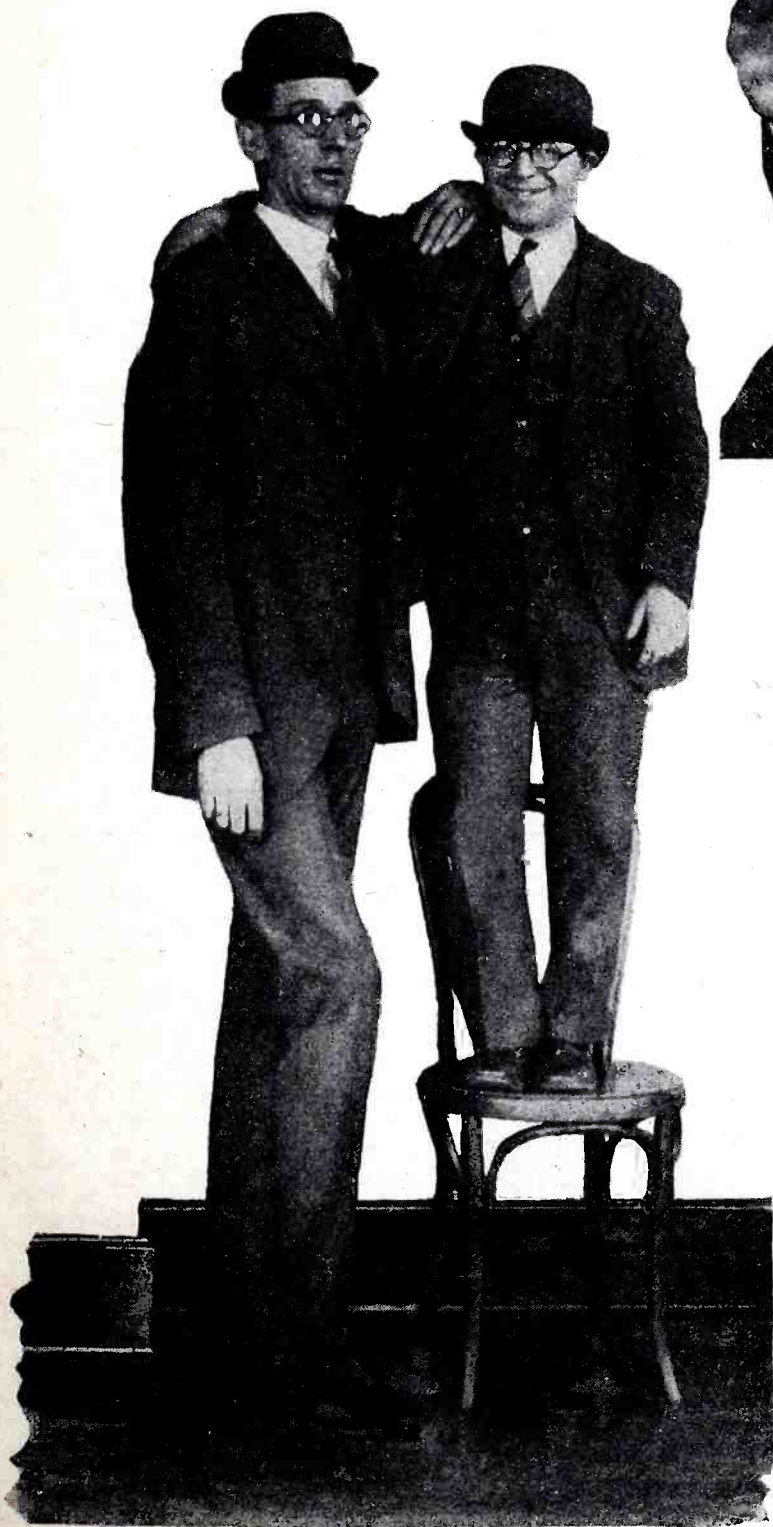
(Continued on page 34)

“IZZY” WOAW’s Comedian
Extraordinary Says

The WORLD is FULL of BLAH

and all the
BOOBS agree

Dizzy Izzy, the Master of Ceremonies of the famous W O A W BLAH club in one of his philosophical moods maintaining the world is full of BLAH and that he is a little prairie flower getting wilder every hour.



*A Little Nonsense Now and Then
Is Relished by the Best of Men*

By JOHN PETERSON

THE world is full of blah but it took Dizzy Izzy, the ingenious radio clown of WOAW, to give it official expression and recognition in the radio world.

Izzy, who is one of the regular announcers on the staff of WOAW, owned and operated by the Woodmen of the World Life Insurance Association at Omaha, Nebr., masquerades under an assortment of titles, which in itself is provocative of a real “blah” feeling. He is the official poet laureate, philosopher, humorist and “what not” of the Station.

For many years he ardently waded through volumes of abstract treatises on philosophy, ethics, teleology, etc. After racking his brain, or as much of it as he possesses that could be called a brain, located in the posterior of his cerebrum, he came to the conclusion that all of this and a lot of other things including income tax reports, actors, vacations, reducing formulas, matrimony and dun letters were simply “blah.” This gave him an idea. One day while taking his customary noon meal, which consisted of “nut sundaes, fricasee of mad March hare, stewed loco weed and the purple berries of the wild asparagus,” he was inspired to create the Blah Club. That afternoon he tried out his idea on the radio audience and it went over with such a bang that the Blah Club has been on the air ever since, every Friday afternoon from four to six.

The last three months, since its conception, it has taken in over 35,000 members, and there are still 25,000 letters of application on file. Each accepted applicant, if male is

Two inmates of the Omaha Psychopathic Institution about to render a selection from WOAW on the Blah Club program. On the left is “The Eiffel Tower of Radio”—on the right none other than “Dizzy Izzy.”

made a "boob," a female is a "boobess," and boys and girls under sixteen years of age are "boobies." Members are deducted into the Blah Club with an elaborate ceremony accompanied by the tintinnabulation of several bovine lavaliers, otherwise known as cow-bells. Each applicant, in order to be accepted into the Blah Club as Boob, Boobess or Boobie, must present a record of disqualifications including height, depth, width, age, criminal record, physical and any other condition of general interest.

Some of the Artists

Among the leading characters, who participate regularly in the Blah Club sessions via radio station, WOAW, is Dizzy Izzy himself, Cy Perkins, Gus, Ole, Fred Jessen, Bill Goodrich, Eddie Stewart and Mac Ohman. All of these principals are residents of Podunk Center, the town from which the Blah Club radiocasts by remote control by means of an ingenious attachment to the barb-wire fence outside of Cy Perkins general store, which includes the Post-office, grocery, barber shop and beauty parlor, drug store and undertaker, restaurant and shine parlor. Cy Perkins himself assists Izzy with the announcing.

The fame of the Blah Club has spread far and wide to such an extent that several of its principal characters have already become professional radio entertainers including Mac Ohman and Eddie Stuart, who are now plugging songs for national music houses. The Blah Club has also included such entertainers as Jack Little and Lew Farris, the Eiffel Tower of radio.

The slogan of the Blah Club is "A little nonsense, now and then, is relished by the wisest men." It is one of the first so-called "nutty clubs" to radiocast, and is the only fun fest that takes the air in the afternoon. Its programs are especially devoted to cheering shut-ins and unfortunates of all kinds; including housewives, who are cooking the evening meal and have nothing else to do; radio dealers, who are trying to demonstrate their sets; etc. The Blah Club is particularly appropriate for the radio dealers inasmuch as interference and static are mistaken as part of the program by the prospective purchaser of the radio set.

Club Afflicted with Bureaus

ANOTHER feature of the Blah Club is the matrimonial bureau, which is devoted to hunting suitable mates for old maids and bachelors.

The animal bureau is particularly solicitous of procuring membership for

the pets of Blah members, and includes dogs, cats, birds, cows, chickens, and elephants.

The following are examples from the many thousands of letters asking for admission to the Blah Club:

Sioux City, Iowa.

Dear Izzie:

In care of the Mycrophone.

I just thought that I would write you a line or two to tell you that I want to be inducted into the mighty Blah Club, which has been going on for so long. I feel that if I were a member I might have more fun. Now I am sure that you will kick that cow good and hard when you see what I have got to say for myself. I am a Church, and not a School House. I cover over 188 square feet and weight 125 pounds to the square inch. I have got a rather high standing and there isn't much in my Belfry. That's the reason why I am so dingey. I have a good many members. I have more than one organ. Now Izzie please don't faint when you read this and fall over against the mycrob foam or Mycha phone or the cow bell. Yes, you can knock the cow, bell, and all, over if you want to. I guess that this is all you want to read so must stop right away off quick.

Your old Radio Fan,

Dwight Church.

Council Bluffs, Iowa.

Pedigree

Izzyl

I am an evolutionist, old enough to grand-father in two places. Eat all I can get but can't sleep on account of listening in, work when I have to. Walk on my hind feet and I am a little lame in the head, otherwise my better half says I am all right. Of course, the County insane board never has had a chance at me as yet.

My profession is just daubing paint around home owners' houses, and if I don't get the job of decorating the famous Blah Club rooms down at Podunk, I'll request my papers of admission returned. Please put this up to the committee.

My criminal career is too terrible to place in black and white. 'Tis painted in streaks of greens and brown and tans in jails and pest houses, and in years gone by, saloons. The trail leads from Iowa to the Gulf and westward to the Rocky Mountains. I have been sober for eight years since the 18th Amendment and this alone should disqualify yours truly.

This is a secret—I wrote poetry and the most of it is too good for the valuable space in the Dailies. Now that I have disclosed this; as a fellow sufferer you should exert an extra effort to secure my nomination. Don't forget my friend wife, give her all the cow-bells, and head the critter east, by north.

Kindly request the Blah Club members to donate that a sufficient sum may be raised to rebuild that depot down in Kansas the woodpeckers knocked down (Way out west in Kansas). This is the only worry I have, having once walked from Cherry-

(Continued on page 38)

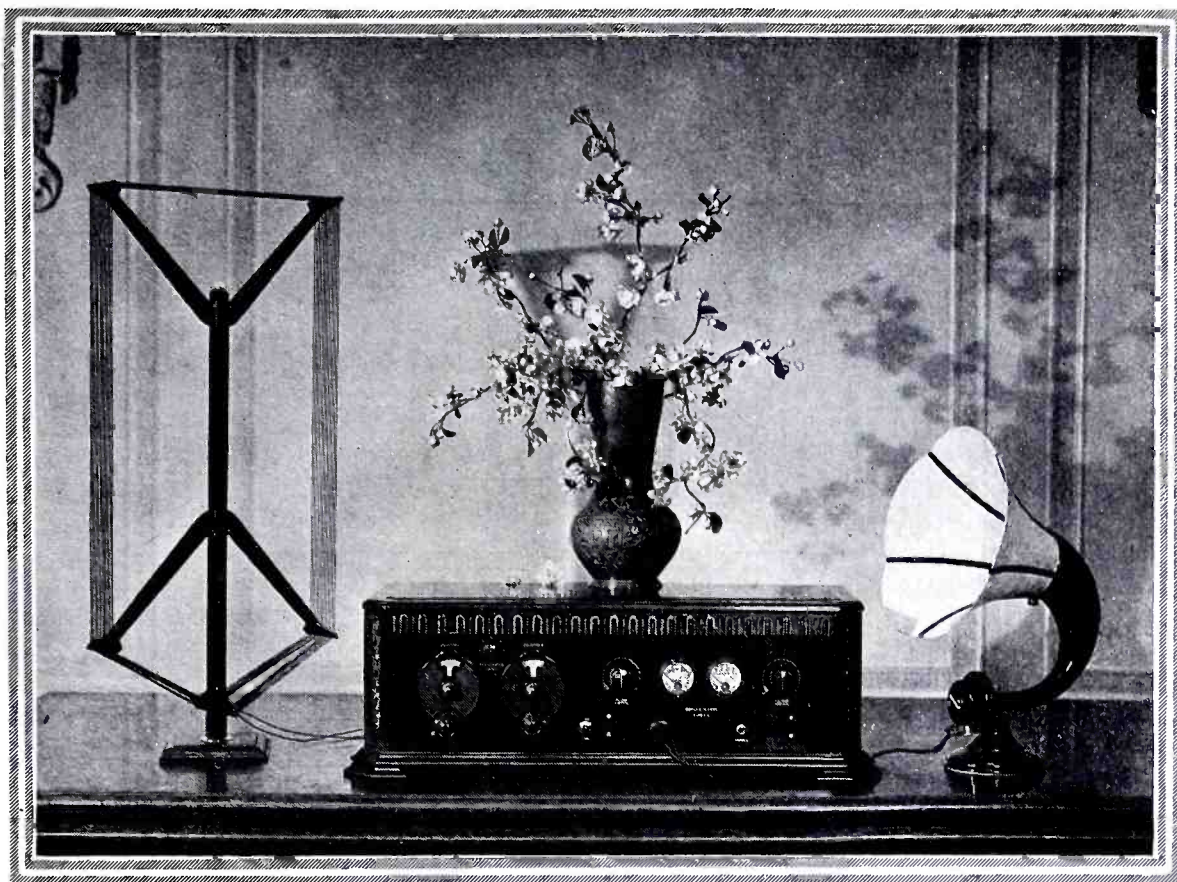


Credit for this unusual radio feature is due Eugene Konecky, Announcer EK of WOAW and a staff member of the station. Here he is, shown in a more serious mood, which we are inclined to believe was affected for publication purposes.



A RARE COLLECTION OF SQUIRREL FOOD

We recently read a report in a local newspaper that the squirrels were swimming rivers and lakes westbound for Nebraska. We thoroughly understand the reason after looking over this choice assortment of nuts who comprise the programs of the WOAW Blah Club proceedings. Top row left to right: Berry J. Sisk, Composer of the official American Legion march "Armistice Day Forever" (he plays piano with his knuckles) Fred Jessen, Sid Jolson, Gus Swanson. Seated: "Ole" otherwise known as announcer L. P. and composer of the popular song "Truly I Do." Louise Race, pianist, and by golly Izzy himself.



An exceptional example of the "better radio" tendency of the industry. This Ajax Loop, Scott World's Record Super 9 and Burns Loudspeaker is an excellent assembly of modern apparatus.

The Quest for the IDEAL RECEIVER

*Radio's Present Experimental Trend Promises
The Long Sought Perfect Radio*

By Felix Anderson

THE tendency of the radio profession, ever since its inception as one of our countries leading activities has been one of experimentation and invention with the object of producing a radio receiver that justifies the title of ideal. The large laboratories maintained by the big corporations, the thousands of smaller experimental installations, the 30,000 amateur stations, and last but not least, the several hundred thousand broadcast enthusiasts who endlessly tinker with circuits and equipment with the hope of developing the "ideal" receiver are ample evidence of this experimental nature of radio.

The past four years of broadcast listening have illustrated rather lucidly that our radio receivers are far from the much desired perfect state. Practically every receiver, and the exceptions are few, embody some limitation or other demanding experimentation and research with the object of overcoming such individual faults. In the sales department of radio, especially in advertising, copywriters have resorted to extremes in describing radio equipment. Sad to say, the radio industry is suffering expected lack of confidence on the part of the average citizen, chiefly because advertisements incorporate too much of the superlative quality. Radio fans have begun to discount radio advertising proclaiming "revolutionary circuits" affording "knife-like selectivity," consistent long distance reception, unparalleled tonal qualities and permanent satisfaction. In a way we can't blame them. Our sets regardless of the fact that they are mighty efficient, are not "perfect." They do have

limitations and peculiarities that are hard to explain. But in no event, should we hide the defects by misrepresentation.

Before you read further, abandon the feeling that the writer is a Doubting Thomas. On the contrary, he is thoroughly sold on the possibilities and value of radio. Neither is the knocking attitude implied, for there are certainly many excellent radios now available. The object is to humble some of the extravagant claims of radio enthusiasts and engineers before disillusionment takes place, and before radio is hurt in the impending crash. We are all looking for the IDEAL radio set—not only you, but the writer as well.

What is the Ideal Radio?

It is interesting to enumerate just what the ideal radio set should comprise. Space forbids going into the minute details of the problem, since we have something interesting to relate in connection with this search for the ideal set. But briefly, suppose we jot down some general requirements that may be used as a basis of discussion; general specifications garnered from the average tastes of the citizen enthusiast.

The average citizen of today is somewhat musically inclined, that is to say, he understands the rudiments of good and poor music, and that he enjoys the ability to distinguish between noise and music. Therefore our ideal radio must reproduce music and selections faithfully. It must incorporate *TONAL QUALITY* to be pleasant to listen to, and if a radio set is to be successful in its purpose, above all things, it must

be pleasant to listen to.

SELECTIVITY is our second consideration, necessitated by the abundance of broadcasting stations. The ideal receiver must be capable of separating stations with great precision, so that Mr. Fiddleeski's violin obligato will not be accompanied by a stock market report on pigs.

Of equal and contingent importance is **SENSITIVITY**, which enables the operator to diversify the product of his loudspeaker or telephones. If a set is both selective and sensitive the operator can at will change from one program to another, and if the selections broadcast from stations in his immediate vicinity are too saturated with local color, which becomes boring, he can exercise the alternative of seeking entertainment from transmitters at widely divergent points, with corresponding dissimilarity in character of renditions. Under the sensitivity requirement we must not forget that distance lends enchantment, and that today the popular charm of radio lies in the thrill of annihilating distance. There is always a sense of satisfaction (at least to the average fan) in being able to report receptions of stations several thousand miles away, regardless of how rotten the selections were recorded. Witness the Trans-Atlantic tests in February as substantiation of this contention.

Complicating the Problem

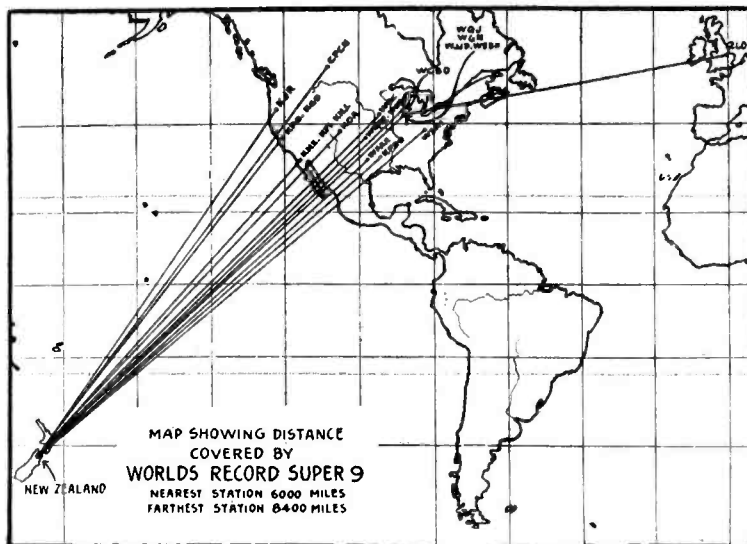
WITH our last and possibly major requirement we come to the "nigger in the woodpile." Primarily, we demand that the ideal radio set afford *tonal quality, selectivity and sensitivity*, and then we complicate the entire business by demanding that it be *practical*. This has been the most imposing impediment in the progress of the radio art, and many grey hairs have been manufactured in the process of solution, which apparently is not yet at hand. A set must be easy to operate by one who has little or no knowledge of radio theory and practice. It must be practical in the sense of dollars and cents, that is, it must be within the reach of the average citizen's purse. It must be economical to operate, and the owner must have at least reasonable assurance that his installation will not be rendered old-fashioned by radio of tomorrow.

In the course of our quest for the ideal receiver, we have come into contact with various types of radio equipment and receiving systems, all of which claim the desirable characteristics of tonal quality, selectivity, sensitivity and practicability. Some of the numerous exhibitions have been gratifying in that the equipment measured up to the requirements of the ideal receiver to a flattering extent. There are several types of radios that have won over the confidence of the writer in the course of these demonstrations and the writer has in mind a particular case that he takes pleasure in recounting, in evidence of his part in the search for the "perfect radio set."

Mr. E. H. Scott of the Scott Radio Laboratories, Chicago, Illinois, a radio engineer of considerable fame is an interesting example of this experimental trend of radio. His chief work in radio is that of maintaining

a large radio laboratory where experiments are conducted with the object of supplying data for articles written for the SNL Newspaper Syndicate, of which Mr. Scott is the head. In the course of his experiments Mr. Scott has been necessitated to test up practically every circuit of popular calibre, in order that he be able to intelligently disseminate news incidental to their construction and operation. This testing work, contemporaneous with the fact that Mr. Scott desired to visit his home in New Zealand and that he wished to include an efficient radio set in his personal equipment led to some interesting research and accomplishments with

the set now known as the World's Record Super 9. In our interview with Mr. Scott, we found him to be an unaffected, unpretentious gentleman of about thirty-five, with a decided continental English accent in his speech. Casual questioning afforded the knowledge that he was born in New Zealand, coming to the United States directly after the war, in which he took part, serving with the Australian forces. His early work was in electricity, particularly in automobile electrical equipment, which forms the basis of his early research in radio. His narration of how his set which he calls the Scott World's Record Super

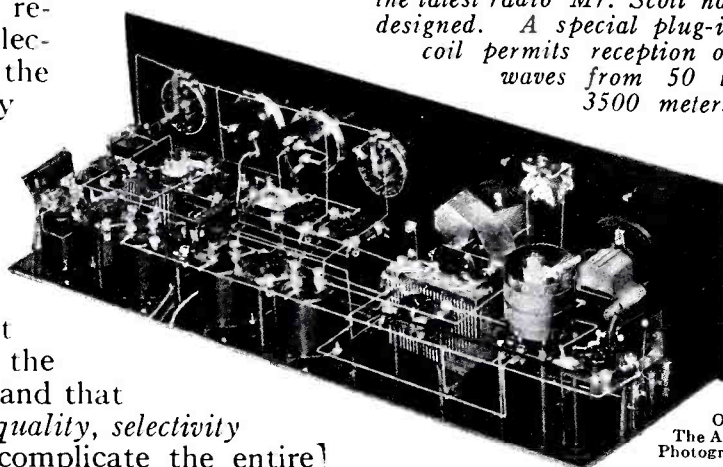


Consistent long distance reception is one of the big requirements of the ideal receiver. Here's an example of what the receiver developed by E. H. Scott did. Some DX!

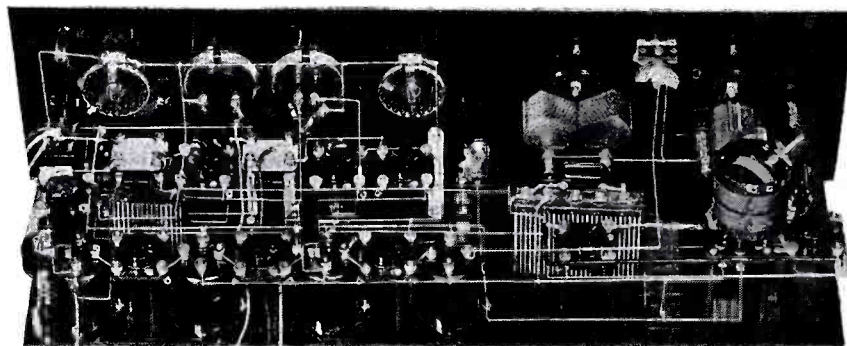
engineer of considerable fame is an interesting example of this experimental trend of radio. His chief work in radio is that of maintaining

a large radio laboratory where experiments are conducted with the object of supplying data for articles written for the SNL Newspaper Syndicate, of which Mr. Scott is the head. In the course of his experiments

This is the laboratory model of the latest radio Mr. Scott has designed. A special plug-in coil permits reception on waves from 50 to 3500 meters.



On The Air Photograph



(On the Air Photograph)

Compactness and efficiency is the secret of the success of this receiver. The choice of parts is unquestionable, and the arrangement is the best we have seen for a long time. Battery connections are made with a Belden Battery Cable which our photographer unfortunately cut off.

Nine was developed is best told in his own words. "Last summer I decided that a visit back home was about due, as I had not had a real vacation for about four years. For the majority of people, this is a simple thing to arrange, but for me it meant traveling continuously for about a month, covering over 8,000 miles by land and sea, as my home is in New Zealand.

"I wanted to take with me, a radio receiver capable of tuning in stations in the United States, and being acquainted with the distance, I could thoroughly appreciate that it would have to be a mighty sensitive and selective type. Fortunately I am in a rather enviable position to know the ability of the various circuits that have been developed during the last three years, chiefly because my work in furnishing newspaper articles on radio requires me to test out, the simplest crystal to the most complicated super-heterodyne.

"I knew that my receiver would require radio frequency amplification in its most efficient form to cover the tremendous distances involved, and accordingly I set out to experiment with transformers, inductances and systems both of manufactured and home-wound design. I spent from July till October at checking and testing with the object of finding the most efficient devices.

"Early in October these tests neared completion, and the final tests were rewarded with the reception of 2LO, London during the Trans-Atlantic tests. The London station came with sufficient audibility to be put on a loudspeaker, and I was so elated with the results that I called the Chicago Herald and Examiner radio staff on the phone, and had them verify the reception by direct witness having them hear 2LO over the local telephone. I was awarded their certificate of Trans-Atlantic reception in recognition of the accomplishment.

"Before leaving Chicago for New Zealand, I arranged with the directors of stations WGN and WQJ, and also with WFAA at Dallas to transmit special test programs

between the hours of 1 and 4 a. m. It is a notable pleasure to be able to say that every program was tuned in, and items were recorded and reported, proving and verifying the receptions. Furthermore, you will agree that a set must be a REAL receiver to afford consistent reception over distances as great as 8,300 miles—from Chicago to New Zealand."

Mr. Scott's results were so phenomenal that he was inclined to believe that he had a "freak" receiver. To see whether this was the case or not, Mr. Scott cabled to Chicago for a duplicate set of parts used in the receiver. These were built up into the circuit, and it performed precisely in the same manner as the original. This set was left behind in charge of a brother-in-law, Mr. Tucker."

When Scott returned to the States, he stopped off in Los Angeles to make a personal check of the records and logs of the stations heard. There was much doubt in the mind of Mr. Rogers, director of station KNX, who was inclined to be credulous about the reception of his 500 watt station at so great a distance. Accordingly, a test program was arranged. Mr. Tucker was cabled requesting that he try to tune in KNX at a specified time, and to acknowledge reception by cable if he got it. The morning after the test program was run off, a cable was received from Mr. Tucker reporting KNX and in due course of the mails, complete logs were received proving beyond all doubt that it was not "freak" reception.



Mr. E. H. Scott at the panel of the original model which has given such unusual results. This photo was taken in New Zealand at the time of his record breaking DX receptions.

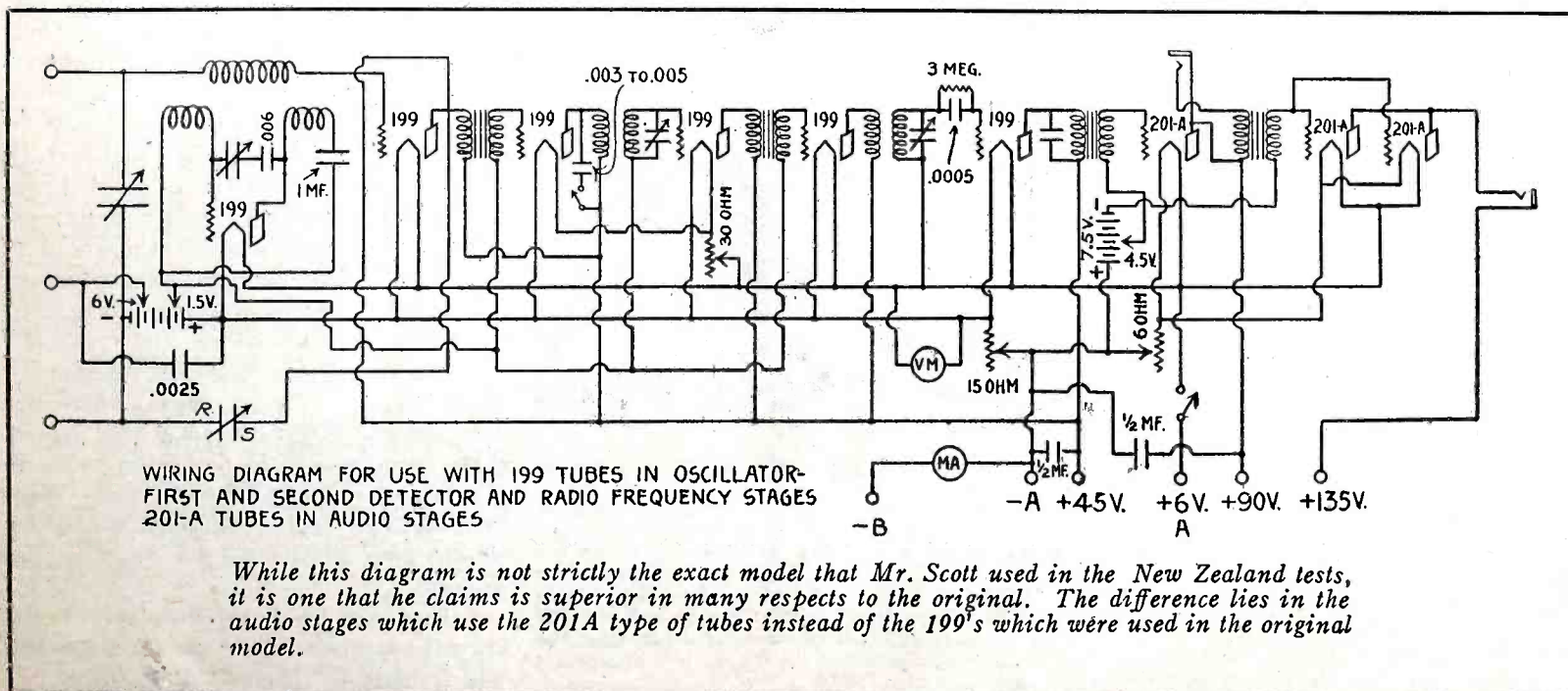
(Courtesy Scott Radio Laboratories)

Checking Over the Log

MR. SCOTT'S log is a rather detailed one, and rather lengthy for publication purposes, and an analysis of reception is probably more interesting than actual records. In checking up on the consistency of reception it was found that the stations came in as follows, the numbers after the call letters indicating the number of different nights the station listed was heard.

KGO 48, KNX 20, CFCN 10, KOA 8, KHJ 7,

(Continued on page 29)



ON THE AIRIALS

ITEMS OF GENERAL RADIO INTEREST

Handpicked by Ray D. O'Nutt



5,000,000 Radios!

The radio audience in the United States at the opening of 1926 totals 20,000,000, a survey just completed by Radio Retailing shows. The number of receivers in use is calculated at 5,000,000. The total retail value of all radio equipment sold during 1925 is estimated at \$450,000,000. Sales were divided as follows: Complete sets, \$180,000,000; accessories and replacements, including "A," "B," and "C" batteries \$200,000,000, and parts, \$70,000,000. Battery sales in the radio industry in 1925 were divided as follows: "A," "B," and "C," \$75,000,000, and storage, \$18,000,000.

Sales of complete radio sets in 1925 totaled 2,000,000; loudspeakers, 2,000,000; headsets, 900,000, and vacuum tubes, 20,000,000.

The inventory of the industry indicates that there are 2,000 radio manufacturers in the country, 1,000 radio jobbers and 31,000 radio retailers.

It is estimated that there are 650,000 radio sets now in use on farms.

More and Better Announcements

It is not alone in the United States that announcers fail to repeat the station's call letters frequently enough to please all fans; especially those at some distance from the station who seek to determine its identity; British fans are also complaining that the announcers are careless and do not give the station calls often enough; they want the call after each and every item on the program.

Down on the Farm

Heavy mail receipts from agricultural areas of the Middle West and Rocky Mountain territory show conclusively, it is said, that farmers are attaching more importance and dependence than ever to radio.

Hundreds of testimonials to KOA, General Electric broadcasting station reveal, it is pointed out, that greater profits said to be due to radio, are frequently made possible because market and livestock reports are heard sufficiently in advance of price increases. Letters also indicate that weather forecasts and warnings are proving of material assistance to cattlemen and ranchers.

Of striking interest in rural districts,

is the question box for farmers which is billed at the Denver broadcasting station every Tuesday evening. This ethereal attraction, it is said, is the means of disseminating technical information concerning crops, gardening, poultry, stock-raising and kindred agricultural topics. It is conducted by George C. Wheeler, managing editor of Western Farm Life.

KFNF Writes Us—

"We have received 225,788 telegrams, easily a world's record. This represents the response to our Anniversary Program featuring Old Time Music with: Fiddler's Contest—126 Fiddlers played; Accordion Contest—43 Accordion Players; Harmonica Contest—36 Harmonica Players; Quartette Contest—15 Male Quartettes—and the usual Seed House Talent.

"Letters and post cards have been

coming in at the rate of 35,000 a day with no idea of that total. Telegraph offices all through the country were swamped, although no telegrams were accepted at the telegraph offices after noon of Wednesday, Feb. 24, they came in until late Thursday night. Thousands of railroad telegraph operators transmitted more messages to KFNF than they handle in a year or more."

Many telegraph operators drove in with their messages rather than wait for a wire and spend all night and another day transmitting them. Some operators drove as far as 90 miles from Shenandoah. Other operators sent them by express.

Whole towns joined the mad rush to congratulate KFNF. Witness a few cases that are typical of how towns responded: Mound City, Mo., with a population of about 1,300, sent over 1,500 telegrams. Yorktown, Iowa, with a population of about 300, sent in over 500 telegrams. So, it was all over Iowa, Nebraska, Kansas, Missouri, Illinois.

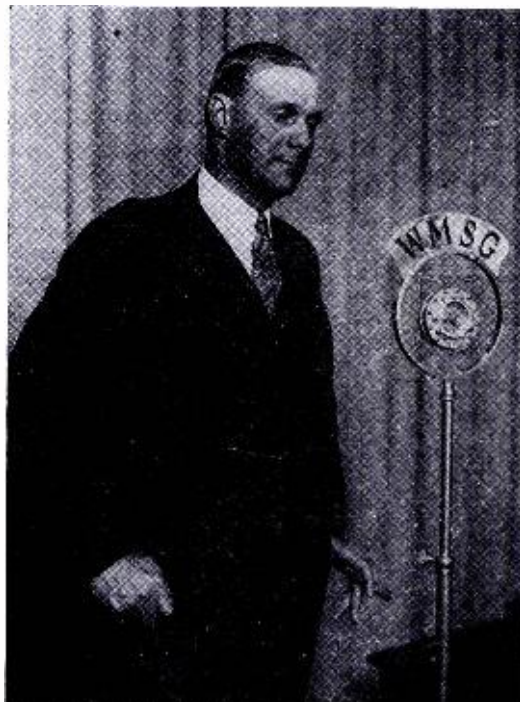
Messages varied from poetry and tomfoolishness about the party to heartfelt and beautiful thoughts directed to Henry Field, owner of KFNF.

Those Crystal Loud-Speakers

I have received a number of letters from listeners who claim to be able to work a loud-speaker from a crystal set. This speaks well for the efficiency of their sets, but it is a quite well-known phenomenon.

Most listeners who receive signals in the ear-phones at really satisfactory strength will find that a good loud-speaker will respond to these signals, and can be distinctly heard if the room is quiet and the listener sits near-by. Satisfactory ear-phone strength is usually accepted as meaning that the transmission can be heard, though not necessarily distinctly, in a quiet room when the ear-phones are several feet away. Under these conditions the addition of one amplifying valve will give quite good loud-speaker results; whereas two valves should give all the volume that can be desired.

I have yet to hear, however, direct crystal reception on a loud-speaker which could be termed "comfortable."



Tex Rickard, impresario of Madison Square Garden, N. Y., sets at rest for all time the stories of his antagonism to radio broadcasting of events in which he is interested, by the erection at the new Garden of a complete broadcasting studio and transmitting station. The station, with call letters "WMSG," will go on the air not later than March 22, on a wave length of 212.6 meters and with 500 watts of power. All manner of sporting, civic and social events staged at the Garden will be sent out on the air thru "WMSG."

The ABANDONED CRYSTAL

By M. L. HARTMAN¹ and JOHN R. MEAGHER²

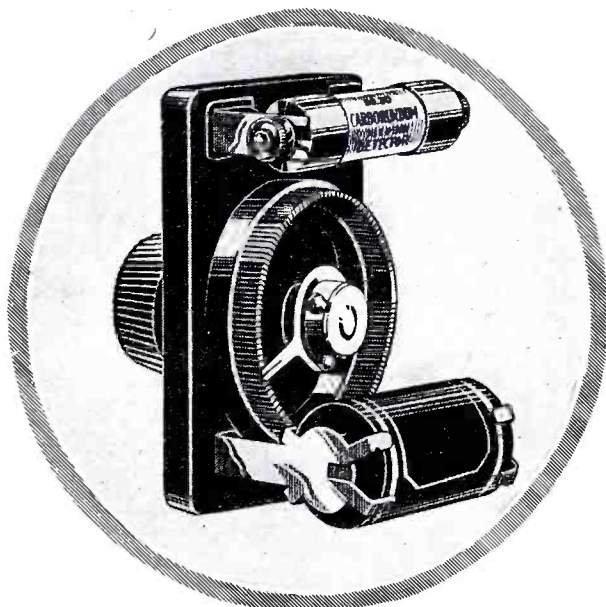
An Efficient Single Control 200 Mile DX Crystal Radio

MANY readers will be surprised to learn that a simple crystal set has given a fairly consistent nightly range of more than 200 miles. Yet this is not unusual; it is just the average performance of a well-designed crystal set and has been done repeatedly this and the latter part of last winter. From our location in Niagara Falls, New York, with an aerial and location no better than the usual, we have regularly listened to Pittsburgh, 200 miles, to Springfield, 325 miles, to Schenectady, 250 miles and to Chicago, 450 miles.

This record may seem out of the ordinary and indeed we ourselves were surprised at first. But the manner in which the first set and others of the same type, used on our own and other people's aeri-als operates, has convinced us that the feat may be duplicated at will.

Of course, there is a reason for this efficiency. It is owing almost entirely to the design of the circuit which incorporates the best "low loss" ideas. Incidentally the low loss plan, because of the absence of resistance-nullifying regeneration, is of far greater benefit in crystal than tube sets.

The splendid range of this circuit and the admittedly fine reproducing qualities of crystal detectors makes this set really remarkable considering its extreme simplicity and low cost. As far as distinctness and clearness of tone is concerned, this, and in fact any well-planned crystal set, is far superior to vacuum tube outfits due to the peculiar rectifying properties.



Everyone knows that a crystal gives unparalleled tone and is simple to operate. These simple instructions warrant fishing the old mineral out of the junk box and giving it another chance

Electrically Biased Detector Avails Sharp Tuning and Tone

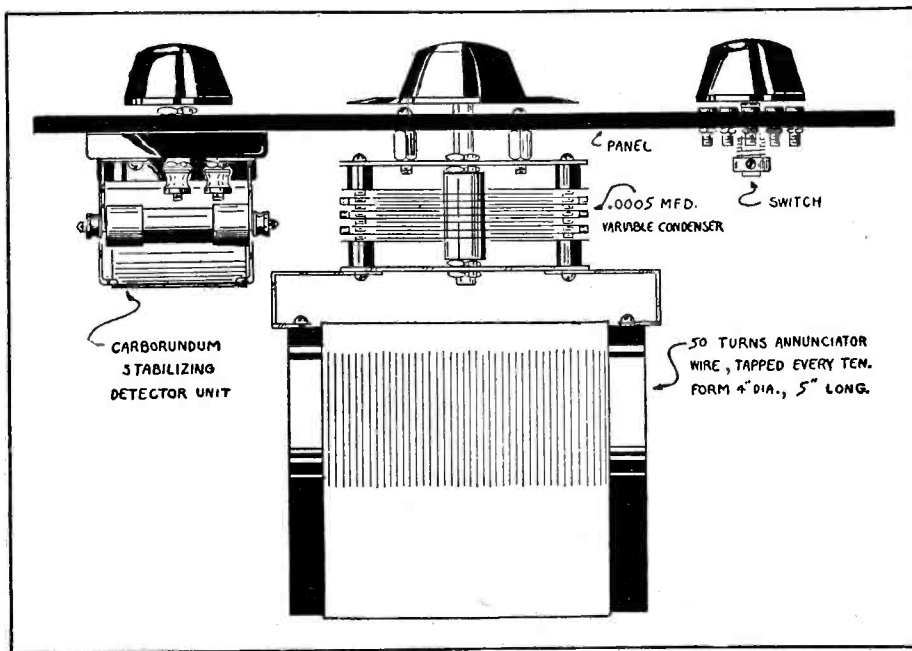
The design of this set is far from being the result of a lucky accident; rather it is the product of considerable research and experimentation. For in the early part of this year, in order to find the particular circuit and arrangement of parts for a crystal set giving the very best results, we spent considerable time comparing the relative merits of various forms of circuits, of different coils, of combinations of coils and condensers and of numerous variometers. The arrangement finally evolved is as efficient as

can be made. It does not sacrifice volume for selectivity nor selectivity for volume, but combines and pleasingly retains the best features of both.

Briefly, the circuit is of the adjustable auto-coupled or conductive type. The inductance is fixed and tuning is accomplished with a variable capacity. Tests have shown this circuit to be fully as selective as any and far more sensitive than the majority.

The connections are shown in Fig. 3. The fixed value inductance—it has no "dead end" turns—is very easily made, consisting of fifty

wire wound in a single layer, turns side by side, on a cardboard, rubber or bakelite form 4" in diameter and 5" long. An empty oatmeal container makes as good a form as any. One foot leads should be left at each end of the coil for connections to the circuit. Annunciator wire (number 18 double cotton covered, paraffine coated, copper) may be bought in any radio or electrical supply store; it is admirably suited for the purpose and should be used. There is nothing mysterious about this coil and while it is not as imposing



The circle above is an illustration of the new electrically biased Carborundum Crystal of the Carborundum Company of Niagara Falls, N. Y. The potentiometer control together with the small flashlight battery permits variance of its impedance for the best tone in the headphones. The lower cut is the top panel view of the set showing the assembly details.

¹Research Director. ²Radio Research Engineer.
The Carborundum Company, Niagara Falls, N. Y.

as spider-web and basket wound inductances, our tests have shown it to be better.

Taps are made to the coil at every tenth turn. One of the best and easiest methods of doing this is to insert a blunt point under a spot on each turn that is to be tapped and raising this spot slightly above neighboring turns. The raised portion may then readily be scraped of its insulation and the lead soldered to the exposed wire. There are six leads in all from the coil, one at each end and the four taps at the 10th, 20th, 30th and 40th turns respectively.

If the wire is wound tightly there will be no necessity for coating with some binding substance. However, if the turns are loose it is well to apply a coat of collodion, a few ounces of which may be purchased in any drug store. This should be done after the leads are soldered in place.

The variable condenser should be approximately .00025 mfd. Maximum capacity. This value is generally found in the 11 and 13-plate types. If purchasing this item, it would be well to specify a straight-line frequency (S. L. F.) type merely to keep abreast of the general popular trend. Actually any other style may be used with equally good results. The condenser should be well made mechanically and electrically. Price is not always a reliable indication of condenser worth. We have seen and used perfectly good S. L. F. "low loss" condensers costing one dollar.

The Detector

THE detector may be of any type, though for best results its impedance or internal character should suit the impedance of the particular headset being used. It should also bear a certain relation (rather difficult of exact specification) to the input impedance. These conditions can best be met through use of the electrically controlled Carborundum permanent detector. With

this detector the impedance may be regulated to match any conditions. Being electrical the control is positive and the design affords smooth adjustment accurate to less than one-

an equally wide selectivity range. This works out in such a way that stations spreading, say, ten degrees over the tuning dial with an ordinary detector, may be restricted to two or three degrees through proper adjustment of the electrically controlled Carborundum detector unit. This is a particularly valuable feature in crowded radio districts.

The coil, the condenser and the detector unit are the main items. They, together with the panel, bus wire, binding posts and inductance switch should be collected before starting actual assembly.

The parts may be mounted on a 7"x-15" radio panel or they may be fastened to a plain shallaced wood base in laboratory fashion. The switch points should be placed close to the coil in order that the tap leads may be as short as possible. A ready made "back of panel" inductance switch may be used as it eliminates considerable work.

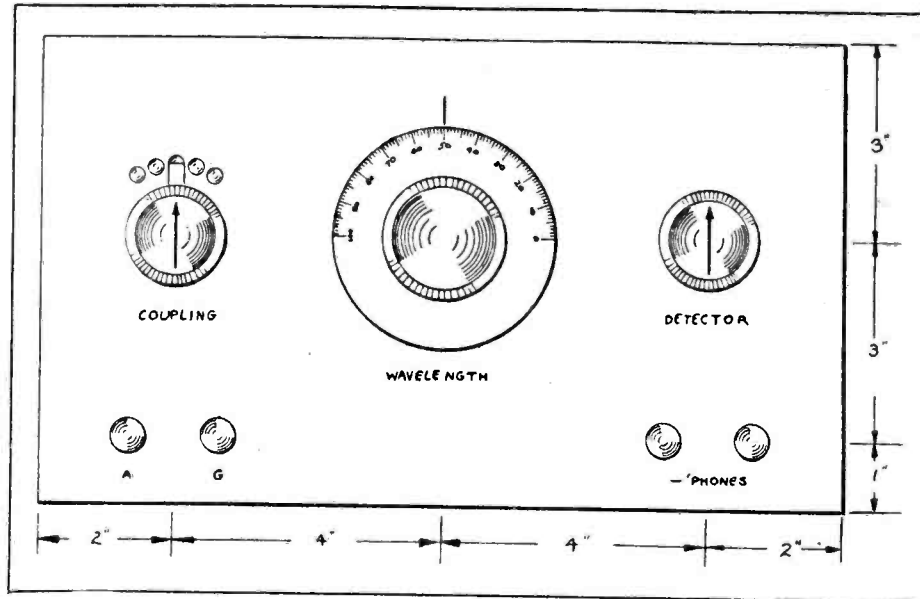
The circuit may be connected with bus-bar or annunciator wire. All connections should of course be tight and preferably soldered.

Operation

The aerial design preferred by the writer is as follows: Single wire, number 12 or 14, solid copper, enamel insulated, erected in a straight line as high above surrounding objects as conveniently possible and having a total length including the lead to the set of not less than 100 feet and not much more than 250 feet. Insulators should be used at all points of suspension.

The ground lead may be of the same wire as the aerial. It should be well connected to a water pipe system or some other grounded metallic structure.

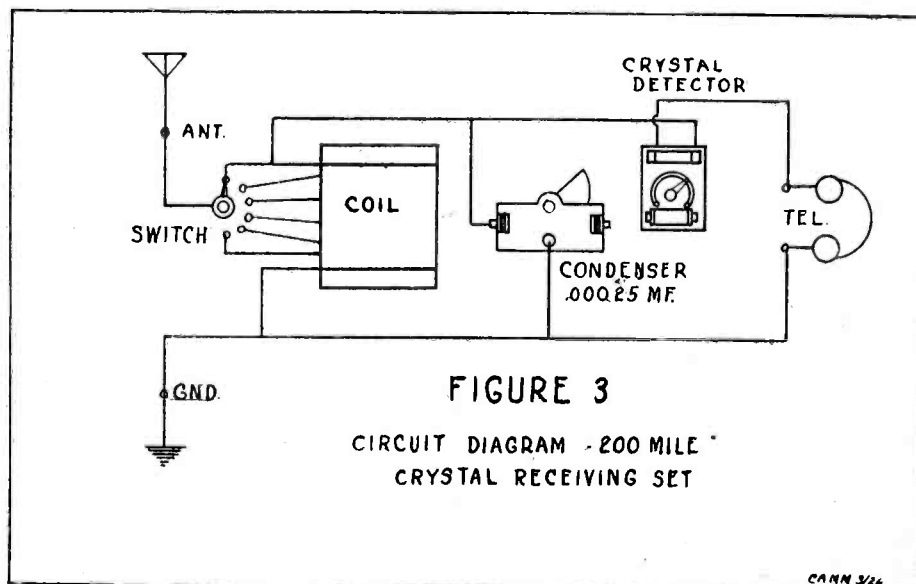
Tuning is so simple that it would be a waste of time to give elaborate instructions. The switch and condenser control the wavelength while the knob of the detector functions as a selectivity and volume adjustment.



The panel layout of this little efficient crystal set is simple and symmetrical. The knob at the left controls the degree of selectivity, the dial is the station selector and the knob marked detector regulates both selectivity and tone.

thousandth of a volt. This is accomplished in the unit with a high resistance neutral-point potentiometer having a positive and negative voltage range. A mica insulated shunting condenser is built in the base of the unit which, as can be noted from the drawings, is a single control, single hole mounting device.

Only a few connections to make on this 200 Mile DX Crystal Receiver. With the new super-power stations it is a cinch to get long distance.



Another point in favor of the electrically controlled detector is that the damping effect of the detector on the tuned circuit may be regulated through a wide range—resulting in



The
Radio Bug's
GIRL

She's the kind of a girl that makes single men sigh and married men wish they were single. Her name is Ruth Allanson, and she sings soprano on Thursdays between 8 and 9 in the evening from KYW, Chicago. This lovely girl is subject to the rapt admiration of thousands of radio fans in the middle west who have heard her charming voice.

Radio Invades MOVIELAND

And HOLLYWOOD Starts to Broadcast

Picture People Do Things Well This Story Proves

By C. Clyde Cook

RECENTLY an innovation in broadcasting was instituted at the Forum Theatre, Los Angeles, California, when the management under John P. Goring, Managing Director, and Richard Mitchell, Publicity Director, conceived the novel idea of broadcasting their regular program over a Portable Radio Broadcasting Station to the Warner Brothers Motion Picture Studio, where the identical program was picked up and rebroadcast for the thousands of listeners-in of the KFWB Warner Brothers Studios Station.

In conjunction with the showing of the motion picture, "BELOW THE LINE," featuring Rin Tin Tin, this famous moving picture dog made a personal appearance with its master, Mr. Lee Duncan, and the entire performance was broadcast and re-broadcast for the benefit of thousands throughout the land who could not personally attend this novel test. And it was a test, for it was the first time in the history of radio that such a performance was attempted and, although the results at first were not so successful, after the first performances, letters started coming in to the Broadcasting Station praising the quality of the program as well as the transmission.

The instrumentality which made this innovation possible is the Portable Radio Broadcasting Station of the Warner Brothers Motion Picture Studio, the largest of its kind ever built, and which the Department of Commerce has caused call letters to be issued for as Station

6XBR on 108 meters, with 250 watts of power. The simplicity of construction and the expedition with which the station can be set up are only a few of the novel features of this remarkable invention.

To Mr. Frank N. Murphy, Chief Electrical Engineer of the Warner Brothers Studio, go all honors for this wonderful invention. After years of constant application he has at last achieved a Portable Broadcasting Station that is entirely successful in every detail and has established an epoch in radio history by the remarkable transmission at the Forum Theatre. In addition to this initial test, Mr. Murphy has operated the station under all conditions, and in every respect it has proven the efficacy of portable broadcasting stations.

The Murphy apparatus is mounted on a Moreland Motor Coach, twenty-two feet in length behind the dash, and affords sufficient room for the four panels and the transmitter. The antenna system consists of two collapsible towers which fold down against the top of the truck; when they are extended they reach forty-five feet at the high end and twenty-five feet at the low end. From these towers the wires are brought down in a fan and fastened to the lead in insulator. The counterpoise runs around the top edge of the truck while the transmitter, of 250 watt power uses coupled Hartley circuit. The antenna circuit is well protected against swaying or jars in order to steady the wave. A tuned grid and plate circuit was originally used but after due consideration, was replaced by the

Some of the entertainers of station KFWB, Hollywood. Standing left to right: Verna Kloess, concert pianist; Frank Stever, baritone; Margaret Lancaster, mezzo-soprano; Billie Dun, studio accompanist; Bill Blake, lyric tenor; Charlie Wellman, announcer; Don Wilson, pianist; June Purcell, radio's sweetheart; Ben McGlashan and Lee Kent with her tarapache. Seated: Charles Beauchamp, tenor; LeRoy Kulberg, Ray Kellogg, and Wilbur (Bill) Hatch, pianist.



Don't be afraid Patsy—it won't bite you. Louise Frazenda is goading Patsy Ruth Miller on with her radio talk from KFWB, the Warner Brothers station at Hollywood. Patsy doesn't seem to be having the least bit of a good time—notice the painful expression—you can nearly hear her knees knock as she reluctantly minces up to the "mike".



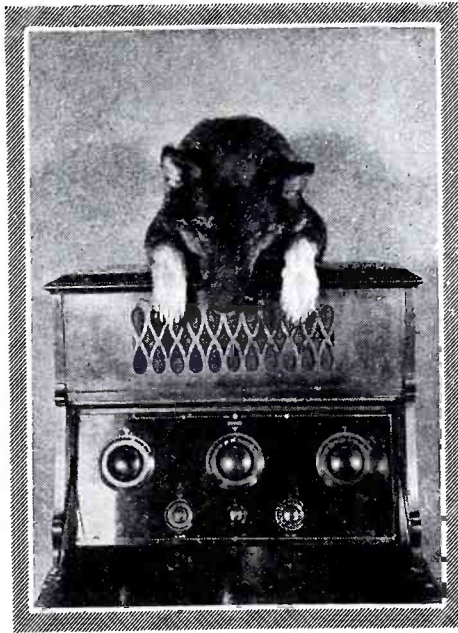
Hartley circuit which, properly adjusted, gives better results.

Constant current system of modulation is used with great success, a fifty watt tube acting as speech amplifier for the 250 watt modulator. The speech amplifier is coupled to the modulator by the use of special transformers insuring the best of quality in transmission. This amplification is very much like ordinary transformer coupled audio, with the exception that the transformers are constructed to carry 1500 volts and the added volume of voice which is required to modulate a 250 watt power tube.

The input panel uses two stages of power amplification, while a third stage is provided for use when needed, these stages being impedance coupled in order to give better and clearer amplification. The input panel delivers about ten watts of energy to the fifty watt speech amplifier, a 500,000 ohm potentiometer controlling the volume of the input. The jack and plug arrangement is employed in all circuits to test currents, while two microphones may be used at times, a switch for changing from one to the other.

A separate panel controls the power from the huge generators. On this are mounted switches for the purpose of changing from one generator to the other or throwing the two in parallel. Also on this same panel there are two volt meters, one for each generator, enabling the operator to read the output of the generators separately, necessary when running them in parallel.

Controlling the entire power supply, there is a fourth panel with switches for the six volt tubes used on the amplifier panels, and also the plate supply for same. The current for the generators and the filament voltage for the 250 watters are also controlled on the fourth panel. Ample provision has been made for charging the batteries at their different voltages.



Rin-Tin-Tin, with characteristic canine inquisitiveness is investigating the source of his master's voice coming over the radio from 6XBR and KFWB. Moviegoers are well acquainted with the unusual intelligence that this wonder dog exhibits.

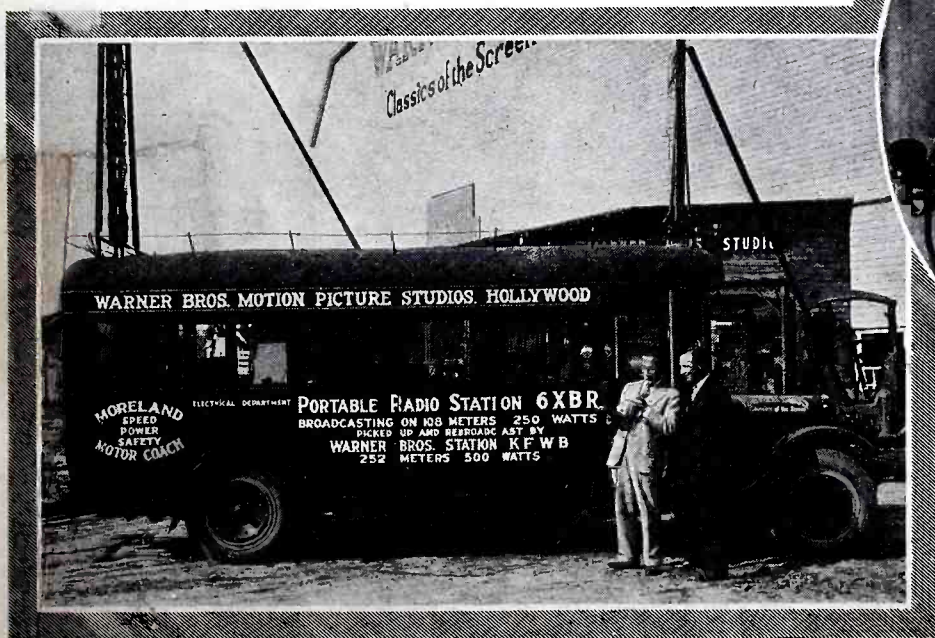
The two generators of Station 6XBR are supplied with 24 volts direct current and they deliver 1500 volts D. C. running at 6,000 R. P. M. Four hours of steady service is secured from but one charging of the batteries. In order to keep any induced radio frequency strays out of audio circuits, extraordinary care was used to run all wires in the truck, in lead covered cable well grounded.

Although Engineer Murphy constructed Portable Station 6XBR for experimental purposes in order to tie up with the Warner Brothers Station KFWB on 252 meters, it has proven so successful that more than experimental purposes can be expected of it. From the very first it was learned that this portable station was reaching a class of listeners-in that have long been overlooked. That class is the Radio Amateur and the BCL who makes it a business to listen-in on the low waves.

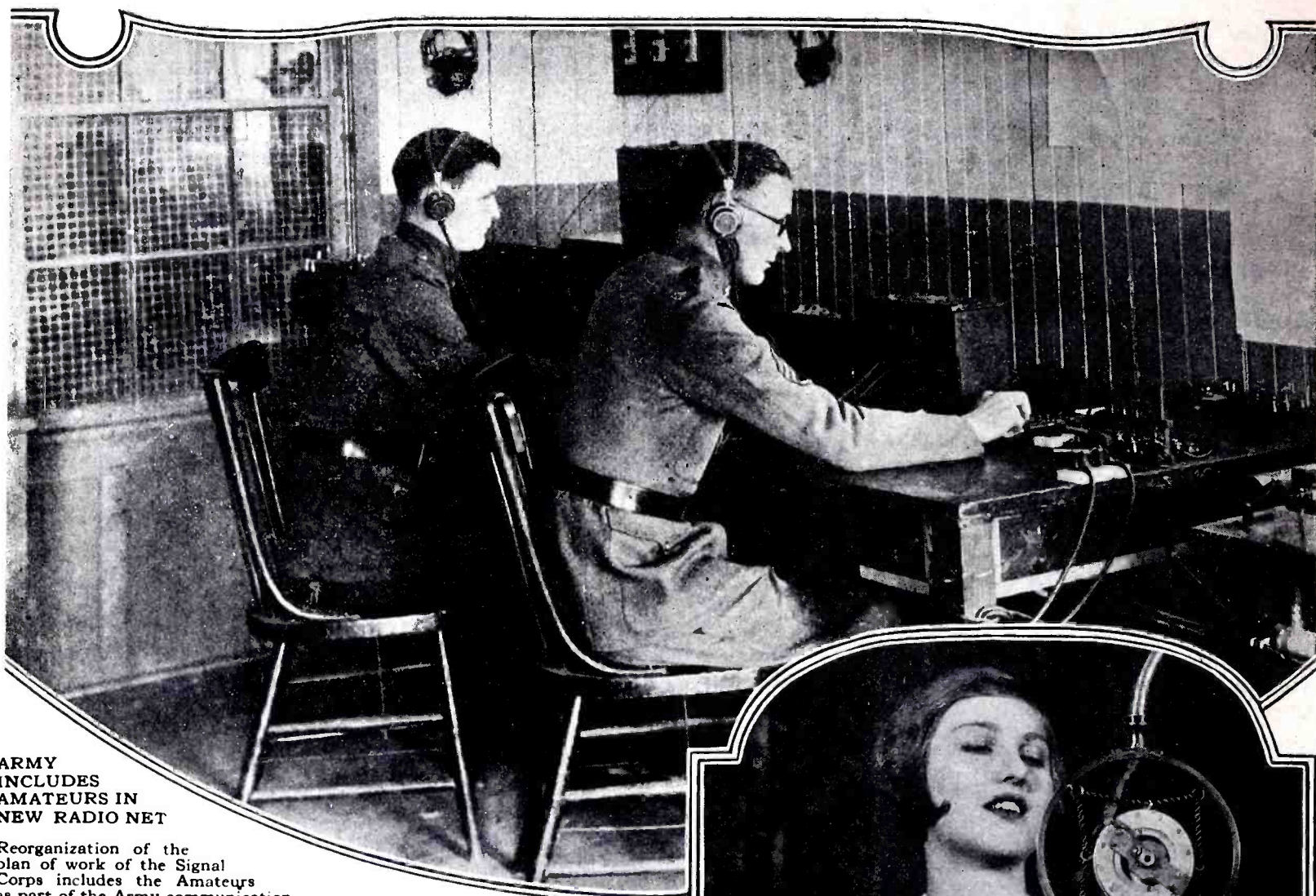
In the future station 6XBR is going to reverse operations and rebroadcast the Warner Brothers Studio Station KFWB on 108 meters. After the first tests, letters were received from as far east as Denver and as far north as Portland, coming from enthusiastic radio listeners who heard 6XBR on 108 meters.

The test performance at the Forum theatre proved so successful, that the Portable Station will also be used to broadcast all sport events, musical entertainment, and regular programs from the various parts of the vicinity of KFWB. These will be put on the air on 108 meters and will be picked up by Warner Brothers Station KFWB where it will be re-broadcast on 252 meters.

It is only to be expected that the movie folk would make a good job of radio after working with Klieg lights and huge electrical effects. This is the latest of their accomplishments—a really effective short wave broadcasting station built on a special truck. The lettering on the car body gives you the details.



Louise Fazenda remonstrating the "mike" for frightening her shy little friend Patsy Ruth Miller. Louise is especially popular at the KFWB Warner Brothers station because of her jovial and congenial personality. Patsy Ruth Miller and Miss Fazenda are two of the most loved actresses in moving pictures.

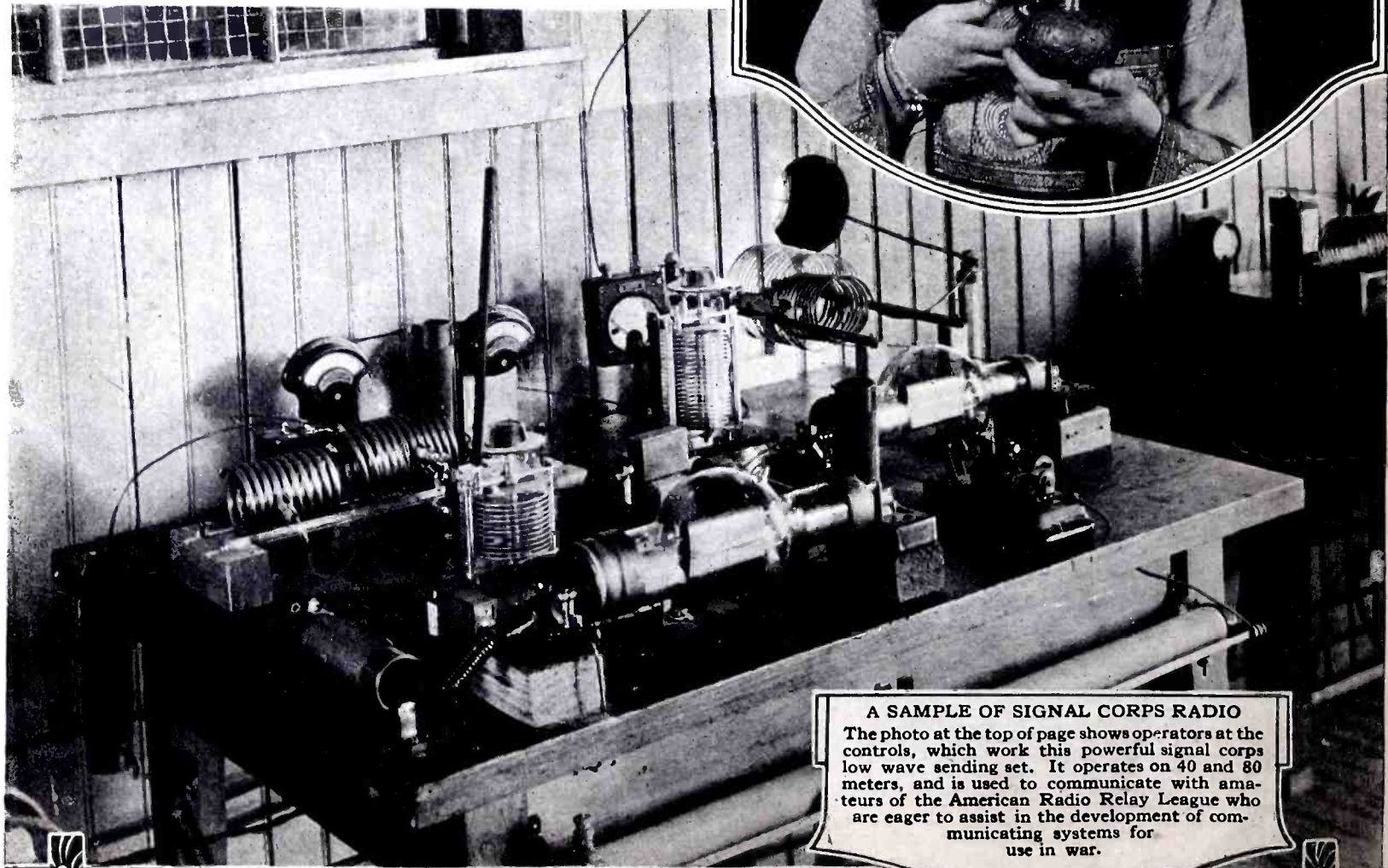


**ARMY
INCLUDES
AMATEURS IN
NEW RADIO NET**

Reorganization of the plan of work of the Signal Corps includes the Amateurs as part of the Army communication system. The photo shows the operators of the Army station 2CXL talking to amateurs with the up-to-date 40 and 80 meter transmitter.

A Delightful Scent—Can't you Smell It?

When Ruth Fallows a Follies girl made a talk on perfumes and atomizers to women radio fans from WJZ she became so absorbed in her narrative that she resorted to the rhetorical interrogation "Can't you smell it?," much to the amusement of the station staff.



A SAMPLE OF SIGNAL CORPS RADIO
The photo at the top of page shows operators at the controls, which work this powerful signal corps low wave sending set. It operates on 40 and 80 meters, and is used to communicate with amateurs of the American Radio Relay League who are eager to assist in the development of communicating systems for use in war.



**HIS VIGILANCE SAVES
27 LIVES**

Chief Radio Operator Otto Dammann of the S. S. Westphalia at the operating table of the radio equipment just as he was at 2 a. m. on January 31st, when he received the S. O. S. of the S. S. Alkaid.

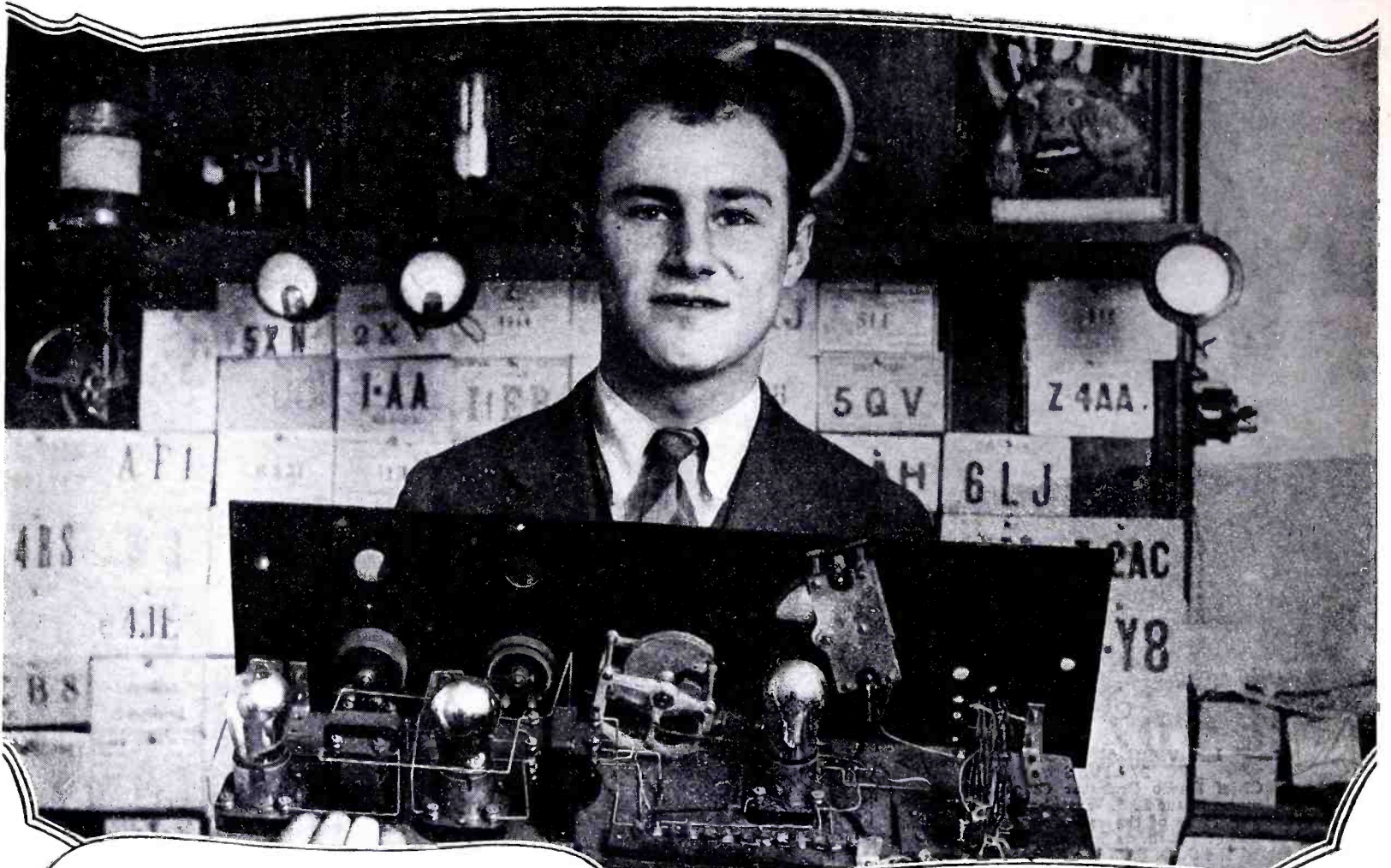
**AMERICA'S PRIMA DONNA
INSPECTS MICROPHONE**

Thousands were turned away from the Metropolitan Opera House in New York on the night that Marion Talley, Kansas City's 19 year old singer made her debut. But two nights later radio brought her voice to more than a million listeners, bringing thousands of telegrams and messages of congratulations. She is shown herewith (left) with her elder sister Florence and her mother and father.



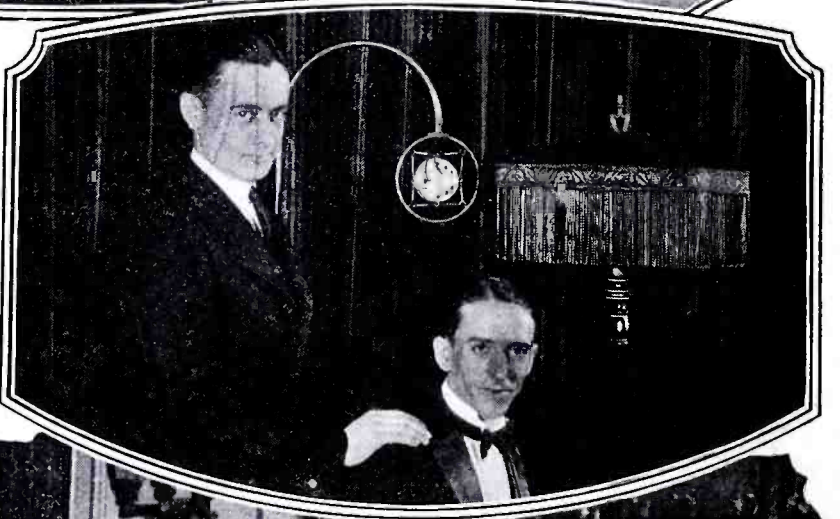
WHO SAYS RADIO FANS DON'T ACKNOWLEDGE?

The photo shows Henry Field the owner of the Shenandoah, Iowa station KFNF and a pile of over 200,000 telegrams which were received by KFNF in a recent contest. The Field station is very popular with the farmers in the middle west.



A YOUNG MAN AND HIS HOBBY

Using a simple Weageant type low wave receiver and a 50 watt transmitter, Jack Berliant, of Bronx, N. Y., has been heard in 27 countries and has conducted two-way conversations with 16 of the 27 countries he has logged. His transmitter operates on 40 and 80 meters, and the receiver which he is holding tunes from 200 to 20 meters. The cards on the wall are the "calling" cards of the gentlemen of the amateur radio transmitting fraternity. Notice the card from New Zealand, Z-4AA under the good luck charm on the shelf which holds the transmitter.



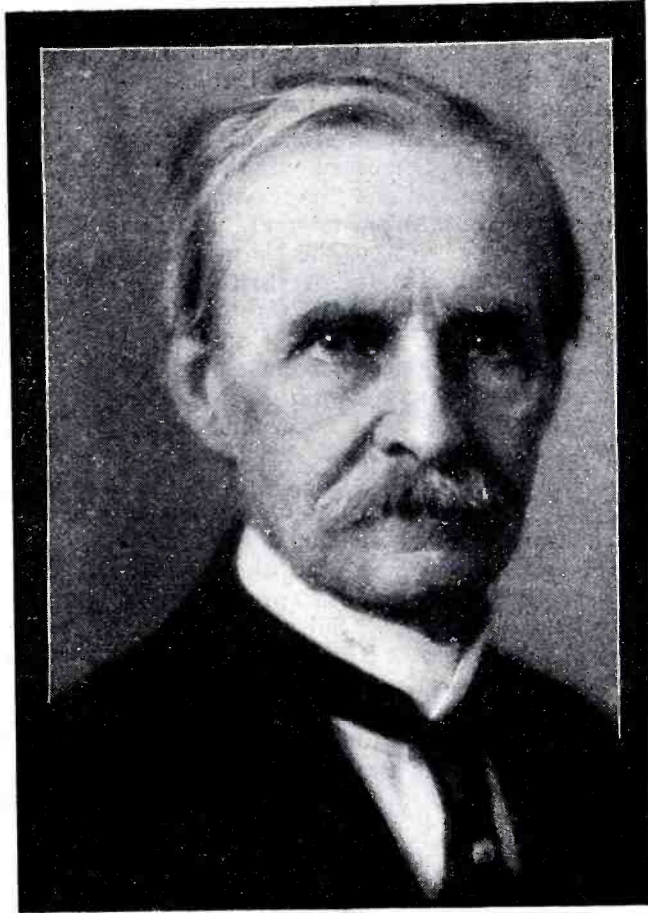
THE KING OF THE IVORIES REMAINS TRUE TO THE PIANO

Do you remember Harry Snodgrass, "the King of the Ivories" at Station Doubleyew OooooH Esssss—Jeff—er—son City, Misssoorah of a year ago last winter fame? He is now pounding the keys at Station WREO Lansing, Michigan, where he is performing under the direction of J. M. Witten studio director and announcer.

CHURCH PUTS MODERN 'PEP' IN ITS PROGRAMS

The Chelsea Methodist Episcopal Church acting on the belief that modernism and pep must characterize the church services of today to attract "we moderns" has installed a high class jazz band as an experiment.

Men Who Are Making Radio History



The Man Who Exploded Antenna Theories

Dr. James Harris Rogers was conducting experiments in electricity when he was fifteen years old on a small scale with crude apparatus—now he has to his credit fifty inventions, one for each year of endeavor during the last half century.

A Story of The BURIED ANTENNA

By S. R. WINTERS

WHEN James Harris Rogers was fifteen years old he was conducting experiments in electricity. His studies of the apparatus and methods of communicating by means of Morse telegraphy called for the devising of a repeater requiring little quantity but great tension or voltage. The originality, and perhaps not too kind regard of this boy for the feline kind, suggested the use of a "live-wire" repeater. He readily obtained a stray animal. A boot was adapted as a container for this species of animal. The toes of the boot were cut off so that the kind feet of the cat protruded clean through and two holes were made in the upper portion of the shoe in order that the front paws would not be confined. The primary current of the high tension circuit passed through the feline, the physiological effects produced on the cat causing its paws to respond to the dots and dashes in telegraphy. By placing the Morse telegraph key on one of the paws and connecting it to a secondary circuit the cat acted as a repeater. Once unleashed from its strapped position in the boot, the feline jumped from a second-story window. It was one cat that never came back.

This feline—we are not told whether it was black or white—may have been instrumental in shaping of the entire future career of James Harris Rogers. Had not this cat responded to his boyish experiments in electricity fate might have pitchforked his efforts in another groove

—and instead of the scientific world having the privilege of recognizing Dr. J. Harris Rogers, inventor of the underground and underwater systems of sending radio communications, he might have been a farmer or a village druggist. As it is, this citizen of Hyattsville, Maryland, has for a period of fifty years or more continued without interruption experiments in the field of electricity and allied sciences. The fruits of his ingenuity have been crystallized into fifty inventions, an average of one each twelve months during the last half of a century.

Hails from Tennessee

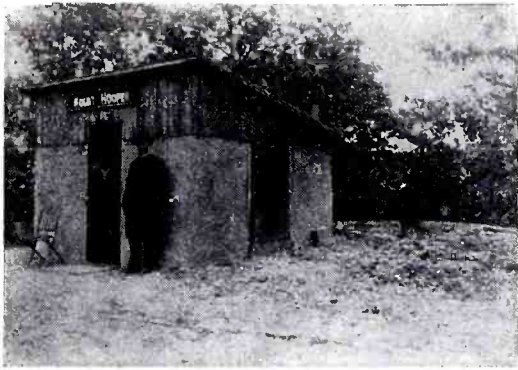
Born in Tennessee and educated in this country and abroad, James Harris Rogers has resided in Hyattsville, Maryland, for approximately 30 years. Here is where the famous doctor has conducted the greatest part of his experimental work—in a special two-story laboratory built to the rear of his home.

The first floor of this laboratory is literally jammed with instruments, ancient and modern, either which have been developed by Doctor Rogers or are instrumental in the furtherance of the experiments which have engaged his attention for a period of fifty years. A flat-top desk, on the right as one enters this workshop, is about the only equipment contained in this laboratory which may not be considered as immediately bearing upon the development of science, electricity in particular, during the

last half of a century. X-ray tubes, vacuum tubes, a visual synchronizing machine for printing, in page form, over one telegraph wire 150 to 200 words a minute, radio-receiving instruments, and apparatus for sending wireless messages, are among the vast array of mechanism that simply bewilders the visitor at first glance. Radio apparatus is predominant, of course, since Doctor Rogers is continually experimenting with this form of communication, with special reference to the sending of messages through the earth instead of through space. The rear room of the laboratory is reserved for the conducting of experiments in the transmission and reception of communications beneath the surface of the earth. An antenna in the form of a loop containing a certain number of strands of wires is buried in a well under this back room of the workshop. This room is screened, and the dug-out under it may be said to resemble the tomb of King "Tut." Messages that are received and sent from this underground passage, however, seem to identify it as a modern miracle-performing well.

Some Queer Antenna

Outside of the laboratory walls, may be seen an iron pipe which extends for a distance of 100 feet. This exposed pipe might be mistaken for a water-carrying channel. However, projecting from the laboratory, some distance above the ground, is a piece of mechanism which is



Dr. J. Harris Rogers at his Mount Hooper laboratory where his experiments with underground wireless were conducted during the war.

called the conning tower. This arrangement was devised to simulate a submarine, whereby experiments could be conducted with respect to the sending of wireless messages under water when submarines were submerged at varying depths. Alfred Crossley, a radio engineer of the Bureau of Engineering of the United States Navy Department, conducted various experiments for the Government with this make-believe submarine. Subsequently, installations of radio apparatus were made on actual submarines and as an outgrowth of this system, practically all submarines in service today are equipped for the sending and receiving of wireless communications. At first, a trailing wire was suggested as a means of picking up electric or radio waves on submarines, but this proved to be objectionable since a 200-foot wire would likely become entangled in this form of water craft or the wire would whip itself into two pieces. Consequently, the system finally determined upon involves the using of one-half of the submarine for the loop antenna—or "ears of radio," if you will—and the other half extended above the submarine and grounded at the bow and stern. The center of the upper wire is brought down into the submarine at the so-called conning tower.

His Military Contributions

DURING the progress of the World War—in 1916 and 1917—extending from this laboratory for distances varying from 200 to 5,000 feet were wires buried under the surface of the earth. They were insulated in various ways and some were bare, but those contained in iron pipes were most effectual in serving the purpose for which they were designed. These installations marked the shaping of a remarkable theory, namely, that electric waves travel through the earth as well as through space. It was this theory, given tangible shape, that made it possible to receive the news of German propaganda and to that extent contributed to the winning of the war. Out in the woods of Maryland, not far removed from Hyattsville, Doctor Rogers erected a radio station by means of burying the antenna wires at varying depths. Here in these woodlands by virtue of the subterranean wires, messages sent from the wireless stations at Nauen, Germany; Eiffel Tower, France; and Darien, Panama Canal Zone, were received daily.

This underground system of communi-

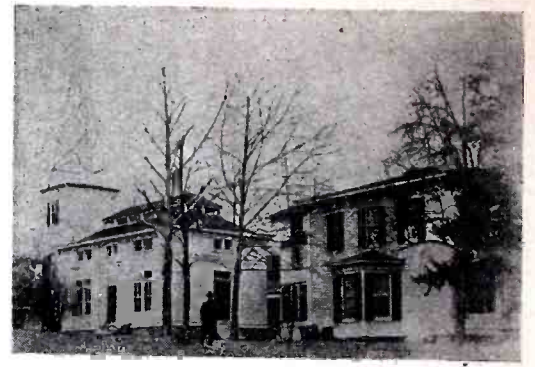
cation was valued as an ally in the cause of winning the war to the extent that Secretary of Navy Josephus Daniels expedited patents through the Patent Office embracing the discoveries of Doctor Rogers. The Secretary of the Navy termed the inventions "improvements in the system of wireless telegraphy of far-reaching importance to the United States Government and especially to the Navy Department." Forthwith, Captain (now Admiral) Strother Smith and Commander Stanford C. Hooper were instructed to investigate the merits of the discovery. The foresight of these two men was responsible for the use of this system of underground intelligence during the World War. Their recommendations led to an immediate installation of the system in New Orleans, and soon thereafter a like method of signalling was in operation at the Great Lakes. Subsequently, the Rogers discovery was applied for transatlantic communication, six wires being installed beneath the surface of the earth, thereby enabling six operators to receive messages from as many European wireless stations at the same time. The towering antennae were abandoned in favor of the subterranean wires for the reception of the radio impulses.

Theories Upset

Thus, once again the "impossible" had been translated into reality. Previous scientific theories adhered to the belief that electro-magnetic or radio waves were restricted to their travels through ether or space. The Hyattsville inventor exploded these accepted theories by a counter theory, in which he substantially stated: "We must not poke our aerials up into the sky; we must bury them." He was confident that electric energy once liberated under the surface of the earth traveled through the ground. He abandoned the radio tower, which he elevated many years before, and although these towers still stand atop of his laboratory they are not in use. The underground antenna—burying of an arrangement of wires in a well to be picturesque—is not



A recent invention of the famous doctor is the loop in the photograph which also shows Dr. Rogers operating this most recent work. It is expressly designed for broadcast work, and takes into consideration several items in its design that present loops do not include.



The radio tower shown to the left of this photo has long been in disrepute in favor of the underground system. The building directly under it is Dr. Rogers' laboratory.

subject to atmospheric disturbances to the extent that the towering wires are. That is to say, some of the noisy interference is eliminated when receiving wireless signals.

"What manner of man is Dr. J. Harris Rogers?", the reader doubtless inquires. First and foremost, he is democratic in his tastes and liberal in tendencies—he entertains General John J. Pershing in a way befitting the occasion or conducts the humblest citizen of Hyattsville through his laboratory with painstaking interest. His hair is snowy white, and although he was 74 years old in July of this year, he can use an auger in drilling a hole or the soldering iron in welding together wires with quite the deftness displayed by his young nephews who assist him in the laboratory. There is an unmistakable kindness about his face, a warmth of touch to his welcoming hand, and yet there gleams forth from his gray eyes an unswerving fidelity to the cause of justice. He is a bachelor, and if he has any hobby other than that found among a multitude of instruments in his workshop this writer failed to bare it during a quissical visit of a day.

The father of James Harris Rogers was a student at Princeton University under Joseph Henry, a distinguished scientist. It was the latter that secured for Young Rogers a position as electrician at the Capitol, in Washington. His first attention in the direction of wireless experiments was attracted by the pioneer investigations of Dr. Mahlon Loomis, a dentist of Washington, who claimed to have sent the first radio message over a short distance between points in the Blue Ridge Mountains. Immediately at the conclusion of the Civil War, James Harris Rogers and his father bore letters of introduction to Commander Maury, who was known as the pathfinder of the sea, for the purpose of demonstration to the latter the use of wave power for propelling small boats. When Guglielmo Marconi succeeded in hurling electric waves, bearing messages, across the Atlantic Ocean, Doctor Rogers conceived the idea that the earth formed another medium for inter-communication. His theory had been sufficiently established during the progress of the World War that his workshop was the only private radio laboratory permitted to function during this conflict.

When a whole town turns out en masse to do honor to a citizen there is reason to believe that the particular individual thus honored has rendered service to

(Continued on page 48)

We Want Better LOUDSPEAKERS

*This is the Time to Correct Our
Erroneous Reproducer
Conceptions*

By A. W. KRAMER

IN DISCUSSING the question of the most suitable design of horn for a loud speaker, a world-famous electrical engineer remarked some time ago, "This problem of horns is a 'house-on-fire' problem, in the sense that loud speakers are now being manufactured by the thousand, and while they are being manufactured and sold, we are trying to find out their fundamental theory." This remark was made some two years ago, at a time when practically no serious effort had been made to construct a really good loud speaker, and when the owner of a radio set first began to recognize the shortcomings of the loud speakers then in use. Previous to that time he had been so fascinated by the sheer novelty of radio that almost any musical sound, however raucous, was considered good. As the novelty wore off he became more critical and soon realized that there was much to be desired in loud speaker performance.

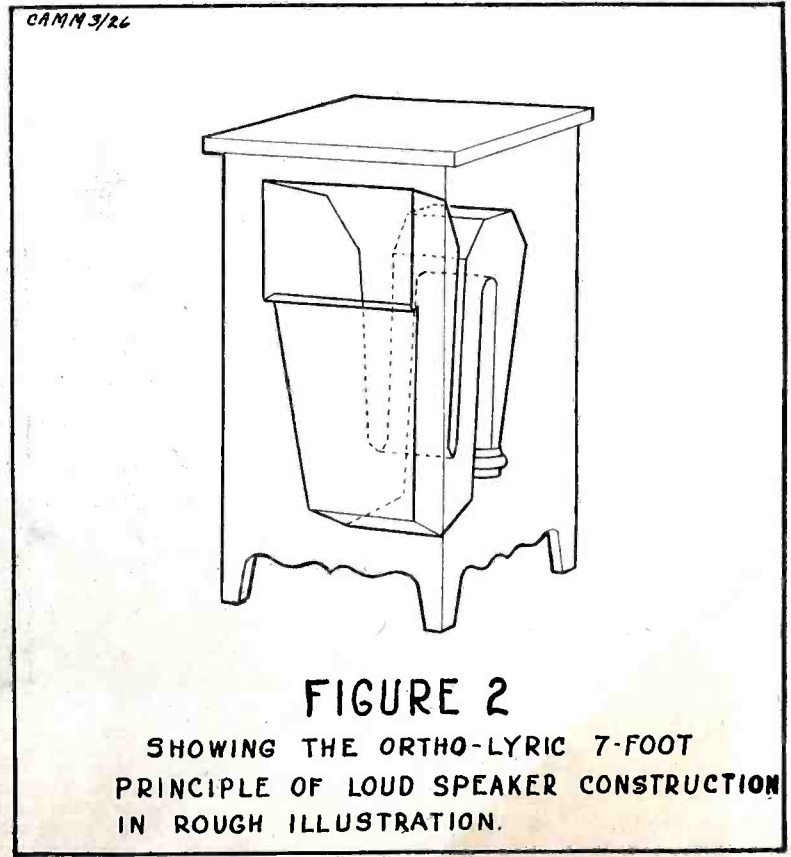
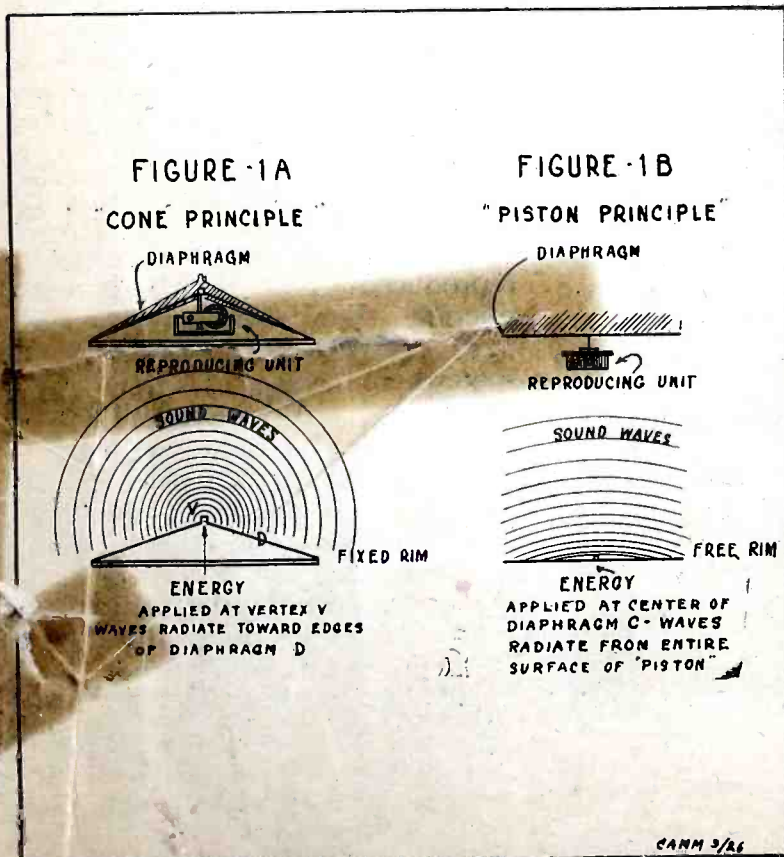
Much still remains to be done but during the past two years we have made great progress in the design of loud speakers. Today, there are a number on the market whose performance is far superior to anything available a few years ago, the Ortho-Lyric shown on this page being an excellent example.

This reproducer possesses a number of interesting features but before we describe them it may be well to touch briefly upon some of the fundamental principles underlying the theory of these devices, particularly with regard to the horn. The popular conception of the function of the horn, either on a loud speaker or on a phonograph, is, as a rule, erroneous. It is regarded as an amplifier and it is thought that the horn actually amplifies the sound produced by the diaphragm. Such, however, as will be shown in the following paragraphs, is not the case.

A GOOD horn merely serves as a connection between the air in the room and the diaphragm of

the reproducing unit so that the energy of the diaphragm may be transferred to the air in the room with maximum efficiency and uniformity for all frequencies within the desired range. If we think of the term "amplification" as meaning the increasing of any form of response by the addition of an outside supply of energy it is readily apparent that the horn cannot amplify since it cannot supply additional energy. What it actually does is to load the diaphragm in the same way that we load an electric motor by connecting a fan or a pump to it. Or, looking at it in a slightly different way, a more familiar one to the radio man, perhaps, is to consider the horn as an antenna for the diaphragm enabling it to radiate energy to the room in the same manner that an antenna of a transmitting set aids in effecting a much greater radiation of energy than would be possible without it.

Since the problem in loud speaker design is to communicate power from a comparatively small diaphragm to the large volume of air in the room, the question has been raised as to whether the use of a horn is essential and whether better or at least equally as good results may not be obtained by the use of a large diaphragm without a horn. The answer to this question has not been settled to anybody's satisfaction notwithstanding much discussion on the relative merits of the two methods. In the meantime a host of the so-called "cone type" of loud speakers which are examples of the large diaphragm type of speaker, have made their appearance upon the market. Some of these reflect much study and research on the part of the

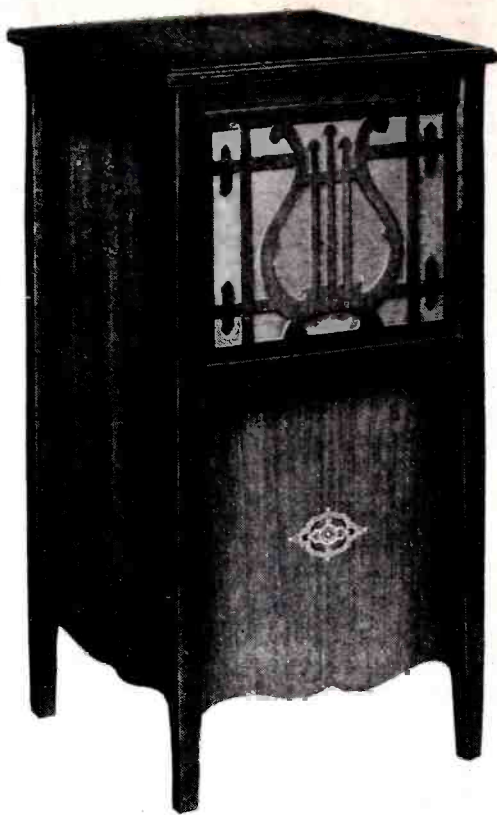


designers in their excellent performance, others are unmistakably makeshifts made only to sell to a too gullible public.

It is not the purpose of this article to enter into a discussion of the comparative merits of the horn versus the "cone" or large diaphragm type of loud speaker. Each type possesses certain inherent capabilities which further research and study will bring out. In most of the hornless types of speakers now on the market, the actuating force is applied at the center or vertex and flexural waves radiate out towards the edge. (See Figure 1A) While this action has been attended with very favorable results, it has been criticized by various investigators who favor the "piston" (Figure 1B) type of which the inertia controlled speaker developed by Kellogg and Rice is a good example. In this speaker the diaphragm which may be large or small depending upon the design, vibrates as a whole, that is, all parts of the disk move in one direction at any instant.

Requirements of a Good Horn

REVERTING once more to the horn type, we can ask ourselves the question, "What constitutes a good horn?" Assuming that we have at our command a good electromagnetic unit capable of radiating energy through the required range of audio frequency with uniform intensity, what are the requirements of a horn which will most efficiently transfer this energy to the air in the room without distortion and without resonance effects? By resonance effects we mean the tendency of a loud speaker to accentuate certain notes, due to certain component parts of the speaker or even the column of air inside the horn, being tuned, as it were, to those notes. In an organ pipe, for instance, the column of air inside the pipe vibrates at a certain frequency depending upon the length of the pipe. If we used a straight piece of pipe instead of a horn on our loud speaker we would find that it would respond to certain notes much more strongly than to others, in the same way that the column of air in the organ pipe responds to the particular note to which it is tuned. A straight piece of pipe therefore would be a poor form of horn to use on a loud speaker. *What is needed is a horn of such shape that with a given air velocity in a traveling wave at its throat, the same amount of power will be radiated at different frequencies over a wide range.* By air velocity we mean the instantan-



The new Ortho-Lyric loudspeaker which has just made its appearance on the market represents a radical departure from the usual design of radio reproducing devices. A seven foot horn is doubled over to fit into this tasteful cabinet which is slightly smaller than the usual phonograph.

eous average velocity of the molecules of air at a given point.

It has been found by experiment and also by mathematical analysis that, if instead of using the straight piece of pipe referred to above, we flare one end of the pipe out gradually making the final opening quite large, the resonance effect becomes less noticeable. It is not sufficient, however, merely to con-



Mr. Ellis P. Cole, who developed this unit, is a man of exceptional musical taste, with considerable experience in pipe organ work. His design embodies some basic ideas in reproducers.

struct a horn with a small opening at one end and a large one at the other. There is a certain relation between the area of the horn at any one point to the distance from the mouth which if not adhered to results in a horn whose performance is unsatisfactory. The total length also must be taken into consideration.

The Ortho-Lyric Has a Seven Foot Horn

In the Ortho-Lyric reproducer just placed on the market and shown in the accompanying illustration, the proper degree of divergence according to Ellis P. Cole who developed it, was determined experimentally by acoustical measurements. In this way it was found that for this particular type of speaker a horn of at least six feet in length was required. This as is apparent was an awkward length of horn to employ in a loud speaker for general household use and to overcome it, an ingenious method of folding the six or seven foot horn in to a space only slightly over two feet was developed. (See Figure 2).

It may seem that with the all wood construction which is employed in this reproducer resonance effects would be present but a demonstration soon proves that such is not the case. It reproduces faithfully throughout the entire frequency range with plenty of depth to the low tones yet not in any way strangling the high violin notes. The non-resonant quality of this reproducer in spite of the fact that wood is used in its construction throughout, apparently is due to the fact that the wood parts are proportioned so as to be non-resonant at any of the frequencies within the music range.

It has been determined by various experiments that a horn longer than one quarter of the wave length of the lowest note to be reproduced gives the best reproduction. The lowest notes in ordinary speech and music will run somewhere between 25 and 30 cycles per second. A note of 30 cycles, for example, has a wave length in air at ordinary temperatures of 22.5 ft. To reproduce this note, the horn therefore should have a length of at least $22.5 \div 4$ or 5.6 ft. Since the horn in the Ortho-Lyric is seven ft. in length, a little mental arithmetic will show that it is capable of handling waves at least 4×7 or 28 ft. long, corresponding to a note of 40 cycles. Most horns are less than three feet long which when worked out in the foregoing

(Continued on page 33)

The Quest for the Ideal Receiver

[Continued from page 15]

WEBH 7, KPO 5, WDAF 5, WQJ 4, WSAI 3, KFI 3, KFRU 3, WCBD 2, WGN 2, WHB 2, WOC 1, KJR 1, WFAA 1, WJJD 1.

The editors of the *New Zealand Wireless and Broadcasting News*, the radio journal of the Australian radio fans went over Scott's log, and claim the following world's records for reception on broadcast wavelengths:

1. New World's record for the greatest number of broadcasting stations heard which are distant 6,000 miles or more. A total of 19 different stations were heard. Six stations distant 6,000 or more miles. Seven station distant 7,000 or more miles. Six stations distant 8,000 or more miles.

2. New World's record for greatest number of programmes heard from station distant 6,000 or more miles. 19 programs from stations 8,000 or more miles distant. 19 programs from station 7,000 or more miles. 79 programs from stations 6,000 or more miles. Total of 117 programs all more than 6,000 miles away.

3. New world's record for greatest number of broadcasting stations distant 6,000 or more miles that have ever been heard on any one evening. Six U. S. Stations were logged on the night of March 29th in two hours and a quarter: KGO, KNX, KFRU, LOA, WEBH, KHJ.

4. New World's record for the greatest distance voice has been heard with a receiver using loop aerial only. WCBD 8,375 miles distant, was tuned in on March 17th.

The Net Result

The circuit used by Mr. Scott is very similar to the standard super circuit. It uses nine dry cell tubes, seven 199s and two 220 power tubes in the last stage of audio to prevent overloading, due to the efficient amplification obtained with the other circuits. The principle difference between Scott's and the standard circuit lies in the IF stages. Instead of using two or three iron core intermediate frequency transformers and one air core tuned stage, Scott uses two iron core intermediates and TWO air core transformers each tuned with a special semi variable condenser. All of these transformers MUST BE PERFECTLY MATCHED if you are to get selectivity, quality or distance. It requires laboratory equipment to do this and cannot be done successfully without it. Two selector dials, a regeneration control (the set wisely uses regeneration in the input circuit to cut down the resistance of the loop circuit) two rheostats, a combination A and B battery voltmeter, milliammeter, two jacks and tone control switch are the only things on the panel. Mr. Scott uses a standard loop manufactured by the Ajax Radio Company which is not revolutionary from any technical standpoint—merely a good loop of better than average design. The secret of the exceptional results lies in the intelligent assembly of components that are

die a damn

absolutely matched—matched with laboratory precision. Every part was tested rigidly with meticulous care before it was incorporated in the finished set, and this extreme care in any design will pay dividends in results in the assembly or construction of any radio receiver.

Another item of interest in the inspection of this receiver is the wiring, which has been carefully planned out and developed to eliminate interaction and excess lengths. Every wire is laid out to make as many direct connections as possible, without sacrificing either appearance or efficiency. This characteristic prevails throughout the entire set. The parts have been carefully placed and space has been juggled until the very utmost in results is effected.

The Scott World's Record Super 9 uses transformer coupled audio frequency connected in the usual cascade fashion. Two low ratio 2:1 Thordarson transformers are used as the coupling mediums, the secondary of the last transformer being coupled to the last two tubes which in turn are arranged in parallel fashion so that the last audio state will not be overloaded. The set uses UX199 tubes throughout, and the B battery consumption for the entire nine tubes is less than 10 milliamperes, due to the effectiveness of the C battery arrangement throughout the set, and the low current drain from the amplifying stages due to the precision matching of the units.

In operation, the set is a pleasure to work with. The two controls Selector I and Selector II are easily handled. The voltmeter on the panel keeps a constant check on the filament voltage, and enables the operator to keep the tubes going at maximum efficiency.

The foregoing account serves to illustrate conclusively that painstaking care always results in satisfaction in radio design. The log of Mr. Scott abundantly illustrates that while haywire construction of a radio set may get results—because the builder has curbed losses, the essence of satisfaction lies in the fact that Mr. Scott knows WHY his set is a success, and can duplicate it every time with identical parts and results.

The writer of this paper is interested in hearing of comparative results and records in this "Quest of the Ideal Receiver," and wonders if there are any who can claim results such as Mr. Scott's and VERIFY them with proof. Personally, Mr. Scott exhibited the letters of substantiation and verification on which were the signatures of nearly all the prominent broadcast station directors.

Mr. Scott has kindly consented to answer any questions relative to his results or receiver, if you accord him the courtesy of a stamped addressed envelope. Mail addressed to Mr. E. H. Scott, 35A South Dearborn Street, Chicago, Illinois, Care of Scott Radio Laboratories will reach him. Remember he is a busy man, and don't be unreasonable in expecting an answer the next day. What he tells you is worth waiting for.

BUILD THE



THE RECEIVER THAT HOLDS 4 - WORLD RECORDS

ALL FULLY VERIFIED

- (1) Longest distance ever received on a loop aerial—8,375 miles.
- (2) Most consistent reception of stations 6,000 to 8,000 miles distant—117 programs in three months.
- (3) In 2 1-4 hours, brought in six different stations—all over 6,000 miles distant.
- (4) Received greatest number of stations located 6,000 or more miles away.

NEW REPORTS

Dr. Sidney Kuh of Chicago, Illinois, writes: "Have just received certificate showing reception 2LO London on my Worlds Record Super 9 in spite of adverse conditions test week—some accomplishment for any receiver."

Last year a Worlds Record Super 9 brought 2LO into Chicago with loud speaker volume on a loop.

Mr. M. F. Beaudoin, Winter, Wisconsin writes: "Constructed Worlds Record Super 9 with your parts and instructions—On North Woods trip picked up 118 stations in six hours—Got Australia, Mexico, Alaska and Cuba—California stations came in like locals—Have tried best receivers made—Yours (The Worlds Record Super 9) outpoints them all."

ALL THE PARTS

Send for data on all the parts necessary to make an exact duplicate of this marvelous receiver.

FREE Mr. Scott's story of the development of his master receiver and proof of its record-breaking performances sent on receipt of stamped and addressed envelope.

Scott Radio Laboratories

35 A. South Dearborn St., Chicago

A&B Battery \$2 Charger ONLY

SATISFACTION GUARANTEED



Charges any type of storage A or B battery, using a few cents worth of ordinary house current. Works perfectly on either alternating or direct current. Cannot injure battery and lasts for years. May be used as a trickle charger. Complete directions enclosed—anyone can operate. No expensive "Extras" to buy. Why pay \$10.00 to \$18.00 for a charger when you can get this splendid GUARANTEED R. B. Charger by mailing us two dollars (bills, money-order, check or stamps) plus ten cents in stamps or coin to pay mailing costs. Charger will be sent postpaid. If you are not satisfied, return within five days and we will refund your money. Order at once—TODAY.

R. B. SPECIALTY COMPANY

Dept. 611

308 East Third Street
Cincinnati, Ohio

The March Toward Monopoly

(Continued from page 6)

Another Angle of the Problem

A MONOPOLY in the control of the use of radio apparatus is another matter. Receiving apparatus is of no use to the general public unless there are broadcasts for it to bring in. The erection, and operation of a broadcasting station involves the expenditure of large sums of money. The general public can only enter this field by demanding municipal or other government stations, and as long as private corporations are willing to supply popular radio programs free of charge there will be no such demand. So far, the government stations have received about as much criticism for interfering with the reception of programs from other stations as appreciation for the very valuable information and worthwhile entertainment that they have provided. They must either lower their standards to the level of the jazz hounds or continue to meet unjust criticism. A large part of the criticism comes, of course from local radio fans who cannot see anything good in any program that does not come from a greater distance than that covered by their neighbors the night before, and whose idea of a good station is based upon their ability to tune it out, and not upon the character of its programs.

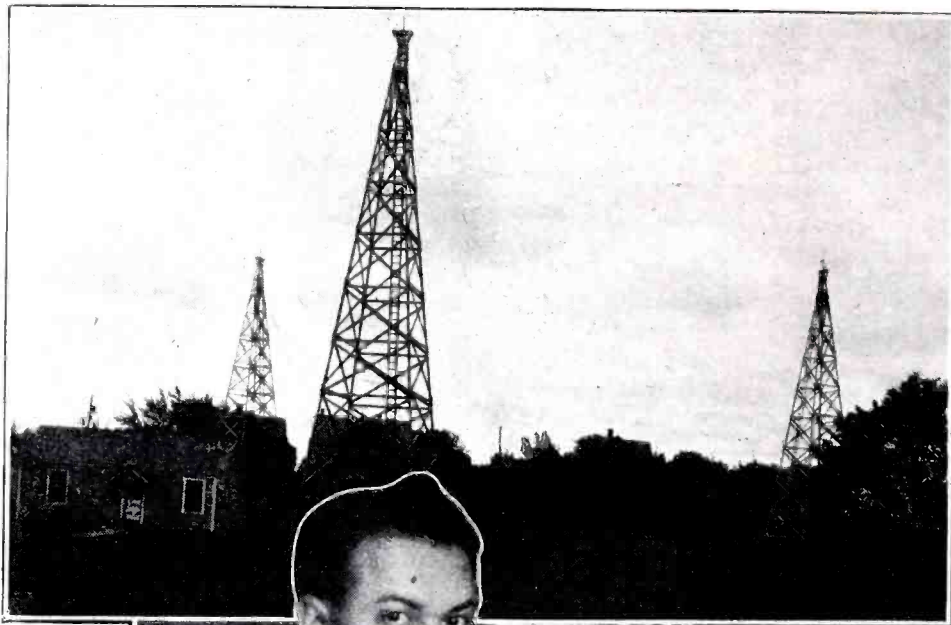
It has been possible, and still is possible in some sections, for a comparatively small concern to operate a cheap broadcasting station just as exhibitors used to open nickel picture shows. The inevitable trend, however, is toward the extinction of these little stations and the concentration of broadcasting in the hands of the larger corporations.

To many persons who have witnessed the rise of broadcasting it has been a mystery. Who pays for it? How do they pay for it? What does the broadcaster get out of it? Will he find a way to make the public pay?

At the start it was necessary for someone to broadcast programs to start the public to buying receivers. Naturally the big corporations, since they made more apparatus than anyone else, found it to their advantage to keep programs in the air. But with patents expiring, patronage flowing to a thousand little concerns

as well as to the larger ones, the difficulty of controlling the manufacture of apparatus increasing, and hundreds of broadcasters clamoring for the use of the air, why do the big corporations make such strenuous efforts to keep their grip on broadcasting? Those efforts seem to indicate the means by which the real

One alternative to monopoly. The people of Pennsylvania maintain this station at their state college. Through it they receive entertainment and also regular college courses for which credits are given.



If there should be a radio monopoly, William Dubilier will probably be in on the ground floor. He began his radio career as a boy by getting into a lecture where no boys were allowed, and he has been going strong as an inventor and manufacturer ever since.

radio monopoly will be secured, if it is ever secured.

Mr. David Sarnoff, who has risen by hard work and the use of a superior quality of gray matter to a high position in the radio business, said in a recent address:

"The present number of stations, 450, merely represents a transient phenomenon in the march of events. Most of these stations will probably go out of business in time. More and more it is evident that the purpose of the broadcast station is to do those things which

other agencies cannot do as well or at all. No other agency can speak with a single voice to 10,000,000 people. It is an instrumentality for national events, for high-grade talent, for good music, for good lectures, and the like, and therefore it means that there will be erected in time a number, possibly half a dozen, possibly three, high-powered broadcast stations, suitably located, that may constitute a chain of national broadcasting stations or a national broadcast service, each of these stations simultaneously radiating the same program, what-

ever it may be, with a power sufficient to reach every city, every town, every village, every hamlet, every home in the United States."

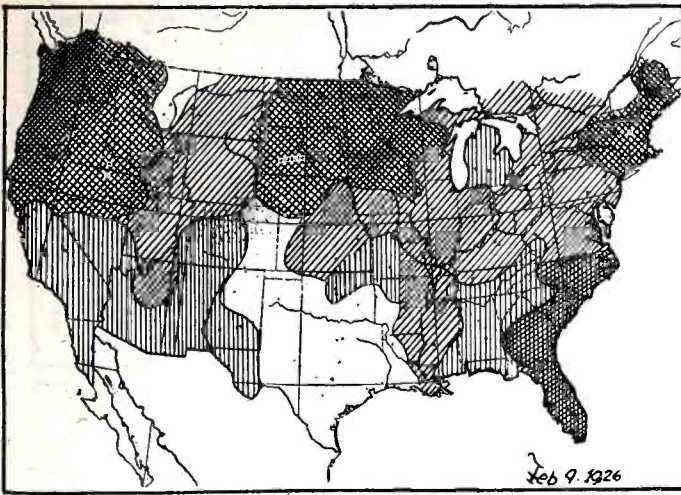
Publicity Value of Such a System

There seems to be the plain forecast, from a man who is in a position to know, of the radio monopoly of the future, if there is to be one. The activities of ten million amateur constructors and listeners-in cannot be controlled, but three or six high-power broadcasting stations, costing perhaps millions of dollars each, backed

by the necessary legislation and the necessary representatives of the corporation in the legislative bodies, can be controlled. If a page of advertising in a popular periodical is worth \$3,500, how much is it worth to use a publicity channel through which it is possible to reach 10,000,000 persons in one day? How much would it be worth on the eve of a close and important election, after it was too late to contradict the statements made by radio?

Publicity is the most valuable commodity in the United States today. It is bought and sold, directly and indirectly at prices that nothing else so intangible commands. Why do the Hearsts and the Northcliffs buy or establish newspaper after newspaper and magazine after magazine? Is it because they enjoy gathering and disseminating news and interesting fiction? Why is the real ownership or control of some newspapers and magazines concealed? Is it because of the modesty of the owners, or because they want what they print to be unaffected by any prejudice that may exist against the owners? Why is it that certain Government officials are mentioned day after day in the "press" transmitted from Government stations, while many men who are doing more interesting

(Turn to page 37)

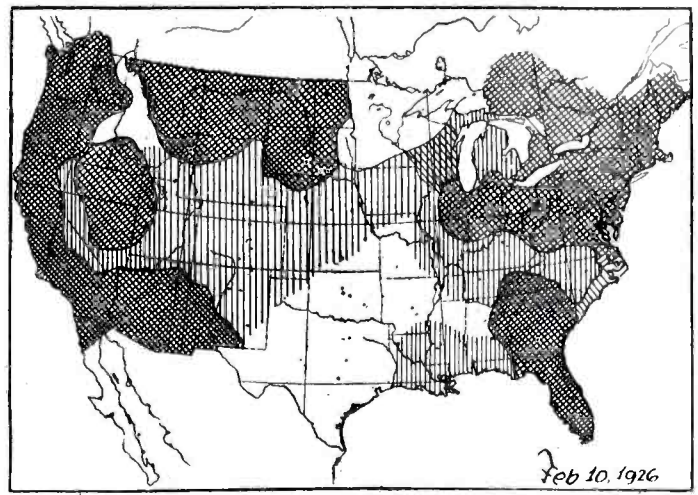


Legend

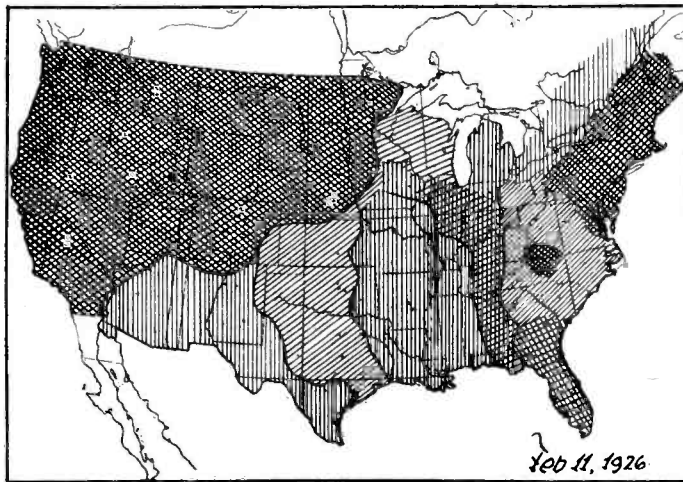
Heavy cross hatching indicates heavy static.

Diagonal lines indicate moderate static.

Vertical lines indicate light static.



A Report on the Results of February Static and Fading Tests



These maps are the result of compilation and tabulation of the thousands of reports which have been sent in on behalf of the nation-wide static and fading tests. Analysis tends to show the south comparatively free from disturbances during the three day test.

BEGINNING:

By **GEORGE A. KING**

The WAR on STATIC

Reconnaissance With The Barometer

DESPITE what was probably America's greatest national radio experiment, static and fading remain what they have always been—the masked villains of the play—their activities hampered by no advance notices of their identity or the cues to which they enter or exit. They may be kindred manifestations, springing from the same causes and observable under the same conditions, or they may be separate evils with nothing in common. They may have some relationship to the barometer, but the indictment so far stands unproved. They may be increased or diminished by travel over water, but that, too, is merely hearsay evidence. Like the tenors in musical comedies, they may be affected by the phases of the moon. Who can say?

Dr. Lester L. Bockstahler, who conducted the survey for the Physics Department of Northwestern University in cooperation with the Stewart-Warner corporation, has finished the preliminary classification of hundreds of reports received from all but six of the zones into which the country was divided for the survey. The rough tabulation shows many unexpected relationships between static, fading, and kindred phenomena. It shows decided manifestations of atmospherics in spots where they were not expected and it shows their almost complete absence in places where previous surveys had led them to be expected. But so contradictory was much of the information obtained that physicists in charge of the survey declined to express any definite opinions and

announced that tests would be made monthly over a period of perhaps a year to determine further just how and where the radio nuisances occur and what correlations are permanent and what merely accidental.

Weather and Static

When it was decided to conduct a great national investigation of static and other things that broadcast listeners are least anxious to investigate, Dr. Bockstahler and his associates were interested merely in charting the occurrence and extent of static. It was advanced as a tentative proposal that tabulation of such reports might be referred to the United States Weather maps for the period of the tests to dispose of the unproved but widely circulated theories that barometric pressure might have something to do with the good or bad quality of radio reception.

At the very start, however, the puzzled radio fans of the United States began to demand answers to their own pet problems: "Does moonlight affect radio?" "Is it proved that radio energy actually travels in a wave form?" "Has super-power transmission any effect on fading?" and there were scores of other queries.

Results Demand Further Research

IN THE tabulation of results an effort was made to pigeon-hole all data that might have a bearing on each of these matters and hope is held out that by
(Continued on page 45)



The Technical Editor to the Broadcast Listener



Please Pardon the Delay

A GREAT many of our readers have availed themselves of our technical information service, and we are very happy and grateful to them because of the implicit confidence that communications place in our judgment. We want to sincerely thank our readers for this unusual spirit evinced in letters to the technical department, and it is hoped that this quality of good fellowship will always exist between the technical editor and the readers of ON THE AIR.

We have an apology to make before we proceed with the contents of the department for this month, which is briefly stated, as apology for not being as prompt in answering letters as we might have wished to be. We never expected our readers to respond so mightily to our offer of help as you have done, and as a result the system of answering questions has been found horribly inadequate. Thousands of letters have been received asking for help . . . far more than we ever anticipated, and believe us, every one of them is going to get an answer.

We are reorganizing our technical information service system, and hope to have things working smoothly very shortly, so that a letter properly conforming to the requirements will be answered without delay.

If you are one of the correspondents who found the wait a bit irritating, please bear with us . . . we've been working overtime to get your letters answered, so that we won't lose the enviable faith that you place in our by mail advice on radio.

Please pardon the delay.

—Technical Editor.

C. W. B., Pensacola, Fla.

Question: I want to build the Super-Frequency Receiver described in the January issue of ON THE AIR. As I will have to purchase the wire to wind the different coils, I would appreciate your giving me the exact size of wire you used. I am enclosing a blank showing the coil numbers, and would appreciate your giving me the data I need.

Answer: I am filling out your blank with the sizes of wire I used on the Super-Frequency Receiver below:

WAVE Coil	L1	L2	L3
15 to 25	18 DCC	14 DCC	18 DCC
35 to 50	20 DCC	16 DCC	20 DCC
70 to 100	20 DCC	18 DCC	20 DCC
150 to 200	20 DCC	22 DCC	24 DCC

Coils L2 on the 20 and 40 meter band

are space wound about the width of the wire between each turn.

Many readers have written me requesting information and advice on where to buy a set of coils already wound for a set of this type. It is fortunate that two manufacturers have placed equipment to accommodate this new interest in the game. Bremer-Tully Mfg. Co. of 528 South Canal Street, Chicago, Illinois, has an excellent kit for this work as has the Aero Products Company of 1772 Wilson Avenue, Chicago, Illinois. The Aero Coil kit is one of the neatest short wave kits we have seen for a long time, and is just the thing for the fellow who doesn't like to wind his own coils. Complete instructions come with both kits.

The Titanafram Speaker

R. E. W., West Lynn, Mass.

Question: I read Mr. Perry's article on the new Titanafram speaker in the last issue of ON THE AIR and would like to know the price of this new speaker and where I could obtain one.

Answer: The story on the Titanafram loudspeaker was intended chiefly as a news item on loudspeakers in our "quest for better radio equipment." As the story says, the speaker was not developed commercially as far as we know, and about the only thing I can do for you and the rest of the readers who have asked for information on this speaker is to refer you to Mr. Armstrong Perry, 383 King's Highway, Westport, Connecticut. Mr. Perry is in full knowledge of further details and can tell you more about this matter than I can.

It occurs to me that you might not be able to obtain one of these speakers, and in this connection I would suggest the new Bemis Ortho-Lyric as a second choice for a high price good speaker. I listened to this reproducer and was quite pleased with it.

What Makes a Tube Work?

J. K. S., Denver, Colo.

Question: Can you tell me how a vacuum tube works, and what part does the plate, filament and grid play? I have never seen an article published on this subject. Also kindly send me information concerning subscription prices to ON THE AIR.

Answer: The fact that you say you are interested in subscription shows that you have not been a reader of ON THE AIR very long, and further illustrates that you have been missing much.

If you will refer to the January issue of our publication you will find a most complete explanation of the action of the tube, the respective function of the plate and filament, and the control action of the grid. This issue also has some interesting data on tubes in the story by William Rados, on "How Broadcasting is Done."

B Substitute Condensers

W. P. S. St. Louis, Mo.

Question: In your February issue you have a diagram of a B Battery substitute using the Raytheon tube. I would like to know if the condensers used are what is called bypass condensers. I would like to know the approximate cost of constructing one of these eliminators.

Answer: 1. The condensers used in the set are not the ordinary bypass condensers we use on radio sets if that is what you wish to know. They are of similar construction, with the difference of being able to withstand higher voltages than the ordinary receiving condensers. Most of them test up to 700 or 500 volts DC. The ordinary receiving by-pass condenser is designed to stand about 150 volts DC maximum. Dubilier, Kellogg Switchboard and Supply Company, and Tobe Deutschmann all make filter condensers designed for B battery substitute systems.

2. The cost of building one of these units ranges from fifteen to about forty dollars, depending upon the amount of current the device is to pass. The average type retails around twenty-five or thirty dollars complete. Almost all of the big transformer manufacturers such as Thordarson, Jefferson, Dongan and Acme put out kits complete for this work. They will gladly supply you with buying specifications and prices.

Long Wave Combination Receivers

G. S. H., Clifton, Kans.

Questions: I am a subscriber of ON THE AIR and enjoy it very much. Every time I open one of the issues, I get a new set of ideas for experimental work in which I am very much interested.

1. I have a long wave coupler with a range for from 175 to 2600 meters. I wonder if you would print a diagram of the best long wave circuit to receive stations (code and phone) over the entire range. I prefer less than 4 tubes—two or three is plenty. 2. What size condenser will I have to use with this coupler? 3. Where can I secure a call book containing all the amateur, government, (Continued on page 38)

Let's Have Better Loudspeakers

(Continued from page 33)

manner gives us a low range of 93 cycles.

Regardless, however, of just how close the basic design of any device conforms to theory, the proof of the pudding is in the eating. Tests on loud speakers may be classified into two groups, i. e., engineering tests and listening tests. Loud speakers are sold on the basis of listening tests, and no matter how perfectly the design fits theory, if it does not meet with the listener's approval, it may be considered a failure. The Ortho-Lyric, judging from a demonstration recently attended the writer, possesses all the qualifications necessary to pass the most critical listening test. Mr. Cole, who developed this reproducer, is a man of exceptional musical taste with considerable experience in pipe organ work and was therefore well fitted for the task he undertook. Like many others, he realized that one of the principal weaknesses of many radio loud speakers was their tendency to accentuate that portion of the musical scale one octave below and two octaves above middle C and to suppress the higher notes. The lower notes as a rule were not present at all. So he aimed to build a reproducer that would place a proper intensity value upon each note so as to give all musical sounds their proper place on the scale of audible vibrations. The Ortho-Lyric was the result.

Of course, it must not be inferred that a good loud speaker used with any kind of a radio receiver will reproduce without distortion. Unless the audio frequency transformers are properly designed or unless the audio frequency stages of the set are designed with care, even the best loud speaker may fail to reproduce satisfactorily. However, the problems involved in producing undistorted amplification within the receiver are purely of an electrical nature and such strides have been made in this branch of the art that it is now possible to build sets that are all but perfect in reproducing ability.

New SM Products

The Silver-Marshall Company of 106 South Wabash Ave., Chicago, Ill., announces several new additions to their regular line of apparatus. A new dial of the popular friction control type a different SLF condenser, and a junior or a midget condenser are featured.

The ORTHO-LYRIC REPRODUCER

A NEW KIND OF LOUD SPEAKER

REVOLUTIONARY

Price

\$40



Finished in lustrous Walnut or Mahogany. Two sizes:

15x15x30" \$40.00
16x16x40" \$50.00

Seven foot sound chamber.

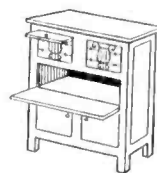
Fills the Home With Deep Rich Music

—rivaling in tone the resonant depth of the mighty pipe organ. Every note is faithfully, gently and equally projected from the scroll of this wonderful speaker, with quality that defies description. From the bass notes of the pipe organ to the highest notes of the violin—such is the musical range of the New Ortho-Lyric Reproducer. It has a six foot sound chamber in a tastefully designed cabinet which fits into any home of good taste—a piece of serviceable ornamental furniture you will exhibit with pride. If dealer is not yet supplied, order direct from us. Write for descriptive circular.



THE BEMIS MANUFACTURING CO., 407 S. Dearborn St., Chicago, Ill.
Factory: Sheboygan, Wis.

Distributors and Representatives—Write for our merchandising plan.



There are also console table models, prices varying according to design, upon application.

VICTOREEN

SUPER-HETERODYNE

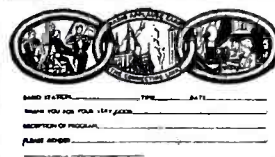
Coast to coast on loudspeaker with inside loop aerial. The set you will eventually build.

We have Complete kits for the construction of the phenomenal Victoreen Super-heterodyne the wiring diagrams of which appeared in February ON THE AIR. Everything from transformers, cabinets to binding posts. Write for blue-print and prices. All equipment as specified. Dealers wanted.

NELSON ELECTRIC CO.

508 Dearborn St.

Chicago, Ill.



APPLAUSE — The radio Artist is doing all he can to make your evenings pleasant but it must be discouraging to do this without a little praise.

The old saying is give an artist a little applause and they will work their head off. The only way a radio artist can feel that his efforts are appreciated, is to send him an applause card. These you can have in a convenient form at \$1.35 per hundred with your name printed in a different color. Just fill out the coupon, don't send any money. Pay the postman on arrival plus a few cents postage.

B. A. BOWMAN, Bldg., Chicago, Ill.
Rand McNally Bldg., Chicago, Ill.
You may send me 100 of your applause cards, by mail, I will pay Postman \$1.35.

NAME _____
ADDRESS _____
CITY _____
STATE _____

amplifier as it gives practically a uniform amplification throughout the speech range of 60 cycles to 3000 cycles. Figure 1 shows the microphone connected to the speech amplifier.

This speech amplifier has a very complicated wiring but it may be simplified in a schematic diagram. (Fig. 6) The amplifier is a three stage amplifier using Western Electric "D" tubes in the first two stages. These tubes have an amplification factor about six times

as great as that of an ordinary UV 201 A tube. This of course, gives great amplification. The third stage has a five-watt power tube.

These tubes are connected by coils and condensers which take the place of the familiar audio frequency amplifying transformers. The use of coils and condensers results in more nearly perfect amplification. As there is a wide variation of voices and instruments, the amplifier must have some sort of adjustment to accommodate the different variations. This is produced by a switch and twenty-four taps, so that as little as one twenty-fourth of the total output may be obtained.

This small output would be used when the performance was very loud. Besides these parts there are meters, rheostats, switches, and other controls on the panel of the instrument so that the current may be controlled and measured. The amplification obtained by this instrument is tremendous and of the finest quality. But while the average fan's amplifier costs about twenty dollars this amplifier costs several thousand dollars. This amplifier is a telephone instrument and is regularly used in long distance telephone communication. In fact, much of this work in radio was done by the telephone engineers.

The next main part of the transmitter after the speech amplifier is the modulator. (Fig. 1).

There are several different methods of modulating among them the grid method, the

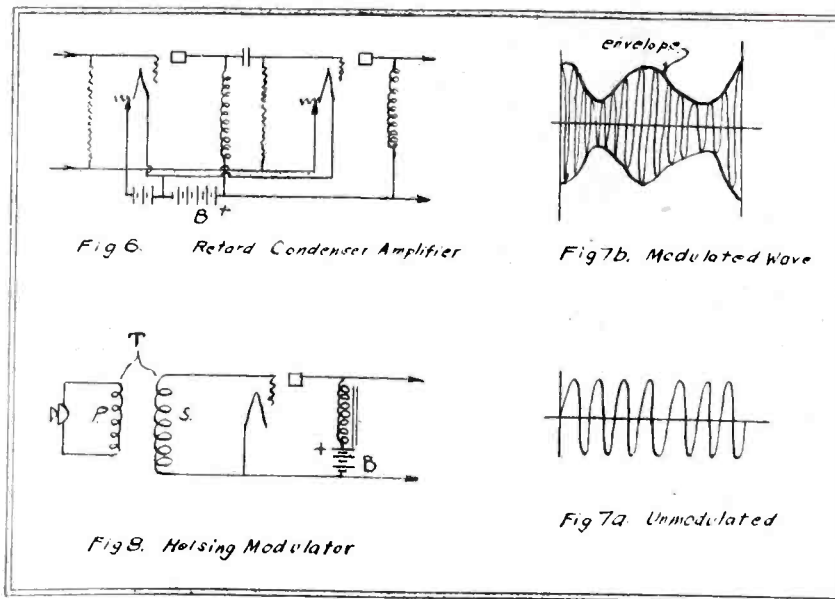


plate power variation, and the magnetic modulator. Of the several methods available, the plate power method is the best. This is called the Heising system after its inventor.

The Theory Of The Heising System

THE Heising system, Figure 8, is a variation of plate power or voltage supplied to the plate circuit of the oscillator tube. This system requires

extra tubes and apparatus but gives best results.

In Figure 8, T is a step up transformer, the primary of which is operated by the microphone and battery. The oscillator tube, connected across the modulator tube, is regarded as a resistance. The microphone and small battery set up a varying voltage in the primary which is stepped up in the secondary and applied to the grid of the modulator tube. Thus the speech is amplified and passed to the plate of the oscillator tube.

The choke coil in the diagram is in series with the plate power. This helps the plate power action so that when the microphone is spoken into, the battery will act somewhat as a variable battery and variations of the tube voltage will follow the variations of the speaker's voice.

Think of the modulator as a generator (excited by the microphone) of speech frequency power. This varying power is supplied to the plate of the oscillator tube. The oscillator tube acts as a resistance (load) and when its resistance equals the resistance of the modulator tube the maximum power is supplied it. Oscillator and modulator tubes are always of the same electrical characteristics so that they will have equal resistance.

The Oscillator Circuit

Now that we have the mike, the speech amplifier, and the modulator, we need only one more device

(Continued on page 41)

How Broadcasting Is Done

(Continued from page 10)

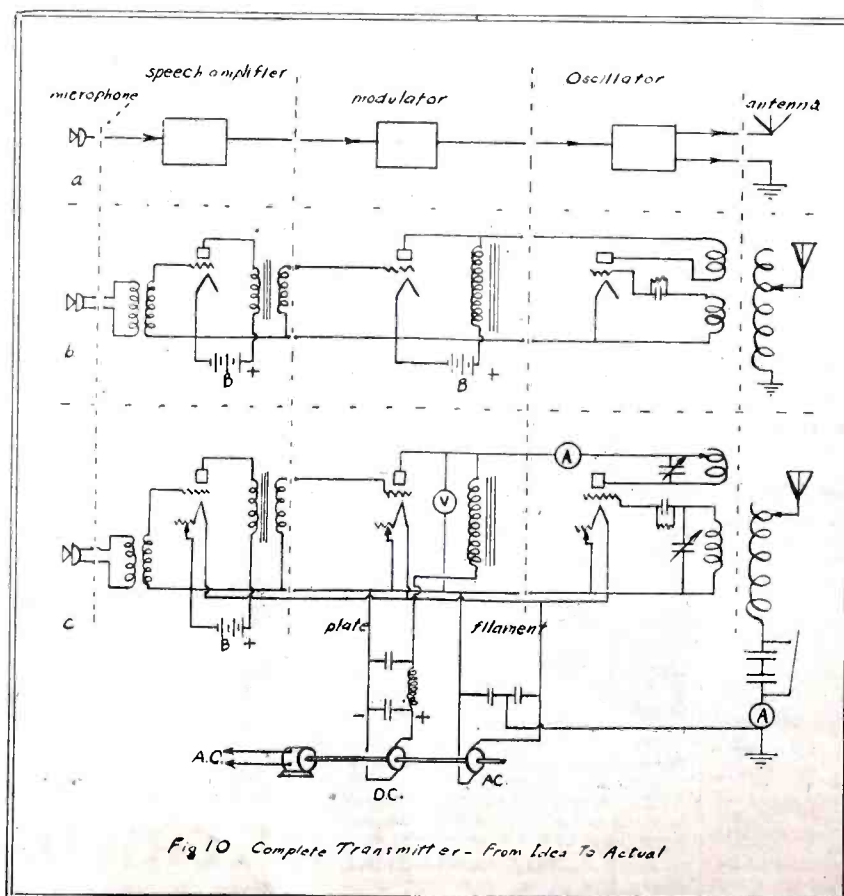
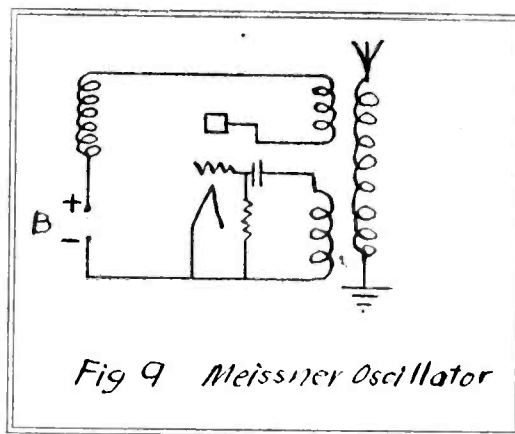


Fig 10 Complete Transmitter - From Idea To Actual

The Best Radio Affords!



"A Wonder"
says user:—

"The Loud Speaker is a wonder. I never heard anything like it. I put it to a little test a few nights ago and it was heard clear and loud nearly one-half mile from my place through an open window."

Burton W. Cooswell,
Brockton, Mass.

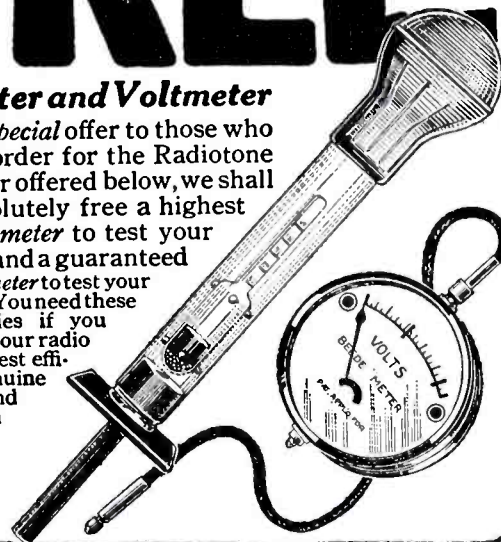
\$1.00
down!

With the Radiotone all the family can enjoy your radio at the same time!

FREE

Hydrometer and Voltmeter

As an *extra special* offer to those who hurry their order for the Radiotone Loud Speaker offered below, we shall include absolutely free a highest grade *Hydrometer* to test your "A" battery and a guaranteed accurate *Voltmeter* to test your "B" batteries. You need these two accessories if you want to keep your radio always at its best efficiency. A genuine \$3.00 value—and given free on this special sale, while it lasts. So act quick!



Radiotone Loud Speaker

Only \$1.00 with the coupon below brings this Genuine Radiotone loud speaker to your home on approval for 30 days! No radio is complete without a *good* loud speaker. Here's a first class loud speaker at an astounding rock-bottom price, direct—and on easy, monthly payments besides! Special now—Hydrometer and Voltmeter, \$3.00 value, included FREE, if you send at once.

Makes Your Radio Complete

The Radiotone is super-sensitive, brings in distant stations with full volume so every one in the room can hear distinctly and easily. Wonderful clearness and absolute purity of tone. No distortion.

The Radiotone has a 14-inch horn made of Thorite in one piece without seam or joint, acoustically correct. This eliminates the metallic clang you often hear in other loud speakers. The reproducing unit is entirely enclosed at the base of the horn. The well balanced construction does away with all vibrations. The Radiotone has a graceful shape with a beautiful black florduline finish. It stands 23 inches high and weighs only 15 lbs. No extra batteries needed for the Radiotone—just plug it in as you do your head set. Nothing to wear out or get out of order. Sent complete with cord and plug.

30 Days Trial—\$3.00 a Month

Straus & Schram, Dept. R9214

Chicago, Ill.

Enclosed find \$1. Ship special advertised Radiotone Loud Speaker. I am to have 30 days free trial. If I keep the Radiotone, I will pay you \$3.00 monthly, total price \$25. The Radiotone is to become my property as soon as you receive the final payment. If not satisfied, I am to return it within 30 days and you are to refund my money and any express charges I paid.

Radiotone Loud Speaker No. Y8726A—\$25.00.

Hydrometer and Voltmeter FREE

My Name.....
(Head of the family must sign this order. If you are not of age, have your parent or guardian order for you.)

My Street Address.....
R. F. D. or Box No.....

My Post Office..... My State.....

My Shipping Point..... I have lived in this Town..... years

And before that I lived in..... Town..... State..... for..... years

Occupation is..... Age..... Married or Single.....

Give names of merchants who know you personally

Name..... Town..... State.....

Name..... Town..... State.....

If you have ever bought goods on credit by mail, tell us from whom. If there is anything else you wish to tell us about yourself, write on a piece of paper and enclose it with this coupon. But the coupon alone, fully filled out will do.

That's all we want to know and we're ready to ship the goods at once. No formalities. No C.O.D. We trust rich and poor alike when they merely show us that they are honest.

When the Radiotone comes, there's nothing to pay. Use it freely at our risk, on trial for 30 days. See how loud, clear and distinct the Radiotone brings in all stations—better than any other loud speaker that you have ever heard, giving you the best that is in your set. After 30 days trial if you think you can get along without the Radiotone, return it to us and we will refund your dollar plus all transportation charges. No red tape. The trial costs you not a cent. But if you decide to keep the Radiotone, pay only \$3.00 a month until you have paid the total rock-bottom direct price—only \$25.00. See if you can equal this offer anywhere on such amazingly liberal terms. You'll scarcely feel those small monthly payments.

Send Coupon NOW!

Only \$1.00 with the coupon brings the Radiotone on 30 days' trial, satisfaction guaranteed, your dollar refunded if not satisfied. Send the coupon now while this special offer lasts. Hydrometer and Voltmeter FREE, if you act quick.

STRAUS & SCHRAM
Dept. R9214 Chicago, Ill.

The SILVER-COCKADAY Receiver

By McMurdo Silver¹

WERE one to mentally review the successful radio receiver developments of past seasons, a single outstanding fact seldom considered would be evident—that practically every popular circuit design has been the result of the work of a single engineer, or at best, that of the engineering staff of a single concern—generally engaged in the manufacture of highly specialized parts.

That there have been many successful and popular circuits developed in this fashion indicates that the individuals responsible had a keen insight into, and appreciation of the requirements of broadcast receiver design.

The S-C Receiver is the result of the application of this idea of cooperation

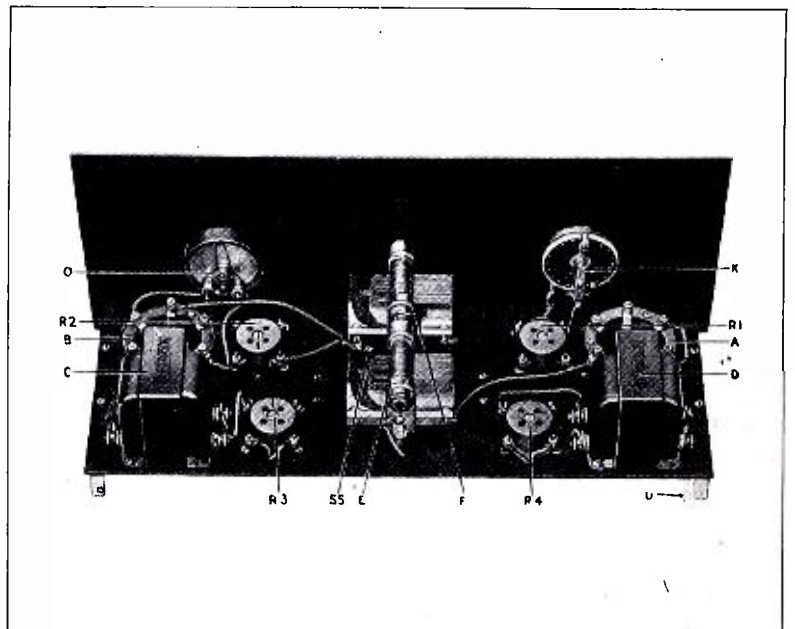
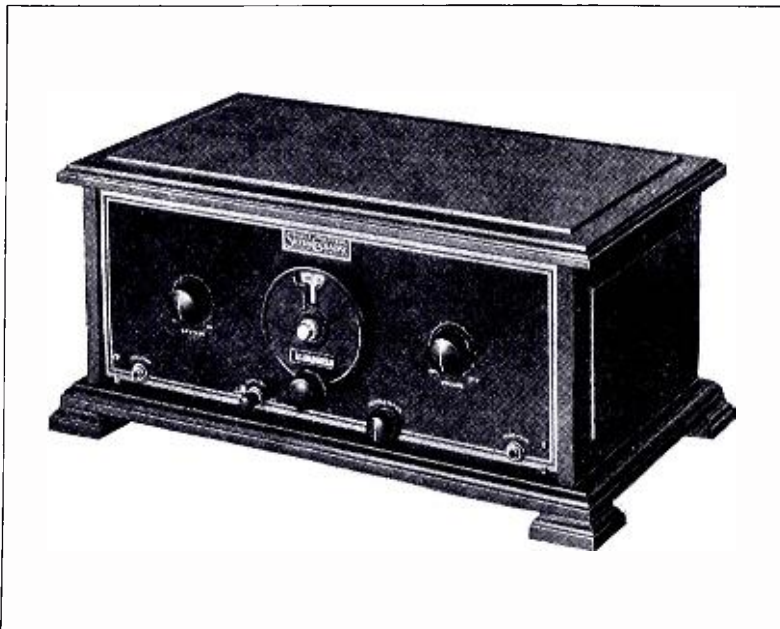
Short or Long Wave Stand-by On This Single Control Receiver

in order that the system which consists of a stage of tuned radio frequency amplification, a regenerative detector and two stages of audio amplification, might operate satisfactorily at any wavelength from 50 to 1800 meters, thus taking in all American and most foreign broadcasting stations. Actually, by the use

only been made practical, but the tuning of different circuits has been simplified down to a point where but a single control is required.

Single Control

A single dial controls all wavelength adjustment or tuning, thus simplifying the operation of the receiver to a point where an absolute novice can operate it with the assurance of far more than average results. This feature is accomplished through the use of two standard condensers so designed that they lock into each other and thus permit of control from a single dial. Their design must be extremely accurate in order that any circuit variations will not affect



and specialization to receiver design, put into operation by two men, aided by the sales and engineering staffs of a number of large manufacturers. Every man—every department of these organizations was closely in contact not only with each other section, but even more important, in direct personal communication with the army of radio fans whose desires had to be satisfied.

Thus, the S-C receiver is the result of the combined efforts of Lawrence M. Cockaday, designer of the famous four circuit tuner, seven prominent and capable engineering staffs—the pick of the industry—and the author, in an endeavor to develop a thoroughly satisfactory set which would adequately meet certain requirements considered necessary to an ideal receiver—features such as have not been found in receivers developed prior to the S-C circuit. Just how these efforts have succeeded, is left for the reader to decide.

Short or Long Waves on one Receiver

ONE of the first conditions imposed was that of wavelength flexibility,

One tuning control, a filament rheostat, a volume control, a neutralizer and two jacks make the panel layout. Not one bit of hardware more than is necessary. The back panel is just as simple and efficient looking as the front view. A few short direct leads represent the only visible wiring.

of plug-in inductances, the range of the S-C receiver is almost unlimited. By using two standard "A" type inductances, the wavelength range is from 190 to 550 meters, while with two "B" type inductances, the range is from .90 to 210 meters. Again, changing to a set of two "C" type coils, gives a range of 50 to 110 meters. "D" or "E" type coils allow adaption to foreign broadcasting on waves up to 1800 meters without difficulty. Due to the design of these coils, which are wound upon ribbed Bakelite tubing, the losses are extremely low. The selectivity of the receiver and its adaptability to different antenna lengths and locations is within easy control—by merely adjusting a small coupling coil located in the antenna inductance. The reader will realize that it is seldom indeed that an all-wave design is practical, yet in this particular receiver it has not

the tuning of the receiver throughout its wavelength range other than to an extent which may be compensated for by the small condenser provided for this purpose—not with an adjustment for each new station tuned in, but rather with a single adjustment for practically the entire wavelength range.

Those condensers possess a straight line frequency curve resulting in extremely easy tuning since low wave stations can be easily separated, with no sacrifice in selectivity on the longer wave stations.

An exceptional bit of engineering work is evident in the audio amplifier on the part of the transformer designers. A new type of special power transformer, heretofore available only in receivers costing from \$500 to \$2,500 or more, is used, possessing a practically straight line frequency curve from 30 to 7,000 cycles. While this curve is not absolutely flat, it is so straight that its slight minor variations are not perceptible to even the best trained human ear—as compared with average resistance coupled amplifiers. There is little difference in quality between transformer and resistance coupling using these particular

(Continued on page 40)

¹Chief Engineer The S-C Merchandising Committee, 725 Lyon & Healy Bldg., Chicago, Ill.

The March Toward Monopoly

(Continued from page 30)

things are never mentioned?

It is because it is possible, by mentioning certain persons, certain products, certain ideas, day after day, week after week, year after year, to make you and me think what certain leaders want us to think. It is the method by which fortunes are made and political control obtained.

Monopolies in Action

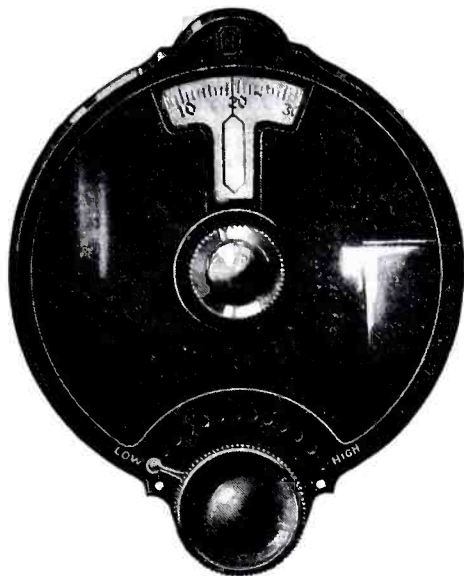
THE struggle for the control of broadcasting is a battle of giants. The first great broadcasting station to maintain a high-grade, popular daily program was KDKA, the Westinghouse station in Pittsburgh. It was not long before the American Telephone and Telegraph Company came into the field with WEA. The broadcasting of a few events such as the world's championship prize fights, the world series baseball games, and addresses by world leaders demonstrated the fact that the public prefers such broadcasts to the best studio programs that can be arranged. The American Telephone and Telegraph Company, which had attracted less attention than its rivals, suddenly shot ahead through its ability to place microphones where events of public interest were taking place, transmit music and speech over its wire lines to any part of the country, and broadcast the event so that it might be heard locally with the crudest apparatus and over great distances by better receivers. Its competitors in the broadcasting field, who had been using pickups and telephone lines, were shut off, so far as contracts would permit, from the use of the telephone wires for broadcasting purposes.

For a time it appeared that the A. T. & T. had an advantage that could not be overcome, then suddenly came the rumor that the Radio Corporation of America or one of its allied corporations had developed a portable pick-up and transmitter that would transmit speech and music by radio, from any point where an event was in progress, to the broadcasting station. If this operates successfully the company will be on at least equal terms with any competitor.

It seems probable that there will be a radio monopoly of the air. Whether the apparent competition between the great corporations is genuine, or whether beneath it there are mutual arrangements and understandings, it is true that corporations do not usually fight when cooperation is more profitable. Since the days when Cornelius Vanderbilt, double-crossed by the New York board of aldermen, obtained a commanding influence over the New York state legislature so that the graft, if it had to be paid, could be paid to responsible parties who could and would deliver the goods, Capital has always found a way to gain its ends. It has been so in fact from the beginning of the human race, though Capital used to be muscular prowess instead of cash.

(Continued on page 39)

National Velvet Vernier Dial Type B, Variable (Patents Pending)



Positive Control—Easily Mounted

YOU control the reduction ratio with this new NATIONAL Type B, Velvet Vernier Dial. And what a difference in the tuning of your set! You'll be astonished.

Easily mounted on the 1-4 in. shaft of any standard type of variable condenser. A screw driver is the only tool you need.

It has the same velvety smoothness, the same freedom from backlash, the same mechanical drive as the NATIONAL'S famous Type A dial.

Write for Bulletin 109-OA

NATIONAL CO., Inc.

W. A. Ready, President

110 Brookline St. Cambridge, Mass.

Cadiz, O.



Verified Reception from Paris by Cadiz, Ohio, Radio Fan



Coast to Coast on a Loop is easy with a Victoreen "Super"



Victoreen No. 170

4—No. 170 R. F. TRANSFORMERS at \$7.00 each and
1—No. 150 Coupling Unit at \$5.50

Constitute the Heart of the Circuit

No Oscillations, howls or squeals
—no matching of tubes

Ask your dealer for free "Victoreen" folder which contains hook up and complete information, or write us direct.

The George W. Walker Co.

6507 Carnegie Avenue

Cleveland, Ohio

Centralab Modulator Plug

The Centralab Modulator Plug is a unique new device that can be quickly attached, without tools, to any radio receiver having one or more jacks, and provides gradual control of tone volume from a whisper to maximum.

In appearance it is slightly larger than the average phone plug, with a small Bakelite knob on one side. Turning the knob through an arc of approximately 300 degrees varies a smooth graphite resistance in the plug base. This in turn controls the tone and volume.

commercial and experimental calls of the United States from low power short wave sets to high power commercial and naval stations. 4. When I connect a 1mfd. bypass condenser across the 90 volt B battery I use I see a small spark. Will this exhaust my B battery faster than otherwise? Thank you for any answers you might give me.

Answers: I am not printing a diagram of the type you ask for; this is being sent you under separate cover. If I do seven thousand, eight hundred and two letters will come in to me asking for details on how to wind a coupler of the type you have. And so I am recommending to you and the rest of the All-Wave Fans that you check up on some system such as the Silver-Cockaday (described in this issue) for a complete diagram. This set uses four tubes, but does the work. 2. Two .0005 mfd condensers, gang control are used on the SC set. 3. You can secure more information on the call book you ask for by writing the Bureau of Printing, Washington, D. C. Unfortunately, radio does not boast a complete call book containing all the calls you are after. Broadcast lists are available everywhere. The amateur calls can be taken from the Citizens or Consolidated radio call book or from the government list. The naval and commercial station calls you'll have to get from the government. Budlong-Clayton Co., of 1045 Main St., Hartford, Conn., put out a call book of *foreign* amateur calls that costs 50 cents. 4. If you test your bypass condensers this way carefully you can tell pretty accurately whether or not they will leak. Charge the condenser by shunting it across the plus and minus terminals of the 90 volts. This should take but a second. Then disconnect the charged condenser and let it stand for ten or fifteen minutes. Short the terminals of the bypass condenser. You should get a spark when the short is complete. The longer the condenser holds its charge the better the condenser. If no spark appears check it with a pair of headphones in series with the B batteries and condenser or a small volt meter. If none of these are available, a small flashlight bulb will do. Connect the bulb, the condenser and the battery in series and if the bulb lights the condenser is leaky and will run down your B battery.

Changing Condensers

H. Y. T., Asheville, N. C.

Question: I am a new subscriber to your magazine, and would like to avail myself of your help. 1. I have a six tube super-het and I have all kinds of trouble in tuning in stations on the same wave band. Could I get Karas Condensers and replace the ones in my set. Do you think this would be practical, if so what size must I get for this set, and would I have to change anything else?

Answer: My advice to you would be to return the set to the dealer from whom you bought it or to sell to someone who is not so fussy about separating stations. Often you will find that a set will perform very much differently in one location and unusually well in another. Then I

TECHNICAL INFORMATION SERVICE

ON THE AIR is inaugurating this special technical service department for the convenience of its readers in helping them to solve technical and general difficulties common to radio broadcast listening.

There is no charge for this service which is maintained by a corps of technical men, and readers who wish to avail themselves of the service need only to observe a few efficiency rules.

1. Do not ask for comparisons between products advertised in this or other journals. In justice to our advertisers, we cannot convict one product and recommend another.
2. Don't ask too many questions. Boil your letter down to just what you really need.
3. Don't ask questions that require too much research work or reference. Give the other fellow a chance.
4. A letter of inquiry written in the following form always gets a quick reply. If you would expect speed, make your inquiry conform to the requirements.
 - A. Enclose a standard *business size* stamped addressed envelope. No envelope, no answer. Foreign countries need no stamps.
 - B. Write, don't scrawl. Use typewriter if possible. One side of paper only.
 - C. Diagrams and drawings on separate sheets. Fasten correspondence together.
 - D. Number your questions or paragraphs, and keep the subject matter of the paragraph unified. When we answer, we'll refer to the number of the paragraph. Keep a copy of your letter for reference.
 - E. Put name and address on each sheet.
5. Address your questions to ON THE AIR, Technical Editor, 1304 Kimball Hall Bldg., Chicago, Ill.

would investigate some other types of superheterodynes of greater selectivity, e. g., the Scott Super 9 or the Madison Moore, or the Victoreen. All or any of these models are exceptionally selective. The system of wave changing in the set you mention is not entirely a success as far as the opinion of the technical editor goes. This is more or less of a personal viewpoint though, and I would prefer that you do not take my attitude toward superautodyning too seriously.

Technical Department Strays

THE Technical Editor just got a letter from the Ensall Radio Laboratory of 1208 Grandview Avenue, Warren, Ohio, commending ON THE AIR, and offering to help out readers with laboratory service on wiring and specialized information. They build receiving and transmitting equipment and sets to order, calibrate wavemeters, and wire all kinds of sets. Super-heterodynes wired if you supply your own parts—charges running from 25 to 50 dollars. They can supply good references.

The technical editor wants to ask some questions. From time to time letters have come in to the office requesting dope on the elimination of various kinds of power line interference. While we are in a position to supply correspondents with general information we are more or less at a loss to locate a laboratory or service that can give specific details for individual cases of QRM. Is there any one in the crowd that has done work along these lines? If so let him be dragged forth to explain why he has so modestly hidden himself while the rest of the brethren suffer the scourge of generator, arc, lighting circuit, X-ray, dentist machines (infernal and otherwise) circuit breakers, motors, and ye one thousand and one other sources of affliction to the radio enthusiast.

Why doesn't someone design a simple, inexpensive and efficient B substitute for the farmers who use the Delco lighting systems on the ranches? We have had any number of inquiries asking for circuits. In many cases we have shown them how to tap the batteries to get the A and B voltages—but this does not suit at all. What is needed is a complete ready to connect unit that can be plugged into the light socket and be used just like the regular A and B substitute. Somebody that does this is going to make \$\$\$\$.

Those of you who have written to H. Q. (head quarters) asking for complete diagrams for a short wave receiving and transmitting station will just have to wait a while. Ye Tech. Ed. is busy at present at designing a simple, low powered and efficient transmitter that he can spring on you without answering seven million questions,—one that will work off the light socket and that is built of parts available to everybody. In a later article we'll show you how to build a short wave relay receiver using manufactured parts—and we'll do our best to simplify the thing down to just what you need. Then we'll go into the details of installation—perhaps we can get Radio Operator 39736 to write us an article on learning the code. How to build a wavemeter and use it, and then a brief outline of operating procedure and getting on the air.

In the meantime, if there are any of you who intend to follow along with us, better brush up on radio theory. A good way is to get in touch with some good correspondence school where they guarantee an operator's license. You'll need a license before you can "pound the brass" (meaning work the key of the transmitter).

Keep your eye open—we're liable to spring these things any minute. You can't afford to miss a single issue of ON THE AIR—this proves it.

WOAW'S BLAH CLUB

(Continued from page 12)

ville to Parsons during the hottest dry spell Carrie Nation ever cast over Kansas.

Reference: WOAW 1st trick operator,
WOAW Market Announcer.

Respectfully,

O. J. Pruitt.

ONE of the new features of the Blah Club is the radio column of jokes and contributions by the Boobs, Boobesses and Boobies of the club. All complaints and razz letters are referred to the knockers bureau, which is a subsidiary organization, especially instituted for chronic knockers of radio programs and everything else.

Political blah is well taken care of by Senator Snag, a mysterious politician of Podunk Center, who speaks each week on some important subject such as, The Segregation of Bacteria, The Preservation of Abused Vacuum Tubes, and the Idiocy of Alimony.

The official pass-word of the Blah Club is "Blah," meaning bunk, or anything else.

The March Toward Monopoly

(Continued from page 37)

It will probably be so until the end of time. The reason why we have scandals about Teapot Domes is because we have so large a percentage of ivory in our own domes. Capital represents the folks who think. Capital thinks a long way ahead. Whatever you and I may think about today, we may be sure that Capital thought it all out at least ten years ago. Capital studies the laws that govern the world. These laws are open for the study of all of us, and the small percentage that delve into them and work in harmony with them inevitably come to the top. The rest have to be content with the results of their own unintelligence.

Radio Not Exempt from Natural Laws

The control of natural resources or of a means of communication by a corporation does not mean that anyone is necessarily crooked or even selfish. The fact that a corporation may be controlled by a single individual with a swollen fortune

does not mean that that individual is necessarily a hog. It is the law of nature that the strong increase and the weak grow weaker. Physical weakness may be overcome by strength of mind that enables the individual to compel his body to exercise, but a general weakness that yields always to the desire for the attractive thing, the latest thing, the thing that frees us from the drudgery of toil, necessitates monopoly. Most of us care more for ease and comfort than for the physical and mental effort that is required for big success, and we will even imitate the hound dog that sat on the thistle and howled because it was easier to howl than to move.

Would we give up the telephone in order to get rid of the alleged monopoly that makes a unified service possible? Would we sacrifice the peace and prosperity of our country in order to get rid of the political monopoly that puts one party or the other in power? Would we give up our automobiles in order to smash the gasoline monopoly? Concerted action would produce the result at any time. We could bust any radio monopoly that could be formed and it would take no longer than six months to do it. The process is very simple—merely stop buying radio apparatus and if that does not make it crash, put our second-hand sets on the market. Three or four years ago we knew nothing about radio. Surely it has not become so great a necessity that we could not do without it for the sake of a principle.

Will we do it? We will not! Revolutions do not start until a lot of folks have been cold and hungry a long time. The politicians know how hard it is to cook up a campaign issue that will arouse enough interest so that the voters will go across the street in the rain to vote pro or con. We like to rant about monopoly but, as long as we have a warm fire to rant around, the monopoly will not have anything harder to fight against than hot air.

We are inclined to ascribe every attempt at monopoly to selfishness. What shall we say about the ten millions of radio listeners who enjoy programs that cost thousands of dollars but send so few acknowledgments that the artists are discouraged and often feel that nobody heard or appreciated their efforts? What shall we say when thousands of these listeners who never said "Thank you" suddenly come to life and send telegrams when a prize is offered that they think they can grab by a quick report? I say that, beside the attitude and actions of most of us broadcast listeners, the things done by the fellows who are said to be trying to secure a radio monopoly look like pure philanthropy.

But monopoly has some powerful opponents. A Chicago paper voiced the sentiment of a large section of the press when it warned against a monopoly and said: "If efforts strictly to limit or squeeze out the independent broadcasters should succeed, the radio listeners doubtless would prove a richer concession than the famous Teapot Dome to any corporation obtaining control of the ether whether by patent rights or by other means."



GEM TUBE
A Guaranteed Radio Tube
Within Reach of All

Every tube guaranteed. A tube for a dollar of \$3 value. A trial order will convince you as it has thousands of others. Send your orders at once.

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Type UV or UX 201-A \$1.00
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220 So. State St., Chicago, Ill.
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Read 'em and rejoice!

Classify your tubes as "good," "fair" or "poor" and you have won the battle for good reception. With the Sterling Home Tube Tester you can make this test yourself, right in your home, without disturbing your set. First, plug into the tube socket, read the meter, compare it with the handy table furnished and you will know immediately the amplifying value of each and every tube.

More than that, you can test your set for defects in wiring, weak sockets, troublesome transformers, etc. The Sterling instruction sheet tells you how to do all this. This is a home instrument, but not a plaything, for it is scientifically constructed. Its results are reliable and there is no wear out to it.

Made in two types R-399 for small tubes \$10.00
R-401 for large tubes 8.50

At your dealer's—be sure you ask for a Sterling.

The Sterling Manufacturing Co.
Cleveland, Ohio

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RADIO PARTS

"Home"



Tube Tester

CARTER
"IMP" Rheostat \$1
All Resistances, 5 to 50 ohms.
Works efficiently in any circuit.
Carter Radio Co.
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Free Mailing Lists
Will help you increase sales
Send for FREE catalog giving counts
and prices on thousands of classified
names of your best prospective customers—
National, State and Local—Individuals,
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Volume
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FOR REAL ENJOYMENT

Use the BURNS Loud Speaker on your receiving set. Produces utmost in volume and clarity of tone. Reaches full range of musical scale—equal to hearing the original production.
At your dealers or direct

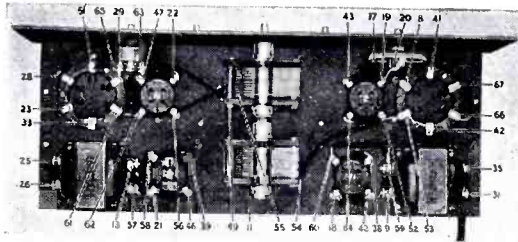
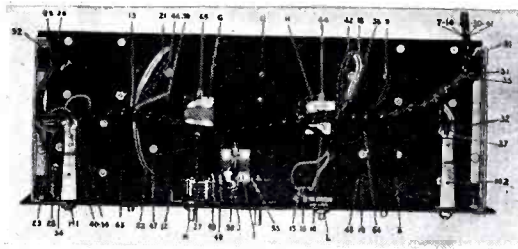
American Electric Company
State and 64th Streets Chicago

transformers. Yet the amplification obtainable from the two transformer coupled stages which are designed for the handling of comparatively high powers, is considerably greater than that obtained from the average resistance coupled amplifier, with a consequent increase in efficiency.

Wiring Previously Prepared

An assembled wiring harness, an almost entirely new feature even in commercial receiver production, simplifies the wiring to a point where anyone can assemble the receiver in a very few minutes. All low potential leads, including battery connections, are contained in the cable so that it is merely necessary to take it, compare the color of the leads with the diagrams and connect the ones of a given length and projecting from the cable at certain places, to the instrument terminals as marked in the photographs and drawings. The high potential leads for the grid and plate circuits of the RF amplifier and detector are separate from the cable but supplied with it, cut to length with the ends scraped and tinned. Thus the wiring is merely a process of pushing the cable ends through the baseboard and either soldering them to instrument lugs or tightening them under instrument binding post nuts so that soldering is not a vital necessity. The cable method of wiring is extremely efficient in that all low potential leads are grouped in one harness and, as a result, coupling to undesired parts of the circuit is reduced to a practical minimum.

Little need be said of the circuit. It is the standard approved four-tube circuit employing one stage of tuned radio frequency amplification, regenerative detector and two stages of power audio amplification. Little more need be said for it for in a recent survey of the country, it was found to be the most popular in the estimation of the public. This is justly so since the sensitivity, selectivity



A top view of the new S-C Receiver which can tune from 50 to 1800 meters single control. The coils plug in the two circular sockets directly opposite the audio transformers. One of the outstanding features of this new universal wave receiver is the use of a special wiring harness which simplifies the assembly work tremendously. The numbers refer to corresponding numbers on the schematic wiring diagram.

and quality of this four-tube combination is in excess of that of many five and six tube receivers now available.

Set is Portable or Permanent

THE general utility of the design, assembled as it is on a 7 by 18 inch Bakelite panel and a 6½ by 17 inch Bakelite sub-base, is astonishing. It may be placed in any type of Console cabinet or any other standard enclosure, or, it may even be put in a portable case since the receiver will operate with a very small antenna—or with a very long one with equal selectivity—say, anywhere from 20 to 150 feet.

Results of Preliminary Tests

On December 28, 1925, between nine and ten o'clock, some thirty-four stations

were logged with the four tubes on a loud speaker, no recourse being had to headphones. Slightly later, when KFI came on, this station, approximately 2,500 miles away, was brought in to a crowded metropolitan area with sufficient volume to be heard throughout two good-sized rooms. This was at the home of Mr. Cockaday, in a residential section of New York City.

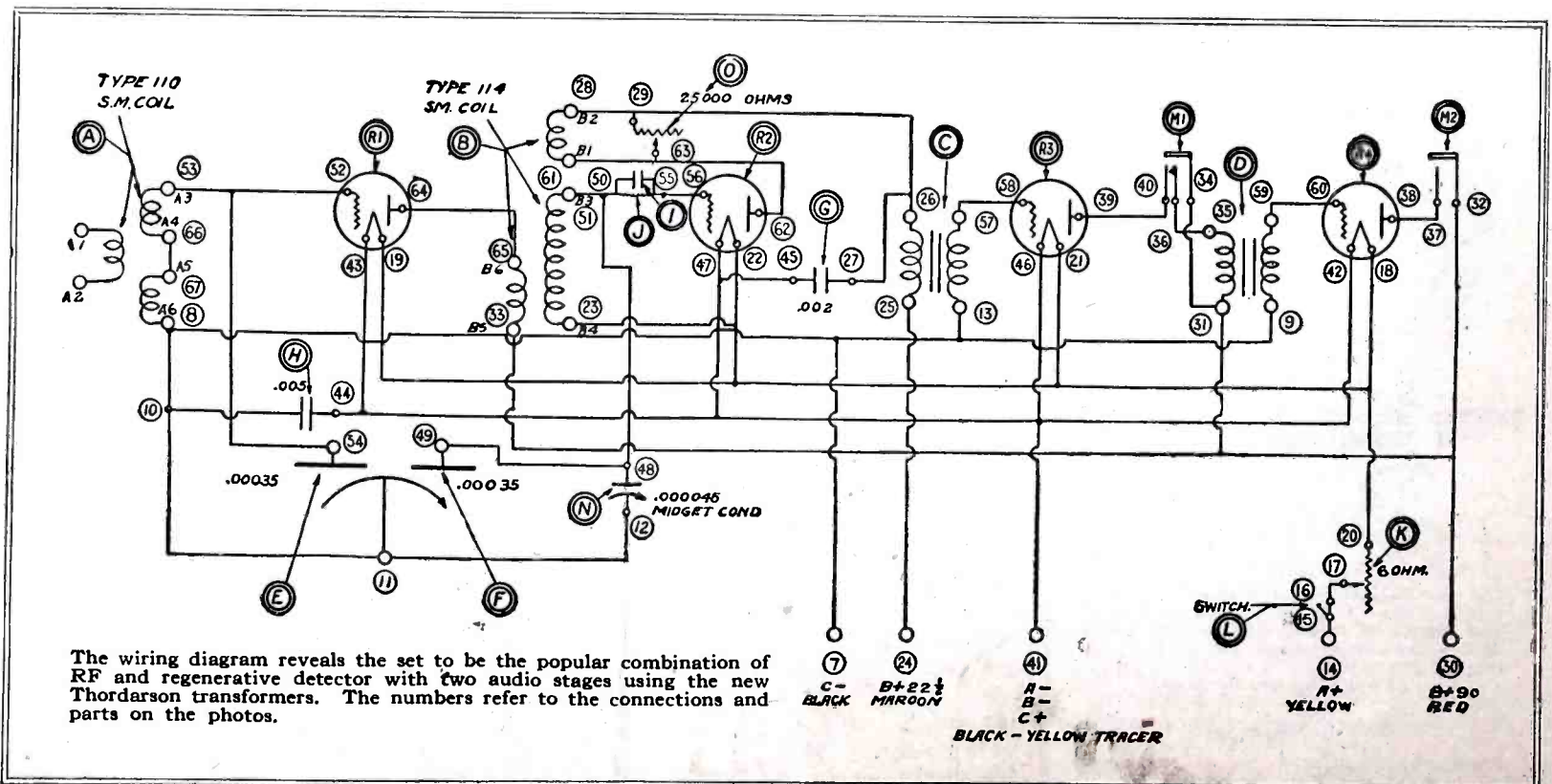
While the S-C receiver does not represent the absolute limit of sensitivity or selectivity that may be realized from a receiver employing twice as many tubes, carefully built in an engineering laboratory, it does represent the best dollar for dollar value available to the home builder since its assembly is simple and positive, its upkeep cost low and its performance equivalent to that obtainable from receivers costing many times its price.

Special Devices Built for Radio Fading Tests

Electrical measuring instruments for recording the extent and duration of radio disturbances were shipped today for use in the National tests for static and fading to be conducted by the Stewart-Warner Speedometer Corporation in cooperation with the physics Department of the Northwestern University on the nights of February 9, 10 and 11 from 8 to 11 o'clock Central Standard Time. These instruments consist principally of sensitive galvanometers and recording devices in which moving pencils will chart minute current variations on a revolving drum. They were built for the test in the laboratories of the Stewart-Warner Company.

The instruments will be used to record an oscillation of fixed tone and frequency to be transmitted from the Central control station of the tests and so will give uniform data on the broadcast.

Affirmative replies have been received from 4,300 of the 4,500 observers asked to assist in the tests.



The wiring diagram reveals the set to be the popular combination of RF and regenerative detector with two audio stages using the new Thordarson transformers. The numbers refer to the connections and parts on the photos.

How A Broadcast Station Works

(Continued from page 34)

before we can begin to broadcast. The oscillator is the fourth part of the transmitter. The usual oscillating system is the Meissner method of generating high frequency oscillations.

The several circuits available for use in radio telephony fall under two general classifications; the self excited and the externally excited. The former (Fig. 5) is the usual one because it requires two less tubes. The Meissner circuit (Fig. 9) is the best of this type of circuit. It is easy to adjust to different tubes, aerials, grounds, and gives a fairly steady wave.

The Complete Transmitter

Figure 10 shows the gradual evolution from the bare indication of the parts layout to the full wiring diagram of a broadcaster.

When the microphone is spoken into, its feeble current is amplified many hundreds of times by the speech amplifier. The speech amplifier passes it on to the modulator. The modulator varies the plate power going to the oscillator tube. The variations correspond exactly to the voice variations at the microphone. This voice variation is superimposed on the radio frequency carrier wave that the oscillator is sending out. Thus the high frequency wave goes out with its envelope of low frequency to the radios in the homes.

The Apparatus In A Large Station

The microphone used is a special Western Electric radio make. The speech amplifier which is used with it has been described in detail. Sometimes, however, besides the amplifier mentioned there is an additional fifty watt amplifier. Two 250-watt tubes are usually used in the modulator, but in the wattage rating of the station these are not counted because they do not radiate. The oscillator has likewise two 250-watt tubes and so would be called a 500-watt transmitter. In the modulator and oscillator plate supply there is a heavy choke consisting of thousands of turns of wire on an iron core, with an inductance of many henries. The plate and grid coils of the oscillator are heavy copper strips coupled to the antenna coil. Meters are placed in all parts of the circuit to indicate current and voltage.

The Motor Generator

THE plate and filament power is supplied by a motor generator set running off the city mains. The motor drives two generators; one a high voltage for the plates of the tubes and the other supplies a low voltage heavy current for the filaments. Across each generator is a voltmeter to indicate the correct pressure.

The output of the plate generator is passed through a filter more or less complicated. Briefly, this consists of several condensers and coils designed to smooth out the commutator hum of the generator.

Wire Telephone Adjunct

Much of the broadcasting now done originates in a place far away from the

station. It may occur in a city a hundred miles away. Broadly speaking, all that is done is to stretch the wires which connect the microphone to the transmitter, to as many miles as are necessary. But electrical conditions are not always favorable to a couple of lonely wires many miles long. The telephone company takes care of these lines and before a program is to be transmitted they check over the line very carefully. A man at each end works on the test.

How The Line Is Tested

Each man has a set of instruments comprising an oscillator and a galvanometer. The oscillator is connected to the line and all frequencies from 50 cycles up to 50,000 cycles are sent over the line. These frequencies are about the limits used in broadcasting.

By using the meter it can be told if all the frequencies are coming over with the same intensity. In order that a speech, a violin, or organ recital will be heard very well it is necessary to connect an equalizer across the line. The equalizer is an instrument consisting of inductance, capacity, and resistance, which can be varied until both the test men report good results. This whole process takes from a half hour to several hours by two trained men depending on conditions.

The result is then that when the artist performs before the microphone, his voice travels over many miles of carefully tuned lines to the station. From there on it is similar to local work.

Ode to the Feminine Radio Fan

"Mary, Mary, quite contrary,
How does your radio go?"

"With whistles and howls,

Grunts and growls
Sensational news,
Dramatic reviews,
Weather reports,
Giggles and snorts,
Lectures emphatic,
Earfuls of static,
Yodeling bassos,
Readings with pathos,
Rattles and roars,
Baseball scores,
Songs paging Sally,
From valley to alley,
Talks about books,
Lessons, for cooks,
Forceful denouncers,
Gargling announcers,
Jazz orchestral din,
How to Grow Thin,

Bumps,
Thumps,
Groans,
Moans,
Squeaks,
Shrieks,
Yells

Knells
Hell's Bells!

THAT'S how my radio goes!"

—June ON THE AIR.

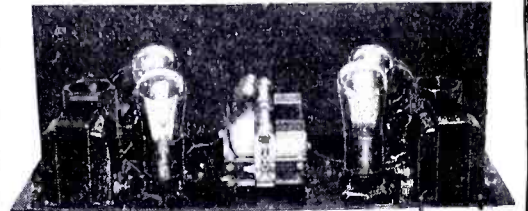


Described in This Issue

Sponsored by Popular Radio Magazine—Endorsed by Radio News—Radio Engineering—Radio Magazine—Christian Science Monitor and Newspapers throughout the country—Proof Positive that the Set-Builder will find a performance equal to promise in the remarkable S-C Receiver.

Send for this
New Hookup

Silver-Cockaday Four-Tube Receiver



The outstanding receiver development of the season, in which is combined the genius of two of the most distinguished radio engineers. A receiver for the home builder that will represent for several seasons to come a far greater value than any other design available.

Several outstanding features place the design in a position far in advance of anything available or contemplated. Unlimited wavelength range, with interchangeable antenna and detector coils; marvelously improved audio transformers; a special self-contained wiring harness; but one tuning or station selector control, are special features.

Over-all design is rugged and solid. Adapted to practically any standard cabinet, any standard tube, any battery or eliminator source of supply, outdoor antenna or loop.

Only a screw driver and pair of pliers necessary. The set can be built at an extremely low cost and parts are readily available at all radio dealers.

Represented Manufacturers:

- Belden Mfg. Co.—S-C Wiring Harness
- Central Radio Laboratories—Centralab Resistance
- Polymet Mfg. Corporation—Fixed Condensers, Leak and Leak Clips
- Poster & Co.—Drilled and Processed Front Panel and Drilled Sub-Panel
- Silver-Marshall, Inc.—Variable Condensers, Coil Sockets, Coils, Tube Sockets, Verrill Dial, Mounting Brackets
- Thordarson Elec. Mfg. Co.—R200 Power Transformers
- Yaxley Mfg. Co.—Rheostat, Jacks, Switch

Get the hand-book at your radio dealer's, or clip the coupon and send with 25 cents to

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725 Lyon & Healy Bldg., Chicago

Herewith please find 25 cents for which send me the hand-book of the new S-C Four-Tube Receiver.

Name.....

Address.....

Squeal Controls

(Continued from page 8)

One method is to employ the usual form of tickler coil coupled to the secondary circuit, but in the reverse direction used for producing regeneration in a regenerative circuit. In other words, the reversed feed back tickler feeds waves that oppose the establishment of oscillations. This can also be accomplished capacitatively by feeding a reversed or counter-current from the plate to the grid circuit through a very small variable condenser having a maximum capacity of about 0.000045 mf. The latter is a very effective method, easily handled and is one of the best methods as oscillations can be exactly controlled on all wavelengths within the range of the receiver. A midget condenser of this type takes but little room upon the panel and can be applied to almost any existing set without much change in the wiring.

Fig. 1 shows a circuit in which several different methods of suppressing oscillations are shown, simply for illustration, but of course all of these systems are not supplied simultaneously to one circuit. The potentiometer method is not shown as it is not so desirable as some other methods in my opinion, and further, the fine wire on the ordinary type of potentiometer is subject to cutting and breakage by the moving contact finger. Any one of these adjustments will prove effective, but my choice is the midget condenser arrangement.

The circuit diagram (Fig. 1) shows the first and second radio frequency tubes (T1) and (T2) and the detector tube (T3). The audio frequency stages are not shown as they have nothing to do with the problem at hand. The antenna coupler has a primary (P) and secondary coil (S) and the following transformers (RFT-1) and (RFT-2) are both tuned by the variable condensers (C2) and (C3) as in any tuned radio frequency circuit. It should be particularly noted that the radio frequency tubes are given a negative bias by connecting the lower ends of the secondary coils to the (-A) line, while the detector tube (T3) is given a positive bias by making this connection to the (GA) or positive side of the filament battery line.

The "Losser" System

A T (R) is shown the variable resistance method of control consisting of a rheostat placed in the grid return line of the first radio frequency tube. This is really a very sharp control providing that regeneration is in excess at all times. If there is not sufficient regeneration or tendency toward oscillation then of course this control is helpless and useless. As a rule, less resistance is in circuit on short wavelengths than on long as the tendency toward oscillation is less with the long waves. If it will not oscillate properly on long waves then the coils must be so arranged that sufficient stray feed-back is had at this point, allowing the excess on short waves to be taken care of by means of the rheostat.

It should be noted at this point that a single circuit antenna inductance is less subject to free oscillations than the two

circuit type shown, and that when the tendency toward oscillation is excessive that a single circuit tuner will sometimes be of great assistance. The single circuit type also reduces the selectivity so that if the circuit is not selective it is usually not advisable to employ this type of coil. Like the two circuit coil, the single coil is tuned to wavelength by a variable condenser.

B Plus Line Control

A T (PC) is the fixed resistance or fixed choke in the plate circuits of the radio frequency amplifying tubes, or more correctly speaking, in the (+B) line that feeds the plate circuits of these tubes. Both the choke and the resistance are placed into circuit in the same way, hence there was no necessity of showing them separately in the diagram. When once adjusted to the circuit in question no further attention is required for they are practically automatic throughout the balance of the wavelength range. With a high value for the choke or resistance the retardation is so great that the receiver will not whistle when brought into the station wave, and this is usually a desirable characteristic providing that it does not adversely affect the sensitivity of the receiver.

The Midget Condenser

My preference is for the midget condenser control shown at (K). Here the 0.000045 mf. variable condenser is connected at one end to the plate of the first radio tube (T1) and at the other end to the grid side of the following radio frequency transformer secondary. This condenser is not only effective in suppressing excessive oscillations but will also incite oscillation on long wavelengths when there would be no tendency toward the proper degree of oscillation. To avoid body capacity effect it is usually advisable to connect the rotor plates of the condenser to the plate and the stationary plates or stator to the grid of the second tube.

Eddy Current Loss System

An ingenious system is employed in the Freshman Masterpiece receiver for suppressing the oscillations but requires careful factory adjustment to avoid excessive "lossing" and decreased sensitivity. This is based upon the absorption system or eddy current lossing system by which eddy currents induced in a metal plate by the coil oppose and limit the degree of oscillation. The tuning coils and transformers are of a basket weave type with one pole held close to the metal back plate of the variable condenser. When the circuit tends to oscillate beyond certain limits, the eddy currents generated in the metal back plate react and holds them down. This is automatic, and of course of advantage in radio receivers designed for the use of the novice.

A similar scheme, long used in amateur built receivers, consists of one or two short circuited turns of wire wrapped around the end of the tuning coils and transformers. The eddy currents induced in these shorted turns act like the metal condenser plate in the Fresh-

man receiver for they react and limit the magnitude of the oscillations in the secondary coil.

Fig. 2 is another variant of the midget condenser control which is similar to the Rice system and which is used by both Harkness and Bremer-Tully in the Counterphrase circuit. In this case, the midget variable condenser (K) is connected at one end to the plate of the tube (P) and at the other end to the secondary coil at a point where the grid return line is ordinarily connected. The grid return, however, is no longer connected to this point. This is also a very sharp control which governs through a wide range of regeneration and throughout the range of broadcasting wavelengths. However, this is noisier in getting the adjustment and requires very much more careful handling than the arrangement of the midget condenser shown before.

Fig. 3 is still another variation of the midget condenser as an oscillation control and in this case it is effective in the primary circuit instead of the secondary. In both cases, however, the current fed back from the plate through the condenser opposes the oscillations set up by the tube and is therefore a sort of inverted regenerative using capacity feed-back instead of a reversed tickler control. It is slightly broader and easier to handle than the arrangement of Fig. 2, and as the grid return is grounded there is not the same tendency toward body capacity, the latter being the most undesirable feature of the circuit in Fig. 2.

In a sense, all oscillation controls are also tuning controls for they vary the oscillations in proportion to the wavelength in all cases except the plate circuit resistance and choke. This is of course a bad feature since it adds to the difficulty of tuning and makes the chances greater of skipping over a station when the oscillation control is not set for that particular wave length. Further, unless such controls are very carefully constructed and installed, they are likely to present a body capacity effect which still further increases the difficulty of tuning.

The controls come either under the head of negative regenerators or friction damping devices. In the first system the self-oscillations are opposed and regulated by a series of opposing oscillations either inductively or capacitatively coupled to the circuit. In the latter method, by damping, the excess oscillations are reduced by frictional resistance placed in the circuit.

Feathered virtuosos, representative of every songster in the Rockies, were heard recently in a unique repertoire of bird calls for nature lovers over KOA, Rocky Mountain broadcasting station of the General Electric company. The program was given by Charles Bowman Hutchins, naturalist, who appeared under auspices of the Mountain club of Colorado. Widespread listener responses included a complaining letter from a Pennsylvania fan who said he "failed to hear the sonorous swells of a Rocky Mountain canary"—donkey—during the program.

A DEPARTMENT OF READER COMMUNICATIONS

FEED



BACKS

POEME TO THE AIR

A man by the name of Blair
Bought a magazine called ON THE AIR
So he said now I'll know
How to build radio
As he sat himself down in the chair.

(Published with all due modesty and blushes by the Feedbacks Editor who broke four buttons on his vest and who had to buy a new hat he was so proud over the receipt of this flattering limerick)

The masterpiece above above is the contribution of Mr. W. H. Rees of 3145 Broadway, New York City, who gives us an idea.

Every month we have to scratch our head for an opening paragraph to start the Feedbacks off with. This solves the problem beautifully—we'll do it with limericks. To the winning limerick each month we will award a year's subscription together with one of the circulation departments unparalleled log and call books. We certainly appreciate this spirit of friendliness and good fellowship on the part of readers and being thoroughly human, we like to be praised when we do something worth while. Thanks some more, Mr. Rees.

The Supro-Multi-Dyne

THE Supromultidyne shown herewith, has been used by the writer since last August with very good results.

Using but 220 foot aerial I had station ORV of Vienna, Austria, during the International Test. The reception was verified by the Chicago Herald and Examiner. Stations in California, Mexico and Canada are heard quite frequently. The circuit is also selective and has good tonal quality.

There are three variable condensers in this set, two of which are mounted on one shaft, leaving only two active controls. Two ticklers are used, but only one of them is operated (L₆) for the high wave lengths. For waves between about 350 and 425 no tickler adjustment will be necessary. Below 350 meters you can either retard tickler (L₂) or else turn down on the rheostat, the latter is recommended. These adjustments are not critical, and they do not require a re-adjustment for every wave length, as is the case with the regenerative set.

Two photographs, front and rear, are shown, which shows the outlay of parts used. The front panel shows from left to right, tickler knob L₂, Condenser dial C₁, filament switch, rheostat, panel light, dial controlling the tandem condenser C₂ and C₃, equalizer for tandem condenser and tickler L₆.

The tube socket shown at the extreme

This department is composed of contributions by our readers, and ON THE AIR assumes no responsibility for statements made by such contributors. It is a department where readers may discuss and submit ideas, achievements, kinks and experiences for the mutual benefit of all enthusiasts.

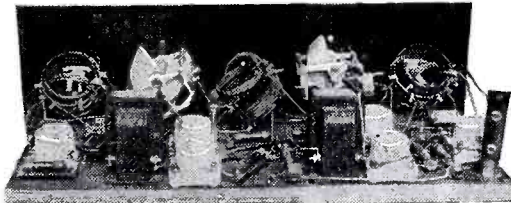
right is not for a tube. It is used for the battery connections, a tube base minus the glass completing the battery connector. This is accomplished by connecting the plate and filament leads to the mentioned socket and the battery leads to the prongs of the tube base. Inserting the base in the socket completes the connector. Care should be taken that the connections to the tube base prongs correspond with the connections to the socket. The best way to do this is to connect the R. F. and detector plate leads to post marked "G" on socket and the audio plate leads to post marked "P" on said socket. The filament leads are connected according to the regular markings, namely, the minus leads to "F" and the plus leads to "FT."

Now insert the prepared tube base, find the corresponding leads and mark them

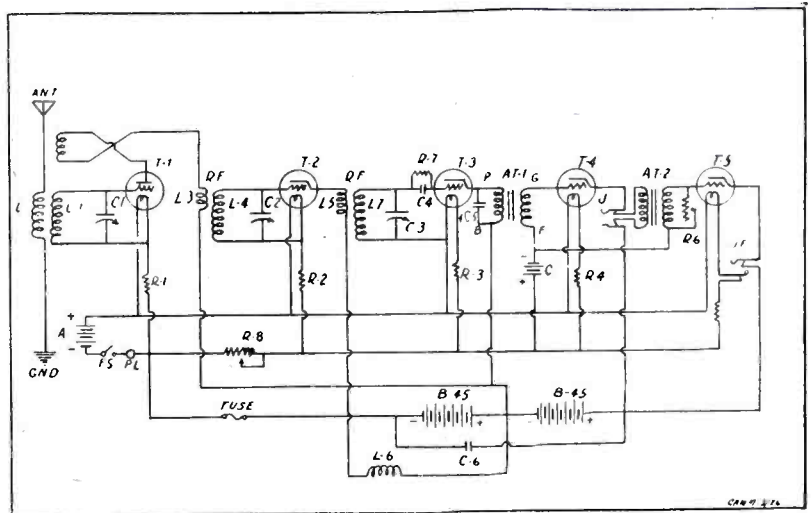
The complete list of parts used by the writer are as follows: L, L₁, and L₂ Bremer-Tully 3 circuit tuner; L₃ and L₄ B. T. No. AC3 L. F. transformer. L₅ L₆ and L₇ another B. T. 3 circuit tuner. C₁ is a B. T. 00025 variable condenser C₂ and C₃ are two halves of the B. T. 00025 tandem condenser. C₄ is an X. L. Radio Laboratory Variable grid cond. Mod. G.; C₅ is a Sangamo .002 fixed condenser. C₆ is a Dubilier 1 MFD bypass cond. T₁ and T₂ are two Rauland Lyrics R₁, R₂, R₃, R₄ and R₅ are Amperites. R₆ is a Durham variable resistance type 100. R₇ is a Durham variable grid leak type 201A. R₈ is a Yaxley 6 Ohm rheostat, S. W. is a Yaxley filament switch. P. L. is a Yaxley pilot light of the bulls eye type. J is a Yaxley interstage jack No. 4. JF is a Yaxley filament jack No. 3.

A Gem fuse is connected in the minus "B" battery lead to safeguard against the possible damage of the tubes.

Besides the above, the writer used a walnut celeron panel size 7x24x3/16 and a baseboard 9 1/2 inches deep. Six Hart & Hegeman cushion tube sockets,



The panel and rear views of the Supro-Multidyne circuit submitted by one of our readers. With this set, stations in Europe and South America have been heard. It is a variant of the well known Superdyne circuit, using reverse feedback for stabilization. The accompanying text gives full details of its construction.



accordingly, either by coloring or else slip a piece of card board over each lead and write whatever it may be.

The strip of bakelite at the right end has two midget jacks in it, which are used for aerial and ground connections.

The phone and speaker jacks are mounted in the rear and are held to the base board by a small strip of bakelite.

Musselman certified tubes, two Yaxley midget jacks for aerial and ground connections and two Yaxley midget plugs to fit the midget jacks.

When connecting tickler L₂ be sure that 7 on that coil goes to the plate of the first tube and 2 to letter P on coil L₃. When connecting tickler L₆ be sure that 2 goes to letter B on coil L₅.

The primaries of these coils usually have 20 turns. Reduce same down to five turns if an aerial longer than fifty feet is used. If fifty feet or less, increase the primary to ten turns.

The Musselman certified tubes have characteristic curves enclosed with each tube. Pick out three that compare the closest and use these for the R. F. and detector tubes.

If any more information is desired, I'll be glad to offer same in a personal letter, if addressed to 1252 N. Campbell Ave., Chicago, Ill.

—P. E. Miller.

We certainly appreciate Mr. Miller's report and photos, and in behalf of the rest of the Feedbacks fans, we convey him our thank you's. The dawgone set has a name that's worth three dollars and war tax alone; judging from Miller's letter it reaches out and gets stuff like the star boarder in a rooming house.

72 East Bigelow St.,
Newark, N. J.

ON THE AIR,
Gentlemen:

I see by the February issue of "On the Air" that the Chicago fans are having trouble getting through the locals. I am enclosing a diagram of a circuit, I am using that will cut out anything alive about a block from WOR and two blocks from WGCP and WBPI, and I can bring in WMBF when the locals are on. I also can bring in WJAX and 6KW when WMCA is on.

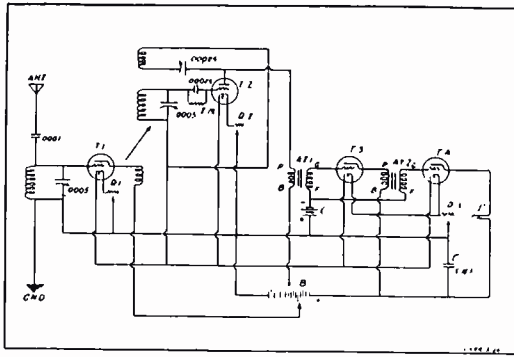
I get the codes once in a while so if some of my brother readers would like to try it, I shall be pleased to give them any information. I discarded Bernard's "Diamond of the Air" and the Harkness for this, and I think there is nothing to beat it, not even the Browning Drake or the Hammerlund Roberts. I have tried them all. The trouble getting the dials to log is in the RF coil. I have a 60 ft. aerial, and I tap the coil on the 13th turn, connect the antenna to this and take the beginning of the coil to the grid as usual, but don't take any turns off the coil. It can be adjusted with the taps according to the length of the aerial.

The drawing is the correct position of the coils as far as the potentials are concerned.

Any further information I shall be glad to furnish.

Yours cordially,
John Harra.

Late evening photo of a radio bug, who is a little green on circuit diagrams, just after he turned on the current to the new home-made B eliminator which he has wired all by himself.



One of our readers suggests this circuit to those having trouble with selectivity. It uses loosely coupled radio frequency and a regenerative detector. Our technical staff advises that it is highly efficient.

The letter above and the circuit diagram printed somewhere in this department should be of considerable interest to fans having trouble with selectivity. The theory of loosely coupled RF and regeneration is sound (incidentally it is the idea used by the Martin Copeland Company of Providence, Rhode Island, in their Marcodyne kit) and really affords great selectivity. We are much indebted to Mr. Harra for his report on this set.

Lennis B. Hoops of Blockton, Iowa, (where the West begins and the tall corn grows) writes us enclosing a long list of DX stations. Afraid that we'd get bored with his list he listed stations using less than 500 watts—56 in all. He uses a Roberts four tube home built set and has 21 California stations on his list. Has heard LOW, LOX of South America and OAX—verified by Radio Broadcast. He has a dandy crystal set record, and we wish he would give us the circuit. Lennis likes KFNF at Shenandoah, Iowa, the best of all . . . he says "without it Iowa would be no good." (Patriotic devil—ain't he?) Says "KFNF is refreshing, even if their programs are 'seedy.'" Hoops M'dear.

1248 W. 80th St.,
Chicago, Ill.

Editor, "On the Air,"
Chicago, Ill.

Dear Sir:

I subscribed to "On the Air" at the Radio Show last year, but have never received an issue. I have not been able to get them, until a short time ago at neighboring periodical stores, and so believed you were "Off the Air," but I bought January's and have found I have been missing MUCH.

I built the 40 and 200 meter coils of the "Super Frequency set" and had wonderful results on the 200 meter set. Have heard 2-1's, a 2, a 4, many 5's and numerous 9's on phone, especially the YL at 9 UH. On the 40 meter KDKA comes in fine.

If I have been missing circuits like this I sure have a complaint coming, haven't I? Hoping to get forthcoming issues, I remain

Yours very truly,
Alymer B. Hussey.

Pardon us while we administer a swift kick in the pants to our circulation

department . . . certainly deserves it for not getting the magazine to you, Mr. Hussey. We're glad you're not angry with us though and we'll see to it that you'll get the magazine regularly after this.

137 Fulton Ave.
Waukegan, Ill.

ON THE AIR,
Gentlemen:

I have had a mysterious as well as a disastrous experience, which I am relating with the hope of getting a solution. On Wednesday evening, Jan. 27th, at 8 P. M., I was tuning my B. T. Counterphase, and got PWX Havana, but the signals were not as strong as usual. As I have two aerials, one running N & S the other E & W, I decided to change aerials, connecting the E & W one but the signals were weaker than before, so decided to change back. In disconnecting them, the ends came in contact, and there was a strong spark from them. Then the end of the live one must have touched one of the mikro-mikes; after that things happened fast. It started to smoke under the Torostyle, and thinking I had a short in my set, I pulled all wires loose. By this time it had burst into flame, which we smothered out with a blanket before any more damage was done. The tubes were not hurt.

After it was out I was looking in the back of the console for a short, when my knee rolled off the aerial, and the end hit my leg, giving me a shock. In getting the aerial out of the house, I had to pull it through the coal-bin, and every time the end hit a piece of coke it sparked good.

The next day I reported it to the Public Service Co. of Northern Illinois, and they sent out one of their engineers, but after looking over the house wiring and their lines outside, he said there was no way possible for it to have come from their lines. Of course, I could not imagine it coming out of the air, until the other day I heard of a fellow near Libertyville, Ill., who had a charged aerial the same night at the same time. Also on that date the Stock Exchange tickers were reported to be all out of order, which was laid to the "Aurora Borealis." There was also a very high wind blowing that evening. If there are any questions you would like to ask, I will be only too willing to answer them to get this solved, as I have not met
(Turn to page 46)

A new use for your radio. Suggested by our technical staff after reading over the letter of Mr. Burge of Waukegan, Ill. Any set with a shorted A battery circuit will serve the purpose.



The War on Static

(Continued from page 31)

the time the survey is completed there will be established some ground from which an attempt at an ultimate solution may be made. In the meantime, the reports encourage a more persistent inquiry by their very lack of uniformity.

It may be that the barometer is purely an innocent bystander in the scheme of radio reception. But the reports showed it to be present in an outstanding fashion in the harried life of the broadcast listener in many localities. There were severe snowstorms in the Great Lakes region and a first rate blizzard along the north Atlantic on February 9th, the first night of the tests. It might have been expected that districts in which such decided atmospheric disturbances were in progress there would be similarity in radio conditions.

This was decidedly not the case. In Chicago, for example, there was little static or fading. Signals were weak in spots but recognizable and apparently uniform throughout the evening. In New York there was violent static.

In Michigan's lower peninsula—with water on three sides and a snow storm on the fourth, reception was 100 per cent normal. So much so that the reports were almost monotonous. On the South Atlantic seaboard in some of the bay districts where geographical location was almost exactly the same as that of Michigan, occurred the most severe disturbances observed from the beginning of the survey until the end. (February 11.)

Barometer Relationship Data.

But there occurred this phenomenon which still lacks an explanation: On Tuesday, February 9, the barometric pressure in the northwest, middle west and parts of the east, was low. It was on this night that the most marked occurrences of static and fading were observed. On the following night the barometer went higher and radio reception, in virtually all localities where this change in pressure was noted, was considerably better. The pressure dropped on Thursday and radio reception became manifestly worse.

Dr. Bockstahler declined to draw conclusions from this juxtaposition of fact. Until further tests are completed and the data furnished by the observers shows that the barometer may be accepted as an instrument of radio forecast, no attempt will be made to add to the numerous theories already propounded on the subject. But the physicists admitted that the correlation was as interesting as unexpected and that further inquiry is amply warranted.

Even in the rough classification of the reports it was noticeable that static and fading were concurrent—at least on the nights of February 9, 10 and 11. Where static was bad, fading was bad. Where there was no fading there was no static.

The worst static did not come from the Southwest, generally believed to be the happy hunting ground of such things.



NEW! Tone and Volume Control

The new *Centrallab Modulator Plug* will sell on sight to most set owners. Gives any desired tone volume by the simple turn of a knob. Great for smoothing out powerful local stations and for lessening static interference. Centrallab Modulator Plug can be attached in a moment. No tools necessary. It replaces the present phone plug. Retail at \$2.50 with a good dealer profit. Widely advertised in the best radio magazines.

Write for discounts and literature on this and other Centrallab patented controls

Central Radio Laboratories

15 Keefe Ave. Milwaukee, Wis.



The fifth birthday party of the Crosley WLW broadcasting station also marked the ten-thousandth hour of transmitted entertainment through the six broadcasting stations owned by Powel Crosley, Jr., since 1921. On that occasion Mr. Crosley told of his entrance into the radio industry and the early experiences encountered in broadcasting.

"While we have been complimented upon our progress during our ten-thousand hours of broadcasting, the past seems relatively unimportant as I look upon the possibilities of future development," said Mr. Crosley to the radio audience. "My associates and I live in the constant atmosphere of dreams and plans for the future."

AJAX LOOP



USED WITH THE
WORLDS RECORD
SUPER 9

Described in This Issue

\$12.50

The Ajax patented screw attachment pictured above keeps the wiring always taut. Extended, the loop is 15 inches wide and 33 inches high and may be folded into a box just 14 inches long. The construction of the Ajax is of the finest—all wood-work of solid walnut and all metal parts heavily nickel-plated. Easily connected to the receiver—all leads supplied. Extra terminal provided for centre tap. Endorsed by the leading Radio Authorities as the most efficient loop on the market. If your dealer cannot supply you order direct. Write for circulars describing the Ajax in detail.

DEALERS Write for Discounts JOBBERS

AJAX RADIO CO.

3335 Eastwood Ave. CHICAGO

Radio Parts·Sets·Kits at BIG SAVINGS

New 1920 Radio Catalog & Builder's Guide brimful of new ideas—all free. Shows savings as high as 50% on sets and supplies. Get this thrifty illustrated book before you buy. It means money in your pocket. Standard guaranteed goods. Write letter or postal now. Also please include name of radio friend.

BARAWIK CO.
102-119 S. Canal St.,
Chicago, U. S. A.

The LATEST
HOOK-UPS
&
RADIO
Catalog

It was more apparent in the Northwest, slightly in the south central states, and at its worst along the south Atlantic seaboard. In Virginia and North Carolina fading was accompanied by "Directional silences." Observers in those zones reported that they were entirely unable to hear Western stations.

In the further tests, to be conducted on the same dates of March, April, May, June, July and probably throughout the year, instruments will be installed in all zones to record current variations automatically and thus provide a check against the less accurate reports of observers whose equipment for fading detection consists principally of a pair of highly fallible ears.

C'mon fellows—get in on this fight against static—if we all help we'll get somewhere. J. K. Smith of the Stewart-Warner Speedometer Corporation, 1826 Diversey Parkway, Chicago, will be glad to hear from those of you who want to help settle this static 'rassle.—Editor.

Feedbacks

(Continued from page 44)

anyone that ever heard of such a thing before.

Hoping you will find time to answer this, I am

Yours sincerely,
Chas. Burge.

We have written the Bremer-Tully Company suggesting to them that they furnish fire extinguishers with each kit of parts for the Counterphase but up to this time have not had an answer from them, Mr. Burge. About the only thing we can suggest is that you shorted your A battery some way or other in making your changes, heating the shorted leads red hot. We are not inclined to believe that you could pick up a charge of sufficient strength to cause a fire.

J. F. Christ of 9551 Longwood Drive Chicago, Ill., is another short wave fan getting excellent results with the Super-Frequency set described in January. He has been hearing all districts in daylight with it. He made some experiments with the 20 meter coil and developed one of his own. He also has rearranged the circuit somewhat in the feedback portion.

276 Colonial Rd.,
Rochester, N. Y.

"On the Air."

I am taking this opportunity to compliment you on your magazine.

It's certainly a beaut, and if it continues to improve in the future at the same rate it has in the past, it will not take long to outclass lots of others that have been with us for the past six years or so.

Among the features, the page "Feedbacks" is highly interesting. Please continue to publish it.

Wishing you the best of luck, and assuring you of at least one "lifer" subscriber.

Sincerely,
C. L. Webber.

Troy Center, Wis.

"On the Air,"

Gentlemen:

Upon reading through "Feedbacks" in your last issue, I discovered many letters from men who are either owners of excellent receiving sets or who are versed in the art of lying. I wish to join that group also.

Last night, Feb. 20th, I tuned in at about nine. Before I had "signed off" at 10:20, I had logged the following 41 stations: WSBC, WFKB, WBAB, WBBM, WHT, KMMJ, WSOE, WWAE, KMA, WKAF, WENR, WKAR, KMOX, KEKX, WORD, WRED, WGN, KDKA, WSMB, WJAZ, WBZ, WLS, WHB, WEBH, WDAF, WGY, WHT (400m), WOAI, WLW, WBHP, WMAQ, WJZ, WEA, WOC, WMC, KYW, (These represent one circuit of the dials) WSB, KOA, WGES, KSO, WOK. As to station WBAB, it is in Nashville and broadcasts on about 230 meters. I could not find it logged in my Radio Call Book.

I have a three circuit regenerative

"one pup" receiver. I have turned in 139 stations, including verified reports of 2LO, London, SBR Brussels, 5SC Glasgow, and LOW Buenos Aires, during International Test Week.

The farthest points I have heard in North America are: PWX, CYK, CYL, KFI, KHQ, CFCK, CNRO, WBZ, WHAR, WBAL, WJAX.

Do you think I am qualified as a full-pledged radio liar? I swear with my hand on a Radio Call Book that I am telling the truth, the whole truth, and nothing but the truth, so help me—
Hoover

Yours for better radio,
Roy M. Hopkins.

All of which reminds us of a little incident we heard last fall when a golf bug and a radio bug met each other. The golf bug had just made a hole in one, and the radio bug had just tuned in 2LO. Both vocabularies were strained to the limit, but the radio nut won by two superlative adjectives and a split infinitive.

The Radio Confessional

That's just what the Feedbacks pages are a place where you tell your woes, your joys, your thrills, so that your fellow radio nut may laugh and sympathize with you. Remember the time when you heard Ponazueala? Or the time when you set the house on fire with a shorted battery? Or the time you caught Willie dropping your tubes out of the window to hear them go "bop"?

Tell it to
THE FEEDBACKS EDITOR

On The Air Magazine
Suite 1322, 306 S. Wabash Ave., Chicago, Ill.

Mr. J. C. Sutherlin of Route 2 Box 188 Tampa, Fla., writes us telling about his experiences with a super-heterodyne that wouldn't get distance, and his subsequent remedies. (Super-het fans who find themselves in like trouble) might write him for his idea of antenna coupling.

LADIES DEPARTMENT

(No fooling . . . we've got a ladies department. Witness Exhibit A)
EXHIBIT A
6348 Kenwood Ave.,
Chicago, Ill.

Editor of Feedbacks,

Dear Sir:

I wonder if you would be interested to hear from a "Mrs. Radio Fan"?

I have just read our first copy of "On the Air," and was especially interested in "Feedback."

I have logged 168 stations since Oct. 17th, 25 including 2LO London, Mexico City, Havana, eight Canadian Stations and seven California stations.

My record for one night is 57 stations outside of Chicago (one Monday night last month) including five California stations, namely, KFON, KFI, KPO, KGO and KNX. We have had KFI almost every night for months. I have

had them at 5:45 P. M. Pacific Coast Time.

My husband built our set and I wouldn't trade it for anyone's Radio

Yours very truly,
(Mrs.) W. F. Mitchell, Jr.

We have a profound respect for Mr. Mitchell, Jr., and we'd like to know how he did it. Any man that can build a radio that his wife is proud of sure knows his stuff. We're on our seventeenth model now . . . and the wife doesn't like the color of the battery cable leads to it's gotta be junked. It's simple *stupendous* the way some guys get away with things.

Stockton, Mo.,
R. R. 2, Box 12.

On the Air Publishing Co.,
Gentlemen:

I think "On the Air" is one of the best magazines published, and do not want to miss a copy. Please let me know when my subscription expires.

I enjoy the "Feedbacks" page very much. I tuned in fifty stations on February 25th. All came in fine on a one tube set. The call letters are as follows: KOA, WWJ, KFAB, WEA, WLS, WSAI, KDKA, WLIB, KPRC, DFNF, WIBO, WOC, WCAE, WJZ, WHB, KLDS, WCCO, WLW, WBAP, KMOX, WOI, WORD, KSO, WBBM, WOK, WSBC, WHT, KGO, WSMB, CFI (Mexico City, Mex.) KFHS, WMBF, KMMJ, KMA, WCAR, KFEQ, KFH, WGN, KFI, WRC, WQJ, WJAX, WJAZ, WREO, WSM, WMBB, WGH, WHAD, WJJD, WSB.

I tune in PWX Havana, Cuba, 6 KW and 6 KJ Tuinneu, Cuba, CKY Winnipeg, Canada. My personal radio log contains 193 stations I have tuned in in fourteen months. Who can beat this with a one tube set?

I also tuned 45 stations in in the day time loud enough to hear the programs, some seem very far away. I could hear the announcers at WJZ New York and KOA Denver and KDKA plain enough to hear what they were saying. This was between one and four o'clock central time.

I would like to know who can beat me and my little Parmak with our record.

Best wishes to "On the Air," I am

Yours truly,
(Miss) J. K. Blake.

P. S. I tuned my fifty stations in between eight and twelve o'clock.

4081 Concordia,
St. Louis, Mo.

"On the Air,"

Gentlemen:

Received my first copy of your wonderful magazine today since placing my subscription for same with a "Club" order, and wish to state that after reading it including ads from stem to stern, that it is the most wonderful magazine I ever read for that price. You know the average reader likes simplicity or plain every day words and pictures regarding this complicated radio. Huge words having little meaning, especially diagrams

(Continued on page 48)

No More "B" Batteries on Your Radio

At last, a practical reliable "B" battery eliminator for your radio. Does away with "B" batteries; no charging; no replacing. Always 100% efficiency in "B" current. The most revolutionary development in radio.

Genuine Fansteel
Balkite
"B"
Eliminator
Sent for Only

\$1.00
Down



U. S. PAT.
MAY 27, 1924

The Balkite "B" is connected to your radio just like "B" batteries and attached to an ordinary electric light socket. Replaces "B" batteries entirely and furnishes "B" current direct from regular house lighting current.

Always gives current equal to four new and fresh 22½ Volt dry "B" batteries. For sets of five tubes or less. Simplifies radio receiving. More convenient, more economical and more efficient than dry or wet "B" batteries. Operates storage battery or dry cell tubes and gives tubes longer life. Entirely noiseless. Creates no disturbance in reception. Has no bulbs, nothing to break, wear out, replace or get out of order. Requires no change in your set, no extras to buy. Operates from 110-120 AC, 60 cycle current. Measures 8 3-16 inches by 8 inches by 3¼ inches. Current costs only 1-20 of a cent per hour.

\$5.00 a Month, if satisfied after trial

Only \$1.00 with the coupon below brings the Balkite "B" to your home on trial. Try it out thoroughly before you pay another penny. See how it improves reception. See how much more convenient than using batteries. Judge for yourself how it will save you money and make your radio set more enjoyable. Then, if not satisfied, send it back at our expense and we'll refund your \$1.00 plus all transportation charges. If you decide to keep the Balkite "B," start paying only \$5.00 a month until you have paid the total price of only \$35.00. That's the price others ask for spot cash. We give you the lowest cash price on easy monthly payments you will never feel.

Send Coupon

Don't miss this opportunity to get the genuine Balkite "B" at the rock-bottom cash price on easy monthly payments. Send coupon now while this offer lasts. Order by No. Y-8578A, \$1.00 with coupon; \$5.00 a month; total price \$35.00.

STRAUS & SCHRAM
Dept. R2214 Chicago, Ill.

.....
STRAUS & SCHRAM, Dept. R2214 Chicago

Enclosed find \$1.00. Ship special advertised Balkite "B" Battery Eliminator. I am to have 30 days free trial. If I keep it, I will pay you \$5.00 monthly. If not satisfied, I am to return it within 30 days and you are to refund my money and any express charges I paid.

Balkite "B" Battery Eliminator, No. Y8578A, \$35.00

Name.....

St. R. F. D.
or Box No.....

Shipping
Point.....

Post Office..... State.....



PRICE
\$18

A Reproducer That Will Outlive Your Radio

Did you ever know that loudspeakers wear out? Reports by engineers show that they do. If your radio seems reluctant to give the results it used to you will probably find the trouble in the reproducer. The New Baumgart "Natural-Tone" Loudspeaker now comes equipped with a unit of advanced design to meet this unforeseen limitation of radio reproducers. Encased in a beautiful mahogany cabinet, with handsome scroll backed by a rich gold screen. Hear this wonderful "Natural-Tone" speaker at your dealers or send \$18 direct and we will forward you one of these speakers immediately.

The Clearest Tone You've Ever Heard.

BAUMGART
NATURAL-TONE
LOUD SPEAKER

F. G. BAUMGART CO.

4556-68 W. GRAND AVE. CHICAGO, ILL.

Sales Representatives

THE RADIOGRAPH CO. 210 E. Ohio St., Chicago, Ill.

A Few Choice Dealer Territories still Available.

Feedbacks

(Continued from page 46)

of variocouplers, etc., etc., passed up and I believe a magazine that tries to explain in simple terms is the one lacking on market today.

Your Feedback column is great, and I hope to see it enlarged. Let's hear what the other fellows got to say, their joys and trouble. Of course, I have "oodles," a 3 tube Crosley and a Baldwin horn furnish them, 85 ft. high aerial and 85 ft. ground have brought LOW CYE CYB KFI PWX WBAL WCAP, etc., into my home all before 9:30 of an evening as that is my limit being a night worker having to leave off then. Of course, my set is like the rest, when you have company it will not do its stuff to perfection.

Again thanking the staff for their "get up" of this most wonderful magazine which enables us to keep posted.

Very respectfully yours,
V. K. Yowell.

P. S. I need KSL and KOB and then I'll sit back and let the other fellow squeal and cat call (my conscience hurts, eh?). Your front cover picture "Dreaming of a Superheterodyne" by Anker Mehlum very appropriate and interesting, a sure laugh getter. Thank you.

THE MAN WITHOUT A BATTERY
Lives there a man with soul so dead
Who never to himself hath said
When he found that his batteries all were dead

"!-----!-----!-----!-----!"

Dr. J. H. Rogers

(Continued from page 26)

humanity either locally, to the State, or Nation. Yet Hyattsville, on parade, rendered appropriate ceremonies in appreciation of its distinguished fellow citizen. The resolution of appreciation, among other encomiums, contained this sentiment, "When our country was in peril he worked ceaselessly in his laboratory, and, when means of communicating quickly with our forces upon the sea and in France became imperative, he had perfected his discoveries, and turned over to a grateful nation his underground wireless and undersea methods of communication." The General Assembly of the State of Maryland by unanimous adoption agreed that "Doctor James Harris Rogers of Hyattsville, Maryland, has marked an epoch in scientific achievement in 'Radio' by the discovery of the underground and underwater systems of radio communication." The Georgetown University has conferred the degree of doctor of science upon him, and he has been awarded the inventor's medal and made an honorary fellow of the American Academy of Sciences. The United States Navy Department in testimonials of liberal praise has attested to the value of his scientific contributions.

Surely, it must be gratifying for one to reach the evening of life amid the plaudits of home-town citizens as well as those of State and national figures by reasons of well-earned recognition because of having advanced the progress of a people. James Harris Rogers has wrought long and well—and, although for many more years doubtless his creative genius will continue to exert itself, he could now well rest upon his laurels—the fruits of science and research which have accumulated to his credit.

Aerovox Filter Condensers

To meet the requirements for A and B Battery Eliminators the Aerovox Wireless Corporation of 489-493 Broome Street, manufactures a complete line of Filter Condensers in addition to By Pass Condensers.

A large variety of Rectifier Tubes and Transformers are now on the market, and one type of Filter Condenser will not give the most satisfactory results under all conditions, and still be economical.

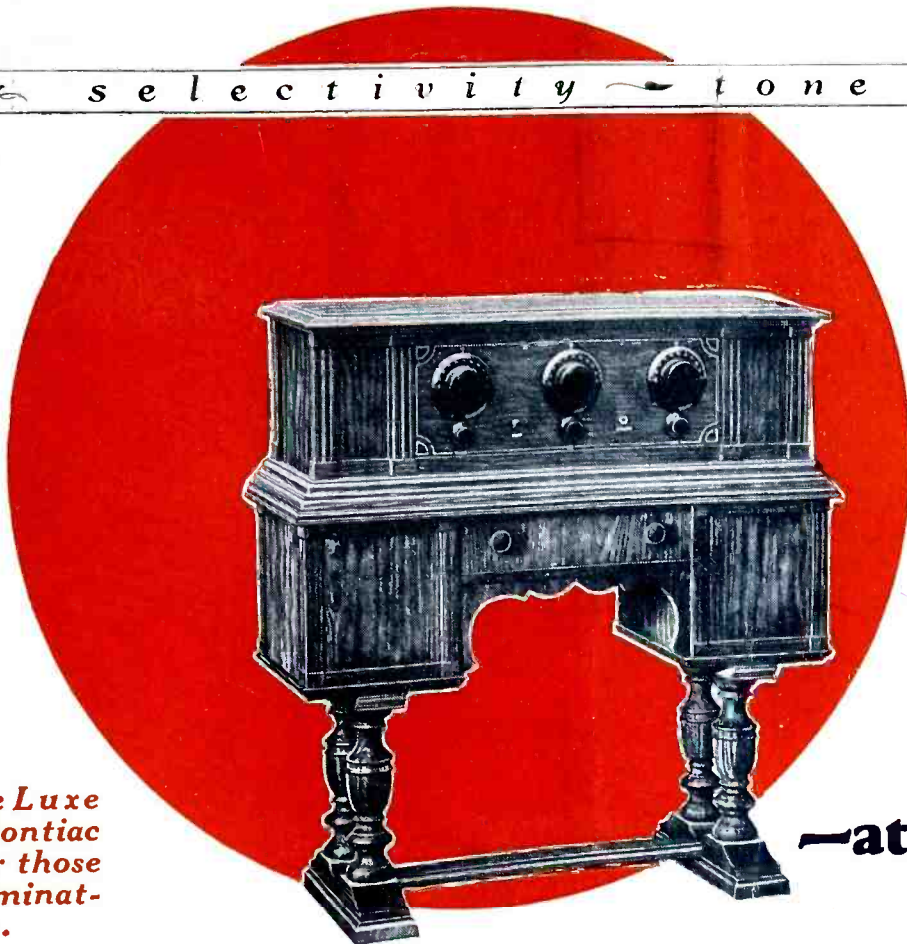
To meet the varied requirements of the different types of eliminators, Aerovox Engineers have decided that two types of Filter Condensers will answer every need. The following table gives information concerning the two types which will be of assistance to the designer in choosing the proper condenser.

TYPE	D. C. Flash Test	D. C. Working Voltage	A. C. Flash Test	A. C. Working Voltage
1225	800	500	550	350
1230	2000	1000	1500	700

Both types of Filter Condensers are made in capacities from .1 to 4.0 mfd., and are furnished either unmounted, or mounted in a metal container with flexible, insulated wire leads.

There are also several combinations of condensers available sealed in blocks to be used in the more popular circuits.

s e l e c t i v i t y t o n e q u a l i t y



*The DeLuxe
Model Pontiac
Radio for those
of discriminat-
ing taste.*

A Radio

*that combines
all desirable
features*

—at a reasonable price

The Pontiac Radio set is all you could ask of a radio. It is designed to tune with the greatest selectivity, and yet so assembled that it does not sacrifice tone quality. It brings in the broadcast programs as clearly and plainly as though you were present in the studio. Its tones rival and exceed the original transmission in beauty.

The performance of the Pontiac Receiver is consistent and reliable, because each set is laboratory tested, and each individual unit of its assembly is rigidly inspected and tested

before and after its embodiment in the finished radio.

Technically, the Pontiac Radio is a five tube set incorporating the latest tuned radio frequency circuit. A 1926 radio designed to meet the present day requirements. Its tuning range is from 200 to 550 meters, pro-

viding reception on all existing broadcast wave bands.

The discriminating buyer will choose the Pontiac radio because it will harmonize with the appointments of his home.

You owe it to yourself to investigate this exceptional radio set. We have a special limited offer in mind for the first hundred prospects who fill out the coupon below and mail it without delay. There is no obligation—we merely want the privilege of acquainting you with this wonderful set.

PONTIAC RADIO CO.

**25 East Jackson Blvd.
CHICAGO, ILL.**

PONTIAC RADIO

*selectivity * tone quality*

Pontiac Radio Company,
25 East Jackson Blvd., Dept. 426
Chicago, Illinois.

Gentlemen:

Please send me full information and prices on the
New 1926 Model Pontiac Five tube Radio

Name.....

Address.....

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

Tell them you saw it advertised in On the Air.

Say "MUSSELMAN" When You Buy Tubes

You will notice that pleasing surge of elusive DX power and sensitivity in your loud-speaker when you turn on the filaments

WHY is there such an increase of microphonic noises and defective tubes so frequently encountered? Why is the performance of a radio so impaired when the tubes are changed around in the set?

The Engineers answer is something like this:

Good reception depends on a good receiving set and an efficient circuit embodied therein, and what is equally important, efficient tubes. To get maximum results we must use tubes that have the proper characteristics.

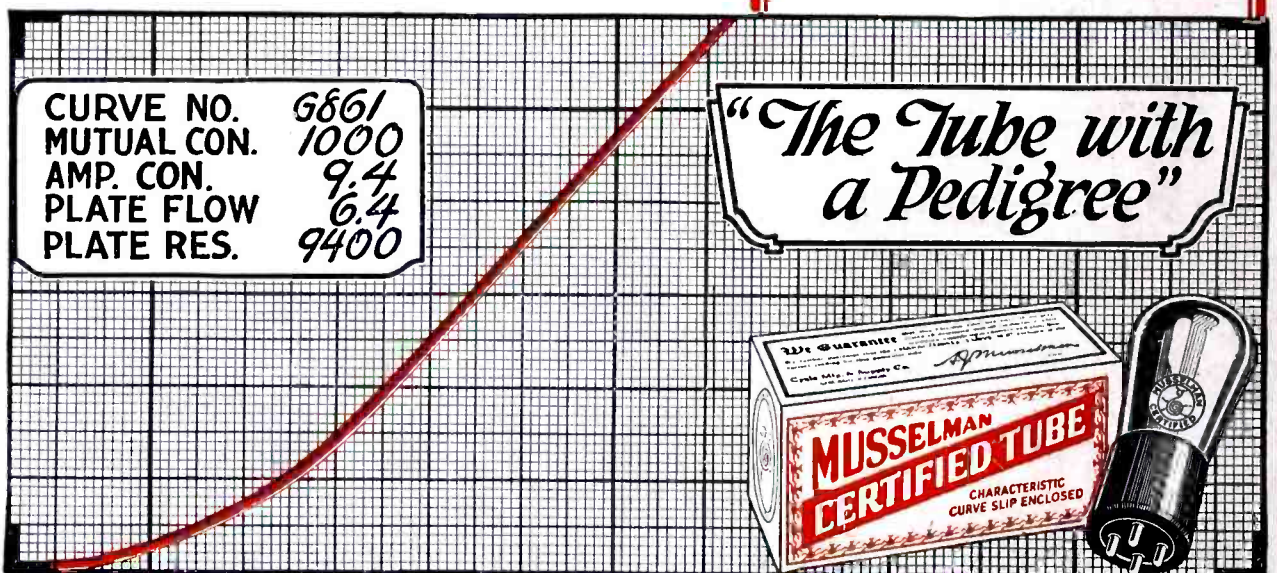
The characteristics of a tube can only be known from an actual laboratory test, in which a curve is plotted giving mutual conductance, amplification constant and plate resistance. In making these tests, and in plotting these readings the tube can be classified into a definite use where its efficiency is greatest.

That explains the time worn phrase "try changing the tubes around in the sockets." It is nothing more than an admission that you are guessing at the abilities of the tube.

The Musselman Sales Policy Eliminates Guessing

If you think your set is only giving indifferent results because of the tubes, you owe it to yourself to check up on this fair tube selling policy.

With each Musselman tube an individual chart is enclosed in the carton, giving detailed readings on its characteristics. You can tell at a glance which tube is the best for your purpose.



What radio men say about the necessity of **KNOWING** the tube used.

By **ANDREW KRAMER**
in *On The Air*

"In testing a vacuum tube, what we wish to know is the manner in which the current in the plate circuit varies when the voltage of the grid circuit is changed. This is an absolute necessity in precision results."

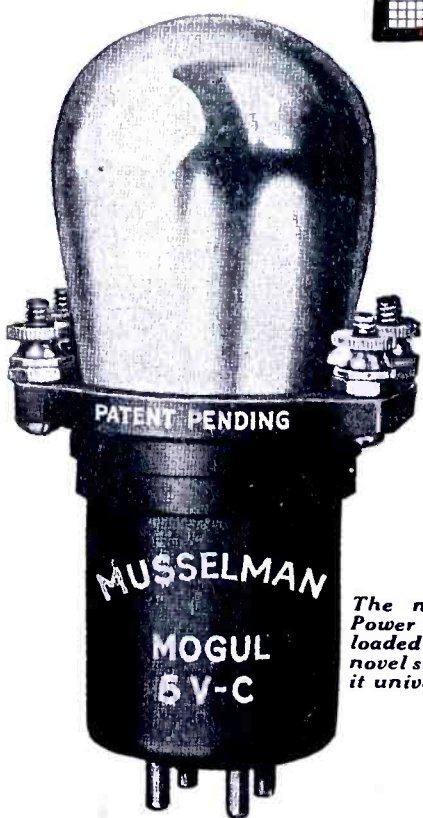
By a well known
TECHNICAL EDITOR.

"The only sure way to determine the actual efficiency of a tube is to take two readings with different values of grid voltage, and determine the change in plate current

The possibility of getting a defective tube is removed, the necessity of changing sockets is obviated (there are thousands of combinations and permutations) and further you definitely know that your set is at its best because you are employing the right tubes in the correct socket. You insure satisfaction and make results a certainty when you buy Musselman Tubes because YOU KNOW JUST WHAT YOU ARE BUYING.

caused by a given change in grid voltage. This gives the true amplification ratio of a tube and is the accepted method of getting the grid voltage plate current characteristic which is the key to tube performance."

The above chart is a sample taken from the carton of a Musselman tube. It shows the tube to be uniform and that it will perform efficiently as an amplifier.



The new Musselman Mogul Power Amplifier for that overloaded last audio stage. A novel strap arrangement makes it universal in use. Write for details.

Write for our booklet on tubes

MUSSELMAN CERTIFIED ELECTRON TUBES

A. J. MUSSELMAN INC.

655 Machinery Hall

Chicago, Ill.