

3211 **Blueprint Section Every Month**

RADIO AGE

The Magazine of the Hour



November
1926

(See Story page 20)

**Radio Age World's Record
Set **Q** Naval Radio Compass
Work **Q** Building the Henry-
Lyford Receiver**

25¢

Complete Broadcast List
In Each Issue

✓ ✓ ✓ ✓ ✓ Glowing spots of light . . . in place of dials

MICROMETER TUNING ACTION to bring you the best your set can give:

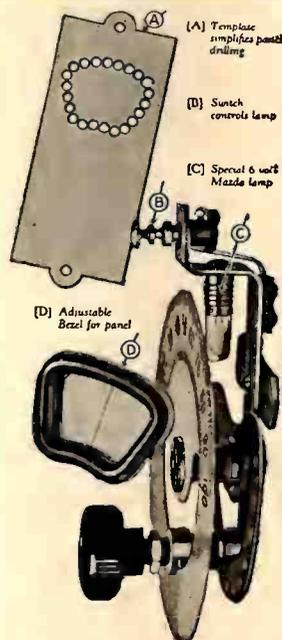
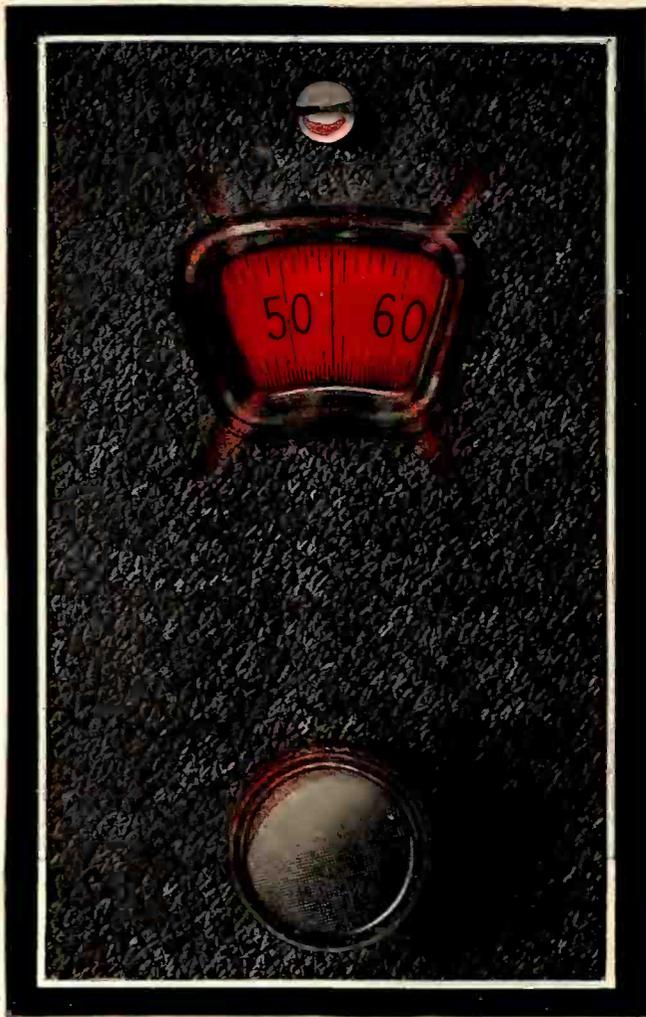
Provides "friction-drive" to control tuning over

Soft illumination to add swifter readability to scale and flashing beauty to the panel

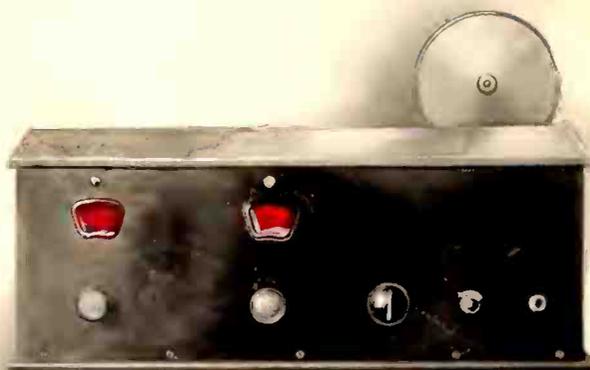
. . . . these are the advanced features that distinguish the set you equip with MAR-CO illuminated controls.

Any receiver—the new one you build, or the old one you remodel—can have MAR-CO controls. They fit all standard condensers. Scales read 0 to 100, or 100 to 0, as preferred. The template makes mounting a simple 10-minute's undertaking. Special Mazda lamp supplied runs on your regular "A" battery or on a separate "C" battery. \$3.50 complete. Send for booklet.

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The "Radio Age Four" has MAR-CO controls as specified equipment.



This new circuit design achieves remarkable efficiency with only 4 tubes. Its simplified panel layout is distinguished by glowing spots of light, in place of dials.

MAR-CO *Illuminated* Controls

FREE!



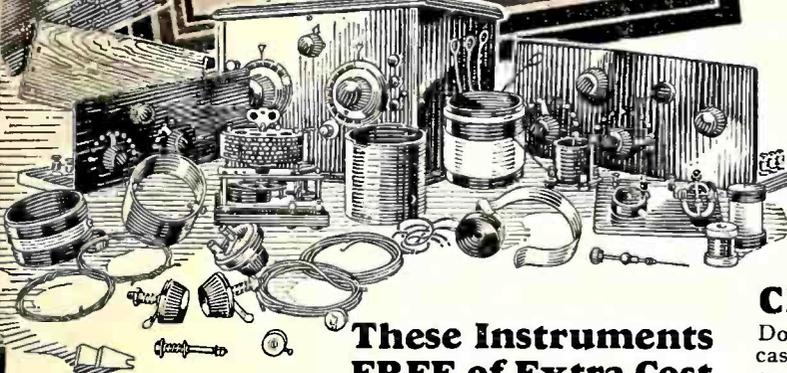
"MEN! Here's the 'dope' you've been looking for

How TO GET INTO THE RADIO BUSINESS"

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J. E. SMITH President

My Radio Training Is the Famous "Course That Pays for Itself"

Spare time earnings are easy in Radio when you know it the way we teach you. Increase your income almost from the start of your course through practical knowledge we give you. We show you how to hold the job, then our big Free Employment Department helps you get one. Free Book "Rich Rewards in Radio" tells how.

Howard B. Luce of Friedens, Pa., made \$320 in 7 weeks during his spare time. D. H. Suitt of Newport, Ark., writes, "While taking the course I earned in spare time work, approximately \$900." Earl Wright of Omaha, reports making \$400 in a short time while taking his course—working at Radio in his spare time only. Sylvester Senso, 207 Elm Street, Kaukauna, Wis., made \$500.

And when your training is completed you're ready to step into a real big Radio job like C. C. Gielow, Chief Operator of the Great Lakes Radio Telegraph Company; E. W. Novy, Chief Operator of station WRNY; Edward Stanko, Chief Operator of Station WGR; and hundreds of other N. R. I. Trained men. The National Radio Institute, originators of Radio Home-Study Training, established 1914, today offers you the same opportunity these men had, under a bond that guarantees you full satisfaction or money refunded. It's your big chance to get into Radio—mail coupon for FREE Book and proof.

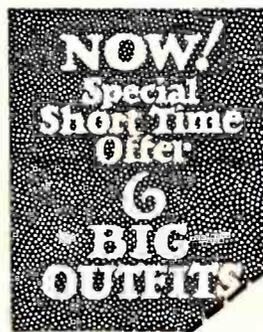
Clip Coupon for Free Book

Don't envy the other fellow who's pulling down the big cash. Our proven home-study training methods make it possible for you too, to get ready for a better job, to earn enough money so you can enjoy all the good things of life. Most amazing book ever written on Radio tells how—thousands of interesting facts about this great field, and how we can prepare you, quickly and easily in your spare time at home, to step into a big-pay Radio job. You can do what thousands of others have done through our training. GET THIS NEW FREE BOOK. SEND COUPON TODAY.

J. E. SMITH, President

NATIONAL RADIO INSTITUTE

WASHINGTON, D. C. Dept. OU-3



Radio Needs Trained Men

National Radio Institute, Dept. OU-3, Washington, D. C.

Dear Mr. Smith Without obligating me in any way, send me your FREE BOOK, "Rich Rewards in Radio," and all information about your practical, home-study, Radio Course.

SEND THIS COUPON TODAY

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RADIO AGE

The Magazine of the Hour

Established March, 1922

Volume 5

November, 1926

Number 11

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Chats With the Editor

REGARDLESS of where you live, by all means visit one of the radio shows being held during this season of the year. Your presence at these expositions of radio progress will help you materially to understand and see what you have been reading about in your favorite radio magazine for the past twelve months.

Especially if you reside in the Chicago area you should visit the fifth annual Radio Show at the Coliseum in Chicago. There you will find ample food for reflection in the designs and circuits found in the products of the radio manufacturers of this country. Many points upon which you may have had some misunderstanding will be immediately cleared up when you can see the actual receiver or device before your eyes.

Over two hundred and twenty thousand persons visited the Radio Show in New York during the week of September 13. Chicago as the center of the American radio industry, according to all predictions, will have an even greater attendance which we hope will serve as a further reminder to Mr. Edison that interest in radio this year is by far greater than during the previous twelve months.

Four construction articles on good receivers will be found in this issue. This should suffice to keep our readers busy until the next edition when there will be other worthwhile circuits, with full constructional details.

An excellent article on naval radio compass work is written by Commander S. C. Hooper, U. S. Navy.

Look up our announcement of a monthly prize contest for your best ideas along radio, electrical, mechanical or scientific lines—your idea may be a winner.

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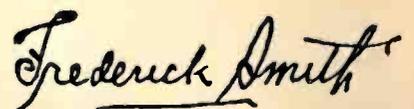
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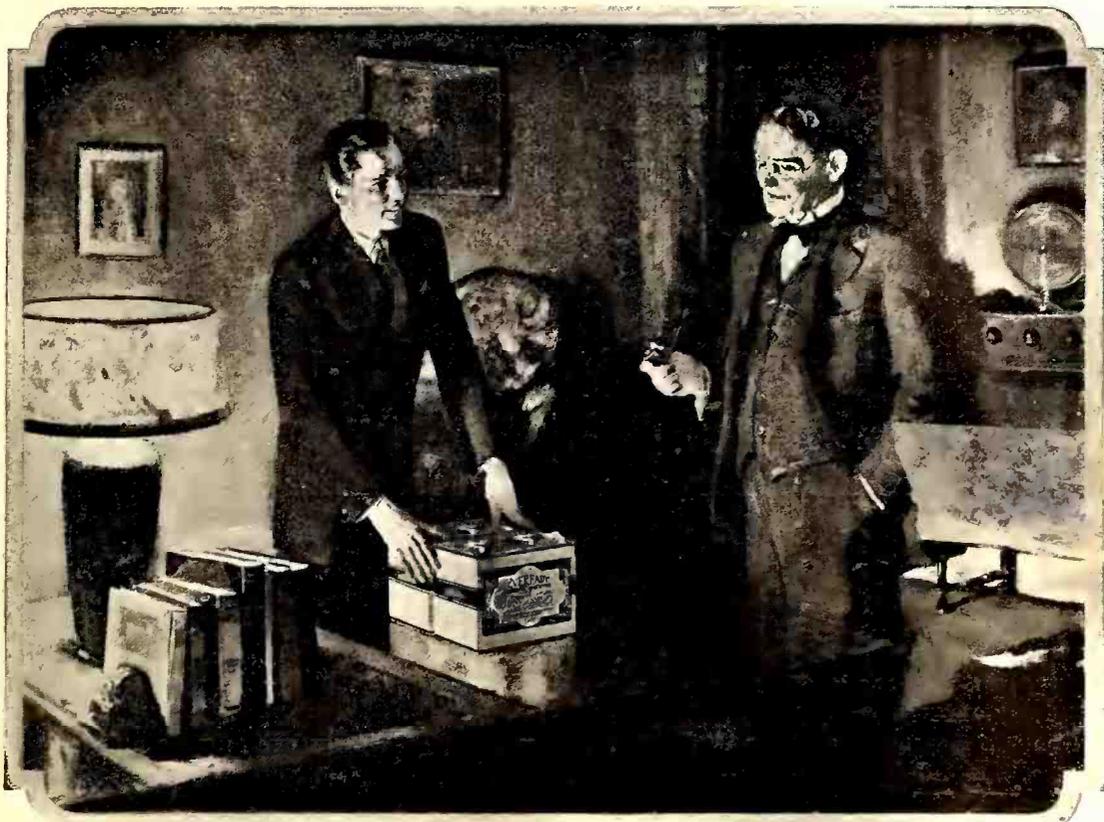
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Editor of RADIO AGE.



Here's the most economical "B" battery ever built for radio

IN THE production of Heavy-Duty radio "B" batteries Eveready has established a new standard of "B" battery life and economy.

Eveready Heavy-Duty +5-volt "B" Batteries will outlast any Light-Duty 45-volt "B" two to one regardless of the number and kind of tubes used! Moreover, though lasting twice as long, they cost only one-third more!

To cap the climax of "B" battery economy, in Eveready Layerbilt No. 486, Eveready has perfected a Heavy-Duty "B" battery of unequalled endurance and dependability—positively the greatest "B"

battery in service and satisfaction its price can buy.

You can make no mistake in buying Eveready Layerbilt No. 486 for *any* set using normal voltages (45 to 135 volts).

You will be buying the utmost in dependability of "B"

power—the greatest "B" power operating economy—D. C. (direct current) in its purest form, which insures pure tone quality.

With colder evening at hand, radio reception is vastly improving. Equip your set now with Eveready Layerbuilt No. 486, the greatest "B" battery ever built for radio



LEFT—Eveready Layerbilt No. 486.

RIGHT—No. 7111 Eveready Dry Cell Radio "A" Battery, 1½ volts.



EVEREADY

Radio Batteries

—they last longer

Manufactured and guaranteed by
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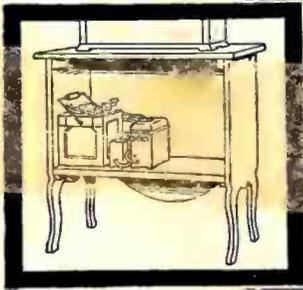
Tuesday night means Eveready Hour—9 P. M., Eastern Standard Time, through the following stations:

- | | | |
|------------------|-----------------|------------------|
| WEAF—New York | WGR—Buffalo | WGN—Chicago |
| WJAR—Providence | WCAB—Pittsburgh | WOC—Davenport |
| WEEL—Boston | WSAI—Cincinnati | WCCO—Minneapolis |
| WTAG—Worcester | WTAM—Cleveland | WCCO—St. Paul |
| WFI—Philadelphia | WWJ—Detroit | KSD—St. Louis |
| | WRC—Washington | |

\$29⁰⁰

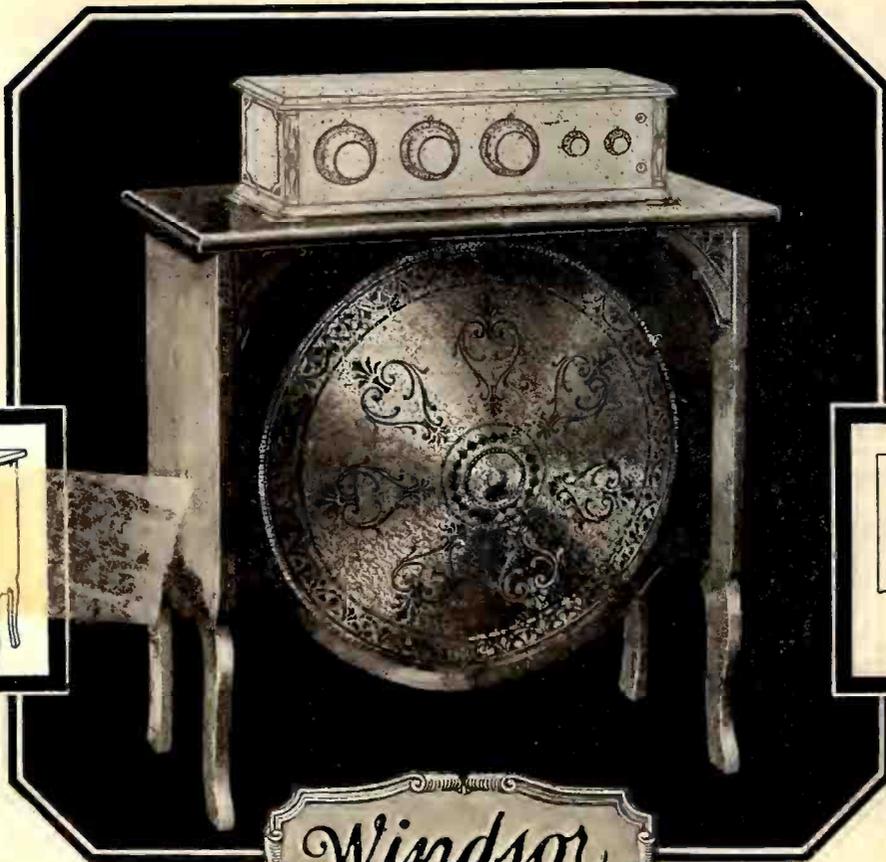
Console with Cone Loudspeaker Ready for Your Set and Batteries

(West of the Rockies \$35)



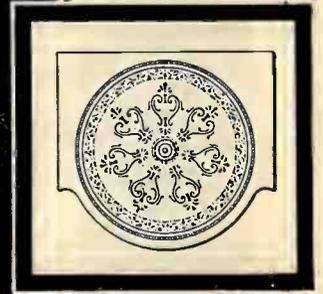
Rear view showing large compartment providing ample space for all batteries, battery charger or battery eliminator. These are entirely concealed from view. The back is open for ventilation of batteries.

MODEL 200 with 22-inch Cone



Windsor
CONE LOUDSPEAKER
CONSOLE
PAT. APPLIED FOR

MODEL 200 with 22-inch Cone



The Cone Loudspeaker, with its Spruce soundingboard, is quickly and easily removable, allowing instant access to all batteries, battery eliminator or other equipment and wiring.

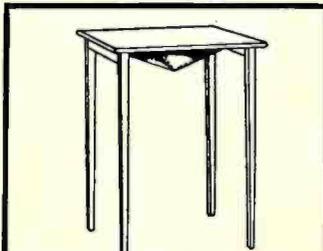
A Revelation in Radio Reproduction

AT LAST—a cone loudspeaker that reproduces *all* the tones as they are broadcast. From the deep voiced tuba of an orchestra to the softest note of a vocal solo—*every* tone—*every* sound is reproduced in all its beauty, just as it entered the microphone.

This 22-inch Windsor Cone Loudspeaker, with its spruce soundingboard, will reproduce the softest crooning lullaby in a softly lighted room, or the full throated march music of a band in an auditorium—both with perfect fidelity of sound and tone.

The Windsor Cone Loudspeaker Console is the greatest value in the

world of radio. When compared with the average cost of cone-type loudspeakers of even smaller size, the cost of the complete Windsor—cone loudspeaker, spruce sounding board, and console—is amazingly low.



Model 600
With 16-inch Cone (Pat. applied for)
This 20 by 17-inch Cone Loudspeaker Table has suspended from the underside of the top a 16-inch Windsor Cone Loudspeaker. Placed in any part of a room, it fills the room with music just as an inverted electric lamp floods the room with light. Finished in Mahogany or Walnut. Price \$19 or Walnut. Price \$23.00 (West of Rockies, \$23.00)

As a piece of furniture, the Windsor Cone Loudspeaker Console is of such manifest high quality and attractive design as to be a welcome addition to any home. Finished in Mahogany or Walnut.

The Windsor Cone and Horn Loudspeakers, combined with attractive pieces of furniture in many models, are being demonstrated by recognized dealerseverywhere.

Go to your dealer today and examine this astonishing new Cone Loudspeaker Console. If he happens not to have one, write to us and we will tell you the name of the nearest store at which you can see and hear one.

Note to Dealers Write or wire today for details of the highly profitable Windsor selling franchise

WINDSOR FURNITURE COMPANY
World's Largest Manufacturers and Originators of Loudspeaker Consoles
1416 Carroll Avenue Chicago, Illinois
Los Angeles Branch—917 Maple Avenue

WINDSOR FURNITURE COMPANY
Electrical Department
1416 Carroll Avenue, Chicago, Illinois
Send me FREE and without obligation circulars of the Windsor line of Cone and Horn Loudspeakers combined with pieces of furniture, and name of nearest dealer:

Name.....
Address.....
City..... State.....
Dealer's Name.....

RADIO AGE

The Magazine of the Hour

M. B. Smith
Business Manager

A Monthly Publication
Devoted to Practical
Radio

Frederick A. Smith
Editor

BUILD A RADIO SET!

By ARMSTRONG PERRY

ONCE I knew a man who lived in a very small city apartment. One evening we spent three hours around his tool chest. It contained tools enough to equip a carpenter and cabinet makers' shop and must have been worth over a thousand dollars. Yet there was nothing in the apartment that he had made himself. His tools and his hankering for constructive work had been brought with him from some place where he had more spare time and elbow room.

All of us have the same urge that this man had, in greater or less degree. It used to break out here and there in the construction of a model steam engine that never performed any work harder than exhibiting itself at the county fair. Since the automotive craze arrived, a few natural mechanics have spent their spare time building cars, or assembling them out of impossible combinations of spare parts. Here and there we run across a home-made airplane. But never, until radio broadcasting began, was there an opportunity for the average man—every average man—and the exceptional men also, to satisfy the fingers that itch for the feel of tools and produce, in a reasonable time and at reasonable expense, something that would be a pride and joy to himself and that would provide his family and friends

with endless and beneficial entertainment.

There are no limitations to radio, up or down. For a nickel the Superintendent of Documents, Government Printing Office, Washington, D. C., will



Charles H. Ordas has charge of all the motor cars that run on the Chicago, Milwaukee and St. Paul Railroad, but he has found time to build a score of radio receivers. He takes this one, with a Flewelling circuit, on many a trip

send any applicant a pamphlet, describing and illustrating in detail a crystal detector set that can be built for ten dollars or less and operated indefinitely for nothing at all. Within twenty-five miles of one of the big broadcasting stations, it is

sure to keep the family busy with broadcasts whenever they have a minute to spare. With an extra good aerial it will surprise the builder some snappy winter's night by delivering a broadcast from some station hundreds of miles away. Whatever else it does, it will introduce the home mechanic into the most fascinating realm of constructive effort that he ever entered. It will teach him the elements of the new science that is revolutionizing the world by overstriding the artificial boundary lines erected by arbitrary rulers to keep people apart who, by nature are inclined to get together and cooperate.

On the Move

BEFORE the varnish is dry on the crystal set, the builder usually is investigating the mysteries of the electron tube. This radio device often has been compared with Aladdin's lamp, but even the fruitful imagination of the Arab wife, who had to deliver that Aladdin stuff every night to her cruel spouse or have her head cut off, never doped out a magic bottle that would compare with a 199 or a 201-A. The true bed-time stories today are as good as any of the imaginative ones in Arabian Nights, and they are almost as wonderful as the yarns that modern wives tell in trying to conceal the fact that they lost



R. D. Moore, a Chicago salesman, has been through the various stages of set building. This is his portable super

the grocery money playing bridge.

A simple tube set costs little more than a crystal set. Twenty-five dollars will purchase the parts. The government sells a pamphlet for a dime that tells what to buy and how to put it together. Radio catalogues show plenty of hookups. Radio magazines are full of them.

One tube extends the constructor's listening range to more than four times that of the crystal set. Stations a thousand miles away, and even twice that, are brought in sometimes. Just catching the call letters of the different stations heard, and spotting these stations on a map, will keep a man busy any night until the milkman comes in the morning, unless there is interference from the bedroom where he ought to be.

Amplifier is Next

ABOUT this time, a man decides to build an amplifier, and promises himself solemnly that he will never go beyond three tubes. When he has two stages of audio frequency amplification working well, he realizes that it is penny wise and

pound foolish, now that he has secured loud speaker volume on the near-by stations, to go without the extra distance that two stages of radio-frequency amplification ahead of the detector will give him. So he buys the extra tubes, batteries, transformers and things and makes it a five-tube set. There is something irresistible about the number five, whether it is in a radio set, on a domino, or on three or four playing cards in the same hand. Some manufacturers brought out four-tube sets to compete with the fives. They were cheaper to buy and operate than the five-tubers, and some of them delivered better results than some folks secured with five-tube sets, but they did not become as popular as the fives.

The man who has gone so far as to build an outfit with five bottles never stops there. He no more can be satisfied with five tubes than America could be satisfied with light wines and beers. For weeks, or maybe months, the smell of pipe tobacco that floats out from the paternal den is mingled with the pungent odor of melting solder. The tap of the hammer and the scrunch of the drill are accompanied by snatches of whistled melodies—sometimes by muttered imprecations. Unearthly howls and shrieks burst upon the midnight air. Announcers, with muffled voices, claim to be speaking from stations where the family just know they cannot be.

Finally, with prideful dignity, the genius emerges from his den with a cabinet a yard long, places it tenderly on the library table, spends an hour hooking on batteries or battery eliminators, and turns on the juice. Everything that comes from the throat of the horn or the shield of the cone-type speaker is music to his ears after that. If it is not so to the rest of the family, they at least know enough to maintain a discreet silence.

From B. C. L. to Ham

AND the end is not yet. With its tremendous range and power, and in spite of its selec-

tivity, the superheterodyne picks up a code station now and then. At first, these are followed by swear words, not in code, from nearer home. But eventually the business-like rhythm of the dots and dashes awakens a keen desire to know what messages they carry. Any man in business today knows that many important matters are transmitted by radio and, while as a good citizen he would not break the law by divulging a private message snatched from the air, there can be no harm in just learning the code and listening in to get the drift of the traffic.

Code is not so hard to learn, and women are not the only persons who tire quickly of one-sided conversations. The radio builder casts about for some way to hook up a key or a telephone transmitter to one of his out-grown receivers. He learns that this is no difficult matter and that certain types of receivers will transmit quite efficiently for twenty or thirty miles. Every bloop that busts up his own reception advertises that fact. However, with boys talking back and forth in code with Australia, Europe, South America and way stations, no man can be satisfied with an improvised transmitter. He builds a regular one.

So it goes. Radio is wide



Inside Mr. Moore's super

open for everyone. The man of untrained hands can buy complete kits that go together far more easily than the jigsaw puzzles that consumed so much time to so little purpose a few years back. With such kits come diagrams that are much plainer than the crossword puzzles he has solved. Templates can be laid upon the panel material and will make it all but impossible to drill a hole in the wrong place. By following explicit directions carefully, it easily is possible for the merest novice to build and operate a set without having the slightest idea as to how the distant broadcasts are brought to his listening ear. But the man who knows a little about electricity, or who learns as he goes along, will find satisfactory opportunities for bringing all his mental powers into play as he traces his circuits.

The expense is what the constructor makes it. A man who went through all the stages and spent several hundred dollars figured it all out one day, and compared his experience with that of a neighbor who had put a similar amount into a car. The man with the radio had built an outfit that brought him and his family continuous entertainment from the far corners of his native land and occasionally from across the ocean. The daily upkeep amounted to less than the



M. C. Hopkins, a set builder who liked to play with "mud" as well as with wire, built this seven-foot loud speaker horn at his country place in Waterford, Virginia and hooked it to a receiver. The neighbors come in and dance or sit at home and listen

other fellow paid for a single gallon of gas.

The radio man had spent his evenings with his family. By exercising patience in answering questions, and by permitting the children to share in the fun of his constructive work, he had kept them at home and happy many hours while his neighbors' boys and girls were running wild, God knows where.

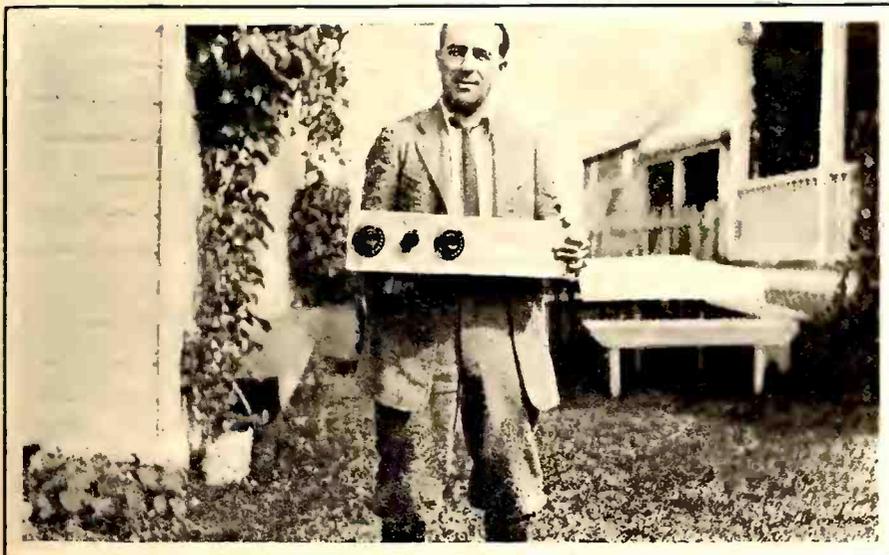
By suggesting a division of time, and systematic use of the receiver, he had interested one of his boys in following a broadcast college course. His girl had learned the difference between classical music and the sort of jazz that is enjoyed so

much by persons who would be as well entertained by someone hammering on a pan with a stick. His joy-riding neighbor's children had not use the car to go to lectures and concerts, nor even to enjoy the scenery. They knew the state of the roads for many miles around and could give the names of many of the morons who got drunk in the road houses.

Learning early in the game that neighbors who liked his receivers were inclined to ask for instruction, advice and even labor, without ever considering that his time might be worth something, he remembered how Israel Putnam opened an inn and thus put an end to free entertainment of uninvited guests. Following the example of the old Revolutionary hero, he had some cards printed, announcing that he would build and install receivers and furnish service at reasonable prices. His income from his outside activities paid for all the radio material used.

In short, the radio man saved money, increased his earning capacity, and developed an ideal home life that is scarce in these days. His neighbor ended the year with a worn-out car, a stack of bills, and a family that could see no hope in life unless they bought a better car, put up a bigger bluff, and hit sixty in the direction of hell and damnation.

Build a set!



Roy Fenderson, a disabled veteran of the World War, began building radio receivers because there was little else that he could do. They sold readily. The part of New Brunswick where he lives is remote from broadcasting stations so he built one and now provides programs for his customers

Naval Development of Radio Direction Finding Equipment

By

Commander S. C. Hooper

(U. S. Navy)

AT the birth of the U. S. Navy when John Paul Jones, its courageous leader, led the "Bonhomme Richard" into the waters of the North Atlantic, the aids to navigation were primitive, the use of wind and tide ended mostly on good judgment coupled with good luck.

The U. S. Navy has since its beginning ever been on the alert to accept and develop any devices which would tend to minimize disaster on the high seas and along the coast of the United States, not only to its own ships but to American and foreign commercial shipping as well. Among one of the simplest, yet most important aids to navigation developed by the Navy in recent years, is that generally known as the radio compass.

How few realize that the principle involved in this instrument which has now been in successful operation over a period of but less than ten years, dates back prior to the advent of commercial radio telegraphy for the principles are identical to those of the electro-magnetic induction discovered by Faraday in 1831. This discovery of Faraday's was followed by the developments of later scientists including Hertz, who in 1888 used a loop called a resonator to receive the wave emitted by a small linear oscillator. Hertz discovered that by placing his resonator loop in various positions greater effects were noted in certain positions than in others and therefore proved the accuracy of the mathematical theory of electro-magnetic wave propagation developed by Maxwell.



Above is shown a typical radio compass station, with the upper doors opened to show the loop mounted inside

Lodge Suggests It

MORE recent than these, it was Sir Oliver Lodge who in 1899 suggested the placing of a loop aboard ship for navigation purposes and the determination of the direction of a transmitting station by swinging the ship. This undoubtedly is the first suggestion of using the directional properties of a loop antenna for navigation.

In 1904, Dr. Lee DeForest obtained a patent on a loop antenna and emphasized its directional characteristics. Following and preceding Dr. DeForest's efforts were such pioneers in radio as Slaby, Brown, Stone, Brown, Fessenden, Harden, Thompson, Babcock, Pickard, Bellini-and-Tosi, and many others, all of whom

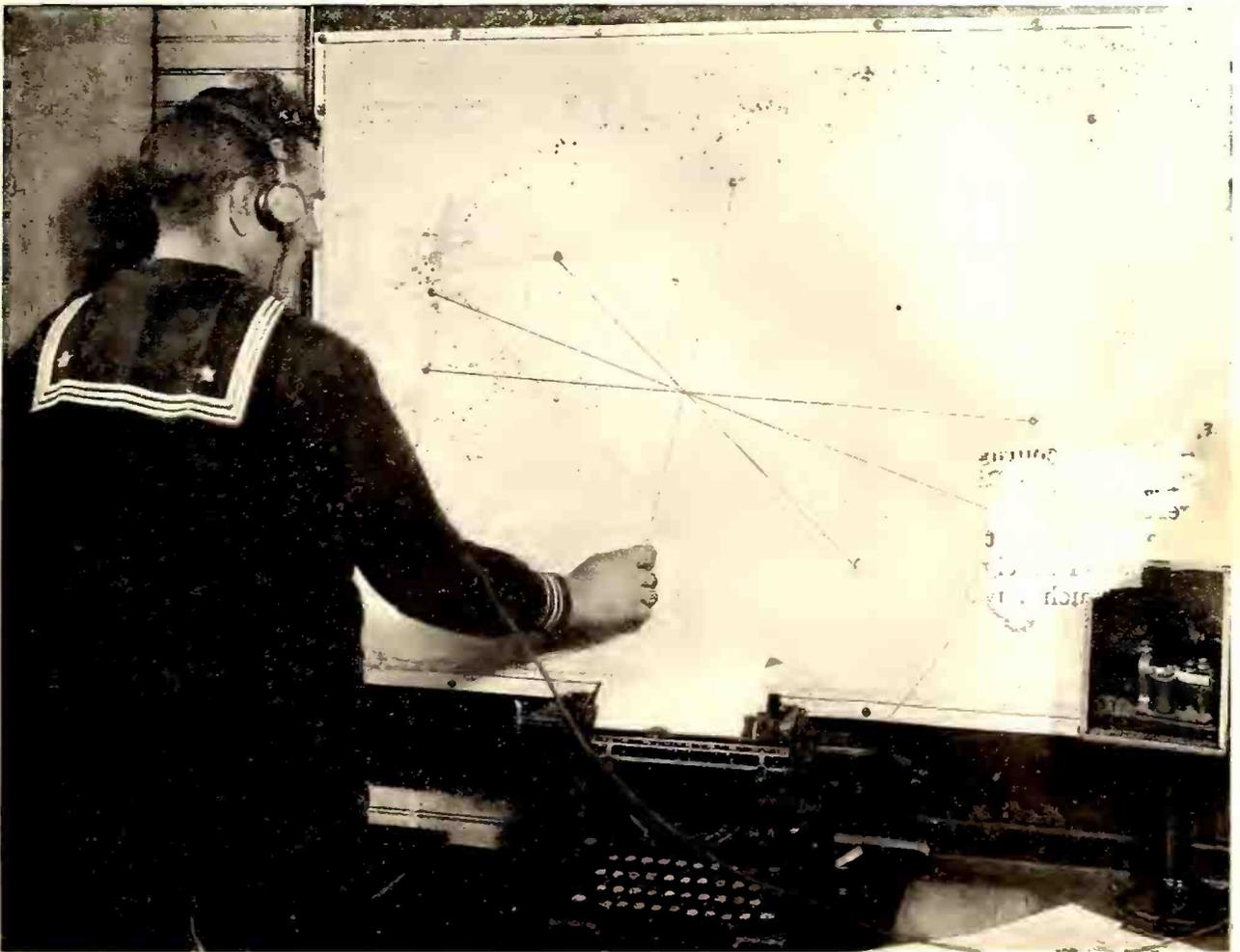
made some contribution to the advancement of the art.

The Navy Department watched with great interest this early development of the radio compass but took no action toward its application because its service use was not warranted by the results thus far shown.

Pickard in 1909 submitted his patent on a radio direction finder to the Signal Corps of the Army but for obvious reasons, it was not applied to service use.

Another method of determining the distance and thus locating ships approaching the coast was tested by the Navy in September, 1911.

A patent was issued to W. J. Smith on July 12, 1910, covering a method of determining dis-



Operator at control station plotting bearings on ship taken by several compass stations. Where the strings converge is the location of the vessel

tances by sound. The apparatus consisted of a plotting device making use of the difference between the velocities of radio and sound waves.

This equipment, known as a Fogometer or Telemeter, was thoroughly tested between the *U. S. S. Washington* and the Nantucket Shoals Lightvessel, and later between the *U. S. S. Ammen* and Fire Island Lightvessel. In brief the method employed in obtaining the distances was the employment of one slow moving submarine bell signal, followed by a radio signal, the reception of which can safely be said to be instantaneous with its transmission, and the difference in time of the reception of the two signals multiple by the velocity of sound in salt water would determine the distance the vessel was from the transmitting station.

The system was made self-recording by arranging the radio transmitter to emit a series of signals which were so spaced that the time interval between each radio dot of the series would arrive simultaneously at predetermined distances from the transmitting station, with the submarine signal. At the receiving station, it was but necessary to have a pair of head phones, one phone of which was connected to the radio receiving set and the other to the submarine signal receiver.

It was necessary to develop the special clock movement which for the transmitting end to maintain the radio signal at the proper interval after a submarine signal was transmitted.

Though these Telemeters were satisfactory the mariner could not be induced to use the service and as no extensive use was ever

made of it, the equipment which was manufactured for the several lightvessels was not installed.

Try Two Sets

STILL believing in the practicability of the radio compass, in the latter part of the year 1911, Captain A. J. Hepburn, U. S. N., was instrumental in securing for the Navy Department direction finding or radio compass equipment of two different types, one Bellini-Tosi and the other Telefunken. One set was tested by the writer aboard the then Fleet Flagship, the *U. S. S. Wyoming*. However, as the results of these tests were unsatisfactory due to various reasons, it was suggested that the equipment be installed and tested out on shore.

Accordingly, the Telefunken set was installed at Fire Island and the Bellini-Tosi at Cape Cod

during 1913-14, where the tests were in like manner unsatisfactory showing deviations of five to ten degrees. The vacuum tube amplifier which has been found indispensable for radio compass operation had not been developed at that time and therefore due to the limited range of the receivers then in service and using the crystal detector, no practical use could be made of these early developed radio direction finders.

From these tests and the experience gained with these direction finders the Navy Department recognized the apparent necessity of this instrument of this type and the initiative as it has been done in other scientific fields, the Navy in order to promote greater interest and progress in the development of the radio compass submitted proposals in 1915 to various manufacturers specifying definite but rigid requirements which were essentially necessary from the tests held with the earlier types of equipment. This proposal called for one battleship type to be installed on board the U. S. S. *Pennsylvania* and one cruiser type which it was intended to

be installed aboard the U. S. S. *Birmingham*.

But one satisfactory bid was received and that from the Marconi Wireless Telegraph Company of America, who submitted specifications of the equipment they intended to supply. Their bid was accepted and the contract for the apparatus awarded on March 28, 1916. The Marconi Company, however, much to the regret of the Navy after considerable expense with no definite results, found it necessary to cancel their contract and forfeit bond.

The publicity given the radio compass previously by the Navy's interest in it, together with the wide-spread advertisement given the proposals to manufacturers seemed to act as a stimulus among inventors in this particular field and in 1916, F. A. Kolster (of the Bureau of Standards) submitted a scheme to the Navy, which because of the war conditions then prevailing, was treated in the most confidential manner. About this time, the vacuum tube detector and amplifier were giving promise of commercial success and immediately

presented the one big possibility of solving the problem which had up to that time been retarded owing to the inability of obtaining sufficient signal strength from a loop antenna using only a crystal detector.

These suggestions of Mr. Kolster were forwarded by the writer to the Navy Yard, Philadelphia, where a secret laboratory was established and where was begun the development of the Navy's present day radio compass.

Developed in Secrecy

IT is obvious, from the nature of this apparatus, the secrecy at that particular time was absolutely essential and therefore a great deal of material of historical importance is not available. As a result of this early development work by the Navy Yard, Philadelphia, the Navy Department on June 15, 1916, authorized the then Bureau of Steam Engineering to manufacture thirty coils for installation on important vessels of the Navy, as well as on shore. The first of those manufactured were installed on the U. S. S. *Wyoming*, *New York*, *Florida*, *Utah*, *Connecticut*, *Nebraska*, *North Carolina*, *Memphis*, *Washington*, *San Diego*, *West Virginia*, *South Dakota*, *Pittsburgh*, *Vestal*, *San Francisco* and *Chester*. These sets were installed in the early part of 1917 and other vessels were likewise equipped as sets became available. As the entrance of the United States into the World War followed shortly, efforts were made to equip particularly the war vessels assigned to convoy duty with the radio compass apparatus designed at the Navy Yard, Philadelphia, and following this class of vessels, special attention was directed toward the equipping of destroyers. Many of the destroyers, however, were in European waters by this time and consequently the installations were made where they were operating. The frequent contact by these destroyers with convoys and in a number of instances enemy submarines,



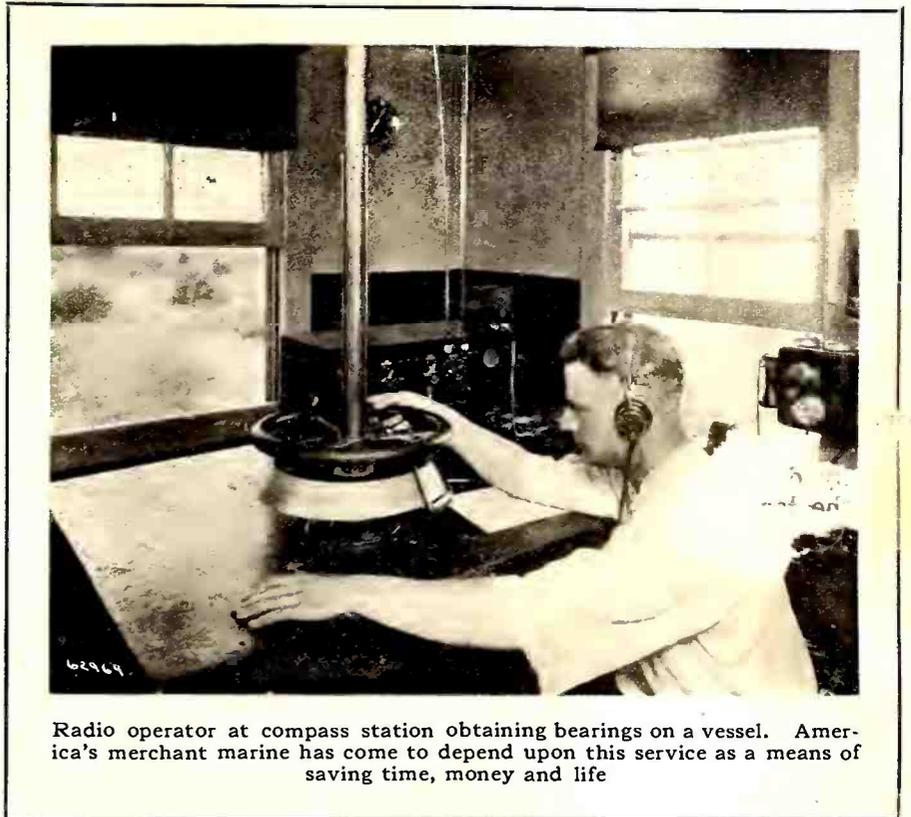
This operator is located at the control station which receives bearings by land wire from compass stations, plots these results and sends the correct bearing to the vessel requesting such service

proved conclusively the great military importance of this apparatus.

In this particular, an excellent example of the use of the radio compass was that demonstrated by the English shore radio compass stations who just previously to the battle of Jutland determined the changed position of the German Fleet who were evading the Allied Fleet and relayed this information to the English Grand Fleet with the result that is generally known to everyone.

Up to this time, owing to the centering of war activities in Europe, efforts in the development of the radio compass were confined almost exclusively to its use aboard ship. However, the activities of the German U Boats along the Atlantic Coast during 1918 suddenly awakened the Navy to the necessity of providing without delay radio compass stations on shore for the purpose of detecting the location of these submarines which were menacing our shore line. Immediate steps were taken to locate temporary shore stations in the most appropriate place in order that they might be co-ordinated by land wire and take simultaneous observations on signals emitted from a ship and thus obtain a fix and determine the location and course of the vessel. As in the case of the compass equipment for ships, so in the design developed for shore, the Navy Yard, Philadelphia, was to considerable extent responsible, although the Navy Yard at Boston shared in the work.

In August of 1917, about the time numbers of ships were being fitted out with radio compass, another apparatus of radio design was developed at the instigation of the Navy Department by the DeForest Radio Telephone and Telegraph Company for the purpose of giving radio signals during fog, mist, rain or falling snow and was installed at the Point Judith Light. This apparatus, known as a radiophore, though having no real military value, had every indication of proving a great aid to navigation. It consisted of a phonograph repeating the name of the "Light" into a radio telephone. The



Radio operator at compass station obtaining bearings on a vessel. America's merchant marine has come to depend upon this service as a means of saving time, money and life

range of this apparatus was supposed to be approximately eight miles. After every third repetition of "Point Judith Light," the apparatus sent out warning, "You are getting closer, keep off" at an approximate range of two miles. The wavelength of the equipment varied slowly and continuously between 550 and 650 meters and only the ordinary receiving set then available, mostly crystal detector, was needed to receive the signals.

The experiments with this Radiophore at Point Judith Light, while successful to a certain degree, did not warrant the installation of similar apparatus on other Light Stations, mostly because of its limited range, and the equipment was subsequently removed in the early part of 1919.

Concentrate Attention

AS the radio compass was being used so successfully, the Navy after its experience with the Radiophore, seemed to concentrate its attention to the use of this type of direction finder. After the Armistice had been signed, the attention of the Secretary of the Navy was invited to the number of returning troop ships who, for the protection of

such vessels, ordered that the harbors of Boston, New York, the Delaware Capes, the Chesapeake Capes and Charleston be provided with radio compass stations of a permanent design.

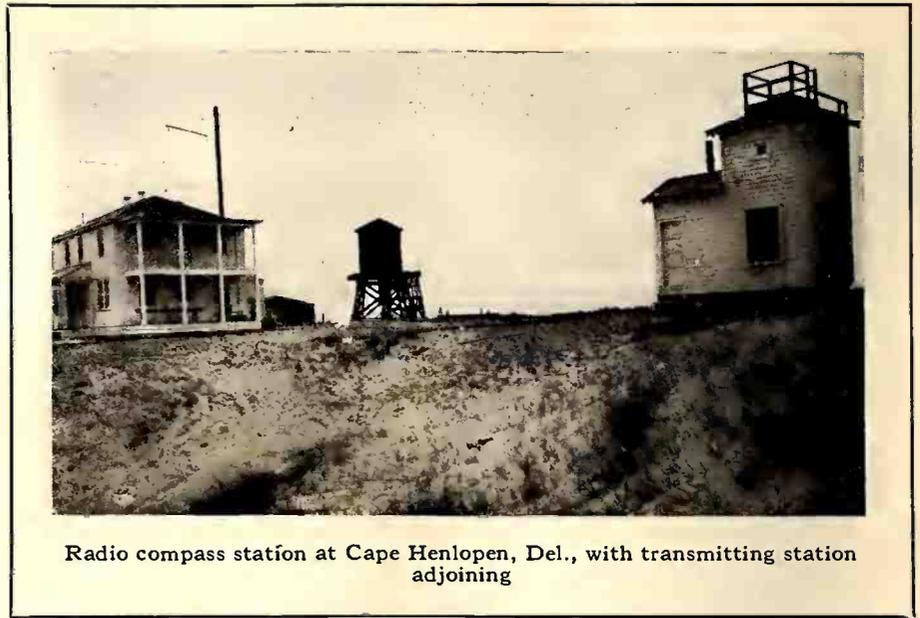
This authorization was issued in the latter part of November 1918, and work on these stations was promptly started. The first group of stations completed to furnish bearings to ships entering any harbor in the United States was at New York. The work on the stations of this group was completed in less than a month and the first bearing furnished the U. S. Fleet on December 26, 1918, on its return from European waters.

All stations at the various harbors were rushed to completion and prior to March 1, 1919, at the five principal harbors above mentioned and intermediate points, a total of twenty-two stations were in operation. These twenty-two stations were the nucleus of the present U. S. Navy Radio Compass Service, which now consists of 51 stations located on the Coasts of the Atlantic and Pacific Oceans, the Gulf of Mexico, the Great Lakes, Alaska and the Panama Canal Zone.

The present type of radio compass equipment consists principally of a number of turns of wire wound around a framework of approximately six feet square (see picture on page 8). This loop is connected to a sensitive regenerative receiver including a vacuum tube detector and amplifier. As indicated in the sketch, the loop is mounted on a rotatable vertical shaft. By swinging or rotating the loop, the operator hears the signal increase in strength, then grow weaker and finally die out. There is a dial on the loop shaft which is calibrated to 360 degrees and which moves past a fixed pointer. When the signal is no longer heard, which is known as a "minimum" the operator reads from the scale on the dial the figures which enable him to give the direction of the vessel transmitting.

At shore stations, the radio compass is housed in a little wooden structure just large enough for the purpose; at each of these stations there are usually four radio operators, one of whom is always on watch.

These compass stations have been located primarily with a view of giving maximum service from a military and Navy standpoint in case of hostilities. By referring to the list of Naval Radio Compass Stations, it is evident that the most important ports and harbors on both coasts



Radio compass station at Cape Henlopen, Del., with transmitting station adjoining

and the Gulf of Mexico have been taken care of.

To maintain the efficiency of the service, however, in peace time, the privilege of obtaining bearings is offered free of charge to the ships of all nations as an aid to navigation which has been another consideration in locating these stations.

It will be noted that the greater part of the U. S. Navy's Radio Compass Stations are arranged in groups; e. g., take the group at the New York Harbor which consists of Manasquan, Fire Island and Amagansett. These stations are not only equipped with radio transmitters but are

connected by private telegraph with the control center located in New York City.

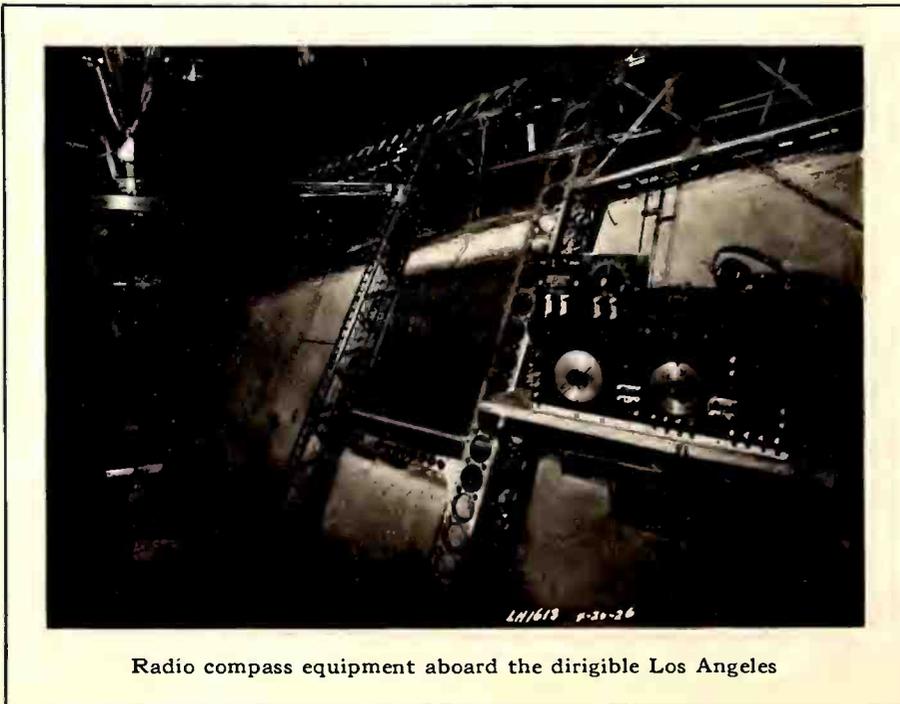
The first 10 minutes of each hour at all stations during the clear weather is devoted by the operators to test and practice, but during the remaining fifty minutes of the hour they are constantly alert on the 375 kilocycles (800 meters) frequency listening for ships requesting bearings.

Call for Bearings

SHOULD a ship desire a bearing, she would call the control station of the group and transmit "QTE" meaning "what is my bearing." After notifying each station of the group by line wire that a ship (giving call letters) desired a bearing, the control station would reply "K" to the ship meaning "go ahead." The ship then transmits its call letter for fifty seconds. During this transmission each of the stations in the group take a bearing on the ship, and sends this by land wire to the control station where on a large chart the various stations are located with a string attached to each.

The string of each station on the chart is placed in the direction given by each respective station and should meet in a point. The location of this cut or fix is then transmitted to the ship as its position. This whole operation is done in approximately 2½ minutes.

(Please turn to page 60)



Radio compass equipment aboard the dirigible Los Angeles

The Melancholy (?) Days Arrive

By

DOROTHY BRISTER
STAFFORD

A LONG about this season of the year, when the leaves are turning brown, the red, red robin has gone, bob, bob, bobbin' back whence he came, the celluloid eyeshades have been packed away for another summer, and the football squads are lining up, the pessimistic old poet was wont to take his quill pen in hand and announce to an interested clientele that:
"The melancholy days have come, The saddest of the year."

In this year of grace he would be greeted with a chorus of guffaws, and "Whadda yuh mean, melancholy days?" from the great army of radio listeners who look eagerly forward to autumn for the resumption of what they regard as their rightful heritage of free entertainment, which has been sadly curtailed during the heated season, and the thrill of again pulling in distant broadcasters unheard for several months. Fall has come to mean feverish activity in all branches of the radio business—the industry of home set-building takes on a new impetus, there are rumors and counter-rumors of marvelous innovations about to be sprung by the manufacturers, the activity around the broadcast booking agencies is reminiscent of West Forty-seventh street on an August afternoon—and while the lover of the open spaces and the great outdoors may have a faint regret of the passing of summer, he is scarcely inclined to regard the autumn days as the "saddest of the year" when he is getting California every night.

Speaking of analogies, we remarked the other day that the season was at hand, not when swords were turned into ploughshares, but when Fords were transmogrified into radio sets—



Nothing melancholy about these faces—L. J. Barnes, left, announcer, and Stephen E. Boisclair, right, organist, who are heard over WGY the General Electric station

and we were forced to translate. For our initiation into the mysteries of high finances practised in the acquiring of radio sets by a certain class of listeners we are indebted to one Jeff—a "high-yellow" son of Ham who brings us our matutinal oatmeal, and who, being in our apartment one day last winter in his official capacity of tray-bearer, volunteered the information that he had a radio set just like ours. Thereupon Jeff became one of our most valuable scouts, reflecting the opinions of his race and class in regard to radio entertainment, and confirming what one had long suspected—that the colored brethren do not listen to negro spirituals, that they dislike all darky impersonators, and comb the air night-

ly for the white man's orchestra playing the best Charleston music. We did wonder several times about the compatibility of Jeff's eighteen per week and three hundred dollars' worth of radio set—to say nothing of four children in the background—but concluded that the matter of tips around an apartment hotel was considerably more than we had suspected. Then one day in the summer we had occasion to ask him about a program in which we thought he might have been interested.

"Ah ain't got no radio no mo," was Jeff's reply. "Yuh see Ah had t' git me a Ford coop t' git me back an' forth t' work, an' Ah'd only made three payments on the radio set, so Ah let's it



Dr. Bernard C. Clausen, Syracuse instructor, whose services are broadcast by WGY

go. Radio ain't no good in summer nohow."

Slightly bewildered, we asked him what would happen to the Ford "coop" in the Fall.

"Oh, Ah'll turn 'er in soon's it gits slippery," was the cheerful reply. "Then Ah'll git me 'nuther radio. Ah've had fo' cahs an' five radios sence Ah lef' N'Awlins."

Jeff's a Schemer

FOR the sake of future dividends of the R. C. A., one trusts that Jeff's modus operandi is not prevalent throughout the length and breadth of the land; but if they carry out the promise of Gen. Harbord on the occasion of the purchase of WEA, to "make broadcasting so good that no home can afford to be without a radio set," the Corporation can scarcely complain of the ethics practised by the laity to obtain the means of enjoying their largesse.

And speaking of the purchase of radio sets, there is something almost pathetic about the credulity of the average buyer who has waited this long before venturing upon his exploration of the air. He has read such astounding things in the newspapers—never stopping to think that the average reporter knows just about as much of radio as he does of the Einstein theory—and heard of such remarkable results obtained with so little effort, that he believes the baby science to be

a full grown giant, and sets confidently out with the thought that he has but to turn a dial and the whole world will be about his ears. It will be—but not as he expects it. We had one of these trusting souls for a visitor the other night.

"I wish you would get Baltimore," was his request. "I happen to have a cousin in the studio down there. We had to admit with shame that we had never heard Baltimore.

"Well, what kind of a radio set do you call that?" he demanded. "I've ordered a coast to coast set. I wouldn't have anything else."

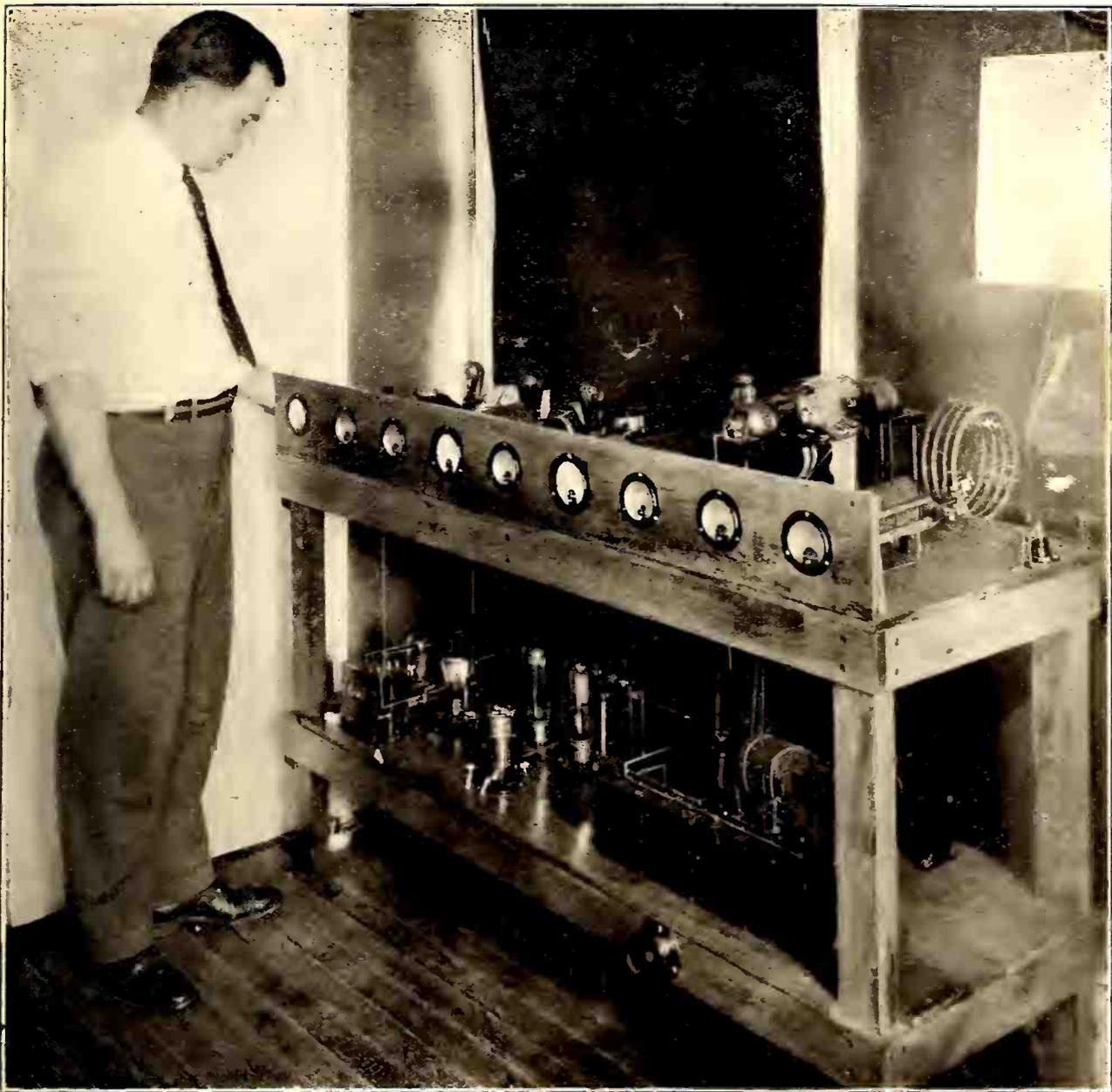
Now, while we know our faithful Hetty hasn't all the modern gadgets, and she keeps us broke with her insatiable appetite for batteries, still she serves us faith-

fully six hours a night, and we hate to have aspersions cast upon her ability. She has to put up a constant battle with automatic elevators and heating pads, and lives in close conjunction to twenty caterwauling sets, but we still contend if some altruistic manufacturer would present us with a dozen tubes of the quality we used to buy back in '24, Hetty could hold her own with the best of them. So we meekly inquired what the "coast to coast" wonder might be, and when we heard the name we chortled with glee, for if our friend can dig Baltimore out of the mess around 245 meters with the selectivity of that set he'll be a wonder at dialing.

"I suppose," went on the optimist, "it's rather foolish to put much money in a radio set when



Booklovers delight to hear William F. Jacob, librarian of the General Electric Co., who gives "Book Chats" over WGY



William E. Jackson, Schenectady, and the crystal control short wave amateur transmitter he uses. He, like many other amateurs, is employed during the day, but spends his nights on his hobby. We often wonder when these amateurs sleep

we will soon have this new invention where all you have to do is to stick a key into the telephone and get all the radio you want."

A Great Invention

WE MURMURED that our idea of a great invention would be something to enable us to stick a key in the telephone and get Central, but our persiflage was lost upon the dreamer who considers the millennium in radio at hand. We'd like to talk to him around the first of the year, after he has had a few

months' experience wrestling with the chaos that has recently broken loose in broadcasting.

However, we prefer the enthusiastic beginner to the crepehanger, who goes about predicting that the bottom is about to drop out of the radio-business. We seem to always have him with us. Personally it appears to us that this fall the whole world is interested in radio. The other Sunday night we had an insight into the inroads the new entertainer had made in a formerly staid and solemn residence dis-

trict. We were taking Grumpy, our beloved bone-polisher, for his evening's airing along a sleepy avenue of stately old homes, where we are confident a few months ago no more inelegant sound than the tinkle of a grand piano broke the nocturnal stillness, when we were surprised to hear the Capitol program coming from no less than six receivers in a single block. And half an hour later, driving through a detour along a street of foreign residents, that might be said to represent the opposite extreme

of society, we caught the tag-end of the same program. Truly, like death, radio may be appropriately called the great leveller.

And since we seem to have gotten out of the studio this month into the receiving end of the business, we ran across a new angle of radio the other day that appealed to us for its human interest. We have heard much of the great blessings radio has brought to the shut-ins, the blind and the dwellers in lonely places, by means of the entertainment and information broadcast, but we had paid little attention to the mechanical end as a high moral agent, until a man declared that the set-building craze struck his house just in time to save him from an early grave and his two boys from states' prison! They are a couple of the modern race of young incorrigibles—fifteen and seventeen—and until last winter the father had spent his evenings listening for the telephone to tell him that Bob had been caught in a road-house raid, or John had gone into the ditch with the new Cadillac, when the younger discovered the modern pastime of constructing radio sets. Quick to see that here was something that might divert a restless, temperamental boy, the father placed every means at his disposal, and while the elder was at first inclined to ridicule his junior's enthusiasm—it wasn't long before they were both hard at it. They built six sets last winter, the older boy grappled with the Continental code and soon was enrolled in that earnest brotherhood of young experimenters known as "hams," and the whole atmosphere of the home became changed. As the father put it, instead of the house being overrun with young cake-eaters, equipped with hip-flasks and ukeleles, the billiard room, which had been given over to the boys' experiments, nightly held a different class of youth—worthwhile youngsters, who worked for what they got, a young engineer or two attracted by the opportunity for experimenting where there was unlimited equipment, and a breathless group of the uninitiated. The boys scarcely went out a night a

week and the triumph came when they passed up the wildest fraternity dance of the season because they had a date to talk with an amateur in New Zealand. The new interest has brought them wholesome, decent contacts, and while formerly their only interest in college ran to football and fraternity good times they are now both preparing for the engineering course with serious enthusiasm.

There are thousands of such young men and boys scattered throughout the country who are experiencing nightly thrills from their contacts with air adventurers in other lands. They alone know the real romance of radio. Some one said the other day that radio did not appeal to the average woman because she had to listen without an opportunity of saying a word back. The "hams" are not so handicapped. They can chatter away to their heart's content, and one is almost again tempted to tackle the mysteries of code, though memory points to two outstanding Waterloos in our life—one an attempt to acquire a nodding acquaintance with the Portuguese language and the other to understand telegraphic code.

The great experimental station of the General Electric Company at Schenectady takes a motherly interest in these young trail blazers. The programs that go out on the 379 meter wave are simultaneously shot forth on a short wave length for the receivers who can pick it up, and the boys tell us it always comes in clear and clean of static, when we, who are confined to the high waves, are unable to receive the station.

In the excellent press matter coming from WGY, they tell us of one of their young employes, William E. Jackson, who must be the super-ham. He has established two-way communication with operators in forty-two countries, including Australia, South Africa and India, has relayed important messages from ships in the far north, and doubtless is the envy of every youth who has ever strung an aerial.

The technical talks that come from Schenectady are of vital in-

terest to young experimenters, and the splendid feature, "The Wonder Story of Steinmetz," prepared by John W. Hammond and broadcast in serial form on Tuesday nights, has attracted many an uninformed listener, as well as those more directly concerned in the technical side of electricity.

WGY a Favorite

AND since we are talking of WGY, we find that with the seasoned listeners throughout the east and middle-west the Schenectady station is the prime favorite. And that is as it should be, for they do such worthwhile things down there. Aside from the usual standard programs of high class entertainment, which is augmented by the WJZ and WRC hook-ups, they give real service to their listeners in their news and sport reports—the later including racing results—and their strictly educational features are always of the highest quality.

Along this line we especially enjoy the "Book Chats" given every Thursday night by William F. Jacob, librarian of the General Electric Company. We have been listening to him close on to two years now, and consider his concise, ten-minute talks on current publications the best feature of this sort put on the air. That there are still a number of people left in the world who *do* read is evidenced by the mail that reaches WGY in regard to this feature. Anyone interested in having intelligent assistance in selecting his reading would do well in tune in on Mr. Jacob's talks.

No matter what else we have doing on Thursday nights, it has become a habit with us to turn to WGY at eleven for Stephen Boisclair's organ recital, and it always seems a fitting end to the day. Mr. Boisclair is one of the outstanding radio organists, and the fact that he has been broadcasting from this station for four years is a sufficient testimonial to his popularity. His programs uniformly are of popular appeal—the song of the moment and melodies of yester-years—which, after all, are what the majority of listeners

(Please turn to page 56)

A Little Discussion on the Aero-Dyne Receiver

High R. F. Gain Per Stage is Achieved

By H. A. FREDERICK

DID you ever start to read a technical article in a radio magazine, get half-way through the first paragraph, stop, glance at the photos and turn the page in boredom, perhaps remarking to yourself, "Huh! another five-tube set!"

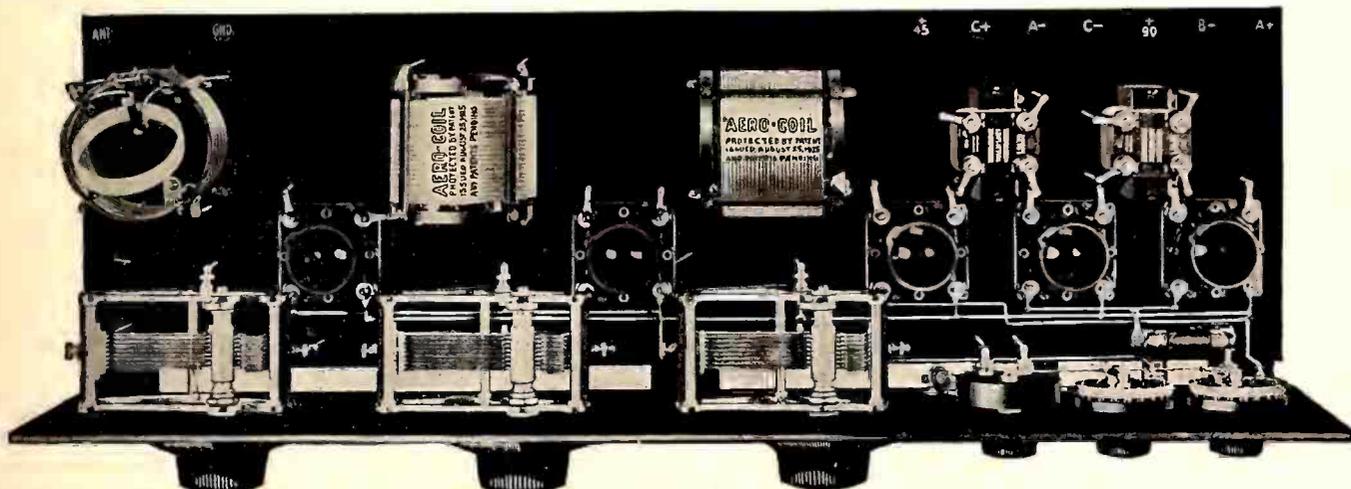
Before doing that injustice to this immediate contribution—wait a minute! All is not gold that glitters—and aptly, all five-tubers do not use five tubes, that is, to their maximum ability. A prominent eastern engineer once said, reversing the reflex argument, that he had many times seen five tubes do the work of three, and, unhappily, that is too often the case. Did you ever see a set that used every last ounce of energy (if energy may be measured in ounces) that it inherently had—one that made you feel that everything was doing its darnedest to add punch to that signal? The receiver to be described was designed to do just exactly that; its engineers called it "high-gain-per stage," and it has it!

Before getting into the details

of its design and construction, let's discuss for a moment the reason for the present-day five tube receiver. When we had only slightly over enough broadcasting stations, several years ago, we were not concerned so much with the problems confronting the home-builder in this day of ten times too many! Any old three tuber in the hands of a good operator would bring in both coasts on a big aerial with plenty of volume every fair night, but now it's getting to be really something to shout about if a large city dweller tunes in Podunk, five hundred miles away, on an out-of-date receiver, through the local hash! The solution to the selectivity problem lay, mainly, in the increased filtering action of a number of tuned stages. Each stage, if sharply tuned, drops off a portion of the unwanted signal, and (even if it did not amplify the desired station) tends to clarify the result. This of course, is an old princi-

ple, but the main difficulty in its adoption was to keep from losing the desired station in the process. Radio-frequency amplification by means of tuned stages was, and still is, in a measure, one of the most difficult problems of the engineer. As soon as the thing would start to amplify, it would immediately pop into oscillation, distorting the result and feeding nothing but a garbled mess to the loud speaker. A compromise was therefore adopted (the ordinary loss-stabilized receiver) wherein the oscillation tendency was cut down by losses, small loosely-coupled primaries (giving poor energy) and the like. Unfortunately the signal also suffers in this process and the result, while a good deal sharper, is usually little louder than would be had by a good three tube set.

Engineers of the Aero-Products Co. realized this fact and finally achieved a receiver that not only sharpens the signal amazingly but gives high amplification at the same time, a



Top view of the five tube receiver described by the author. The sub-panel assembly makes a neat job



Front panel view of the receiver described by the author

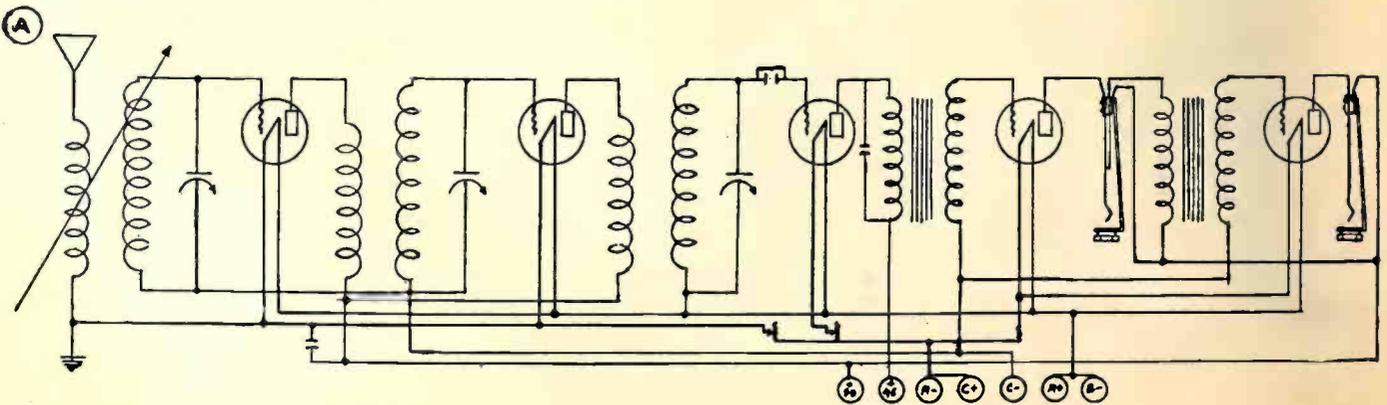
thing formerly realized only in high-priced, laboratory built receivers. The accompanying photographs and diagrams tell the story.

The Aero-dyne, as can be seen from the circuit, uses two tuned stages of cascade radio-frequency amplification, a tuned detector and two stages of high quality audio. The radio-frequency coils are the heart of the whole success of this set. They are wound with heavy, uncolored wire in solenoid form on a skeleton-framework of thin bakelite construction, giving a coil whose losses (that much misused word) are remarkably low and whose mechanical strength is sufficient to withstand a good deal of rough handling. Inasmuch as the amplification per stage of a radio frequency transformer is inversely proportional to the square-root of its resistance, all other things being equal, low resistance is a distinct advantage. Greater selectivity is also gained by this means, the "band-pass" or width of the resonance peak is directly proportional to the resistance (again all other things being equal). Therefore it can easily be seen that a coil

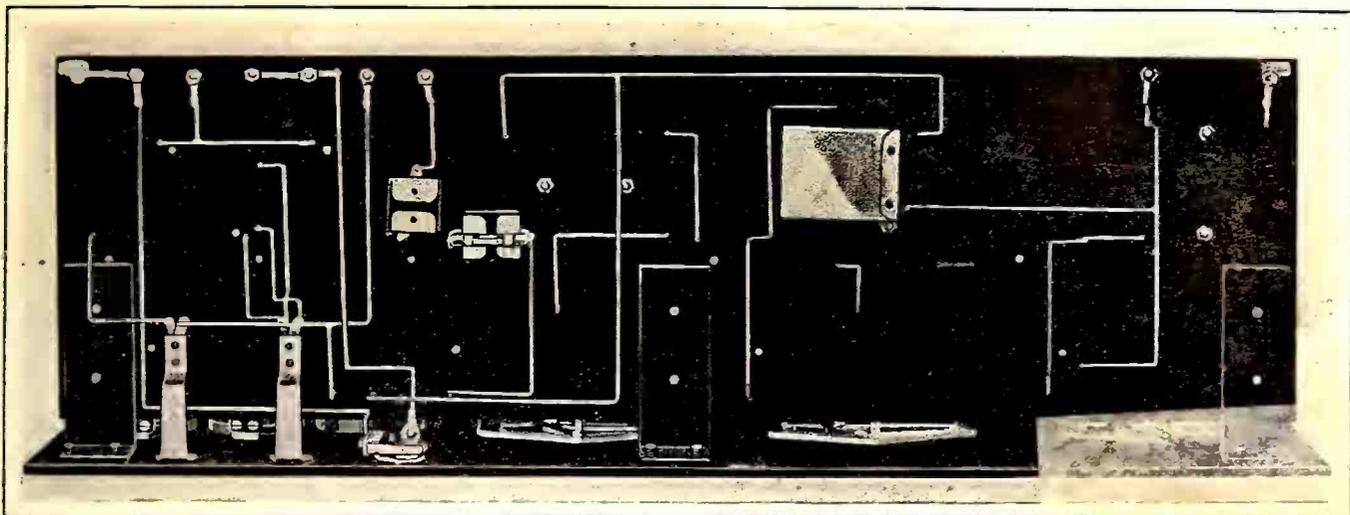
having twice the resistance of another will only give seven-tenths (.707) of its amplification and will be *twice as broad*. Other ratios will, of course, be in proportion. When these figures are carried out to include three such coils in a row (as in the five tube set), their ratios are much more pronounced (Only about one-third the amplification!). Remember these facts the next time you build a set.

Of course, the secondary coil, of which we have been speaking, is only part of the story. The primary, which transfers to it its energy, is equally important in that it must also obey several laws of coupling to give the best of results. In this type of receiver the best primary coil is the one which has the highest coefficient of coupling to the secondary (up to a certain maximum), with the minimum of self-inductance. This may sound forbidding but merely means the primary should have the least number of turns (to give a certain coefficient, or transfer factor), and that it be closely associated with the secondary, not all bunched a half an inch away from the filament end of the

coil. The primaries in Aero coils are of only six turns, but so spaced and associated with the secondary (inside, covering almost an inch of surface) that the energy transfer is unusually high. While we are speaking of primaries it may be best to mention the *adjustable* primary on the antenna, or first coil. It is a well-known fact that all antennae characteristics are not equal even if they *are* (the antennae) all exactly one hundred feet long, and that a fixed arrangement is only a compromise in any one case. Antenna resistances and natural periods (wavelengths) differ and with them differ the conditions of local interference. For each condition there is a *best* coupling which when deviated from, causes a loss of signal strength or selectivity, or both. This does not mean that the variable primary adds another adjustment to the set; it is merely set, once for all, to suit the individual conditions by adjusting to the loudest response from a distant station, and after that need not be touched unless the governing conditions are changed. It may be readjusted for silent night, when we want volume and care



This is the schematic circuit of the receiver, well known to all fans



Under view of the subpanel showing simplicity in wiring

little for local selectivity, and when all the locals come on again may be set further away from its secondary, allowing the user to reach out for the fifty watters (are there any more?) a thousand miles away. It's just like the choke on a car, you only use it under unusual conditions, but you'd be lost without it!

The set is stabilized, that is, prevented from oscillating, by means of a variable control of the plate voltage applied to the radio-frequency tubes. This control also acts as a volume adjustment, allowing anything from the merest whisper to a full loud-speaking roar. By its use the set may be operated at the limit of critical regeneration, if the distance and weakness of the signal warrants it, and the most feeble carrier made to deliver, by careful adjustment, an enjoyable result. Thus are combined both radio-frequency amplification and regeneration, realizing the advantages of both. Few systems can claim this superiority.

There is one very appealing thing about controlling regeneration of the receiver by means of the variable resistor in the plate circuit. While it is true the receiver may be thrown into oscillation and become a miniature transmitter, the simple act of doing this precludes the possibility of the manipulator hearing a program under those conditions. The curse of the blooping world has not been so much

List of Parts

For readers who desire to make up the receiver described by Mr. Frederick we are listing below the parts required:

- 1 Set Matched Aero Coils
—TRF-120
- 3 Variable Condensers,
.00035 Karas SLF.
- 5 Benjamin Cushion sockets
- 2 Thordarson 3½:1, Audio
Transformers
- 1 Formica Verichromed
Aero-Dyne Panel 7x
28x3-16
- 1 Sub-panel 7x28x3-16
- 3 Sub-panel brackets
- 1 Central Lab. 0-200,000
ohm Var. Resistance
- 1 Yaxley 20 ohm rheostat
- 1 15 ohm rheostat
- 1 No. 2A two circuit jack
- 1 No. 1 open circuit jack
- 1 1MF By pass condenser
- 1 .001 Fixed Condenser
- 1 .00025 Grid condenser
with leak mounting
- 1 2 to 5 Meg. grid leak to
suit tube
- 1 Pilot light switch
- 3 National type B or C ver-
nier dials
- 9 X-L Push posts
- 1 ½ Amp. (No. 112 Amp-
erite and mounting)
- 25 Ft. Bus Bar
- 1 4½ volt C battery
- Solder lugs and mounting
screws

the swiping across a wave band with a receiver in the oscillatory state, as it has been the chap who through ignorance feels the proper way to receive a station is through the zero beat system. This type of blooper hangs onto a station like grim death but after all his rewards are so scant that he soon learns the right kind of tuning and is no longer a nuisance.

This article started out to be a construction paper, a how-to-build-it article, but the writer became so side-tracked in his enthusiasm for the *details* of the set that it has turned out to be a discussion of these main points of difference. Nothing is lost, however, for the fan may build it from this magazine or Aero puts out an eight-page full-size set of blue-prints and color-diagrams showing step-by-step wiring and the general, detailed construction plan. A complete discussion of the set's operation and control is also included together with a preferred list of parts to go with the coils. Incidentally, so successful has it been that Formica is marketing a Veri-Chrome panel specially designed for this receiver.

The writer of any kind of an article, either technical or just general discussion, usually has a concluding paragraph in which he sums up all that has been said before. This article has none. The moral is: build it yourself, and see! or rather hear!

Conveniences for Radio and Press at New N. W. Stadium



An architect's idea of the new million dollar Northwestern stadium at Evanston now approaching completion. Newspapermen and radio sports announcers will be pleased with the number of conveniences included for their special benefit.

REALIZATION that radio has risen to a position of highest importance in connection with the broadcasting of sport events caused Northwestern university officials to take radio possibilities into account in drafting plans for the new million dollar football stadium which is now nearing completion.

Installation of two large booths adjacent in the press box and capable of accommodating five men was the first step taken by the engineers in their plans for the radio operators. These booths will be glass enclosed, steam heated and fitted with every convenience for the men who broadcast.

To further facilitate the work of the announcer, telephone connections with the sidelines have been established where a man familiar with the players and plays will communicate with the operators in the booths above.

In this way Northwestern university officials hope to provide the best of facilities to broadcast the games each fall. Each game will find two radio stations broadcasting a play by play account. In order to give the listeners a more graphic account of what is transpiring at the scene of the contest it is planned to broadcast songs and cheers from the student body at all intervals in which play is halted.

The great amount of interest

shown by owners of radios throughout the country was one of the foremost reasons that caused university officials to make special plans to broadcast the contests.

In every large city in the United States alumni clubs of the university assemble for Saturday luncheons, tuning in the afternoon's game. It is for the accommodation of these alumni who are unable to attend the game that the university is interested in providing a radio account.

THUS instead of a group of some 50,000 fans witnessing the game from the stands, through the aid of the radio this crowd is augmented to a number of unknown thousands. Bringing the game into a banquet hall in San Francisco and New York is regarded by university authorities as one of the greatest means of cementing continued loyalty to the university.

Besides broadcasting a play by play account, several broadcasting stations have made plans to conduct a college hour on Saturday night from 7 to 8 o'clock at which time an account of the game will be given by a prominent university official. It is also planned at this hour to have a quartet of students to sing university songs and to have a cheer leader give the yells that were used at the afternoon's game.

Extensive plans have also been made for the accommodation of sport writers. A press box second to none in the country is to be installed on top of the second deck. The press stand will be large enough to accommodate several hundred writers and telegraph operators. All writers will be provided with individual desks and will thus not be hampered in their work as in the past when writers were crowded together along a single table. As in the radio booths the press box will be glass enclosed and steam heated.

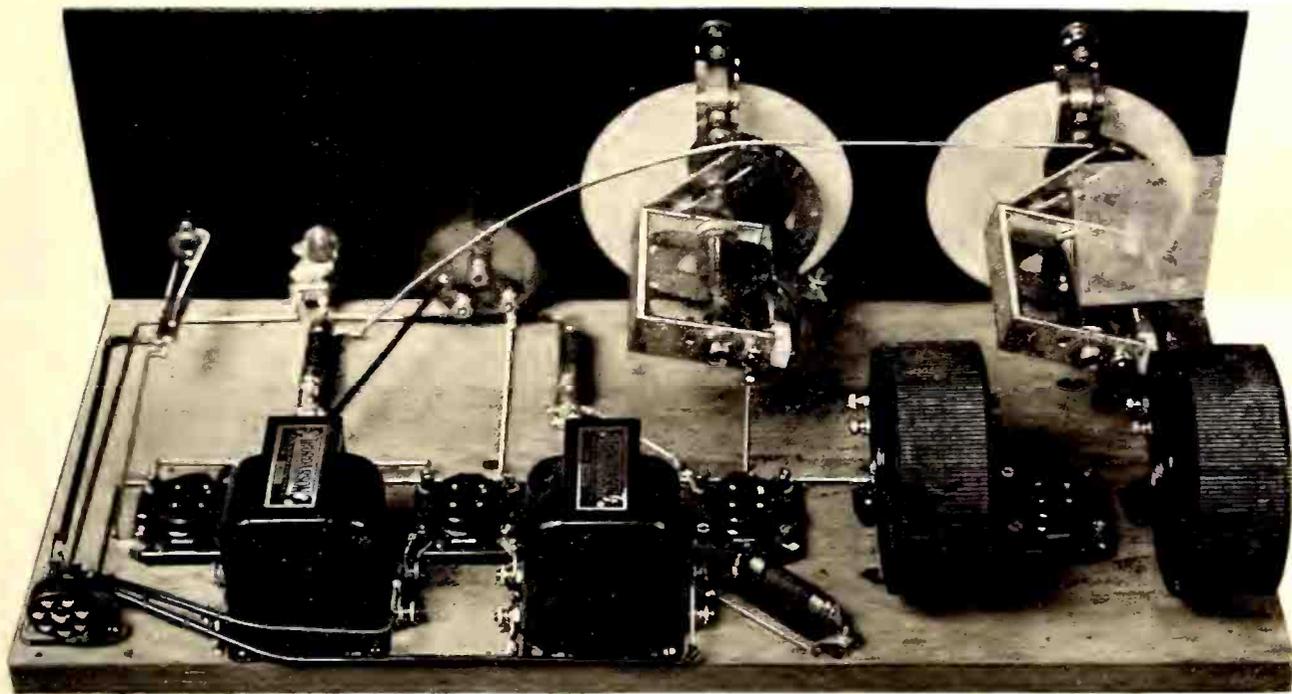
Both the radio booths and press box will be reached from the ground by a specially installed elevator which will be used only by pressmen and radio operators.

The stadium itself is the latest word in stadia construction. The curved stands bring the maximum number of spectators within the goal posts and focus the eyes of every spectator towards the center of the field.

Long, gently rising ramps underneath the stands permit the spectators reaching their seats quickly. This does away with the necessity of walking up long tiers of stairs. The entire stadium can be emptied in 15 minutes.

Every bit of space underneath the stands is to be utilized. Football practice rooms under the east stands provide ample room for scrimmage in rainy weather.

Illuminated Controls on Radio Age Four Tube Receiver



Rear view of Radio Age four tube receiver showing the Marco illuminated controls attached to rear panel. Assembly is very simple and the appearance of the set is greatly enhanced

ONE of the greatest handicaps a beginner in radio has to overcome is the thought the finished product on which he spends a great deal of time, will not have a commercial appearance such as he would like to exhibit with pride to his friends and neighbors. But with the advances constantly being made in the refinement of the integral parts of a set, it is now very easy to make up a set which will have a pleasing frontal appearance as well as a clean cut interior.

Recently an Eastern manufacturer of vernier dials, one of the first in the business, has issued an illuminated control which has, in addition to the vernier action of the dial, several interesting features which make it especially desirable in the construction of receivers in the home, or even for that matter, in commercial practice. The illuminated controls made by the Martin-Copeland Co., eliminate the necessity for bor-

ing holes in your panel every time you desire to change a type of variable condenser in the "old faithful" home made receiver, for the dial mechanism acts as a holder for the condenser. Thus the front panel of the receiver may always remain the same, although you can change the interior of the set as much as desired without inconvenience—which is a great boon to the set builder who does not care to rip everything apart merely to change from a SLC to SLF condenser.

In the four tube model illustrated on these pages it was desired to have an extremely simple assembly of parts so the construction of the set would not be difficult for even a novice. On the other hand the experienced set builder could appreciate as well its simplicity, and perhaps think of other combinations that could be made from this basis.

One stage of tuned radio,

detector, and two stages of high class audio amplification is the arrangement shown. Flexibility of voltage control is provided by means of the variable resistance in series with the plate coil of the first tube, so the set may be operated on the verge of regeneration. If the resistance is turned too far oscillation will ensue but under that condition reception is neither pleasant for the owner nor the neighbor. Accordingly no one with any sense will operate the set in that condition.

Inductances are of the toroid type well known to set makers. The antenna inductance has a single winding, with a number of taps for altering the RF energy applied to the grid from the antenna. The grid to filament section of this inductance is spanned by a .0005 mfd variable condenser. This value may be used or if it is desired the smaller value of .00035 mfd will generally

suffice to reach from the lowest of the broadcast channels to the highest.

Sockets of the cushion type have been used to cut down as much as possible any microphonic noises created by the jarring of tube elements. Instead of an inductive RF choke in series with the plate of the detector, uses made of a fixed resistance of 5,000 ohms to prevent RF energy getting into the primary of the first audio transformer. This value may be altered, from 5,000 to 25,000 ohms without a great deal of difference being noticed except of course with the greater values of resistance the voltage applied to the detector plate will be accordingly less.

Audio transformers with generous windings and plenty of core material were used to maintain the quality of the output as high as possible. The ratio of the transformers is 2 to 1. Grid biasing is resorted to to operate the audio tubes at their best operating characteristic and to limit the amount of plate current consumed. For plate potential of about 90 volts a bias of 4 1/2 volts negative will suffice, although if higher plate voltage is used an increase should be made in the value of the C battery.

Filament control is fixed, two resistances serving to supply filament current; the first resistance with a carrying ca-

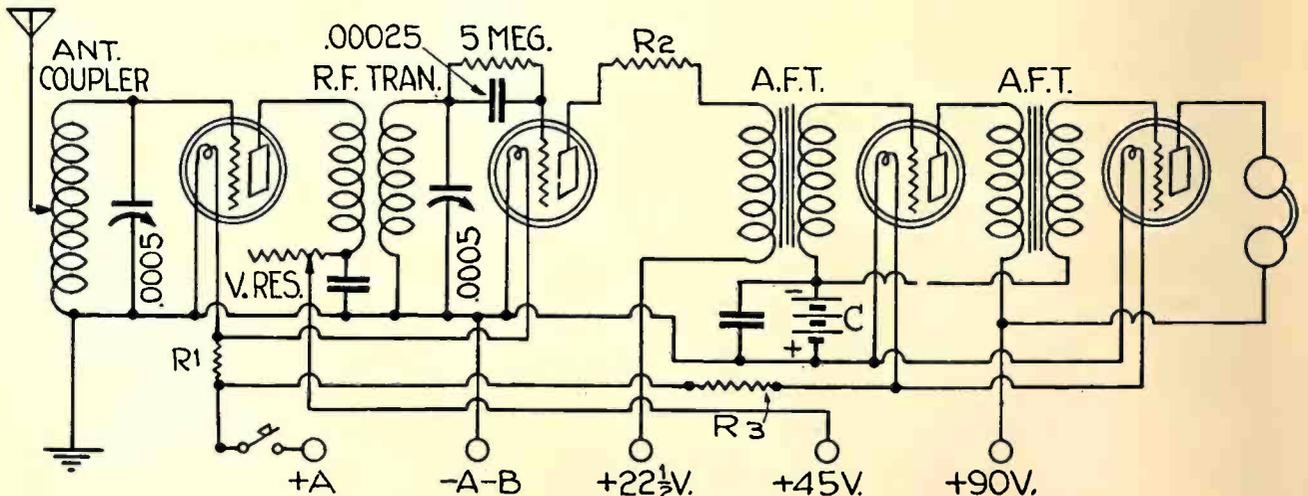
capacity of a half ampere serving for the RF tube and the detector, while another half ampere fixed resistance takes care of the two audio tubes. While it is true that one single resistance could be used however it would not give the flexibility of two, since a power tube may be used in the last stage by making proper change in the value of the second resistance, leaving the first one alone.

For ease in wiring and facility of testing all the wiring terminates in a base mounting plug. The assembly is base-board style although if desired the sub-panel may be used. Drills, screw driver, pliers and a soldering iron are all that is required to assemble the set. Where a possibility of short circuits exists spaghetti is used, the balance of the bus bar wire being uncovered.

Drilling Is Easy

WHILE at first blush it might appear that drilling the holes for the bezels would be a hard job, such is not the case. A metal template is provided with the illuminated controls by means of which drilling may be accurately performed. By referring to the picture at the top of page 23, the reader will see there are only three apertures in the panel; one for the light switch which is the top hole; below it the hole for the bezel, and below that the hole for the

vernier knob. By taking the template, marking first for the top and bottom holes, drilling these holes, and then tightly affixing the metal template to the panel, the drilling of the holes for the bezel may be done with the least labor and the greatest accuracy, for the template carries a series of holes in the form of the bezel. Using a drill which just fits the template holes, the drilling may be accomplished. Then the connecting sections between holes may be punched out with a chisel and hammer, or may be sawed out with a small coping saw blade held in the hand. After this a rough file is used to clean up the edges of the hole in which the bezel fits. The mechanism is tightly held to the panel by means of the switch shaft bearing and the vernier knob bearing, both of which have nuts which allow tightening of the mechanism against the panel. The variable condenser (any of the standard makes on the American market) is attached to the mechanism back of the panel. In the rear of the mechanism is a celluloid dial which presses against the bezel on the front of the panel. The bezel carries a thin hair line. When the light is on the dial figures may be clearly seen. There being practically no space between the bezel hair line and the celluloid dial, the trouble due to parallax is done away with. Exceedingly fine tuning and logging may be done,



By means of the above schematic the builder may easily construct the receiver described



Use of the illuminated controls adds a great deal to the beauty of the panel as will be seen above

not only as in this case where a receiver is used, but for other purposes such as laboratory oscillators, wavemeters and any other indicating devices, where it is required to preserve settings in accurate fashion. The light circuit is connected into the filament busbar line at the positive terminal, the negative terminal of the battery and the rotor of the condenser being in common. Since the condenser rotor is touching the metal of the control mechanism it is only necessary to run one wire for the light circuit. The celluloid dials are made in both clockwise and anti-clockwise reading which should be specified when ordering. A majority of the condensers on the market are clockwise, that is, capacity increases as the rotor is turned to the right. This control has been found adaptable to all condensers except those of the 360 degree rotation where the rotor makes a complete revolution.

Wire Filaments First

IN making up the receiver after all parts are placed in position on the baseboard and the panel, the filament wiring is run in, then soldered to the base mounting plug. After the filament wiring can come the B battery connections to transformers and sockets, the fixed resistance in the plate circuit of the detector. Last of all the inductances are connected up and soldered at the same time the proper grid

and plate connections being run on the first two tubes. In the photograph shown on page 21 the inductances are shown without any connections attached, this having been due to the premature arrival of the photogra-

up the set. The negative of the A battery and that of the B battery are common for ease in wiring and in case of using a double range voltmeter for noting either the filament or B voltages used.

Both the antenna coupler and the RF transformer are made by Bremer-Tully as are the cushion sockets. The variable resistance is a product of Centralab. Two audio transformers of the newer type are made by Thordarson. Plate resistor is an Allen-Bradley product, while the two fixed filament resistors are Amperites. The illuminated control is a Marco, made by the Martin-Copeland Co., while the variable condensers are the new ones recently made by the Samson Electric Co. and which are quite compact. The base mounting plug is one manufactured by Howard B. Jones, while the jack for the phone or loud speaker, and the filament switch are two of the many Yaxley items. The .00025 mfd grid condenser is a Sangamo with clips for the grid leak made by Durham. Bypass condensers across one side of the variable resistance and the negative and across the C battery (not shown in the picture) are Electrads, capacity 1 mfd.

This receiver is an exceedingly simple affair which even a novice may build. In future issues of this magazine there will be other combinations which may be made without altering the panel.

List of Parts.

- 1 Bremer-Tully antenna coupler, torostyle.
- 1 Bremer-Tully RF transformer, torostyle.
- 4 Bremer-Tully cushion sockets.
- 1 Insuline panel 7 by 20 by 3/16 inch.
- 2 Marco illuminated controls, clockwise.
- 2 Samson .0005 mfd variable condensers.
- 2 Thordarson R200 audio transformers.
- 1 Jones base mounting plug.
- 1 Allen-Bradley fixed resistance, 5,000 ohms (R2).
- 2 Amperite 112 fixed resistances and mounting (R1-R3).
- 1 Centralab variable resistance 0-200,000 ohms.
- 1 Yaxley filament switch.
- 1 Yaxley phone jack.
- 1 Sangamo .00025 mfd grid condenser with clips.
- 1 Durham 5 megohm grid leak.
- 2 Electrad bypass condensers 1 mfd.
- 1 7 1/2 volt C battery, Eveready.

pher before the finishing touches could be put on the two inductances. However since that operation is the last one it hardly requires description. The schematic circuit, of course, should be consulted in hooking

Feeding Hubby Is Chief Concern of Young Brides

*Home Economics Programs
Now Broadcast By U. S.*

By JOSEPHINE HEMPHILL

*"I'm a nervous wreck," sobbed the sad young bride,
"Each day I'm getting thinner,
And all because I can't decide
What to cook for William's dinner."*

SAD young brides perked up a bit the first of October when Uncle Sam, through the radio service of the U. S. Department of Agriculture, commenced giving suggestions for William's dinner. Five days a week the young bride listens in, notebook and pencil at hand, while information from the National Bureau of Home Economics is broadcast from 60 stations in the United States.

Her husband has probably told her, if they live on a farm, that "agriculture is America's basic industry." She may believe him for a while, but she soon discovers that the basic industry of America, as far as she is concerned, is feeding the family three times a day—one thousand and ninety-five times a year.

Quite an assignment for Mrs. Average Housewife, who, besides planning the meals, doing the marketing, cooking the food and washing the dishes, must keep the family clothed and happy, her home neat and attractive, do her washing and ironing and mending and all the thousand and one other tasks that come under the head of "keeping house."

When Uncle Sam planned his enlarged farm radio program for the 1926-27 season, he made special provision for the five million women of the United States who have an opportunity to listen in to whatever they please,—during the day time. He employed a rep-

resentative of the U. S. Department of Agriculture, known as Aunt Sammy, whose official duty it is to assemble material and write entertaining and reliable programs for the "Housekeepers' Chat," a 15-minute period devoted exclusively to up-to-date information on subjects of interest to women.

Aunt Sammy, who has had special training in home economics and in writing, spends a great deal of time in the Bureau of Home Economics, the nation's laboratory for scientific research along the lines of Food and Nutrition, Economics, Textiles and Clothing, and Housing and Equipment.

In June, 1925, when Chief Louise Stanley made her annual report to Secretary Jardine, the Bureau was carrying on work in the following laboratories: an animal laboratory for the study of nutritive value of foods, a chemical laboratory for studying food composition and analyzing metabolic material, a canning laboratory for the study of home canning problems, a baking laboratory, a laboratory kitchen for the study of general problems in food preparation, a textile laboratory, and a room for the study of more practical problems of home sewing.

What better place than this "clearing house" to gather the latest facts about various phases of home economics?

Get Suggestions

AUNT SAMMY has no idea of revolutionizing housekeeping in the United States—she does not expect five million women, or one million women, or even one thousand women to have Southern ham and sweet potatoes and Brown

Betty for dinner simply because she broadcasts this menu. But she does believe that the women who listen in will get workable suggestions from her programs.

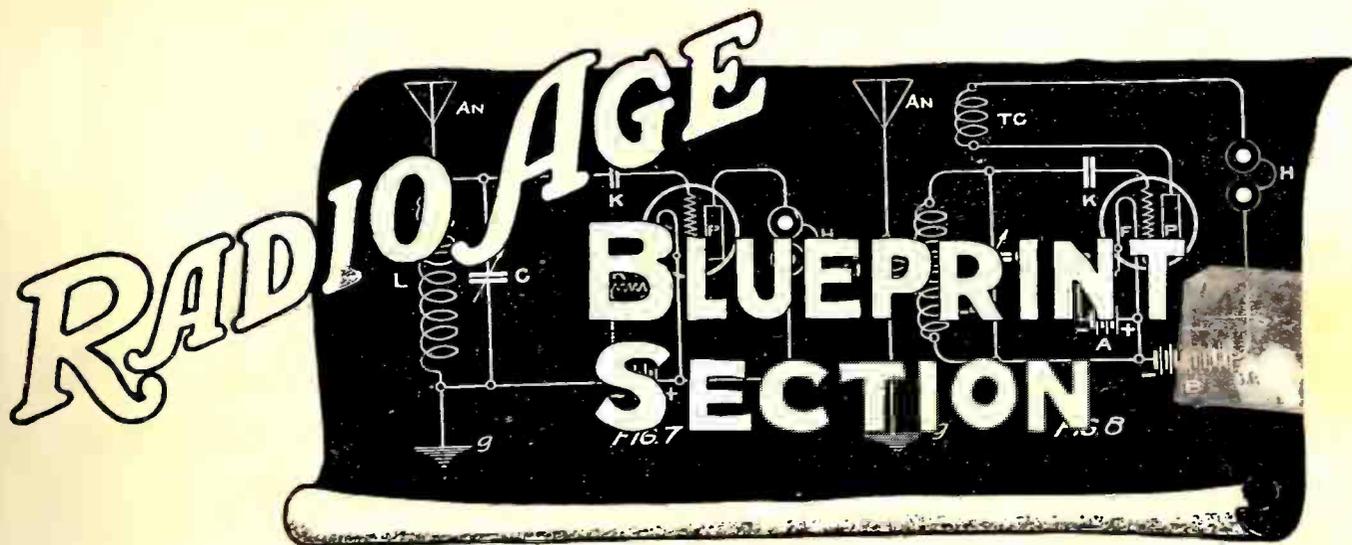
She does not enter the American home as a Liberator of Housekeepers, but rather as a next-door neighbor who has learned by experience a better-than-ordinary method of doing the family washing, making jelly, or decorating the living room. Her programs are as informal as it is possible to make them; indeed, if the occasion arises, she may indulge in a little spicy gossip now and then to add a feminine "tone" to the radio talks.

Aunt Sammy's subject matter is not limited to cooking, sewing and house-cleaning. She prescribes authoritative diets for those who would preserve a youthful figure and a school girl complexion, and special exercises for those who would have slim ankles. Knowing that man does not live by bread alone, nor his wife by the baking of it, she includes in her programs attractive color schemes for the living room, and becoming lines and colors for the stylish-stouts and the tall-and-thins.

The programs for the Housekeepers' Chat has three divisions of five minutes each: "Backyard Gossip," "Questions Women Are Asking," and "What Shall We Have for Dinner."

"Backyard Gossip" includes informal discussions of such subjects as the home, food and nutrition, health, clothing, gardening, and social diversions. All information is authentic and practical. The modern house-

(Please turn to page 44)



Building Henry-Lyford Tuned and Untuned RF Receiver

By ELMORE B. LYFORD

PROGRESS in radio consists of rearranging fundamental apparatus into new and more efficient circuits. The Henry-Lyford receiver is neither radical nor revolutionary, but a scientific attempt to combine the best radio theory and practice into a receiver for the home builder and experimenter. Tuned radio frequency circuits are many, and untuned radio frequency circuits are well known, and they both have their good and bad features. This receiver takes advantage of the good points of each and the poor of neither, and by using in addition the most efficient system of radio frequency control yet devised, combines the whole into a circuit which is one step nearer the ideal.

First in the Henry-Lyford circuit comes a stage of tuned RF amplification, which is followed by an untuned stage. Then comes the detector, which again is tuned. Two stages of transformer coupled, quality audio amplification complete the circuit. The entire receiver has been developed for storage battery tubes—all are 201A type except the last,

which may be any of the several types of power tubes now available.

The completed receiver, as may be seen from the accompanying photographs, is simple in appearance and construction, and when built according to specifications is a finished product. It is very selective, has remarkable distance-getting ability, and unsurpassed tone qualities. More will be said about each of these points later.

Let us examine the circuit part by part, and see what gives it all of these good qualities. First let us take the radio frequency amplifier. As has been said before, it is a combination of the best points of both the tuned and untuned systems, each of which has many faults when used entirely. Two tuned stages, in the first place, require too many controls for simplicity. No one has more than two hands, and there should be no more than two tuning controls on a radio receiver. Attempts have been made to control two tuned stages with single dial "gang" condensers, but these have not been entirely satisfac-

tory. Also, there is the ever-present tendency toward feedback between the coils. This results in oscillation, which may render the receiver difficult to neutralize, unstable, and generally tricky to handle.

Combination Used

WHEN an attempt is made to use two untuned stages, there is no selectivity, naturally, and not quite as much amplification as there is with tuned stages that are working properly. The advantages of it are that it needs no tuning condenser and that, due to the small coil fields, the tendency towards oscillation is easily controlled. The ideal radio frequency amplifier would seem to be one stage of each kind of amplification, and that is what is used in the Henry-Lyford. This combination, followed by a tuned detector, gives ample selectivity, while necessitating only two tuning controls.

Oscillation in the entire radio frequency amplifier is prevented by the introduction, in the grid circuit of the first tube, of a counter e. m. f. to oppose the e.

(Please turn to page 28)

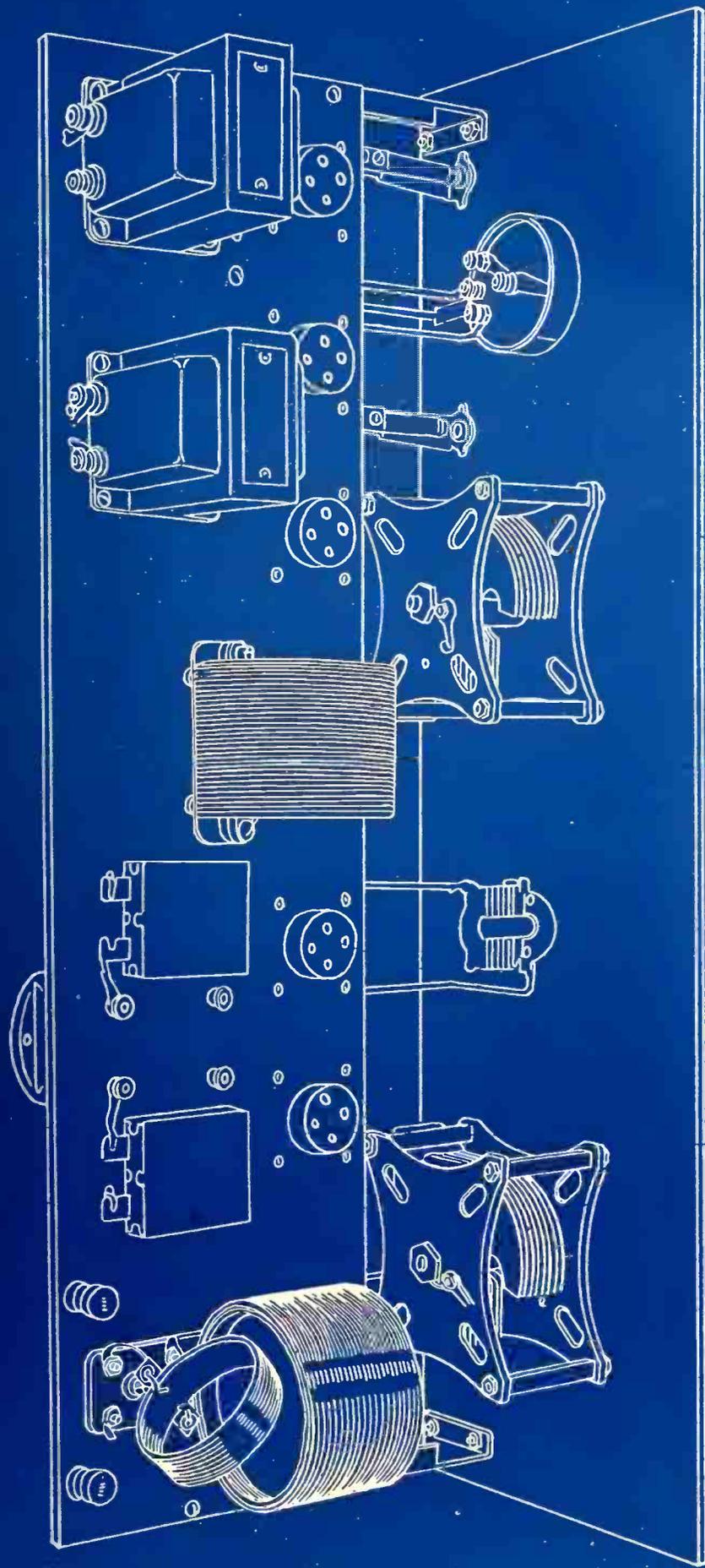


FIG. 2
REAR PANEL AND BASEBOARD VIEW
HENRY LYFORD RECEIVER

m. f. introduced by the tube capacity. The amount of counter-balancing e. m. f. introduced is controlled by a small condenser mounted on the panel. This allows the operator of the set to regulate this "back voltage" until just enough is introduced to stop all oscillations. Right at this point, however, the receiver is in its most sensitive state, and the greatest gain can be realized from the amplifier. All of this sounds complicated, but in practice it is not. It resolves itself into setting the "balance" condenser so the amplifier just stops oscillating—that is all. This setting of the balance condenser is not exactly the same for all frequencies, but remains constant over a wide band, seldom needing to be changed, and then only slightly. Both R F tubes are biased negatively to secure maximum amplification.

This system of neutralization has the advantage that the compensating element is not in the plate circuit proper, nor are any losses deliberately introduced into the circuit by means of resistances, or similar devices. If this counter e. m. f. coil and condenser were directly in the plate circuit, the condenser setting would vary widely with the frequency, but shunted as it is, the setting is practically constant. The principle is very similar to the more familiar Rice system of neutralization, but that is carefully balanced, while this is deliberately unbalanced.

The detector does not make use of a grid leak and condenser, but instead detector action is secured by the use of a negative grid biasing voltage. This results in a much quieter receiver, and in better tone qualities than are generally secured by the other method. Tuning this detector circuit results in additional selectivity, without any sacrifice of stability.

The radio frequency amplifier incorporated in the Henry-Lyford receiver is worthy of special notice. It is a two-stage, transformer coupled amplifier, designed to give better quality than the usual transformer or resistance coupled amplifier. The

transformers used are the new Thordarson Type R 200, which show an excellent amplification curve on test. In addition, the grid and plate circuits of each amplifying tube are by-passed directly to their own tube filaments by 1. mfd. condensers. There is a total of five of these condensers used in the receiver, and every one of them is essential to insure absolutely perfect reproduction. They allow the audio currents to take a direct path back to filament, instead of traveling through long battery leads and high-resistance batteries to get there. This feature is generally overlooked by circuit designers, but it is very important.

These by-pass condensers also have another function, which is to prevent much of the "howling" and "singing" often encountered when the loud speaker is placed too near the receiver. As an additional precaution against this, Benjamin spring-suspension sockets are used, so that it is practically impossible to make the receiver "sing" by placing the loud speaker near it.

Use Any Power Tube

SEPARATE B and C leads are provided for the second audio tube, so any type of power may be used in the position. A UX 112 or a UX 171 tube is recommended, though any of the other types of tube may be used, depending upon the voltages available and the inclination of the owner.

The filament circuits of the Henry-Lyford are entirely automatic. There are no rheostats in the receiver, and none are recommended. All of the tubes are controlled by three Amperites, and the last tube is on a filament control jack. This tube is not lighted unless it is actually in use, when the receiver is built according to these specifications, so that a saving of A battery is effected when only four tubes are in use. Four tubes are all that are generally needed for near-by reception.

Only the best available apparatus is specified for use in this receiver, as can be realized by a glance at the list of parts used.

The Precise condensers used for tuning are of the combination type—straight frequency line for the first 50 degrees, and straight wave-length line for the balance. This gives the maximum separation and ease of tuning on all wave-lengths, which is an improvement on condensers purely of either type.

The plug-in coils are wound in the most approved low-loss manner, and are so proportioned that the tuning condenser dials run together over the whole tuning range of the receiver. G. R. type plugs and jacks are used, assuring positive contact to the coils. Drilled and engraved panels and drilled sub-panels, with the Benjamin sockets riveted to them, are available for use in building this receiver. Bakelite is specified for both the panel and sub-panel.

No expense has been spared in the engineering of the Henry-Lyford circuit, or in the layout of the finished receiver. It was designed to be the ideal set for the average listener who wants a good receiver which he can construct for himself.

The complete list of parts used in the receiver here described and illustrated are shown on page 29.

The specified parts should be used, if the finished receiver is desired as perfect as possible. The designers of the receiver have satisfied themselves that they have used the apparatus most suitable and any variation from the parts recommended may give as a result a receiver not nearly as good as it should be.

There will undoubtedly be some constructors who will wish to build one of these receivers immediately. For their benefit, we are giving below detailed instructions as to the procedure to be followed in the making of the Henry-Lyford. We will assume that the builder has the complete set of parts before him and is ready to start assembling the set.

Mounting the Apparatus

START by mounting the ten coil jacks as shown in the picture wiring diagram. After

that mount the antenna and ground binding posts, placing a lug on each to overlap the lugs on coil Jack No. 1 and 2. The binding post marked "ANT" should be mounted nearest the end of the sub-panel.

Next the Benjamin brackets should be mounted with the screws that are in the small envelope supplied with each pair of brackets. Refer to the picture wiring diagram for the proper position of these brackets and no trouble will be had. Now mount the single supporting post in the center of the sub-panel with the long screw furnished. Before the audio transformer No. 2 is mounted, put in the mounting bolts for by-pass condenser No. 5. After this we are now ready to mount transformer No. 2, with the G and F binding posts nearest the front panel. Now mount the audio transformer No. 1, first inserting the mounting bolts for by-pass condenser No. 3. This transformer is also mounted with its G and F posts facing the front panel.

The next step is to turn the sub-panel upside down so that we may mount by-pass condenser No. 5. The proper position for it is between the four bolts that are used to mount the audio frequency transformer No. 2. Next to condenser No. 5 mount the by-pass condensers No. 4 and No. 3 in their turn by means of the holes drilled for that purpose. The Amperites are now mounted in their proper places as shown in the drawing and also in the photograph.

By turning the sub-panel right side up again we will be ready to mount the by-pass condenser No. 2 in the mounting holes drilled behind and slightly to the right of tube socket No. 2. Note that the position of the connecting lugs are toward the back edge of the sub-panel. Now mount by-pass condenser No. 1 right behind and slightly to the left of the tube socket No. 1. We have now finished mounting the instruments on the sub-panel with the one exception of the radio frequency transformer which will not be mounted until we wire the set.

Mount all of the instruments on the front panel. The two large variable tuning condensers are mounted with the screws and collars that are furnished with each condenser. The balance condenser is now mounted between the two large condensers in the single hole provided. Mount this condenser so that the non moving plates are toward the bottom edge of the panel.

that the metal frames are toward the bottom of the panel as shown in the illustrations.

The next and final step in mounting the apparatus is to bolt the panel to the brackets on the sub-panel by means of the machine screws furnished with the brackets.

We will now start wiring the receiver. Place the receiver upside down in front of you with the panel away from you. The sockets, condensers, Amperite mountings and jacks are numbered for ease of reference in the picture wiring diagram, which shows the receiver in the position which you have placed it. Frequent references to this picture wiring diagram and to the photographs will aid in making the instructions easy to follow.

The best way to make connections is to solder them. Best results will be obtained in soldering by using a good grade of soft strip solder and a good soldering paste such as Nokorode. Use the soldering paste very sparingly and after the joint is made wipe off the excess with a cloth saturated in alcohol. Rosin core solder may be used if you have a very hot iron. When using rosin core solder, however, make sure the joints are actually soldered and not insulated by a film of rosin.

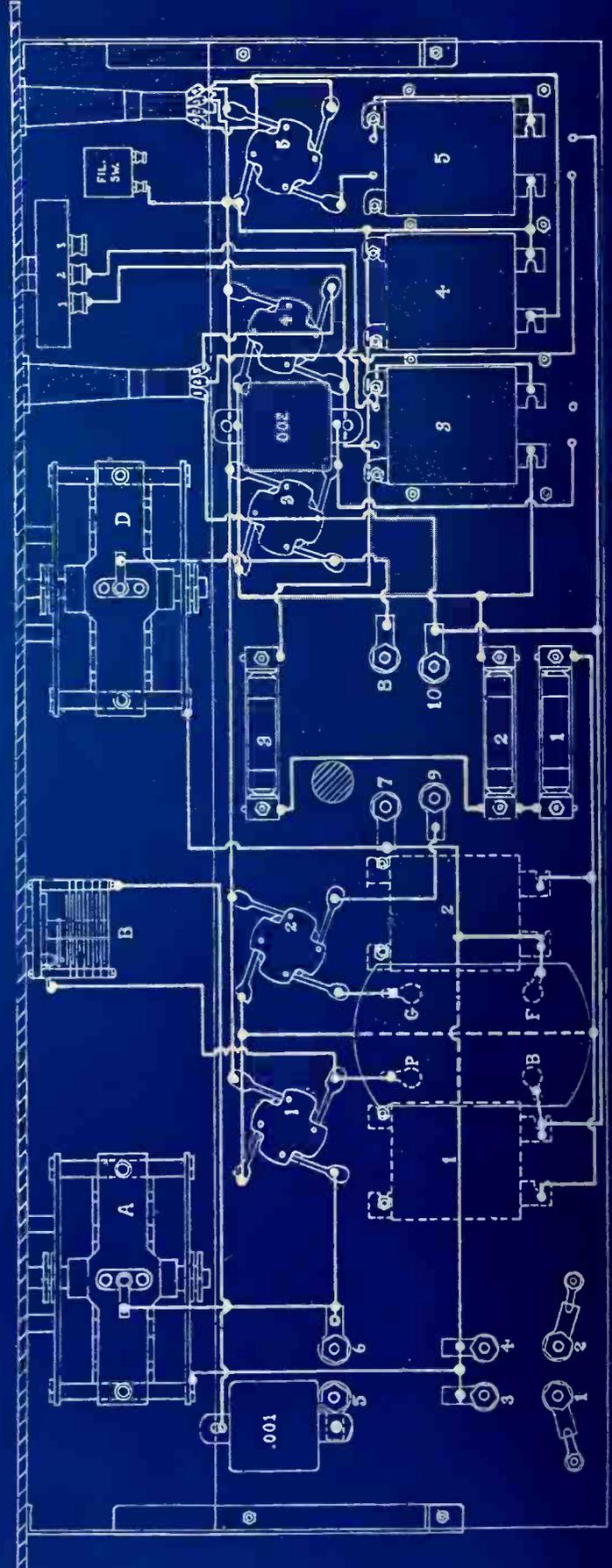
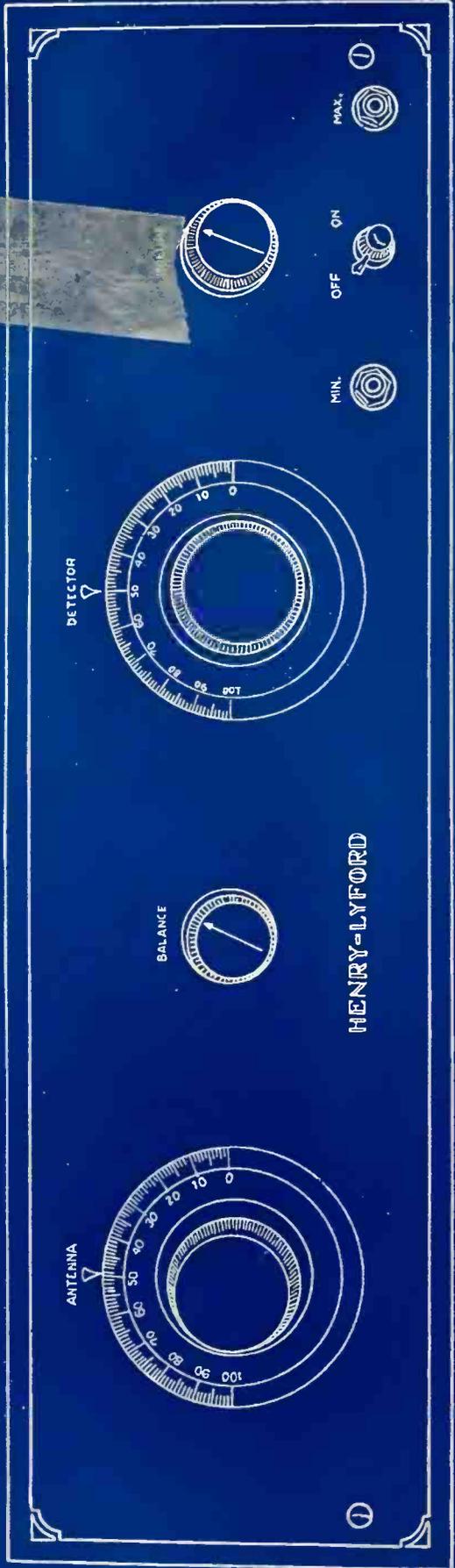
First we will connect the positive filament terminals of the first four sockets together. This is the upper right hand contact of each socket. Also connect this wire to terminal No. 3 of the Max. jack. This is the next terminal to the top of the jack, No. 4 being the top, or furthest away from the metal of this jack. Now take two pieces of wire and solder a lug on one end of each of them. Take the four nuts off the radio frequency transformer and put one of these lugs over the G post and one over the P post. Now put the transformer posts through the holes in the sub-panel provided for them, as shown in the diagram, with the P and G post toward the sockets. Put the nuts back on the posts of the

(Please turn to page 32)

List of Parts.

- 1 Bakelite panel, drilled and engraved 7x24
- 1 Bakelite sub-panel, drilled with 5 Benjamin cushion sockets mounted
- 2 Precise 350 mmfd. variable condensers, type 845
- 1 Precise 55 mmfd. variable condenser, type 940
- 1 Centralab modulator, 500,000 ohms
- 1 Carter Imp filament switch
- 1 Carter No. 102a jack
- 1 Carter No. 103 jack
- 1 University antenna coupling transformer, type B-1
- 1 University radio frequency transformer, type B-2
- 1 University tuned radio frequency transformer, type B-3
- 2 Thordarson audio frequency transformers, type R-200
- 5 Tobe Deutschmann 1 mfd. fixed condensers, No. 201
- 1 Micamold .002 mfd. permanent condenser
- 1 Micamold .001 mfd. permanent condenser
- 3 Amperites No. 112
- 10 Coil mounting jacks
- 1 Pair of Benjamin brackets, type 8629
- 1 Bakelite post
- 2 Eby binding posts, Ant. Gnd.
- 2 4" Kurz Kasch dials
- 1 Belden 7 wire battery cable
- 1 Coil of Belden hook-up wire
- 1 Complete set of hardware.

Now mount the Centralab modulator in the hole directly below the word "Volume." The Carter switch is now mounted right below the Modulator with its binding posts parallel with the bottom edge of the panel. The Minimum jack is now mounted which is the Carter No. 102a. The Carter No. 103 is mounted in the remaining Max. hole. Mount both of these jacks so



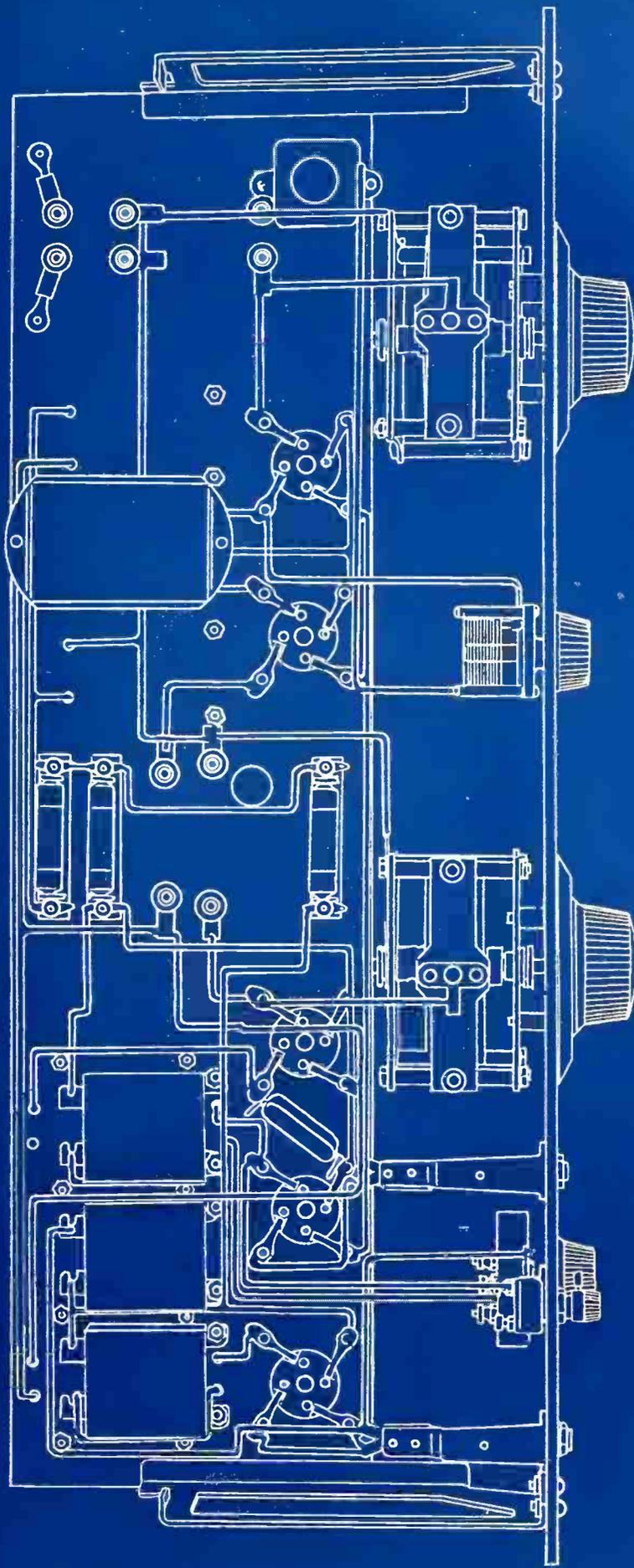


FIG. 4
UNDER PANEL VIEW OF
HENRY LYFORD RECEIVER

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RAVIG AGE INC.

transformer from the top side of the sub-panel. These are all that is necessary to hold it in place. The wire from the G post of the transformer is soldered to the lower left hand terminal of tube socket No. 2. This is the grid terminal of the tube. The wire from the P post of the transformer is connected to the lower right hand or plate terminal of tube socket No. 1 and continues on to the rotary plates of the Balancing condenser B.

Now connect together the three left hand terminals of the Amperite mountings as shown. Next run a wire through the sub-panel over the left hand terminal of by-pass condenser No. 1 and solder to this terminal. Connect the other end of this wire to the right terminal of Amperite No. 1. Run another wire through the sub-panel over the right hand terminal of by-pass condenser No. 2 and solder it to this terminal. Now join this wire to the wire which runs from by-pass condenser No. 1 to Amperite No. 1. Continue it on to the upper left hand terminal of tube socket No. 2 and end it at the corresponding terminal of tube socket No. 1. These are the negative filament connections of the tube sockets.

Now solder one end of the .001 fixed condenser to coil jack 5 by bending the lug of the jack up and over the terminal of the condenser. The other end of this condenser is connected to the stator plates of balancing condenser B. This can be done most neatly by looping the wire under the wire connected to the upper right hand terminal of tube socket No. 2 and then straight out to the balancing condenser. Next connect a wire from the lower left hand terminal of tube socket No. 1, then to coil jack 6 and finally to the stationary plates of antenna condenser A. Now connect a wire to the rotary plates of antenna condenser A and run it to coil jacks 3 and 4. Continue this wire under the radio frequency transformer to coil jack 7 and end it by connecting it to the rotary plates of detector condenser D.

Next run a wire from the low-

er right hand or P terminal of tube socket No. 2 to coil jack 9. Now run a wire through the hole in the sub-panel over the left hand terminal of by-pass condenser No. 2. Solder it to the terminal and also to a soldering terminal under the nut on the F post of the radio frequency transformer, as is shown. Solder the other end of this wire to coil jack 7. Now solder the end of a wire to the left hand terminal of by-pass condenser No. 3. Run it over to the right terminal of Amperite No. 2, and continue it to the upper left hand terminal of tube socket No. 3 and the same terminal of tube socket No. 4. Connect the right terminal of by-pass condenser No. 4 and the left hand terminal of by-pass condenser No. 5 together and run this wire to the upper left hand terminal of tube socket No. 5, which is the negative filament. Now run this wire over to the right hand terminal of Amperite No. 3.

Connect a wire to the stationary plates of detector condenser D and then solder it to the lower left hand terminal of tube socket No. 3 and also to coil jack 8. Now run a wire from the P post of audio frequency transformer No. 1 to the lower right terminal of tube socket No. 3. Run a wire from the G post of this transformer to the lower left terminal of tube socket No. 4, and also connect it to the No. 1 terminal of the Modulator, or Volume control, as is shown.

From the F post of audio frequency transformer No. 1 run a wire to terminal No. 2 of the Modulator. Connect another wire to this one and run it to the right hand terminal of by-pass condenser No. 3. Run the next wire from the G post of audio frequency transformer No. 2 to the grid terminal of tube socket No. 5 which is the lower left hand terminal. Connect the F terminal of this transformer to the right hand terminal of by-pass condenser No. 5. Now place the .002 by-pass condenser between tube sockets No. 3 and No. 4 as shown. Connect one terminal of it to the lower right hand terminal of tube socket No. 3 and the other terminal of it to the upper

left hand terminal of tube socket No. 4. These connections are all that are needed to hold this condenser in place.

The next thing to do is to solder a wire to the No. 1 contact on the Min. jack, which is the contact nearest the jack frame. Solder the other end of this wire to coil jack 10. Connect the No. 3 or top terminal of this jack to the lower right hand terminal of tube socket No. 4 which is the P terminal of this socket. The No. 2 or middle terminal of this Min. jack should now be connected to the P post of the audio frequency transformer No. 2.

The terminal nearest the frame of the Max. jack, terminal No. 1, should now be connected to the left hand terminal of by-pass condenser No. 4. Terminal No. 4 of this jack which is the terminal furthest from the jack frame should now be connected to the upper right terminal of tube socket No. 5, which is the positive filament of this socket. Terminal No. 2 of this jack is now connected to the lower right hand terminal of tube socket No. 5, which is the P terminal.

Solder a wire to a lug under a nut on the B post of the radio frequency transformer, then to the right hand terminal of by-pass condenser No. 1. Run this wire through the adjacent hole in the sub-panel. Run the other end of this wire through the hole in the sub-panel over the B post of audio frequency transformer No. 2 and connect it to this post. At the same time run a wire from this wire to coil jack 10 as shown in the diagram.

Connect the upper right hand terminal of tube socket No. 4 to one terminal of the filament switch. Now solder the lugs under the antenna and ground binding posts to coil jack 1 and 2. The wiring of the receiver is now completed, and we are ready to connect on the battery cable. The yellow wire of this cable is connected to the terminal of the filament switch which has not been previously connected to. The yellow and black wire should now be connected to the left hand terminal of Amperite No. 13. The maroon and

(Please turn to page 65)

How to Use a Power Tube in Your Present Set

By H. MELCHIOR BISHOP

UP until this year, a prolific source of distortion in practically all sets was the overloading of the last audio tube. This was due to the tremendous power which this tube was forced to handle in comparison to the other tubes, although it possessed no greater power handling capacity. To illustrate this great power increase, let us get down to figures for a moment. For our example, we shall take the ordinary five tube tuned radio frequency set. Let us say that each stage of radio frequency gives us an amplification factor of eight; the detector being considered as absolutely non-regenerative, hence contributing no amplification, but acting merely as a rectifier (this is almost never the case, but I am attempting to give very conservative figures); while the audio amplifier will be considered as having the lower than average amplification factor of forty per stage. The total amplification of our set is then eight times eight times forty times forty or one hundred and two thousand, four hundred (8x8x40x40 or 102,400). Just imagine it;—the power handled in the plate circuit of the last audio frequency tube is then just one hundred and two thousand, four hundred (102,400) times as great as the power in the grid circuit of the first radio frequency tube, and sixteen thousand, eight hundred (16,800) times as great as the power handled in the plate circuit of this tube! In six and eight tube sets, the first of the above figures runs into the millions, but the difference in power handled is astounding even in the five tube sets.

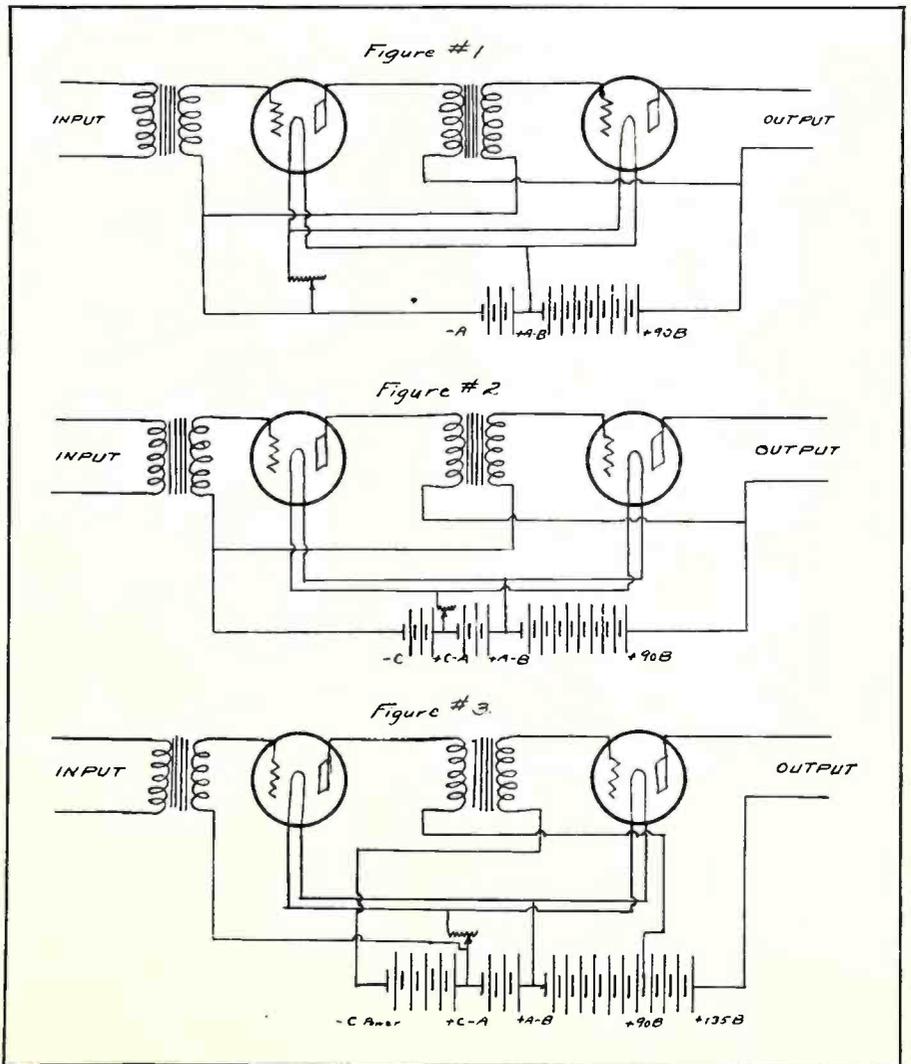
Formerly several schemes were employed by the up-to-date experimenters to obviate this difficulty, but these meth-

ods were rarely, if at all, incorporated in commercial sets, due chiefly to their greater cost and complication. One method, perhaps the simplest and cheapest, is to use two tubes in parallel in the last audio frequency stage. This arrangement is very effective and thoroughly satisfactory if the two tubes which are paralleled are perfectly matched, and herein lies the difficulty. Another scheme is to use a stage of push pull power amplification, but as this necessitates the doubling of practically all equipment in the last audio stage; i. e. two transformers, two sockets, two tubes; and as it draws a very considerable

"B" battery current, it is at best a very expensive manner of obtaining the desired results, and has for this reason not been used as extensively as would at first be expected. Tube matching, although fairly critical, is not a prohibitive matter in this case.

Power Tube Solves Trouble

WITH the advent of the power tube, a satisfactory and economical method of eliminating overloading of the last audio frequency tube has at last been found. It is true that power tubes have been on the market for years, but they were hard to obtain, were prohibitive in



price, and drew a very heavy filament current, often as much as two amperes.

The new tubes use only double the filament current of the ordinary type of tube, hence do not cause a seriously increased drain on the "A" battery, since only one is used. Also for the same reason, they can generally be satisfactorily handled by the standard rheostats in the set. The only obstacle to their use is the fact that they require higher "B" and "C" voltages than the standard, and this makes imperative either the use of an adaptor or else some rewiring in the last stage. When the wiring is inaccessible, as in a sealed type of set, the adaptor will be found satisfactory. It is not necessary to go into the use of an UX adaptor here, though, as complete instructions are packed in the carton of each one.

Table Showing Battery Requirements of UX and CX type Power Tubes Compared With Standard Tubes.

(UV or UX 201A)	5	0.25	22½ to 90	-4½ at 90 volts B
(C or CX 301A)				
UX 112 or CX 212	5	0.50	135	-9
(UV or UX 199)	3	0.06	22½ to 90	-4½ at 90 volts B
(C or CX 299)				
UX 120 or CX 220	3	0.12	135	-22½

Should the wiring of the set be easily reachable, however, the best method is to rewire the last stage where necessary, as it is easy to do, involving the changing of only two or three wires, and precludes any possibility of loose connections, with their consequent noises and inefficiency.

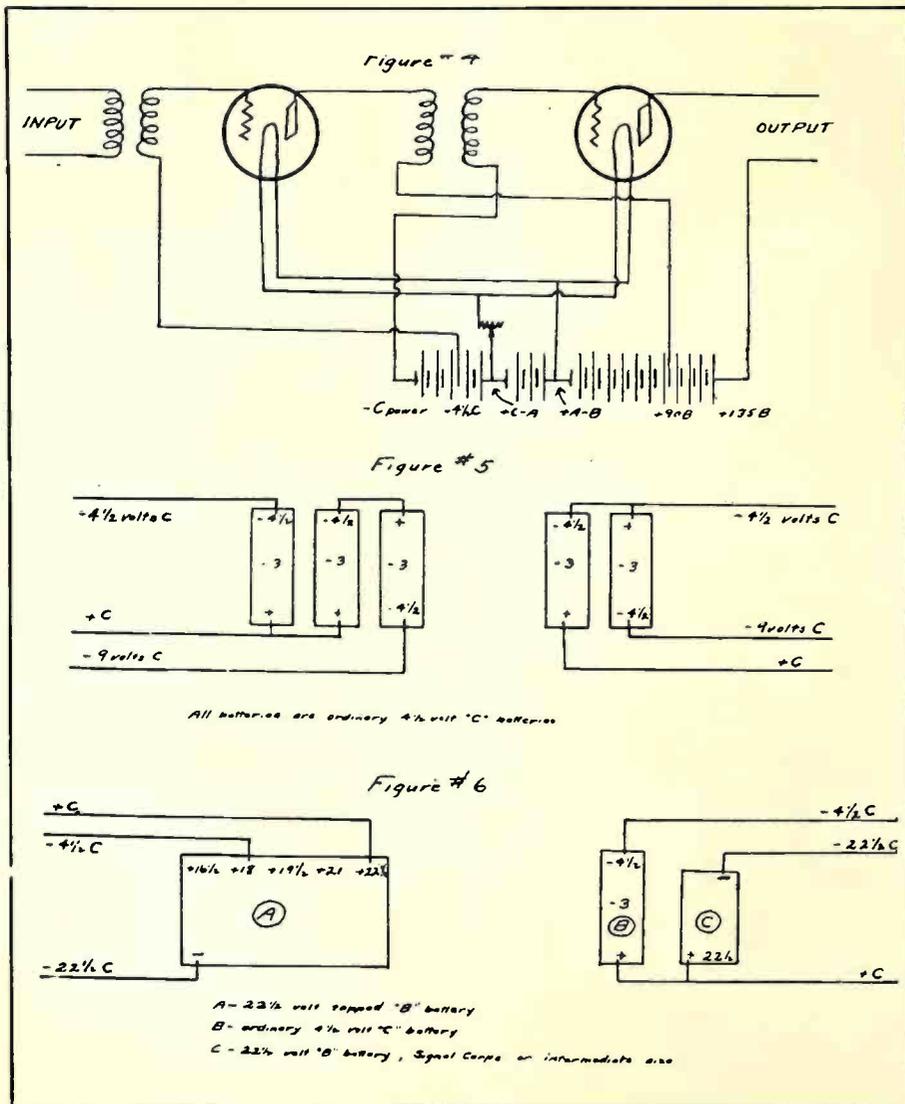
Accompanying this article are four sketches, schematic diagrams of four variations of the fundamental transformer coupled audio frequency amplifier. Figure No. 1 shows the simplest type of two stage audio amplifier, in which no "C" battery is

used, the grid returns being connected directly to the negative side of the "A" battery, the only negative grid bias available being the voltage drop across the rheostat, which is connected in the negative filament lead. This type of amplifier was formerly used in all sets, and is still used in some of the cheaper ones, but due to its very extravagant use of "B" battery current, as well as to its tendency to harshness of tone, it has been largely superseded by the type of amplifier circuit shown in Figure No. 2, which employs a small "C" battery, usually of four and one half volts, to obtain adequate grid biasing. The drain on the "B" battery with this amplifier is only about one third as great as that experienced with the amplifier shown in Figure No. 1, yet it is superior in tone and undistorted volume.

Figure No. 3 shows the same circuit as does Figure No. 1, with the last stage tube replaced by one of the new UX or CX type power tubes. This circuit is not recommended, as the tube in the first stage has insufficient grid bias and hence draws excessive "B" battery current. For this reason, if one has the type of amplifier shown in Figure No. 1, it is very advantageous to rewire the first stage for the use of a "C" battery at the same time one rewires the last stage for the use of a power tube, this procedure involving the changing of only one more wire. Figure No. 4 shows this completely rewired circuit, which is really that of Figure No. 2 with the last stage adapted for the use of UX or CX power tubes.

Few Changes Necessary

A PERUSAL of the above four circuits will show that the only changes necessary to
(Please turn to page 56)



Field Intensity Measuring Instruments

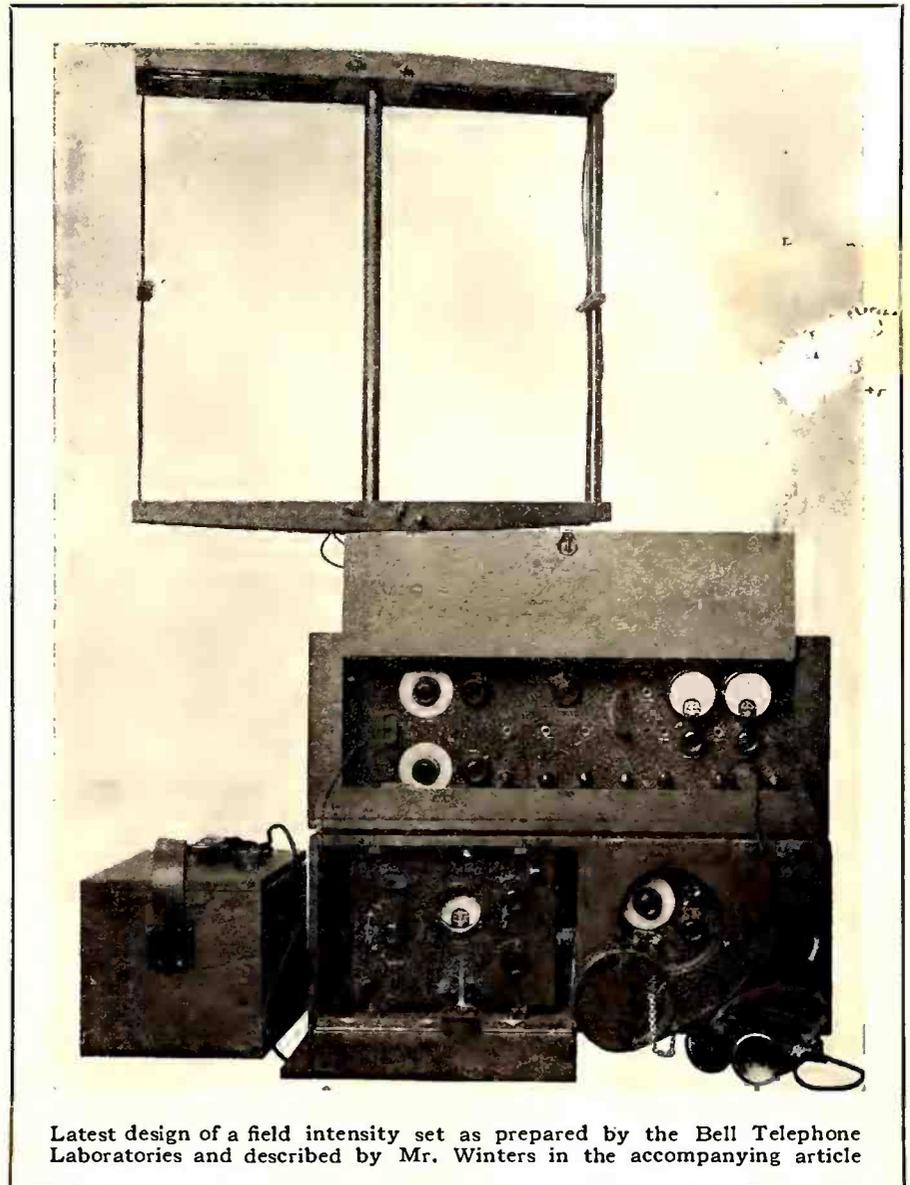
By
S. R. Winters

WHEN upward of 400 broadcasting stations are using variable amounts of electric energy—ranging from 50 watts to 50,000 watts—there is not only an opportunity for service but an exigency or real demand for a portable receiving outfit for measuring the field strength of transmitting stations.

Several laboratory units of this kind have been designed and put to use but it seems that the Bell Telephone Laboratories is the first radio research organization to meet the needs for portable equipment, apparatus that is fairly compact and sufficiently rugged to withstand usage afield. Furthermore, it operates over the band of wave lengths occupied by the broadcasting stations—from 250 to 500 meters.

The present model of this portable radio receiving outfit is a product of evolution—the result of modifications and improvements in which earlier models have been discarded. The super-heterodyne circuit is employed. This equipment, both as a means of facilitating transportation afield and as a logical division, resolves itself into two units—the oscillator unit and the input unit, each contained in metal boxes. The oscillator unit is shielded, and a special container is provided for the power supply, which consists of dry-cell batteries.

The difficulty experienced with earlier designs of portable



Latest design of a field intensity set as prepared by the Bell Telephone Laboratories and described by Mr. Winters in the accompanying article

receiving sets for measuring the field strengths of broadcasting stations was the variations in resistances of the loop or coil antenna when exposing the equipment to unfavorable weather conditions in service afield. It was, therefore, necessary to measure this resistance frequently each day, a task at once troublesome and time-consuming. The recent design, however, is said to overcome this obstacle, a method having been devised whereby frequent calibrations of the loop antenna are obviated. The number of turns of wire and the shape of the loop antenna are not arbitrarily specified, but it is necessary to know the distributed capacity, the inductance, and resistance values of such a pick-up system.

Describes Apparatus

AXEL G. JENSEN of the Bell Telephone Laboratories describes somewhat in detail this new apparatus and indicates its true operating conditions: "The receiving set unit," he points out, "is a double detection set provided with a sensitive meter in the plate circuit of the low-frequency detector and the first part of a measurement consists in tuning in the signal to be measured and adjusting the gain of the receiving set so as to obtain a suitable signal reading on the detector meter. Next, the local signal oscillator is started and adjusted to the same frequency as that of the signal by zero beating, after which the loop is cut out of the circuit and the input shunt adjusted so as to give the same

function of its geometrical proportions and the frequency, and may be determined once for all. The calibration of the tube voltmeter will stay constant for a considerable time, but the determination of the loop step-up is inconvenient, especially in a set intended for field use. In order to find the loop step-up it is necessary to determine the distributed capacity and the inductance of the loop, and the resistance of the loop as a function of the frequency.

"The potentiometer shown in the diagram directly under the plate current meter is used for balancing out the initial plate current of the low frequency detector, in order that the entire scale of the meter may be made useful for indicating the increase in current due to a signal impressed upon the grid of the detector tube.

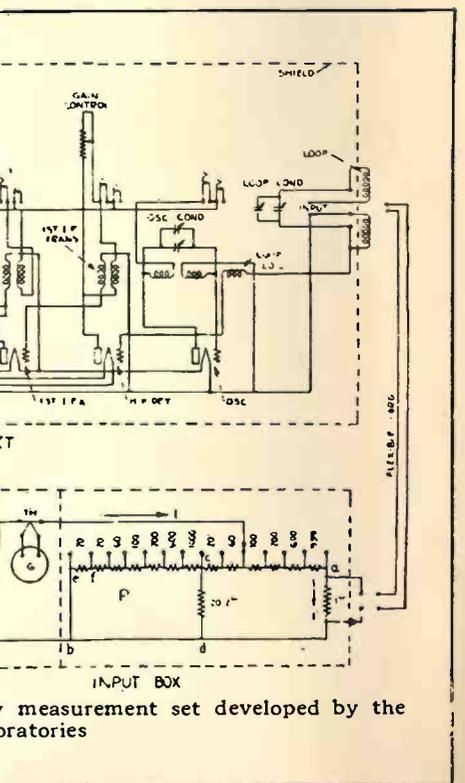
"The power supply for the filament and plate circuits of the receiving set is a dry-cell combination contained in a special battery box. It is seen also that the loop is made with flexible wire and is collapsible in order to facilitate transportation.

"A patch-cord is used for connecting the middle terminals

meter deflection as before, which means that the local signal voltage impressed upon the grid of the high frequency detector is the same as the voltage across half the loop due to the signal. This voltage is equal to the voltage across the entire non-inductive input shunt, as measured by a tube voltmeter, multiplied by the step-down ratio of the shunt; and by dividing this voltage by half the step-up ratio of the loop we obtain the voltage induced in the loop by the signal.

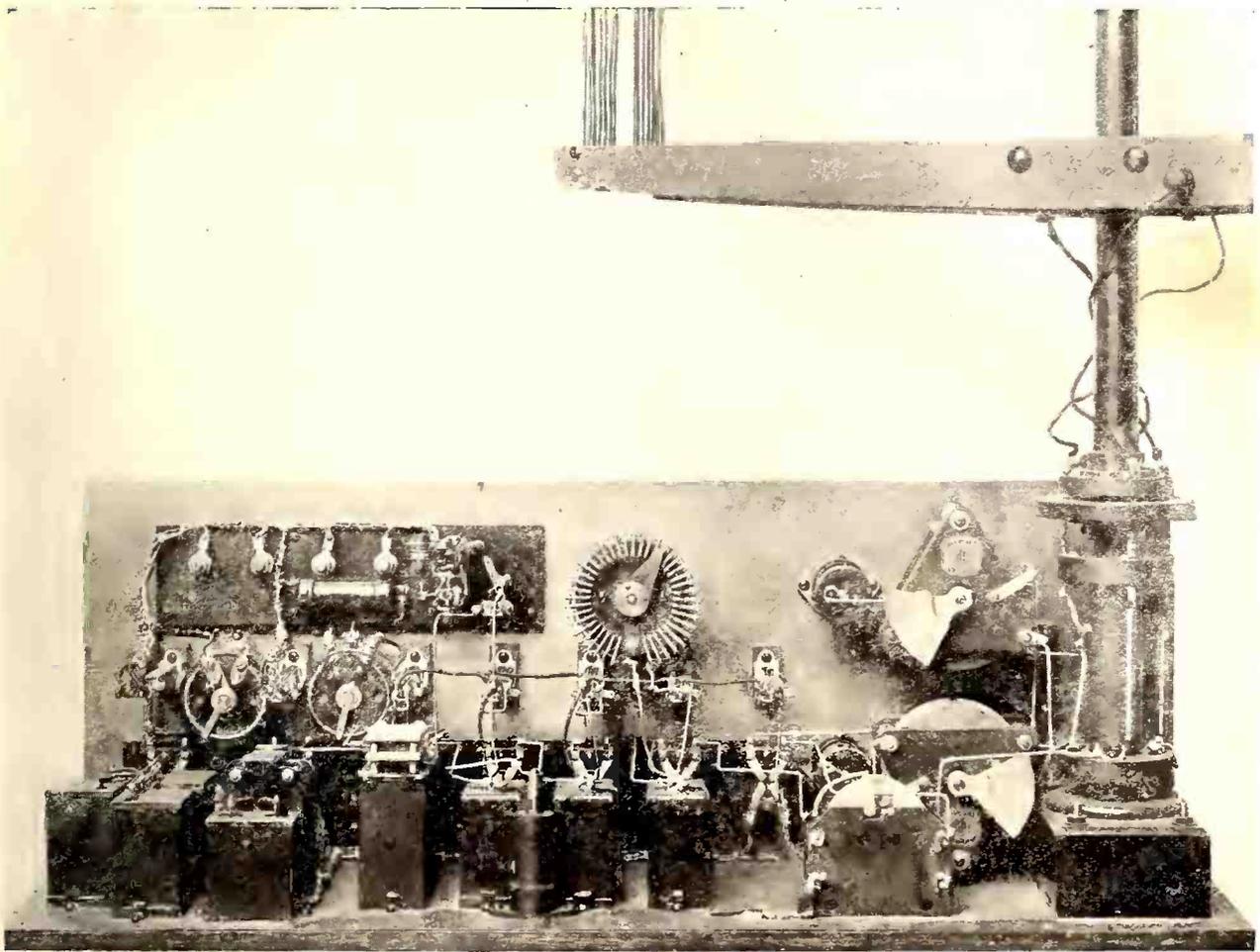
"The step-up ratio is given by the ratio of (1) L over R, in which L is the inductance and R the resistance of the loop. This ratio is thus a measure of the resonance effect of the loop, giving the voltage E across the loop at resonance as (1) L-R times the voltage E induced in the loop. This loop voltage e gives the field strength on division by the ef-

factive height of the loop. The effective height of the loop is a



Portable field intensity set in use afield

Schematic circuit of the field intensity measurement set developed by the Bell Laboratories



* Rear view of the receiving unit included in the field intensity set.

of the loop to the terminals on the input box, thereby closing the loop circuit through a known resistance of normally one ohm. This resistance is located in the input box.

"During an actual measurement the hole in the box showing the oscillator unit is tightly closed by a metal cover, ground to fit, thus completely closing an outer metal box formed by a heavy copper lining on the inside of the compartment containing the oscillator box. The leads from the input unit to the oscillator unit are enclosed in a heavy copper unit connecting the input box to the two terminals shown on the oscillator panel. The inner oscillator box is mounted insulated in the outer box and is connected to this only at one point, namely, through one of the two leads connecting the input unit and the oscillator unit, this lead

forming a direct connection from the inner oscillator box to the input box and thus, through the copper tube, back to the outer oscillator box.

"This double shielding of the oscillator unit is absolutely essential in order to avoid any direct (pick-up) from the local signal oscillator by the loop. Without careful shielding this (pick-up) voltage may easily be larger than the voltage to be measured, thus making the measurements worthless. The oscillator coil is, of course, also wound in toroidal form in order to make its external field as small as possible, and the power supply for the oscillator consists of dry cells contained in the oscillator box itself, since any outside battery connections would increase the (pick-up) considerably.

Obtaining Measurement

"A FIELD strength measurement may be obtained as follows: First, the signal is tuned in on the receiving set and the gain of the set is adjusted so as to give a suitable reading on the detector meter; next, the local signal oscillator is started and by zero beating tuned to the same frequency as that of the signal. Care should be taken here to make sure that the local signal oscillator is not zero beating with some stray signal or with the heating oscillator, and it is found convenient in this connection to watch the detector meter while adjusting the frequency of the local oscillator. When the beat note between the oscillator at the signal becomes very low; that is, below audibility, the needle on the meter will start moving up and

(Please turn to page 63)

Radio Age Adapts World's Record Super To Storage Battery Use

Two Filter Stages Give High Degree of Selectivity

MANY of our readers will recall reports of the excellent long distance reception last year by a Chicago experimenter, E. H. Scott, using a home built superheterodyne. Stations 6,000 to 8,000 miles distant were brought in consistently, and during a period of three months four world's records were established for long distance reception.

New Zealand was the scene of this fine work by Mr. Scott who was on a vacation at Tasman. The set showed results soon after it was built, having been completed shortly before the first International tests and one of the first stations brought in was 2LO London with loud speaker volume sufficient for the radio editor of a leading Chicago newspaper to hear distinctly over the telephone. This was a good start and was so encouraging that before leaving Chicago for New Zealand Mr. Scott arranged with stations WGN and WQJ to broadcast a special test program between the hours of 1 and 4 a. m.

WGN'S program was transmitted on January 29. It was first picked up at 7 p. m. just shortly after dusk in New Zealand and about 2 a. m. in Chicago. It was logged for nearly an hour and a half. A cablegram was sent the following morning to WGN giving a number of the items heard. WQJ transmitted their program on February 19 and this was logged for over two hours and a cablegram sent the Rainbo Gardens quoting the highlights in the program.

Duplicate Made

RESULTS were so good that it was feared this was the result of a freak set. To see whether this was the case or not, a cable was dispatched ordering a duplicate set of parts. On their arrival another set was built which in performance duplicated the feats of the first one. This receiver is still in use in New Zealand.

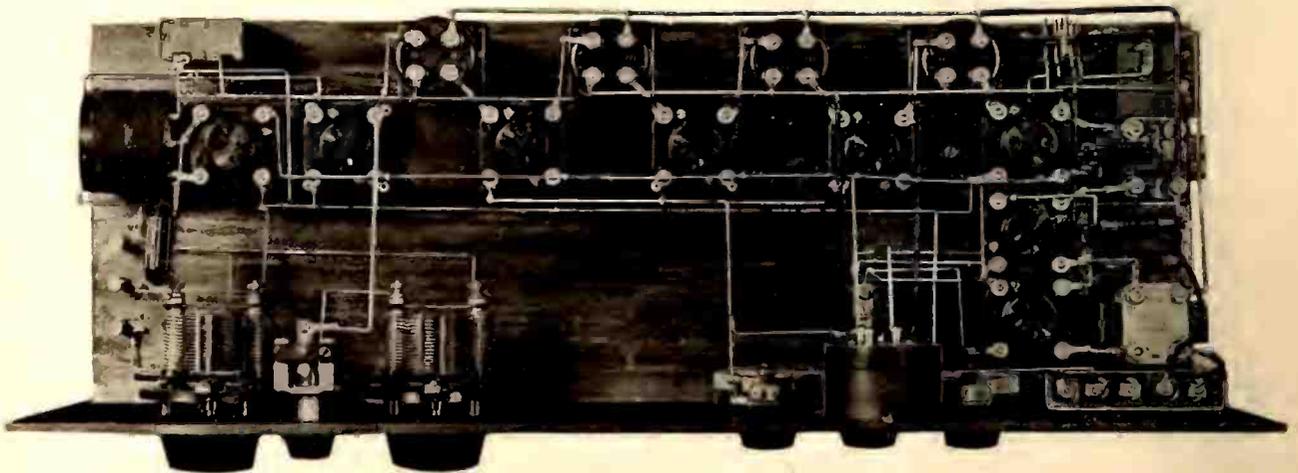
All of the stations received did not use high power. KNX at Hollywood was picked up on 20 different nights and at this

time was using only 500 watts. Airline distance between Hollywood and New Zealand is 6,000 miles. When Mr. Scott returned to the United States he visited the KNX studio and astonished the director with his log of consistent reception of that station. To further clinch the argument a special program was arranged, a cablegram was sent notifying Mr. Tucker in New Zealand (who has the duplicate receiver) of this fact, and the following day a cablegram was received giving the gist of the special broadcast. This accomplishment was detailed in the Los Angeles Express.

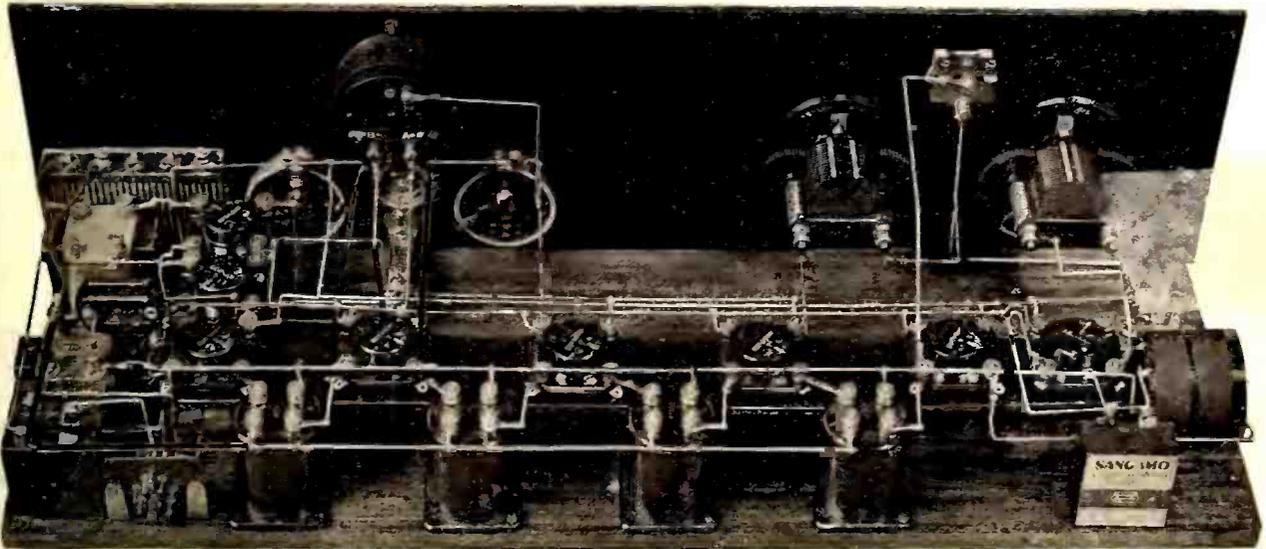
Standard Parts Used

PARTS used in the receiver were all standard and can be secured from any reliable radio dealer. Owing to the fact there was no electricity available at the Tasman location in New Zealand, it was necessary the super make use of the dry cell tubes. That receiver had 9 tubes, the last audio stage having two 199's in parallel.

Radio Age's laboratory has



Top view of the Radio Age laboratory model World's Record Super 8 showing all parts wired in place in accordance with the schematic circuit shown on page 40



Rear view of the completed receiver as adapted for storage battery tube use. Tube sockets are mounted on an elevated strip so the long wave transformer leads to sockets will be but an inch in length

now adapted the receiver for use with 201-A tubes and by using either a 112 or 171 in the last stage the necessity of using two tubes in this position has been eliminated.

One of the principal features of the Radio Age model of the World's Record Super 8 is the fact two filter stages are used to maintain a high degree of selectivity which today is imperative on account of the congestion in the broadcast band. To get best results these long wave transformers and the filters must be perfectly matched. The Selectone transformers used are a laboratory product and are matched to within one turn before being sealed in the case.

By means of the schematic circuit and the various pictures of the superheterodyne shown in this article anyone may with fa-

cility duplicate this receiver.

A small RF choke coil is shown between the plus B connection of the first long wave transformer and the plate section of the oscillator inductance. The oscillator filament circuit has been arranged with an Amperite instead of being on a separate rheostat or attached to other filament lines. The RF choke is not shown in the picture, having been added during the tests.

Across the plate circuit of the next to the last long wave transformer is shown a variable resistance. If desired this may be removed from that position and placed across the secondary of either the first or second audio transformers and there used as a volume control.

While the first and second detectors are shown together on a single rheostat marked No. 1,

this may be altered and a 112 Amperite used instead, since on tests it was found that little gain was found in a variable element in this filament circuit.

Thus with the oscillator, both detectors, and both audio stages on fixed filament resistors, only two controls are left for manipulation. The first is the rheostat No. 2 which has the filaments of three intermediates, and the second is the volume control resistor across the plate circuit of one of the intermediate stages (or across an audio secondary).

The midget condenser which permits the introduction of a small amount of regeneration in the loop circuit is not a variable control, since when once set, it remains in one position without further change.

Tuning is accomplished with the loop dial on the right and the



This shows the front panel view of the World's Record Super 8 as modified by Radio Age

oscillator dial on the left. Volume control is by the rheostat in the intermediate stages.

The receiver was modified for use in congested areas with the thought in mind that residents of non-congested neighborhoods would still appreciate its extreme selectivity without any sacrifice in tone quality.

In Chicago where two dozen or more radio stations have listeners practically hemmed in, this type of receiver should be particularly appealing. Ten kilocycle separation between stations which have long been considered disputed ones, is quite easy and no trace remains of the undesired signals.

Operation of the receiver was tried in two locations. First in the center of the city surrounded by tall buildings where excellent results were secured considering the shielding effect. The other test was made out in a suburb of the city. In both places fine selectivity was obtained, it being apparent that in the heart of the city a much broader receiver might be used whereas in the suburb greater selectivity was required. This appeared to be due to the fact radio waves in the city proper were subjected to excessive absorption whereas in the open areas, full value of emitted energy is unloosed.

For example KDKA comes through clean and sharp without any interference from WGN below or WGES above that channel. Three stations between WJAZ and WGES (WSMB-KOA-WSAI)

- ### List of Parts
- 1 Bakelite panel 7x26x3-16
 - 1 Wood baseboard 8 1/2 x 25
 - 1 Piece Bakelite 16x2x3-16
 - 1 Piece Bakelite 6x2x3-16
 - 3 Pieces Bakelite 3x2x3-16
 - 7 Small angle brackets, 3/4 inch
 - 2 Remler .0005 mfd variable
 - 1 Hammarlund Midget .00004 mfd condenser
 - 3 Sangamo 1 mfd bypass
 - 1 Sangamo .006 mfd bypass
 - 8 Benjamin cushion sockets
 - 1 Amperite type 201-A
 - 1 Amperite type 112
 - 2 Yaxley 6 ohm rheostats
 - 1 Centralab variable resistor
 - 2 Selectone RF transformers type R400
 - 2 Selectone RF transformers type R410
 - 1 Single circuit filament jack
 - 1 Jewell double reading voltmeter 7 1/4 -0-150
 - 1 Thordarson audio 3 1/2 -1
 - 1 Thordarson audio 2-1
 - 1 Yaxley plug
 - 1 Thor coupling unit No. 460
 - 3 X-L Pushposts
 - 2 National vernier dials

come in without the slightest difficulty of an overhang from either WGES below them or WJAZ above them. The same applies to KTNT being received without interference from WJAZ.

A little higher on the band WDAF at Kansas City is brought in without a trace of WEBH, and above the latter station, KTHS may be held during their entire program without a break-over from Edgewater. WGY, WTAM, WOAI, who lie between WEBH

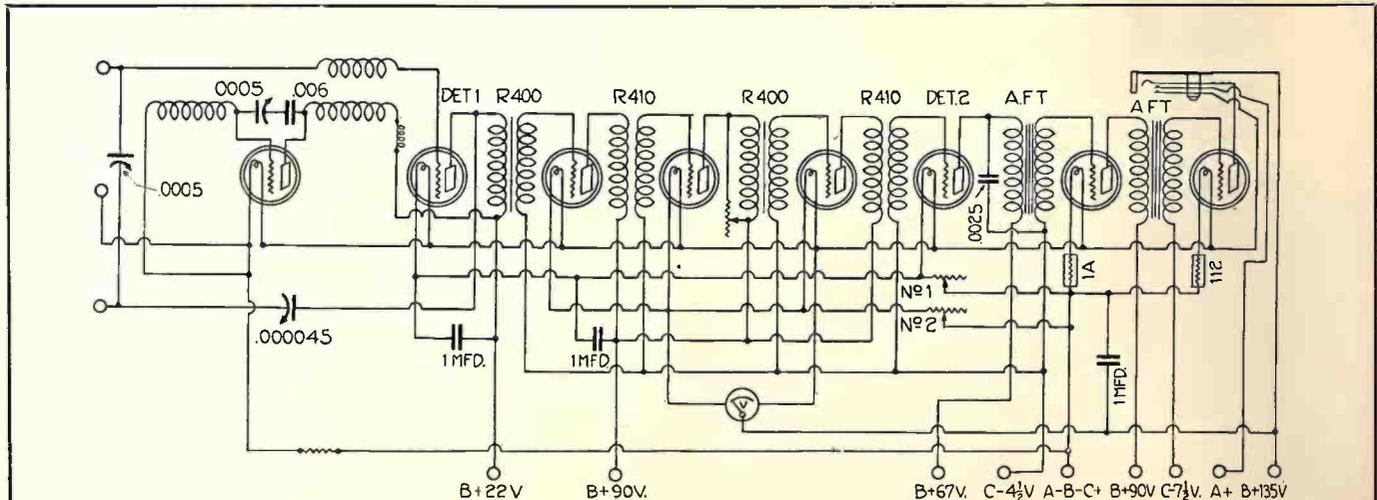
and WHT may be separated easily.

Against WQJ-WMAQ the Radio Corporation Station WJZ comes through with excellent volume and no hangover from the adjoining local station. KFNF, KFI, WRC, WBAP all come in nicely between WQJ below and WCFL above. WHO is copied solid for over an hour without any disturbance from KYW.

As is customary with any receiver using a loop, full advantage should be taken of its directional effects. In many cases a slight change in the position of the loop will mean the difference between an audible and inaudible signal. It is especially of advantage when the receiver is used very near the site of a broadcasting station.

Operation with both A and B eliminators is possible this receiver having been tested with the new Andrews-Hammond Abox filter (described elsewhere in this issue) and a Majestic B supply unit. It may also be adapted to dry cell operation but frankly we do not recommend such a plan since the smaller tubes cannot be expected to deliver the quality nor volume available with the storage battery type of vacuum tubes.

We shall be glad to have the benefit of the experience of our readers with this type of receiver. An indication of interest on the reader's part will enable us to have further data on super heterodynes with full constructional details.



By following the wiring shown in this schematic circuit anyone may duplicate the receiver described



Pick-ups and Hook-ups by our Readers



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

DIAL Twister P. E. Chapman, 841 N. Preston St., Philadelphia, Pa., breaks his long silence finally and writes of his results with super hets. We are quoting liberally from the letter because it may be of interest to other super-heterodyne owners:

"Since radio is my hobby and I am a subscriber to your magazine (which in my mind is the finest one published for every one interested in radio) I am taking the pleasure of sending you a few lines after a long period of silence.

"I have followed with much interest the various circuits published in your magazine by McMurdo Silver and after constructing the 'super autodyne' taken from your paper (July, 1925) I was astonished at the remarkable results obtained on six tubes.

"Now comes your February, 1926, issue with details of the S-M Six. This again attracted my attention so I at once started its construction, completing it in May. I have since that time run up a list of stations that resemble a telephone directory, and have just now received a letter of verification of a 32 minute program of the World's Christian Endeavor Convention broadcast from the Crystal Palace, Savoy Hill, London, Eng., through their station 210 at 4:50 p. m. daylight savings time on Sunday, July 18.

"This remarkable reception was accomplished in daylight with a temperature of 86 degrees, with sufficient volume to be heard on the speaker. Seven announcements were heard including 3 hymns, 2 speeches, 1 prayer and the Benediction.

"I am sending you these few



Readers who tuned in the Dempsey-Tunney fight on September 23, may be interested in seeing a sketch of the radio hookup that evening, one of the largest yet established

lines in the hope that readers of your pages will realize the true value of your magazine and the efficient hookups you publish."

WBZ at Springfield and WBZA at Boston, two broadcasting stations of the Westinghouse Electric & Mfg. Company are now operating on the same wave length—333 meters or 900 Kc., but as they are controlled by a single quartz crystal they do not interfere with each other. Both these stations of course are transmitting the same program, else the scheme could not be followed. The shift was made recently when WBZA gave up its 241.8 meter channel and adopted the same wave length utilized by the older station at Springfield. Although this plan is unique in broadcasting, it is believed of exceptional interest since it permits two stations, although not at great distances from each other to utilize the same channel without interference when the same program is carried. It may be a forerunner of hand-

ing broadcasts from several stations on a single channel and thus save using several individual wave lengths.

CONSISTENT 6,000 and 7,000 mile reception from Japan and California has recently been reported by a New Zealand radio fan using a standard and six-tube Isosfarad set. The receiver was operated by W. A. Waters, a resident of Palmerston, North Island.

"On the second night after it had arrived," writes Mr. Waters, "I had KGO (Oakland, Calif.) full strength on the loud speaker, and have since had Japan on the loud speaker several times. This is a station on about 355 meters and often comes in very good. Last night I had KNX Los Angeles and the Jazz Orchestra and male songs were very fine. The set has also operated as a test on only twelve feet of wire as an aerial and brought in Brisbane (Australia) 1,500 miles away quite audible on the loud speaker. Palmerston is Lat. 40.19 S, Long. 175.38 E.

BUILD YOUR OWN?

INVESTIGATE THE B-T POWER-SIX

The B-T Power-Six has history behind it and the reputation of a firm who have never put out a product that was not a continued outstanding success.



The Essential Parts for the B-T Power-Six are Available in Kit Form

The Power-Six is based on the B-T patented Counterphase Circuit improved, simplified and up-to-the-minute with the latest developments.

It's more efficient, easier to build, easier to operate and gives the finest reception known to radio. Full size colored picture diagrams leave no room for errors.

The Power-Six Kit includes the essential parts—purchased separately they would cost \$45.10.

**Pr
emer
Tully**

Manufacturing Co.
520 S. Canal St. Chicago, Ill.

Price of Power-Six Kit \$41.50.

(If your dealer cannot supply you, we will ship prepaid on receipt of list price.)

If you are using the present Counterphase and desire to change over to the Power-Six model with power tubes send 10c for the Tenth Edition Better Tuning. It tells how.

THE first superheterodyne radio receiver, built by Major E. H. Armstrong of the United States Signal Corps in a laboratory in Paris in 1918, is still in operation in Washington.

The set was built by Major Armstrong to prove the practicability of the new type of receiver which he had invented. It is now in the historical collection of the Signal Corps in the office of the Chief Signal Officer in Washington.

Although the superheterodyne of today uses the same principles as were evolved by Major Armstrong eight years ago, there is, of course, a vast difference in appearance.

METHODS to overcome curious behaviour of the short waves, which do not follow the ordinary routes taken by longer-wave transmissions, have been perfected. It was found that short-wave transmissions could not be heard at all distances

from a source; in other words, the waves skipped some points and could only be received at certain distances. By transmitting each short-wave message on four different channels, it is found that one of the four carrier waves is available at all distances from the station, up to the limit of its transmission. Knowing the four channels used are in the 4,000, 8,000, 12,000, and 16,000 Kilocycle bands, and that messages are about to be transmitted, the radio operators on ships listen in on the frequency which is more likely to reach them, dependent on their location. An operator knows how far his ship is from the station, and chooses a frequency on which to listen, based on his knowledge and the phenomena of the skip wave. At first it was feared that the short-wave system, due to its skip distance handicap, would not be available for naval use except between shore stations or ships, the definite location of which

were known. But the new method of transmitting on four frequencies has overcome this difficulty and this new service is now reliable in spite of summer static.

The navy now has short wave stations in Washington, San Francisco, Key West, Puget Sound, San Diego, Cavite, Guantanamo, Cordova, Honolulu, Balboa, Guam, Tutuila, Lakehurst, Norfolk, and Charleston. All of these stations are handling traffic daily, and it will be noticed that with stations on both sides of the Pacific, regular transpacific communication is now possible. The stations in California now communicate with those in Alaska, while Washington is in touch with the stations on the West coast, the Canal Zone, and the West Indies.

9BHX

Transmission

Amateurs listed below are reported by 9BHX as having been worked during the month of September:

4QB	9BHB
2DS	9CRL
4QE	1KL
4RR	8RJ
2AFO	2ARN
9BSK	9CES
5HY	6KB
4IZ	8BRU
4BK	4BY
9BLF	9MO
C3JL	8BBE
4EI	9CAA
9CKD	8AKK
3AHL	3AKS
6UD	2NM
9ALH	1AUF
2KH	6BZD

C5CT

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This 84 Page Wonder Book of RADIO Bargains



Send for this guide to Radio prices and Radio quality. All of our vast resources and radio experience have been utilized to assemble for you in one gigantic institution, the best and newest things in radio. The Randolph catalog is indeed the radio market place of the world—a masterpiece of merchandising that befits our house—the largest exclusive radio mail order house in the world.

What Our Catalog Contains

Over 2,000 items—from the most beautiful, fully equipped console model radio set, down to the smallest part or tool for the set builder—kits, parts, and supplies of every conceivable type and style. All beautifully illustrated and interestingly described. And to give this book added value, we have included radio data that makes it an invaluable text book for every lover of today's most fascinating and most wonderful achievement—RADIO.

Radio Sets

In this great radio market place you will find table model sets and console types with built-in loud speakers; the newest ampliphonic console sets; new Spanish period consoles; five, six, seven, and eight tube sets, with three dial, two dial, and the newest and most popular single simplified control. All sets are assembled in beautiful, genuine mahogany and walnut cabinets in a choice of latest types and designs.

5 Tube sets as low as \$24.90
Latest 1927 Models

All Randolph sets are sold at amazingly low prices. No matter what kind of set you want—no matter how little you want to pay—you can select YOUR SET AT YOUR PRICE from the Randolph catalog.

Radio Kits

Includes the following well known circuits, designed and approved by the world's foremost radio engineers: Madison Moore Super; Victor-teen Super; Silver Marshal Six; Sargent's In-fradyne; Remler Super; Short Wave Kits; 9-in-Line Super; New Acme Reflex; Cockaday; Neurodyne; Browning-Drake; all classes of radio frequency, Super Heterodyne and every other approved popular circuit.

YOU MUST HAVE THIS BOOK

Space limitations here prevent our telling you more about the Randolph Catalog. Simply fill out and mail the coupon—or you may send a postal or letter—and this truly remarkable Radio book will come to you **ABSOLUTELY FREE. MAIL THE COUPON NOW.**

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The Randolph catalog also contains a most complete line of "B" Battery Eliminators, including the famous Raytheon Eliminators; the latest type of Loud Speakers, Cone Speakers, a complete line of quality "A" power units—in fact, you will find listed in this wonder book every part that goes into the construction of a radio set, or any accessories you desire, at prices that mean a substantial saving to you.

Free Radio Service

Everyone has need for radio service. The average man has no time to keep up with the rapid developments of radio. We employ Radio Engineers who have made radio their life work. Their expert advice and helpful suggestions solve every radio problem of our customers.

Our Guarantee

Every article in our catalog is based on careful laboratory analyses and tests. We guarantee to back up every item in our catalog with our own as well as manufacturer's assurance of quality.

Save
1/3 to 1/2

Why We Save You Money

Because we handle radio exclusively and sell a tremendous volume of everything in Radio, we can concentrate our buying power for the benefit of our customers.

Volume purchases regulate prices. We command rock bottom prices from manufacturers, and in many cases we contract for entire factory output of exclusive products. You will benefit by our great volume of purchases and sales, by securing anything you may want in radio at a substantial saving.

This Coupon Brings the Great RADIO Book FREE

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Send me—free—your 84-page, 1927 Radio Book.

Name _____

Street and No. _____

R. F. D. _____ Box _____

City _____ State _____

SM

630



Shielded Six

Approved and endorsed by Radio Broadcast, Citizens Radio Call Book and many other prominent publications and newspapers. The Shielded Six is one of the highest types of broadcast receivers. It embodies complete shielding of all radio frequency and detector circuits. The quality of reproduction is *real*—true to the ear.

Behind the Shielded Six is competent engineering. Day in and day out it will get distance—on the speaker. Local stations in the most crowded areas separate completely—yet there are but two dials to tune. These features—its all metal chassis and panel, its ease of assembly and many others, put it in the small class of ultra-fine factory built sets, priced at several times the Six's cost.

The S-M 630 Shielded Six Kit—including all specified matched and measured parts—price \$95.00.

The 633 Shielded Six Essential Kit contains four condensers, four radio frequency transformers, four coil sockets, four stage shields and the link motion—all factory matched—price \$45.00.

Clear and complete instructions, prepared by S-M engineers, go with each kit—or will be mailed separately for 50c.

635 Short Wave Kit

Contains the carefully designed and matched essentials for a real short wave set. Its range is 18 to 150 meters. The kit contains 4 plug-in coils, 1 coil socket, 1 coupling condenser and two 140 mmf. condensers—all carefully designed for operation together. With the four coils, the amateur bands fall well to the center of the tuning scale—and "dead spots" are totally eliminated. The antenna condenser allows coupling adjustment to suit individual conditions. Price \$23.00.

All prices 10% higher west of the Rockies.

SILVER-MARSHALL, INC.
850 West Jackson Blvd.,
CHICAGO, U. S. A.

Feeding Hubby is Chief Concern of Young Bride

(Continued from page 24)

keeper is familiar with the advice of William Morris, "Have nothing in your home which you do not know to be useful or believe to be beautiful." She does not take much stock nowadays in directions for making crocheted tidies and red velvet posies, although she maintains a lively interest in decorating her home so that it will be both comfortable and beautiful.

SEVERAL years ago a magazine for farm women conducted a survey, in which first hand information was obtained from readers about their home life. Among many others, questions were asked about meal planning, food preservation, the making of clothes at home, and home decorating. It is interesting to note that more letters contained statements about decorating country homes than about any of the three items previously mentioned. The correspondents were enthusiastic about "arranging pictures, furniture, and rugs so as to bring about the most pleasing effect." Painting, papering, hardwood floors, curtains, shades, and windows came in for their share of attention, as well as the arrangement of buildings to bring about the greatest convenience.

"Questions Women Are Asking" are answered during the second five minutes of the housekeepers' program. These questions are as varied as the interests of women, and range all the way from what to feed the undernourished child to how to get rid of household pets. If the question is brief and of universal interest, the answer is broadcast. If the question is long, and not of general interest, a personal reply is sent.

The last five minutes of the program are concerned with the problem every housewife must solve three hundred and sixty-five times a year: "What shall we have for dinner?"

Only seasonable, well-balanced, easily prepared, and in-

expensive menus are broadcast. The principles of meal planning, and the necessity of including fresh vegetables in the diet every day were explained in the first programs. Various methods are given for preparing common vegetables. There are nearly a hundred ways of preparing potato yet a

For Perfect
"SELF-ADJUSTING"
Filament Control

AMPERITE has been universally adopted by all leading engineers and set-builders; accepted as standard in every popular circuit.

Eliminates hand rheostats. Simplifies wiring.

Amperites specified in the Henry Lyford Receiver, FREE—Send for "The Radiall Book", containing hook-ups and construction data. Dept. R. A.-11.

Radiall Company
50 FRANKLIN ST., NEW YORK



Price \$1.10
Complete

AMPERITE
REG. U.S. PAT. OFF.
The "SELF-ADJUSTING" Rheostat.

See that screw

A SCREW DRIVER
ADJUSTS AN X-L
IN CROWDED
PLACES



RESULTS in easier tuning, more distance, volume and clarity—greater stability. Indorsed by leading radio authorities. Model "N"

A slight turn obtains correct tube oscillation on all tuned radio frequency circuits. Neutrodyne, Roberts two tube, Browning-Drake, McMurdo Silver's Knockout, etc., capacity range 1.8 to 20 micro-micro farads. Price \$1.50

Model "G"
With grid clips obtains the proper grid capacity on Cockaday circuits, filter and intermediate frequency tuning in beteroodyne and positive grid bias in all sets.

Capacity range: Model G-1 .00002 to .0001 MFD. Model G-5 .0001 to .0005 MFD. Model G-10 .0003 to .001 MFD. Price \$1.50

X-L Plush Post

Push it down with your thumb, insert wire, remove pressure and wire is firmly held. Releases instantly. Price 15c. Also furnished seven to a strip. Nicely marked in white with seven standard markings. Price \$1.50.

Information on Request
X-L RADIO LABORATORIES
2424 N. Lincoln Ave. Chicago, Ill.



Remember . . .

on your present set, or the one you're building, you can't sacrifice the added convenience, neatness and mechanical superiority of the

Jones
MULTI-PLUG
THE STANDARD SET CONNECTOR

Ask Your Dealer
HOWARD B. JONES
618 S. Canal St. Chicago, Ill.

good many persons seem to know but four—boiling, mashing, baking, and frying.

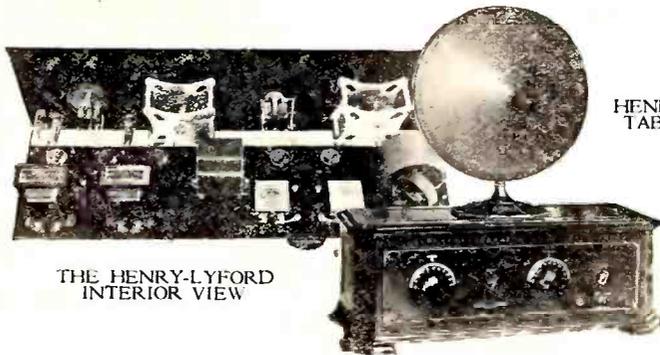
MEMBERS of the radio audience are introduced to vitamins and calories and mineral constituents in such an easy manner that these dignified culinary terms lose their fearsome aspect. For instance, it is all right for every housewife to know the story of the scientific research on vitamins. This knowledge will not benefit her nearly as much, however, as knowing that in order to get their proper amount of the highly necessary vitamin, the member of her family should include in their daily diet at least a pint of milk, whole grain foods, a raw vegetable or a raw fruit, and two vegetables besides the ubiquitous potato.

If the baby cries while the menu is being broadcast, or the turnips boil over and the housewife misses part of a recipe, she can get a mimeographed copy of the recipes and menus from the broadcasting stations.

One fact that appeals to the woman who must do her own cooking is that a good many of the recipes broadcast are new, worked out and tested in the Bureau of Home Economics.

The housekeepers' program may be said to have a dual purpose: to help the housewife in the intricate and vastly important task of managing a home, and to show her how, by careful planning of meals, saving of steps and labor, she may have more leisure time for what are broadly termed "cultural activities."

YOU CAN BUILD A BETTER SET THAN YOU CAN BUY



THE HENRY-LYFORD INTERIOR VIEW

THE HENRY-LYFORD TABLE MODEL

Deliberately Unbalanced

RADIO authorities for years have said it could not be done. Yet the Henry-Lyford Receiver is *deliberately unbalanced*—and this very principle is the foundation for its firm, full tone; its supersensitiveness; its knife-like selectivity; and its fool-proof simplicity! The Henry-Lyford Receiver is not a freak. It's the answer to the radio fans demand—a sound logical circuit that performs as near to the "perfect receiver" as any receiver to-date can perform—a receiver easy to build, even for the novice—a receiver whose beauty will charm any wife.

North Pole Expeditions, prominent amateurs, powerful foreign stations, and experimental programs that the ordinary receiver can never get.

DROP US A CARD

The wonder of the all-around perfection of the Henry-Lyford Receiver can only be realized by hearing it, and testing it yourself. It is so simple to construct

that you can put it together in an evening. The panels come all drilled. Diagrams are simple to follow and you can't make a mistake.

Drop us a card. Let us tell you more about the receiver designed by the radio fan from his idea of what perfect reception is. Let us tell you about the Henry-Lyford principle of audio-amplification. Every part is guaranteed. Address the University Radio Mfg. Corp., 50 Park Place, New York City.

YOU CAN TUNE IN FROM 37 TO 550 METERS

You can get even the very short waves with the Henry-Lyford Receiver. Supplied with plug-in coils, you are protected against the most radical change in broadcast wavelengths. Hear the

Complete List of Parts

- 1 Bakelite panel, 7x24, drilled and engraved.
- 1 Bakelite sub-panel, drilled, with 5 Benjamin sockets mounted.
- 2 Preciae 350 mmfd. variable condensers, type 845.
- 1 Preciae 55 mmfd. variable condenser, type 940.
- 1 Centralab modulator, type 500 M.
- 1 Carter "Imp." filament switch.
- 1 Carter No. 102a jack.
- 1 Carter No. 103 jack.
- 1 University antenna coupling transformer, type B-1.
- 1 University radio frequency transformer, type B-2.
- 1 University tuned radio frequency transformer, type B-3.
- 2 Thordarson Audio Transformers, type R-200.
- 5 Tube Deutchmann 1 mfd. fixed condenser.
- 1 Micamold .002 mfd. permanent condenser.
- 1 Micamold .001 mfd. permanent condenser.
- 3 Amperites, type 112.
- 10 Coil mounting jacks.
- 1 pair of Benjamin brackets, type 8629.
- 1 sub-panel supporting post.
- 2 Eby binding posts marked Ant., Gnd.
- 2 4-in. Kurz Kasch dials, 100 to 1.
- 1 8-wire battery cable.
- 1 coil of Belden hook-up wire.
- 1 complete set of hardware.
- Complete set of parts. **\$69.50**

THE NEW HENRY-LYFORD RECEIVER

UNIVERSITY RADIO MFG. CORP., 50 PARK PLACE, NEW YORK, N. Y.

Vesta Battery Corp. Now Owns WFKB

Announcement has been made by Ward S. Perry, President of The Vesta Battery Corporation, Chicago, that station WFKB is now known as "The Vesta Battery Corporation Station, WFKB, Chicago."

WFKB has been operating for over a year on 217.3 meters, as an experimental station, and is now equipped with the very latest transmitting apparatus using 1000 watts.

POWER-PLUS COILS

For those who demand the ultimate

\$9.75

List Price Per Set of Three

Fieldless Coils Space Wound Highest Amplification

Power-Plus Dual Condenser is side by side in mounting—matched so both condensers are uniform—will tune Power-Plus Coils over entire wave band without additional compensating condensers. Double weight construction throughout. List price.....\$12.00

SEE These at your Dealers or write us for complete information.

A. F. HENNINGER CORP. 4509 Ravenswood Ave., Chicago

\$60. to \$100 Weekly Selling 40 to 550 Meter Set

Spare Time Profits—No Capital

Public wants this Amazing New Set. Coast-to-coast reception. Receives all waves, 40 to 550 meters. Shot sub-panel makes assembly quick and easy. We need distributors everywhere. Demonstration sells. We carry stock. Set sells at half store prices. \$60 to \$100 weekly easily made.

FIVE TUBE DEMONSTRATOR FREE with RADIO TRAINING

Our Special Plan trains you in Radio—gives you a Free Demonstrator Set and appoints you as distributor.

The entire cost is less than regular dealer's price for Set alone. Hundreds are making big money in spare time. Get started now while territory is still open. Write Today! Don't miss this opportunity to make a fortune in Radio. Get complete training and sal's plan Free! **AMBU ENGINEERING INSTITUTE** 2633 J Prairie Avenue Chicago, Illinois

\$50⁰⁰

Cash Prizes

Every Month in

RADIO AGE

To encourage our readers in developing their ideas along radio, electrical, mechanical or scientific lines, Radio Age will offer each month two prizes of twenty-five dollars each for the best new and original stories or pictures, or both, submitted to its Editors covering the fields of radio, telegraphic and telephonic communication, maritime, automotive or railroad transportation, aviation or any of the present day scientific, electrical or mechanical arts.

One prize will be awarded for the best article along radio lines, while the second one will cover ideas other than radio. Sketches should accompany the contestant's manuscript, which should be limited to 1,000 words. Decision will rest entirely with the Editors of this magazine and awards made each month.

Articles which do not win a prize will be published in Radio Age if found desirable and will be paid for at our usual rates. Address all manuscripts for this contest to

Contest Editor

RADIO AGE, INC.

500 N. Dearborn St.
Chicago, Ill.

Bramco B Supply



ANNOUNCEMENT is made by the Breit Radio and Mfg. Co., of the marketing of the "Bramco" B eliminator and audio power supply A and B, which is illustrated above.

This device, in addition to furnishing the usual detector, RF and amplifier voltages for all types of receivers, has a winding for the filament supply of power tubes of the 216-B type. In addition provision is made for the use of either the Raytheon or the Rectron tubes as rectifying elements. A single socket is provided for the Raytheon while two sockets are provided for the Rectron tubes.

On test the supply unit gave uniformly good results for either regenerative or RF receivers and superheterodynes.

Navy Gives Schooling In Radio Principles

Thorough grounding in radio is one of the features of education in the various trade schools operated by the Navy, where thousands of men annually are trained for civilian trades.

The underlying principles of the trades taught in Navy schools are identical with those taught by civilian schools in connection with the same trades. The naval radioman must know the same fundamental principles of radio as thoroughly as men following similar trades in civil life. Much of the practical work of the trade that is taught in the Navy trade school is identical with the practical instruction in any civilian trade school, but in the Navy every effort is made to familiarize the man with the same types of equipment and the same types of jobs that he will find at sea.

"B" BATTERY ELIMINATOR

Only \$7⁹⁵

Money-Back Guarantee

No more worry with "B" Batteries! Throw the worn-out old cells in the ash can! Hook up a Roll-O "B" Battery Eliminator and forget battery troubles forever. This wonderful new invention means better reception, sharper tuning. Gives you more real pleasure from your set.

Completely Equipped—No "Extras" to Buy Operates perfectly on direct or alternating current giving up to 90 volts current, and using the full wave of the power supply. Simple directions enclosed—anyone can plug it in to any kind of set up to six tubes. Constant voltage gives set more power without danger of burning out tubes. Costs no more than set of good "B" Batteries. Solidly built in beautifully finished metal case, with genuine bakelite top.

Send \$1⁰⁰

SEND YOUR ORDER NOW

Don't blame your set because run down "B" Batteries won't let it work right. Order your Eliminator NOW. Former price \$12.95. Now cut to \$7.95. Write name and address on a piece of paper, pin a dollar bill to it, and mail it TODAY. Pay postman balance (\$6.95 plus a few cents postage) when he delivers your Eliminator. Use it ten days. If not more than satisfied, return it and get your money back.

THE ROLL-O-RADIO CO.

1111 S. P-1, Third & Sycamore Sts., Cincinnati, O.

Free 60-page Reference Book

Mailing List Catalog No. 55

POLK'S REFERENCE BOOK FOR DIRECT MAIL ADVERTISERS

Shows how to increase your business by the use of Direct Mail Advertising, 60 pages full of vital business facts and figures. Who, where and how many prospects you have. Over 8,000 lines of business covered.

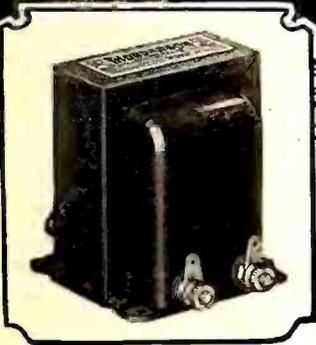
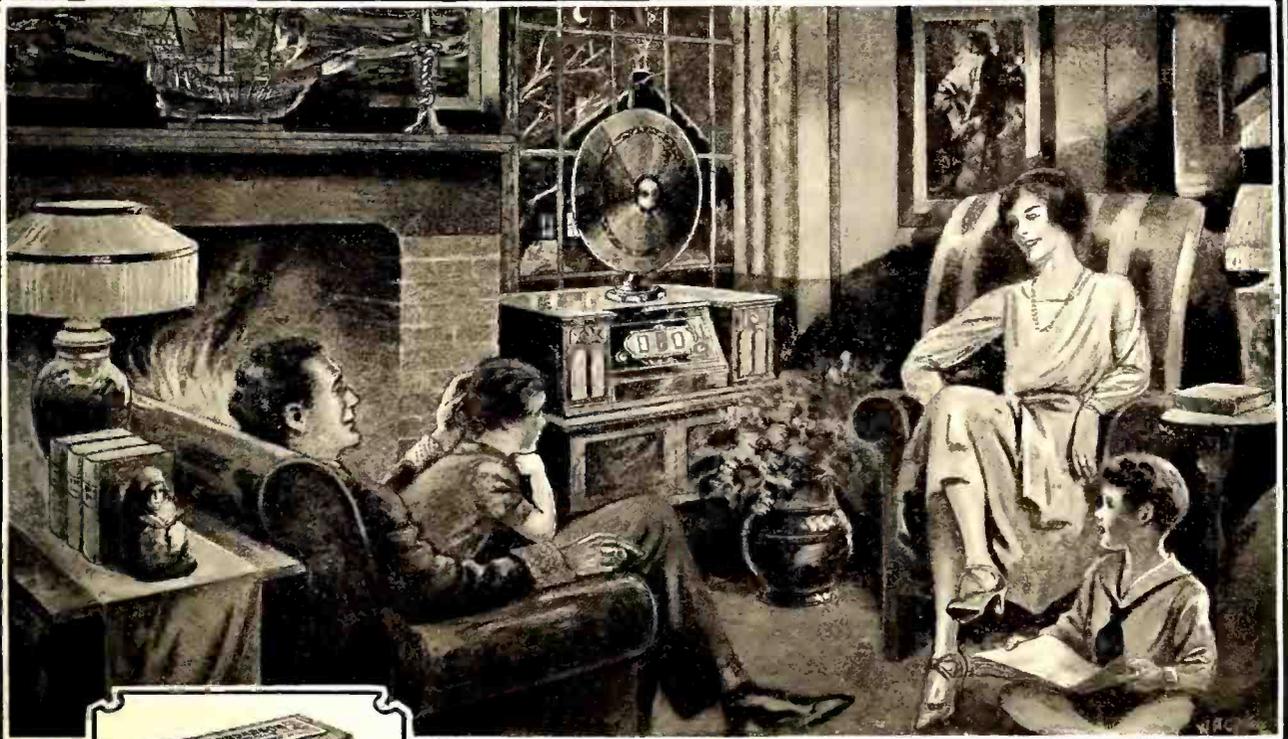
Write for your FREE copy.

R. L. POLK & CO., Detroit, Mich.
599 POLK DIRECTORY BUILDING
Branches in principal cities of U. S.

Radio Weather Maps

A weather service by radio will be put into operation within a month between the naval radio station at Arlington, Va. (NAA), and the transport *Kittery* and the light Cruiser *Trenton*, it has been announced by the Navy Department.

Instruments for the reception of weather maps by radio are being installed on the two vessels. The maps will be transmitted by the Jenkins picture transmission system, using a transmitter on 36 kilocycles.



THORDARSON

R-200
AMPLIFYING TRANSFORMER

Supreme in
MUSICAL PERFORMANCE!

THE secret of good reception lies not in attempted correction of the deficiencies of poor broadcasting, but in faithfully reproducing the programs of the better stations.

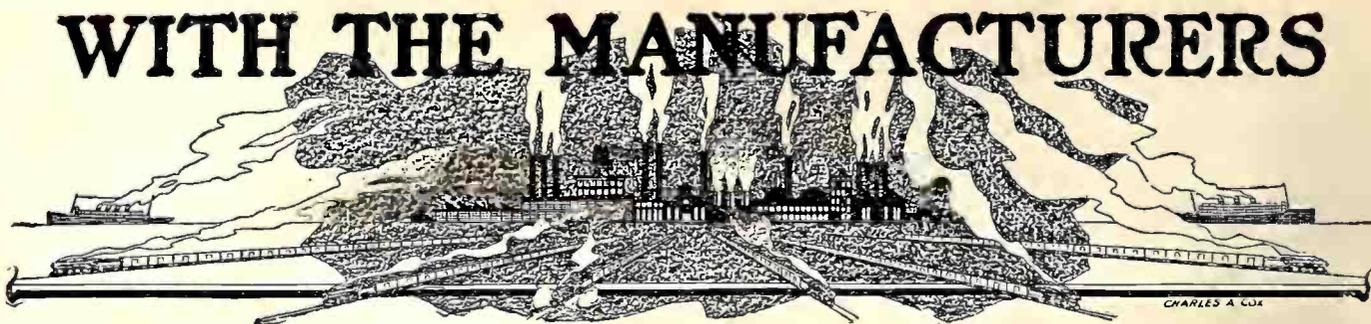
Thordarson transformers employ neither a "rising" or a "falling" characteristic for corrective purposes. They are designed to give, as nearly as possible, equal attention to all notes.

The majority of leading quality receivers are equipped with Thordarson transformers—a substantial evidence of the musical supremacy of Thordarson amplification.

THORDARSON ELECTRIC MANUFACTURING CO.
Transformer Specialists Since 1895
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
Huron and Kingsbury Streets — Chicago, Ill. U.S.A. 3445



WITH THE MANUFACTURERS



E. R. Hurley Jr., New Head of Walbert Manufacturing Co.

E. N. HURLEY, Jr., well known in the electrical trades through his previous long connection with the Thor Washing Machine Company and as an organizer and executive of young industries, has recently been elected to the presidency of the Walbert Manufacturing Company, makers of Isofarad radio sets, the Pentrola, and other recent radio developments. About six months ago Mr. Hurley became interested in this company and has since been engaged in extending channels of distribution, securing a new plant, and in reorganization of the various departments of the company.

Use of Resistors Told

In New Pamphlet

INFORMATION for the set builder and the experimenter is contained in the Radiall Book, a 24 page pamphlet recently issued by the Radiall Co., of New York, and which is sent to anyone upon request.

Use of fixed filament resistors for proper value of filament current is discussed and many applications shown together with a number of the standard circuits popularized by the radio magazines.

NOTICE

It has come to our attention that individuals have recently been making requests upon manufacturers for parts to go into receivers to be described in this magazine.

Such requests are not authorized by RADIO AGE. When parts are desired by this magazine they will be ordered by RADIO AGE and not by individuals who have no connection with this publication.

—Editor
RADIO AGE, Inc.

Bosch Has 7 Tube Single Control Set

MUCH has been published, favorable and otherwise, about single control receivers. That a single control receiver can be made so accurate in its operation a new simplicity of tuning is achieved is the boast of the engineers of the American Bosch Magneto Corporation at Springfield, Mass.

These engineers claim to have perfected a circuit for the new seven tube Bosch Amborada receiving set in which the input stage is perfectly co-related with the four successive radio frequency amplifier stages so maximum efficiency and amplification is obtained without recourse to minor adjustments. The Bosch engineers declare the new circuit works perfectly over the entire broadcast wave band and the use of so-called compensating condensers is unnecessary.

Having Its Biggest Year

RADIO manufacturers will be interested in the article written by Frederick A. Smith, Radio Editor of the Chicago Herald and Examiner and publisher of RADIO AGE, showing the fallacy of Thomas A. Edison's recent statement that interest in radio was today but ten per cent of its former value.

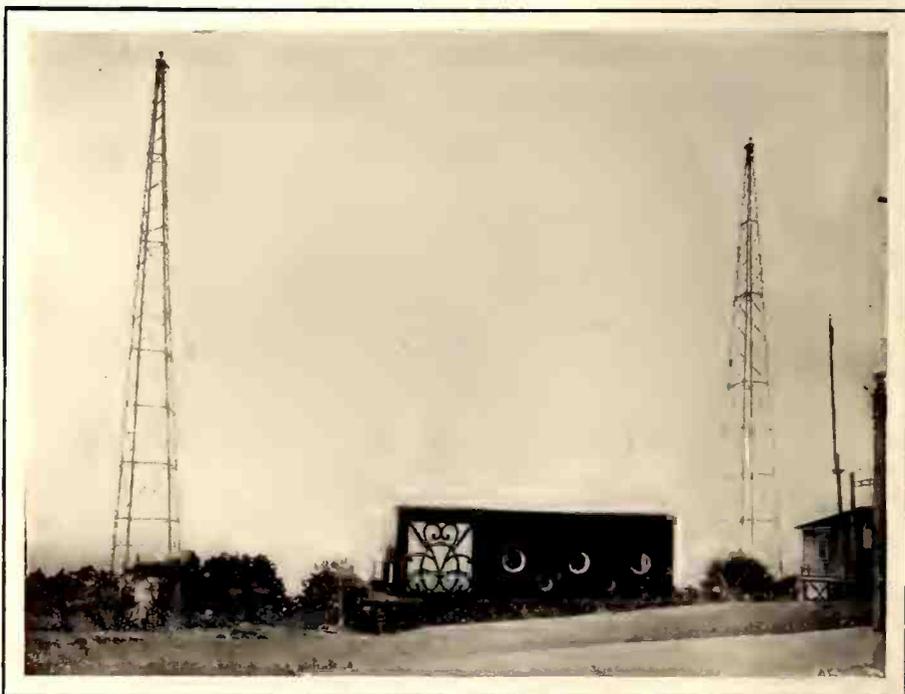
Mr. Smith's article follows:

The radio industry, which handled \$450,000,000 in merchandise last year, has turned on its loud speaker in a concerted protest against the published statement of Thomas A. Edison that "There isn't 10 per cent of the interest in radio that there was last year."

Mr. Edison also was quoted in a Chicago newspaper as saying that dealers are abandoning the handling of radio sets because they have been unable to make money on them.

Chicago has been called the center of the American radio industry. Manufacturers of complete radio receivers, of radio accessories and of materials for the making of radio sets are grouped in large numbers in the Chicago territory.

From the leaders of this important commercial group The Herald and Examiner yesterday received a broadside of facts to controvert the surprising statements of Mr.



Designed to represent the Freshman Masterpiece, the studio of Station WPAP, located at the Palisades Amusement Park, New Jersey, is quite novel. The antenna is shown above the studio building

Edison. The consensus was that radio is not only more than holding its own against the record of last year, but that it is to have the biggest and most successful year in history.

This opinion was backed up by hard facts taken from the business books of radio manufacturers showing greatly increased production and the employment in some cases of more people than were engaged during the peak of the radio season last December.

Public Interest Widens.

Within the radio department of The Herald and Examiner facts were obtainable which supported the view of radio manufacturers. It probably will surprise the fans themselves to learn that the radio service department of The Herald and Examiner answered 57,000 individual inquiries about radio construction during 1925.

During the first eight months of the current year the department has answered 15,923 letters. A total of 31,000 circuit diagrams have been mailed to other readers, making a total of 46,923. This indicates that the peak total of 57,000 replies last year will be exceeded by a considerable margin.

Following are some of the reports submitted to The Herald and Examiner by manufacturers of radio sets, parts and miscellaneous equipment:

Thordarson Electric Manufacturing Company, makers of transformers, eliminators and power amplifiers: "The radio manufacturers and individual consumers using our product have created an early demand which has required us to run our factories twenty-four hours a day for the last six weeks. We expect the rush to continue this season until January or even into February, whereas last year the production began to fall off in November. Nevertheless, manufacturers are somewhat conservative this year in production and they are producing better stuff."

Fred G. Parker, executive head of the Chicago offices of the Radio Corporation of America: "According to our figures, Mr. Edison seems, indeed, to be sadly misinformed. The Radio Corporation is basing its production activities upon an estimate which must be a conservative one, that 1,250,000 sets, of all makes, will be sold this year. For the last four years, the average gain from year to year has been 35 per cent. Therefore we do not look for a decrease this year."

Carter Radio Company, manufacturers of plugs, jacks and other essential parts for radio sets: "We are employing more people now than we had on our payroll at the peak of last season. We have more unfilled orders than at any time in our history. We have doubled our factory space, but still it is not large enough to handle the production. This is to be radio's biggest year."

Belden Manufacturing Company, makers of wire and cables for radio: "Orders now on our books show, conservatively, a 20 per cent increase over last year. Our relations with radio manufacturers indicate that radio interest this season will be materially greater than it was last year."

A. A. Howard, president of the Howard Radio Company: "I expect the value of the radio output this year to be appreciably in excess of what it was last year, which is the biggest year radio has had thus far. I have on my desk now a sheaf of telegrams from today and one from yesterday that we have been unable to pay any attention to because we are more than a month behind our orders. The greatest problem that confronts us is how many radio sets we shall be able to turn out. There are orders enough in the house now to keep us busy for the remainder of the radio year. We are working our plant day and night and are still more than a month behind our orders."

U. J. Hermann, managing director of the Chicago and New York Radio Shows wired Mr. Smith as follows:—

"Won't you please ask Thomas A. Edison how he enjoyed listening to the Dempsey-Tunney fight on a phonograph?"

PROVED!

Los Angeles, Calif.
Ferbend Electric Co.,
Dear Sirs: No doubt you will be interested to know that we have installed your "B" Eliminator on eight different eight tube Super-Heterodynes, and that every one is giving complete satisfaction.
(Signed)
NATIONAL ELECTRIC CO.

Hawkesbury, Ont., Canada.
Ferbend Electric Co.,
Gentlemen: I am pleased to inform you that I received the FERBEND "B" Eliminator and after giving it a fair trial am glad to say it has exceeded all my expectations. I must say it was money well spent.
(Signed)
Will Dooley.

Naugatuck, Conn.
Ferbend Electric Co.,
Gentlemen: My FERBEND "B" Eliminator has been doing fine work since last December. After seven months' use will say that I am very well pleased with it.
(Signed) Frank S. Lohdell.

Lincoln, Nehr.
Ferbend Electric Co.,
Dear Sirs: I have found your "B" Eliminator to be very satisfactory and the results obtained were even better than the more expensive — which I had been using, as it was free from all hum. I also found that it made the reproduction through the loud speaker fully 50% clearer. I am more than satisfied with the machine.
(Signed) H. W. Bradley.



\$12.50

COMPLETE
nothing else to buy
Replaces "B" Batteries. Operates Direct from Electric Light Socket.

~ FERBEND ~ "B" ELIMINATOR

Many careful buyers choose to adopt a policy of "watchful waiting." This is often true in the purchase of an apparently better, but yet-to-be-proved, automobile. The same holds good for many other commodities. And Radio. With the original announcement of the good Ferbend "B" Eliminator and its amazing low price of \$12.50, many there were who chose to wait. They wanted to be convinced. True, thousands bought at the start and they are the ones who now tell you what to expect. Lack of space alone prevents us from publishing the hundreds of fine testimonials from satisfied users. They are all in our files open to public inspection at any time. A few reproduced here.

The Ferbend "B" Eliminator successfully passed the rigid Laboratory tests of Radio News, Popular Radio and Radio Broadcast. It is a Proved Radio necessity, and a great one.

Ask Your Dealer—or Send Direct

If you prefer, we will make shipment direct to you upon receipt of price, or C. O. D., if desired. Use for 10 days to convince yourself—if unsatisfactory, write us within that time and purchase price will be refunded. Use the coupon now.

Ferbend Electric Co., 431 W. Superior St., Chicago, Ill.

FERBEND
Wave Trap

This Company also manufactures the famous Ferbend WAVE TRAP—the instrument which has been widely imitated but never equaled. It is the only original and genuine. Priced at

\$8.50

MAIL THIS COUPON TO-DAY!

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Send at once. Payment enclosed Send C. O. D. Send Literature

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LOUD SPEAKER**

A three-foot cone speaker—unit developed by the inventor of the Tropadyne. Easily assembled, saving 80% of the cost. Complete Kit with blue prints sold on rigid money-back guarantee — shipped prepaid or C. O. D.—
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FOR THE
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Super 9 and 10**

Send for free catalog of all the parts needed for these marvelous receivers that have made four world's records. We have in stock complete sets of the exact parts used by the designer in his original receiver. Verification of records sent upon request. Write today!

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319 Crilly Bldg. Chicago

MICADON 640A
Capacities:
.006 to .02 mfd's
Price
\$1.00 to \$1.95

METALEAK
15,000 ohms to
200,000 ohms
75¢ each
.25 meg. to 5 meg.
50¢ each

tone reality
need not be
expensive

You don't need an expensive set to get faithful reproduction. Resistance coupling given even amplification of all tones. And it has the added advantage of costing little, and consuming less "B" battery current.

Micadon 640 A is the Dubilier resistance coupling unit. It is a fixed condenser of the famous Micadon type, designed and patented by Dubilier to provide unvarying capacity with the lowest dielectric loss—so essential for the true reproduction of sound.

Used with the silent Dubilier Metaleak, Micadon 640 A will give you the foundation for an amplifier unit with all the tone quality found in the best radio sets.

Send 10c for our booklet showing fourteen ways to improve your set with simple applications of fixed condensers.

Dubilier
CONDENSER AND RADIO CORPORATION

Radio in Wilds Aids Rail Work
RADIO sets, steam shovels and dynamite helped to put through on time the largest railroad construction job of the decade, completion of which is now being celebrated throughout Oregon, according to Geo. W. Boschke, chief engineer for Southern Pacific Company. During the past three years more than 70 radio sets were in constant use in isolated construction camps along the route of the new \$39,000,000 main line built to shorten the distance between San Francisco and Portland, and to open many thousands of acres of valuable timber and farm lands to development and settlement. Each camp possessed from one to eight powerful radio sets.

"Throughout the summer and fall of 1924," Boschke said, "an average of 3,000 men lived and worked in the depths of the wilderness penetrated by the new line and radio was a principal source of entertainment. In some camps rough dance floors were built and the men danced nightly to music of orchestras playing anywhere from San Francisco to New York. Radio brought the most remote camp into instant contact with the news of the world.

One Man Orchestra



Obey Pickard, known to listeners of WSM at Nashville, as the "One Man Orchestra"



Ruggedness!

Sturdy as the evergreens of the mountain slopes, the Durham Metallized Resistor is built like them to endure the stress of changing atmospheric conditions. Noiseless, and permanent in resistance value.

10 meg. to 500 ohms, from 50 cts. to \$1.00

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METALLIZED
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World STORAGE BATTERIES at Cost!

LIMITED TIME OFFER!

For a limited time only, genuine World Storage Batteries can be gotten at actual cost. Every cent of profit has been cut out in order to keep our full factory organization busy during the slack season. Prices below are lowest in history.

World Batteries are nationally known for dependable, long wearing performance. Solid Rubber Case prevents acid and leakage.

Send No Money!

Just state battery wanted and we will ship same day order is received, by Express C. O. D. subject to examination on arrival. 5% discount for cash in full with order. Send your order now and get your World Batteries at actual manufacturing cost.

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1219 So. Wabash Avenue
Chicago, Ill.
Dept. 36

Solid Rubber Case
Radio Batteries
6-Volt, 100-Ampere \$10.50
6-Volt, 120-Ampere \$12.50
6-Volt, 140-Ampere \$18.25

Set your Radio Dial for the new 1000 w. World Storage Battery Station W 5 B C, Chicago. Interesting programs every night.

2-Year Guarantee Bond in Writing
Approved and Listed as Standard by Leading Authorities

including Radio News Laboratories, Popular Science Institute of Standards, Popular Radio Laboratories, Radio Broadcast Laboratories, Radio in The Home, and Lefax, Inc.

Solid Rubber Case Auto Batteries
6 - Volt, 11 - Plate \$10.50
6 - Volt, 13 - Plate \$12.50
12 - Volt, 7 - Plate \$16.25

KDKA WSCB WEAF KYW



\$132.50 F. O. B. Chicago. Ozarka Senior 5 Tube Model complete with Loud Speaker and all accessories. Also built in a 7 Tube Model



\$100 F. O. B. Chicago. Ozarka Junior 5 Tube Model complete with built-in speaker and all accessories.



\$215 F. O. B. Chicago. Ozarka Console 5 Tube Model, solid walnut cabinet, complete with all accessories. Also built in a 7 Tube Model

Many will Start ~ But Few can Finish

IN the development of the radio industry, many have started but only those will finish who are building on a foundation of service which will stand.

IT is one thing to sell a radio instrument but quite a different matter to keep that instrument working perfectly in your home. Any new radio should deliver satisfaction but only trained service will keep it doing so—

In the rapid development of the radio industry the demand has been, in the past, generally more than the supply. It is only natural that little, if any, attention should have been paid to the one most vital requirement—trained service.

Four years ago Ozarka Inc. recognized the necessity of service—trained service, with the result, that now we have a trained service organization of 4364 men. One of these men is near you, ready and willing to deliver Ozarka service.

These men are not radio wonders who know all about all radio instruments. They make no claim to be able to service any radio

instrument but they do know the Ozarka perfectly.

Radio is no different to any other mechanical device—sometimes little things will go wrong, serious to the owner, but very easily and quickly repaired by a trained service man who knows that instrument as he should.

In the mad rush of selling radio very little, if any, attention has been paid to service. A trained service organization requires time to develop and train—it has taken us four years to train 4364 men, who today constitute the Ozarka service organization.

Ozarka instruments are only sold by these trained service men by demonstration in your home—the only place where you can decide what a radio should do.

The Ozarka representative will gladly set up an Ozarka in your home. He will not operate it but let you do all the tuning. Only in this manner can you decide if its tone, volume and ease of tuning is what you expect of a radio. Bring in station after station until you satisfy yourself of what it will do for distance. then discuss with him the most important matter of all—service—trained radio service.

We have a few Openings for the Right Men

WHILE there are today 4364 Ozarka representatives, some territory is still open. We want men who believe in the future of radio—men who are tired of working for some one else—men who would like to add to their present income by devoting their evenings to Ozarka.

At the start you can keep your present position. Later on, after you have proven what you can do, then you will give us all your time because it will pay far more than your present position.

The man we want may not have much money but he is not broke. He has lived in his community for some time—be has a reputation that his word is good. He may not have made any startling success but he has never "put over something" just to make money. He may know nothing about radio or salesmanship but he will be successful if he is willing to study what we are willing to teach him, without cost.

The field in radio is wide open for the trained man. The success of the 4364 Ozarka representatives proves what men can do. If you are interested, ask for a copy of the Ozarka Plan, a 100 page book which tells a true story of how big money and a permanent business can be built in radio. It is a story of life; of why some men fail while others succeed. This book has shown many men how to start making extra money immediately and within a very short time establish a business of their own.

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INCORPORATED

120 Austin Avenue B

CHICAGO, ILL.



From
Atlantic to Pacific
From
Canada to South America



Registered U. S. Pat. Off.

TRANSFORMERS Have Made Finer Radio Reception Possible

These improved transformers assure selection of radio programs at choice, regardless of broadcast conditions. They combine tremendous power with an unexcelled purity of tone and amplify the weakest signals to full loud speaker volume. They operate with all types of standard tubes. Unsurpassed for quality, clarity and volume.

Praised Endorsed-Approved

H. F. L. Units have been heartily endorsed by such leading Radio Authorities as Radio News—Citizen's Radio Call Book—and Radio Age.

H. F. L. Users Write: "Picked up Rome, Italy, from Evanston. Also Aberdeen and Edinburgh." "Lima, Peru, came in on my H. F. L. Receiver with full loudspeaker volume." "Get coast to coast from Chicago regularly using H. F. L. Units."

PRICES

H. 210 Iron core transformers with an exceptionally high amplification factor. Each unit carries laboratory calibration. Range 32,000 to 42,000 cycles. Price \$8.00.

H. 215 Air core transformer, tuned stage, designed to amplify signals at a maximum efficiency of 37,000 cycles. Each unit carries the laboratory calibration. Price \$8.00.

F. 320 Audio frequency transformer which will amplify signals to greatest volume with incomparable faithfulness of tone. These units are the result of an entirely new principle in transformer construction. Price \$3.00

L. 425 Radio Frequency Choke Unit. Price \$5.50

L. 430 Low Loss Radio Frequency Transformer. Price \$3.50

Jobbers Write Dealers Today

Try H. F. L. Units for Better Results
If your Dealer cannot supply you order direct.

HIGH FREQUENCY LABORATORIES

133 N. Wells Street
Chicago Illinois

Abox is Real Filter



A BATTERY elimination has arrived with a bang if recent tests conducted in the Radio Age laboratory are any criterion. The new device, as developed by E. F. Andrews (of Deresnadyne fame) and Laurens Hammond, both of Chicago, comprises a filter and a choke, the former being the work of Mr. Andrews on which patents are now pending.

The smoother, or filter, as it is called, is attached to the output end of a tube charger (transformer type) or a good electrolytic charger; where it performs enough smoothing and filtering to permit the use of anything from a one to ten tube set to be operated from this source of supply.

Based upon an electro-chemical action on low voltage work the condenser invented by Mr. Andrews has a capacity of about a thousand microfarads per square inch. The Abox filter has approximately 20 square inches of active surface so the value of capacity must run quite high.

Lack of space prevents going fully into the new design, which is now on the market. However extensive tests in Radio Age laboratory have been made with the filter running off a Tungar charger without any hum. Receivers from one to ten tubes, including the superheterodyne, were operated on loud speaker, and excellent quality reception secured.

The Abox is illustrated above.

TRANSMITTING APPARATUS

In addition to our regular broadcast apparatus we carry a very good stock of transformers, chokes, grid leaks, high test condensers, etc., for transmitting purposes.

We will shortly issue our new catalog and we quote discounts to dealers or set builders who can give satisfactory buying references. Please address us on your regular letterhead.

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12 Cells 24 Volts
Lasts Indefinitely — Pays for Itself

Dependable. Quiet "B" power, clear without "hum." Economy you have never before thought possible. Convenience. Outstanding performance. Recharged for almost nothing. Solid rubber case insures against leakage or acid. Extra heavy glass jars. Heavy rugged plates. Approved and listed as standard by Pop.

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Extra Offer: 4 Batteries in series (96 Volts) \$10.50.

SEND NO MONEY! just state number of batteries day order is received. Pay expressman after examining batteries 5 per cent discount for cash with order. Send your order today—NOW!

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Makers of the Famous World Radio "A" Storage Battery
Prices: 6-volt, 100 Amp. \$10.50; 120 Amp. \$12.50; 140 Amp. \$13.25.
All equipped with Solid Rubber Case.

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Set your Radio Dials for the new 1000-watt World Storage Battery Station. WSRB, Chicago. Always something interesting.

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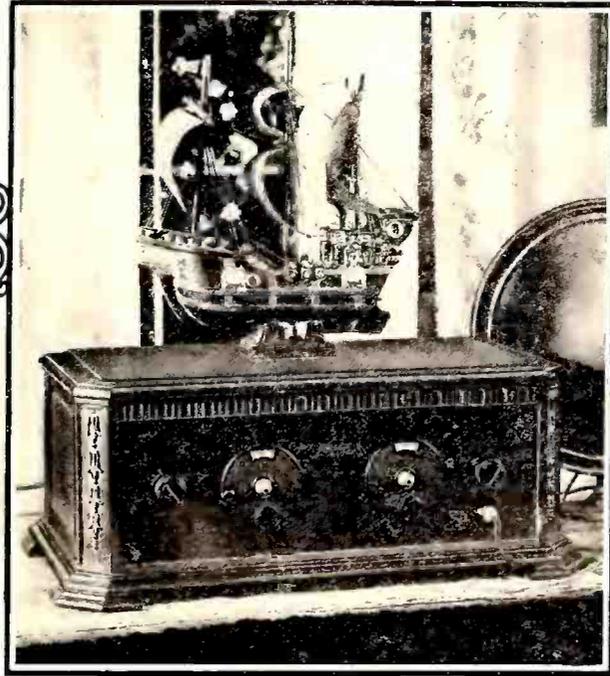


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"How To Build It" Book

Complete instructions for assembling, wiring and operating the Hammarlund-Roberts Hi-Q Receiver. Prepared under the direction of the Engineer-designers.

25c

\$63.⁰⁵

Complete Parts (less cabinet)

Automatic Variable Coupling—same control operates tuning condenser and primary coil coupling simultaneously, gives maximum and equal amplification and selectivity over entire tuning range.

Stage Shielding—prevents coupling between stages, preventing oscillations and increasing selectivity. Clarifies reception.

Hi-Q Foundation Unit



Includes drilled and engraved Micarta Bakelite panel, drilled Bakelite sub panel, two complete shields, extension shaft, two equalized fixed Resistances, hardware, wire, nuts, and screws,

\$10.⁵⁰

Associate Manufacturers

- Carter Radio Co.
- Martin-Copeland Co.
- Radiall Company
- Samson Electric Co.
- Sangamo Electric Co.
- Benjamin Electric Mfg. Co.
- Eby Manufacturing Co.
- Hammarlund Mfg. Co.
- Durham Resistors
- Westinghouse Micarta

Hammarlund-Roberts Performance Means A New Measure For All Radio

THE Hammarlund-Roberts Hi-Q is an outstanding example of scientific radio engineering. No ordinary standards of tone, selectivity or volume, can be applied to this new receiver.

In designing this Hi-Q Receiver, the Hammarlund-Roberts Board of Engineers representing twelve nationally known manufacturers, had at their disposal the finest experimental laboratories—and no handicap in building to establish specifications or to a set price.

This concentration of the leaders in the perfection of one radio Receiver has developed entirely new features that produce results unknown to the average radio man. The automatic variable coupling gives maximum and equal amplification and selectivity over the entire tuning range. Stage shielding eliminates coupling between stages and prevents oscillation and increasing selectivity. Two dial control simplifies tuning.

ANYONE CAN BUILD THE HAMMARLUND-ROBERTS HI-Q.

All the research, the selection of parts, the exact placing of units, has been worked out in advance for you. And you have a receiver that will equal an eight-tube set—simplicity of design and operation hitherto unthought of—all at less than half the price you would pay for a factory made set of anywhere near equal efficiency.



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We guarantee that SELEGTONES will improve the performance of any receiver using Long Wave Transformers. Try them in your set. If they do not prove far superior to any transformer you have ever used, return them and your money will be refunded. Price each, \$6.00.

DESIGNED

By E. H. Scott, and used in his famous Worlds Record Super Nine. Every Selectone Transformer is perfectly matched to within one turn. They assure greater selectivity and high amplification with perfect tone quality.

SELEGTONE Untuned Transformer—R400—has specially designed closed iron core, which limits interstage coupling and is impregnated in a vacuum so that all characteristics of coil remain constant. The coil design gives an extremely high amplification. Can be used in any circuit requiring a long wave transformer.

Either 199 or 201A Tubes Can Be Used SELEGTONE Tuned Stage Transformer—R410—is air core. Each transformer is matched to within one turn before sealing in case. The matching of these filters is so perfect that where extreme selectivity is desired, two can be used and are guaranteed to match perfectly. This is an exclusive SELEGTONE feature.

FREE Send for illustrated literature describing Selectone Transformers and the tests they undergo.

RESPONSIBLE DISTRIBUTORS—We still have some desirable territory available. Write or wire today.
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Run ANY set, ANY number of ANY type tubes from 110 volt A. C. No hum. Easily done with NEW TYPE ELIMINATOR quickly made for few dollars from STANDARD parts. No liquids. No salts. NO TRICKLE CHARGER! No battery of any kind. Gives perfect "A" and "B" current in any quantity. Nothing like it. Dollar bill brings detailed blue prints and instructions that assure perfect results.
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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.

Of RADIO AGE, published monthly at Mount Morris, Illinois, for October, 1926.
State of Illinois, } ss.
County of Cook

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Frederick A. Smith, who, having been duly sworn according to law, deposes and says that he is the President of the RADIO AGE, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, RADIO AGE, Inc., F. A. Smith, President, 500 N. Dearborn St., Chicago, Ill.; Editor, Frederick A. Smith, 500 N. Dearborn St., Chicago, Ill.; Managing Editor, Frederick A. Smith, 500 N. Dearborn St., Chicago, Ill.; Business Manager, M. B. Smith, 500 N. Dearborn St., Chicago, Ill.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) RADIO AGE, Inc., 500 N. Dearborn St., Chicago, Illinois; Frederick A. Smith, 500 N. Dearborn St., Chicago, Illinois; M. B. Smith, 500 N. Dearborn St., Chicago, Illinois; J. H. Lohbeck, 6429 Cates Ave., St. Louis, Mo.

3. That the known bondholders, mortgages, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is..... (This information is required from daily publications only.)

FREDERICK A. SMITH,
Editor.

Sworn to and subscribed before me this 21st day of September 1926.

(SEAL) AMANDA FRIIS.
(My commission expires Mar. 5, 1929.)

AUDIO FREE AMPLIFICATION

The four types thoroughly explained in a fully illustrated booklet 9" x 12". This book will be sent to you absolutely FREE if you will send me six cents in stamps to cover cost of handling and postage.

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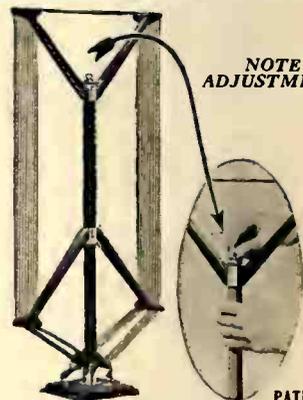


NEW
DRUM
TYPE

\$30.

Just as the amorous nobles of old Spain, France and Italy charmed a continent with their hauntingly beautiful music and poetry—so has the marvelous reproduction of the TROUBADOUR impressed itself upon the Radio World of today. It is Music and Song and Poetry unaltered, undistorted—true. Distinctively artistic in design, body finished in rich walnut brown, base and faces in dull black Morocco leather finish. Troubadour's weight of 11 pounds is absolute assurance against vibration, while Quali-Tone's advanced construction results in a new quality of reproduction—that amazes listeners by its depth, resonance and purity. Height, 16 1/4 inches, Diameter 13 1/2 inches, Depth 5 1/2 inches..... \$30.

SEND for literature describing Quali-Tone's complete line, which includes the Junior Speaker—\$7.50, Quali-Tone No. 2 Speaker—\$10., Quali-Tone No. 3—\$15 Quali-Tone No. 4—\$25 and Quali-Tone Radio Units at \$6 and \$7.50.



NOTE
ADJUSTMENT!

8,000 MILE RECORD

The Quali-Tone Loop pictured above holds two World's Records for distant reception, having brought in stations 8,000 miles away. Write for verification of these records. Exclusive Thumb-screw Adjustment keeps wires taut always. Guaranteed to improve the reception of any receiver..... Price \$10

DEALERS Write for discounts. JOBBERS Send for circulars.
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Free Mailing Lists
Will help you increase sales
Send for FREE catalog giving complete and prices on thousands of classified names of your best prospective customers—National, State and Local—Individuals, Professionals, Business Cooperatives.
99% Guaranteed 5¢ each
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Radio, the wonder of all ages, has grown with gigantic strides. Radio experts are needed to keep pace with the growth. Thousands of good-paying positions are open to trained men. Be a radio expert—earn big money—travel—get into the limelight. There's romance, power and fortune ahead for men with vision now just as there was when Henry Ford got started on his auto. The great opportunity is here.
YOU EARN WHILE YOU LEARN
Our home-study course in practical radio can be mastered by you in 3 months. Become a radio expert. Write for free booklet "Millions Unattached."
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DAYS
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7 Tube Set Single Dial Radio



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ONLY ONE DIAL TO TUNE

Retail Price
\$75
Completely Assembled
Big Discounts
to Agents and Dealers

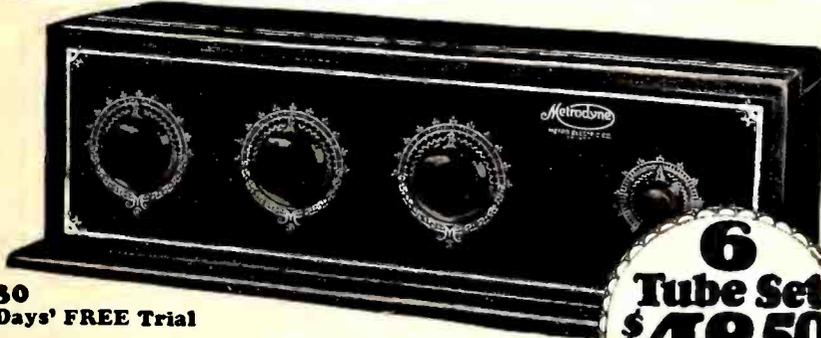
Wonderful offer direct from the factory! The world's greatest radio. A perfect working, single dial control, 7 tube receiver. And just to prove our claims, we will ship it to your home for **30 days' free trial**. Test it under all conditions. Test it for distance, volume and tonal quality—and if you are not convinced that it is the best single dial set you ever heard, return it to the factory. We don't want your money unless you are completely satisfied.

**BIG PROFITS
TO AGENTS AND DEALERS**
Our Agents and Dealers make big money selling Metrodyne Sets. You can work all or part time. Demonstrate the superiority of Metrodynes right in your home. Metrodyne Radios have no competition. Lowest wholesale prices. Demonstrating set on 30 days' free trial. Greatest money-making opportunity. Send coupon below—or a letter—for our agent's proposition.

Metrodyne Super-Seven Radio

A single dial control, 7 tube, tuned radio frequency set. Approved by America's leading radio engineers. Designed and built by radio experts. Only the highest quality low loss parts are used. Magnificent, two-tone walnut cabinet. Artistically gilded genuine Bakelite panel, nicked piano hinge and cover support. All exposed metal parts are beautifully finished in 24-k gold.

Easiest set to operate. Only one small knob tunes in all stations. The dial is electrically lighted so that you can log stations in the dark. The volume control regulates the reception from a faint whisper to thunderous volume, 1,000 to 3,000 miles on loud speaker! The Metrodyne Super-Seven is a beautiful and efficient receiver, and we are so sure that you will be delighted with it, that we make this liberal **30 days' free trial offer**. You to be the judge.



**30
Days' FREE Trial**

Metrodyne Super-Six

Another triumph in radio. Here's the new 1927 model Metrodyne 6 tube long distance tuned radio frequency receiving set. Approved by leading radio engineers of America. Highest grade low loss parts, completely assembled in a beautiful walnut cabinet. Easy to operate. Dials easily logged. Tune in your favorite station instantly on same dial readings every time. No guessing.

Mr. Howard, of Chicago, said: "While five Chicago broadcasting stations were on the air I tuned in seventeen out-of-town stations, including New York and San Francisco, on my loud speaker horn, very loud and clear, as though they were all in Chicago."

We are one of the pioneers of radio. The success of Metrodyne sets is due to our liberal **30 days' free trial offer**, which gives you the opportunity of trying before buying.

**6
Tube Set**
\$48.50
RETAIL PRICE
Completely Assembled

MAIL THIS COUPON
or send a postal or letter. Get our proposition before buying a radio. Deal direct with manufacturer—**Save Money.**

Mail COUPON Below!

Let us send you proof of Metrodyne quality

F. L. Warnock, Greentown, Ind., writes: "I received the Metrodyne in good shape and am more than pleased with it. Got stations 2,000 miles away."

C. J. Walker, Mariposa, Calif., writes: "Received my Metrodyne Single Dial set O. K. I believe that these one-dial sets are going to be excellent sellers. I had no trouble in tuning in stations enough to satisfy anyone, so you will please send me another set."

Roy Bloch, San Francisco, Calif., writes: "Very often we travel from New York to the Hawaiian Islands quickly—from station to station—by means of the little tuning-knob which operates the electrically-lighted dial. The Metrodyne Single Dial Set is much easier to operate than any radio set I've ever seen."

We will send you hundreds of similar letters from owners who acclaim the Metrodyne as the greatest radio set in the world. A postal, letter or the coupon brings complete information, testimonials, wholesale prices, and our liberal **30 days' free trial offer**.

METRO ELECTRIC COMPANY
2161-71 N. California Ave., Dept. 118
Chicago, Illinois

Gentlemen:
Send me full particulars about Metrodyne 6 tube and 7 tube sets and your **30 days' free trial offer**

Name.....
Address.....

If you are interested in AGENT'S proposition, place an "X" in the square

METRO ELECTRIC COMPANY

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You Get it All



With an Austin Aerial

A few advantages of the AUSTIN AERIAL. Increases selectivity. Non-directional. Minimizes interference. Eliminates wires. Easily installed. Guaranteed.

THE TRIANGLE ELECTRIC CO.,
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Payment enclosed.

C. O. D. Send circular.

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Can You

Pick out the program you want, without getting any interference from other nearby stations? Or can you cut out your local stations and get the distant ones? If you want to get the best results from your radio use an

Austin Aerial

Regardless of the kind of reception you are getting, we GUARANTEE the Austin Aerial will improve it. PRICE, \$14.00.

At your dealers, or direct from us. MONEY BACK GUARANTEE.

Manufactured by

**THE TRIANGLE
ELECTRIC CO.**

329 Rex Ave. CANTON, OHIO

How to Use a Power Tube in Your Present Set

(Continued from page 34)

adapt any audio frequency amplifier to the use of the new UX or CX type power tubes are battery feeder changes, and these are few in number. For the most part, the new UX and CX storage battery tubes will fit the old sockets, but in the case of the UX and CX dry cell tubes, it will be found necessary to either use an UX adaptor or change the socket. The latter method is much preferable, costs no more, and is little trouble while one is rewiring. Care should be taken, however, to get the various wires on the proper terminals, as the terminal arrangement on the UX socket is different from that on the old standard UV 199 socket. Since both the old and new sockets are plainly marked with identical letters, this should present no difficulties, it being merely necessary to transfer the wire from "G" on the old socket to "G" on the new socket; transfer the wire from "P" on the old socket to "P" on the new socket; and transfer the filament wires, which are the two remaining ones, regardless of how marked, from the old socket to the new one.

The battery requirements of the new power tubes are shown in the following table, together with those of the standard tubes used in the set, making it easy

**A&B Battery
Charger ONLY \$2**

Satisfaction Guaranteed



Charges any type of storage A or B battery, using a few cents worth of ordinary house current, either alternating or direct. Cannot injure battery. Complete directions enclosed. Anyone can operate. No expensive "extras" to buy. Why pay \$10.00 to \$15.00 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. D-1

308 East Third St., Cincinnati, Ohio

The Melancholy (?) Days Arrive

(Continued from page 16.)

prefer. During the entire four years, Mr. Boisclair's announcer has been L. J. Barnes, and to those who have followed the programs, the two seem inseparable. Mr. Barnes is essentially a technical man, but like many another has had to fill in an emergency, and now combines the two duties to everybody's satisfaction.

The WGY Players is a feature that has become a household word, and while almost every station today features a church service with a convincing preacher, Dr. Bernard C. Clausen of Syracuse, has become nationally famous for the inspiring sermons broadcast each Sunday from WGY.

To sum it all up Schenectady is a mighty dependable broadcaster to tune to week after week, and whatever alarms and bugaboos may arise to worry us in regard to our air entertainment, we feel confident that in this station we can always find an antidote for melancholy days.

AMSCO



GANG CONDENSERS

Amsco engineering has perfected the multiple condenser—made practical, at last, the old ideal of simplified control.

The illustration shows the new Three-Gang Amsco Straight Tuning Line Allocating Condenser.

Ask your dealer or write for leaflet

AMSCO PRODUCTS, INC.
Broome and Lafayette Streets
New York City



CONE UNIT

For use on cones of any size up to 4 feet. Most powerful and efficient made. Sold on rigid money back guarantee.

C. O. D. or Prepaid \$7.50

TUNBAR RADIO CO.
26 Cortland St. New York

to select at a glance the proper tubes and extra batteries for use in your particular set.

Proper "C" battery voltages for the various stages may be obtained either by using separate "C" batteries for each stage, or by tapping off a common battery, as shown in Figures No. 5 and No. 6. There is no great advantage in using separate batteries unless trouble is encountered with feed back between stages, causing howling. This is rare. The size of "C" battery used is not important, as the current drain is negligible, the shelf life of the battery without material voltage drop determining its life when employed in this manner.

The conversion of the circuit shown in Figure No. 2 to that of Figure No. 4 is accomplished in the following simple manner. The wire running from the "F" or "A" or "C" post on the last stage audio transformer (the transformer feeding into the last tube before the loud speaker) to the "-4½ volt C" binding post or cable wire is removed and replaced with a wire running from the above mentioned transformer terminal to either the "-22½ volt C" or the "-9 volt C" battery post, depending on what type of tube is being used. The wire running to the "-4½ volt C" battery from the first audio transformer is not to be disturbed. The wire running from the "+90 volt B" battery to one of the loud speaker terminals is next disconnected from the battery, an extra forty-five volt block of "B" battery is connected in series with the existing ninety volt battery, and the wire from the loud speaker which has just been disconnected from the ninety volt "B" battery terminal is now run to the one hundred thirty-five volt terminal thus formed, usually designated "+135 volt B." The wire running from the first stage transformer to the "+90 volt B" terminal is not to be changed. That's all there is to it, except for inserting the tube and turning on the "juice."

Should the circuit which it is desired to convert to that represented in Figure No. 4 be that



Until Your Set—

—is voltmeter controlled you will not know its power to perform.

Careful set owners invariably run their radio tubes much below their rated filament voltages in fear of injuring them.

Radio tubes all have a very critical voltage requirement. A 15% reduction in filament voltage simply means a 60% reduction in set efficiency. The only way to know filament voltage is to check it with a voltmeter.

Jewell has both portable and panel mounting voltmeters in many styles. Send for new Radio Instrument catalog No. 15-C.

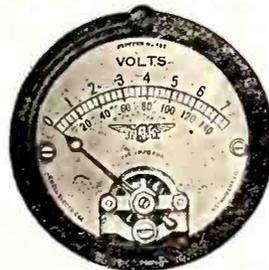
JEWELL ELECTRICAL INSTRUMENT CO.

1650 Walnut St., Chicago

"Twenty-six Years Making Good Instruments"



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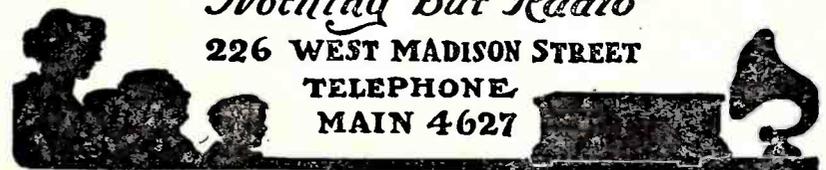
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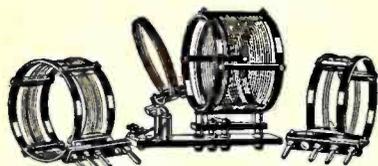
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Replace your present inductances with this Aero Coil Tuned Radio Frequency Kit. It will positively improve the performance of your receiver. Special patented Aero Coil construction eliminates radio frequency losses. You will notice instantly, a tremendous improvement in volume, tone and selectivity.

This kit consists of three matched units. The antenna coupler has a variable primary. Uses .00035 condenser. Coils are uniformly air spaced. No dope is used. Consequently they tune into resonance on a "knife's edge."

FREE with each kit

Eight page color circuit, layout and instruction sheet for building the super-sensitive 5 tube Aero-Dyne Receiver packed with each kit. Extra copies, 75 cents each. Get yours TODAY from your nearest dealer.

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Resistance-Coupled
PERFECT AUDIO AMPLIFIER



Provides audio amplification with minimum distortion. Bradley unit molded resistors used in the Bradley-Amplifier do not vary with age and are not affected by atmospheric conditions. Can be used to replace transformer amplifiers in standard radio sets with decided increase in tone quality.

Allen-Bradley Co.

Electric Controlling Apparatus

289 Greenfield Avenue Milwaukee, Wis.

shown in Figure No. 1, the procedure is slightly different, it being necessary to change one more wire, and to insert a "C" battery. This may be accomplished in the following easy way. The wires running from the "F" or "-A" or "-C" terminals on both transformers to the negative filament battery binding post, usually designated "-A" are removed, and the positive or "+" terminal of the "C" battery to be used is connected to the "-A" binding post. A wire is now run from the above mentioned transformer post or terminal on the first stage audio transformer to the "-4½ volt C" battery terminal. Another wire is connected from the same binding post or terminal lug on the last stage audio transformer to either the "-9 volt C" or the "-22½ volt C" battery post.

In both amplifiers described above, it will probably be found necessary to slightly advance the controlling rheostat to compensate for the increased current flow caused by the power tube filament. If Amperites or other ballast resistors are employed for tube control in the set under discussion, the one controlling the last audio tube must be replaced with one of the proper capacity. If a single ballast resistor is used for controlling a group of tubes, the next larger size must be used. For instance if the group controlled by one resistor and containing the power tube contains three tubes in all, a resistor designed for controlling four standard tubes is proper.

The insertion of a power tube in the last audio stage of your set will not only give increased capacity for volume, but will result in a better, smoother tone due to the lack of distortion which always occurs with the overloading of a tube, regardless of how slight the overload may be. If, however, you should try to use a power tube without the above outlined proper battery connections, you would find that it gave little or no improvement, and that due to insufficient grid biasing, your "B" batteries veritably melted away!



FULL VOLTAGE

Under Any Load

with

Burns

"B" BATTERY ELIMINATOR

Smooth constant plate current with ample reserve powers for set of any number of tubes. Operates from house lighting system, using Raytheon tube. First cost the only expense.

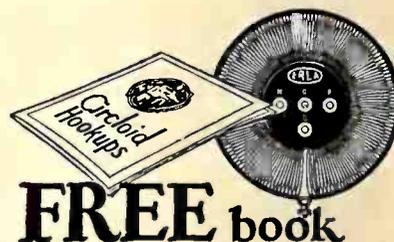
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Science has discovered a new principle in radio amplification . . . a striking new development that is bringing unheard of results. This principle is founded upon a new kind of coil—the Erla Balloon Circloid. It brings 4 distinct improvements. These are explained in a fascinating book just published and being mailed free.

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Get this book and read about this newest scientific radio principle. See the many different circuits in which it may be used. Find out how you can turn your present set into the latest example of radio engineering—and at a remarkably small cost. There are only a limited number of these books, so you must write immediately.

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Let me show you how 4364 men, without experience add \$25 to \$75 weekly to their income without giving up their present position.
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Build a Better Set Than You Can Buy

HENRY-LYFORD is the new 1927 circuit that everybody at the New York Radio Exposition talked about and is endorsed by all the leading radio magazines; read about it in this magazine. This NEW circuit with a wide wave length of from 37 to 550 meters permits you to tune in where the ordinary receiver NEVER GETS.

The Outstanding Circuit of the Year

HENRY-LYFORD RECEIVER

With the Deliberately Unbalanced Circuit

This new unbalanced feature gives a tremendous increase in sensitivity without losing selectivity, and its simplicity of construction is such that any one can build the Henry-Lyford and everyone should, for it is really a wonderful and beautiful receiver. Its high and low wave length range permits you to hear the North Pole expeditions, government stations and amateurs, a tuning feature not obtainable with the average circuit.

A SIMPLE CIRCUIT—EASY TO BUILD

Simple instructions are furnished with each complete set of parts and all you need is a screw driver, soldering iron and a pair of pliers.

COMPLETE LIST OF STANDARD PARTS

1 Bakelite Panel, 7x24, drilled and engraved	\$ 5.25	2 Thordarson audio transformers, type R-200.....	16.00
1 Bakelite sub-panel, drilled, with 5 Benjamin sockets mtd.....	5.75	5 Tobe Deutschmann 1 mfd. fixed condensers.....	4.50
2 Precise 350 mmfd. variable condensers, type 845.....	9.00	1 Micamold .002 mfd. permanent condenser.....	.40
1 Precise 55 mmfd. variable condenser, type 940.....	1.50	1 Micamold .001 mfd. permanent condenser.....	.40
1 Centralab modulator, type 500M.....	2.00	3 Amperites, type 112.....	3.30
1 Carter "Imp" filament switch.....	.65	10 Coil mounting jacks.....	1.25
1 Carter No. 102a jack.....	.70	1 Pair of Benjamin brackets, type 8629.....	.70
1 Carter No. 103 jack.....	.80	1 Sub-panel supporting post.....	.20
1 University antenna coupling transformer, type B-1.....	4.50	2 Eby binding posts marked ANT., GND.....	.30
1 University radio frequency transformer, type B-2.....	5.50	2 4-in. Kurz Kasch dials, 100 to 0.....	1.50
1 University tuned radio frequency transformer type B-3.....	3.50	1 8-wire battery cable.....	1.10
		1 Coil of Belden hook-up wire.....	.40
		1 Complete set of hardware.....	.30

DEALER'S CATALOG on request

Complete parts carefully packed and fully guaranteed **\$69.50**

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THE naval radio station at Brownsville, Texas, may become the "central" through which will be cleared communications between the United States and Mexican and Central American points, if experiments conducted by the Navy Department prove successful.

Tests conducted with the U. S. S. Henderson indicated that the Brownsville station can furnish good communication to ships in the area between Cape Mala, Panama Republic, and Cape San Lucas, Lower California, Mexico it was reported. Ships in that area have often complained of inability to receive Balboa or San Diego, and it is believed that Brownsville would be a good station to take their messages, as well as those from ships in the Gulf of Mexico.

CHELSEA

Send for the latest folders on our new 3, 5, 6 and 7 Tubes Sets, \$26 and up.

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One of the Oldest Established Radio Manufacturers

No Change in Wiring ~ with the adapted Mogul 5 VCX Power Tube



ONE USER SAYS

"Let me congratulate you on the splendid performance of the Adapted Mogul 5 VCX Power Amplifier Tube. I found that these tubes give remarkable amplification and clarity. The tube actually gives considerable increase in volume when used without additional voltage or grid bias, but when 135 volts is applied to the plate the volume is virtually doubled."

THIS unusual tube in your set brings you closer to natural reception than any addition you can make.

Realistic reception—greater volume—fullness of tone—all this the Mogul 5 VCX brings from your set—without a change in set wiring. Order one from your dealer today—and find out about other Van Horne tubes that will improve your reception.

The Van Horne Co., Inc.
102 Center Street, Franklin, Ohio

Set users—who are not satisfied with ordinary reception are equipping their sets throughout with Van Horne Tubes. They are made in a number of types for all receiving purposes, every tube being unconditionally guaranteed. Ask your dealer about Van Horne Tubes or write for descriptive matter.

There's money for you in RADIO



Wonderful opportunity for ambitious men to win success in this fast-growing profession

THE Radio industry is expanding so rapidly that trained men are at a premium. There is a constant, urgent demand for operators — factory superintendents — engineers — service men — designers — salesmen.

There is no better way for you to succeed in this fascinating business than to study the Radio Course of the International Correspondence Schools. This course is new and complete. It was written by practical authorities in this field. It is endorsed by leading radio experts and radio manufacturers.

Mr. R. E. Thompson, president of the R. E. Thompson Manufacturing Company (makers of the famous Thompson Neutrodyne Radio Sets), says:

"I was once a student of the International Correspondence Schools myself and I am familiar with your methods and texts. I recommend them to any young man who is sincerely seeking to improve himself in position and salary."

Quincy J. Workman writes that he has "nearly doubled his salary" since he took up the I. C. S. Radio Course. He is now manager of the Radio Department in a large store.

This same course enabled John M. Paynter to get a position as Radio Operator and Ship's Electrician. Scores of other men in radio factories, laboratories and stores report similar progress.

You, too, can get in on the ground floor if you act quickly. But don't delay too long. Mark and mail the coupon today and let us tell you all about the I. C. S. Radio Course and what it can do for you.

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Without cost or obligation, please send me all the facts about the new I. C. S. course in

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RADIO We want to hear from hard-hitting radio dealers operating live-wire stores who want to make the best jobber connection in America.

DEALERS

Our eight big warehouses furnish you with the finest products in radio. And we ship fast.

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Write today on your letterhead for big catalog of nationally advertised lines.
Ask for L 1008

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Naval Development of Radio Direction Finding Equipment

(Continued from page 12)

During the period when no bearings are being taken, the operators listen in on nearby ships whenever they hear them and check their positions. In this manner more than one ship, which has been steaming along in a fog, has been warned of its approach toward dangerous waters in time to avert disaster.

The efficiency of the U. S. Navy radio compass system is wholly dependent upon the service it gives and in this particular mariners are constantly urged to make use of the service as frequently as they desire.

Though rather skeptical at the advent of the radio compass service, the masters of merchant vessels now fully appreciate the great assistance afforded them by the use of it not only guarding them against possible grounding but avoiding delays due to fogs by guiding them to port. The popularity of the U. S. Navy radio compass and the confidence being placed in it is borne out by noting the continual increase in the number of bearings given.

1919-1920, 16,344; 1920-1921, 53,344; 1921-1922, 93,000; 1922-1923, 120,523; 1923-1924, 138,094; 1924-1925, 137,592 (decrease due to Navy ships); 1925-1926, 184,206.

While radio compass development with regard to ship and shore stations only have been mentioned in the foregoing, radio compass design applicable to aircraft has in like manner kept abreast of the times.

From June, 1916, when steps were first taken to consider radio compasses for aircraft and development in this particular direction started, at the Naval Air Station, Pensacola, up to the present day the use of radio compass in aircraft has steadily increased until today it can safely be said that all the larger planes are equipped with this apparatus.

It is generally conceded that the successful navigation of the Navy plane NC-4 across the Atlantic was due largely to the use of her radio compass in locating

one of the destroyers guarding the line of flight. As has been previously implied, up to the present summer the shore radio stations have been calibrated over the sea area.

Because of the increased activity in the use of Army, Navy and commercial aircraft, the U. S. Navy during the past summer used the dirigible, the U. S. S. LOS ANGELES in calibrating the inland sectors of the shore radio stations located between Otter Cliffs and Cape Hatteras.

It is the same indomitable spirit of determination and "stick-to-it-iveness" handed down from a century ago by the father of the U. S. Navy, John Paul Jones, that actuated the present U. S. Navy in pushing the development of the radio compass as one of the greatest contributions made to the safe navigation of ships at sea, and in the air.



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FREE Write for a complete description of the Peer of all receivers—the World's Record Super 9—the wonder receiver that holds 4 fully verified World's Records for distance. The World's Record Super 9 is one of the few receivers to bring London into Chicago during the last two International Contests. Thousands of testimonials hail the World's Record Super 9 as the marvel of Radio. Write for free list of records and testimonials today!

Easy to Build

You can build an exact duplicate of the original World's Record Super 9 by following our Blue Prints. Building instructions complete in every detail with each set of Blue Prints make it easy for anyone to build this remarkable receiver with perfect success. Complete Building instructions and Blue Prints \$5.00. Remit with order or we will send C. O. D.

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Please send me free literature and verifications of the records made by the World's Record Super 9.

Am enclosing \$5 for Blue Prints, etc.

Send me Blue Prints, etc., C. O. D.

NAME.....

ADDRESS.....

Old Songs Most Popular

Say Carl H. Butman

SURVEYS made by broadcasters indicate that the old-time music is still the most popular, despite the craze for jazz so pronounced in the younger generation. The reason for this may be that the younger fans are all out dancing, or buggy riding, and that the only ones who listen in regularly in the evenings are the older members of the home, who naturally prefer the songs popular in their youth. At any rate, a very large percent of the requests received by stations today come from fans who ask for old-time songs.

A request to WEAf from a man describing himself as "a

common clod hopper of Illinois," requests the song "Somewhere a voice is calling" to be rendered on his birthday if possible. A Baltimore woman wrote WRC that she liked the old songs best and gave the names of some her mother sang to her eighty years ago. Some of the correspondents who wrote to WGN requested songs which they used to sing themselves or heard sung by stars of the opera in their early days. Others take the better class of music quite seriously and arrange to listen in every Sunday night, with their lights dimmed and the whole family seated around the receiver. It would appear that there are many of the older listeners who do not care for modern music, especially on Sunday evening and hundreds of the letters sent to the Atwater Kent stars request the classic and semi-classic songs of long ago.

On the other hand, there are still some listeners who object to what they call "Old Chestnuts," preferring some of the numbers which are not sung so frequently, although they do not specify modern music. One writer asks WGN not to let Mr. McQuhae sing "Little Boy Blue," while another fan asks him to repeat it, adding that his children sat about the loud speaker spell-bound the last time. A much punished fan, according to his own letter, objects to having "Ave Maria" sung by any one.

A number of listeners, many of whom are apparently not of American birth make special requests to have songs of foreign origin broadcast. A Welch-American asks for Welch songs, an Irishman asks for the songs of Erin, and fans from Scotland and other countries make similar requests.

SANGAMO
Mica Condensers
in
intermediate
sizes



IMPROVE
TONE
RANGE
AND
VOLUME.

IT IS accuracy, not luck, that makes one receiver sweeter and more powerful than another that is almost its twin. Especially condenser accuracy, for the closer you come to absolute accuracy at these critical parts, the more wonderful your receiver will be. The cost of accurate condensers is small—the effect is immense.

Now you can get Sangamo Mica Condensers in capacities in between the usual stock sizes, so you can build with greater accuracy than ever before. They are guaranteed to be accurate and they always stay accurate, being solidly molded in bakelite. Neither heat, cold, moisture, pressure, nor acid fumes will affect their capacity, because bakelite seals the delicate parts against all outside influences.

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0.00004	0.001	} 50c.
0.00005	0.0012	
0.00006	0.0015	
0.00007	0.00175	
0.00008	0.002	} 60c.
0.0001	0.0025	
0.00012	0.003	
0.00015	0.0035	
0.000175	0.004	} 40c.
0.0002	0.005	
0.00025	0.006	
0.0003	0.007	
0.00035	0.0075	95c.
0.0004	0.008	\$1.00
0.0005	0.01	1.15
0.0006	0.012	1.20
0.0007	0.015	1.25
0.0008		

With Resistor clips, 10c extra.

Also Sangamo By-Pass Condensers.

0.1 mfd.	80c.	0.5 mfd.	90c.
0.25 mfd.	80c.	1.0 mfd.	\$1.25

Sangamo Electric Company

6332-1 Springfield, Illinois

RADIO DIVISION, 50 Church Street, New York

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- "Infradyne" Receiver
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- "New-Day" Short Wave Receiver,
- Most Amateur Stations
- The Best Receivers.

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Field Intensity Measuring Instruments.

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down the scale as the two frequencies pull in and out of phase, thus indicating that the oscillator is being adjusted to the right frequency."

The field intensity range of this portable equipment is about 30,000 to 20 microvolts per meter, but this range may be extended to 200,000 microvolts per meter by increasing the resistance unit in the output side of the potentiometer to a corresponding degree. The wave length range, too, may be broadened at both the higher and lower bands by the use of interchangeable oscillator coils, but the accuracy of the potentiometer is limited somewhat to 200 meters in the higher frequencies.

For Radio Supervisors

NINE radio supervisors, in as many geographical districts in the United States, have been termed the traffic officers of the air, in recognition of the characterization that Secretary of Commerce Herbert Hoover is the "Chief of Police of the Ether." Thus, the radio supervisors are to be held accountable for any undue interference created by high-powered stations in their respective districts. This duty of measuring the strength or field intensity of broadcasting stations is of increasing importance, and the proper fulfillment of this function by the radio supervisors requires the use of special equipment.

Therefore, the Radio Laboratory of the Bureau of Standards is designing and equipping the radio supervisors with portable apparatus for measuring the strength or field intensity of broadcasting stations. The diagram reproduced with this article illustrates in detail the new equipment, the first unit which has been furnished S. W. Edwards, radio supervisor of the eighth district, with headquarters in Detroit. He has installed this apparatus on his mobile transmitting and receiving station, or so-called radio labora-

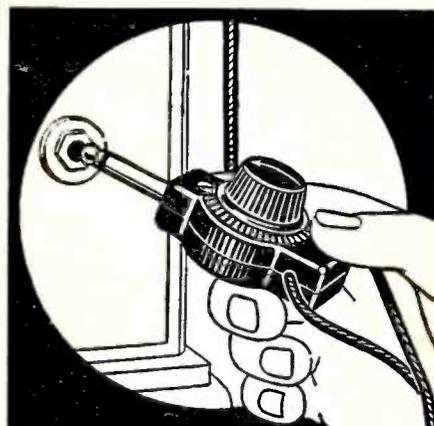
tory on wheels. The other eight radio supervisors will be similarly equipped in due course of time. Dr. J. H. Dellinger, Chief of the Radio Laboratory of the Bureau of Standards, in discussing this portable field equipment and the objects for which it was designed, furnishes this writer with the following statement:

"The factor which determines the strength of signal produced in a radio receiving set by the waves from any transmitting station is the field of intensity produced by the station. This field intensity is not determinable from a knowledge of the power of the transmitting station, and so the interference caused by a station at a given point is measured not by the station's power but by the field intensity which it produces.

"During the past few months the Bureau of Standards has been making a study of the several methods heretofore used for the measurement of field intensities and is developing methods and apparatus suitable for such measurement for various purposes. A portable apparatus has been developed for the supervisors of radio, so that they may be equipped to measure the field intensity of transmitting stations and thus regulate the power of the stations so that they do not produce excessive interference.

"With the advent of higher-power broadcasting, the Bureau of Standards has measured the field intensities produced at Washington by a number of the higher-power stations. These measurements have shown that the effect of the higher power is to produce louder signals and to increase the radius of the small zone around the broadcasting station in which there is freedom from atmospheric disturbances ('static') and other interference. This gain is not proportional to the increase of power. The higher power does not materially increase the interference produced by the stations. The signal fluctuation (fading) at a distance is not reduced by the stations. The signal fluctuation (fading) at a

(Please turn to page 69)



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KLX	Tribune Publishing Co.....	Oakland, Calif.	508	WAIU	American Insurance Union.....	Columbus, Ohio	294
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KMJ	Fresno Bee.....	Fresno, Calif.	234	WARC	American Radio & Research.....	Medford, Mass.	261
KMMJ	M. M. Johnson Co.....	Clay Center, Nebr.	229	WATT	Edison Elec. Illum. (Portable).....	Boston, Mass.	244
KMO	Love Electric Co.....	Tacoma, Wash.	250	WBAA	Purdue University.....	W. Lafayette, Ind.	273
KMOX	Voice of St. Louis.....	St. Louis, Mo.	280	WBAC	James Milliken University.....	Decatur, Ill.	270
KMTR	Echophone Mfg. Co.....	Los Angeles, Calif.	238	WBAK	Pennsylvania State Police.....	Harrisburg, Pa.	275
KNRC	C. B. Juneau.....	Hollywood, Calif.	208	WBAL	Consolidated Gas & Power Co.....	Baltimore, Md.	246
KNX	Los Angeles Express.....	Los Angeles, Calif.	337	WBAP	Wortham-Carter Pub. Co.....	Ft. Worth, Texas	476
KOA	General Electric Co.....	Denver, Colo.	322	WBAW	Braid Elec. Co. & Waldrum Dru. Co.....	Nashville, Tenn.	236
KOAC	Oregon Agriculture College.....	Corvallis, Oreg.	280	WBAX	John H. Stenger, Jr.....	Wilkes-Barre, Pa.	256
KOB	N. Mex. College of Agric.....	State College, N. Mex.	349	WBBC	P. J. Testan.....	Brooklyn, N. Y.	250
KOCH	Omaha Central High School.....	Omaha, Neb.	258	WBBL	Grace Covenant Presbyterian Church.....	Richmond, Va.	229
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KQV	Doubleday-Hill Electric Co.....	Pittsburgh, Pa.	275	WBOQ	A. H. Grebe & Co., Inc.....	Richmond Hill, N. Y.	236
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KSAC	Kansas State Agricultural College.....	Manhattan, Kans.	341	WBRE	Baltimore Radio Exchange.....	Wilkes-Barre, Pa.	231
KSD	Pulitzer Publishing Co.....	St. Louis, Mo.	545	WBRS	Universal Radio Mfg. Co.....	Brooklyn, N. Y.	394
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Building Henry-Lyford Tuned and Untuned R. F. Receiver

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white wire goes through the hole in the sub-panel over the B post of the audio frequency transformer No. 1 and connects to it. The maroon wire should be soldered to coil jack 10. Connect the bright red wire to the left hand terminal of by-pass condenser No. 4. Connect the green wire to coil jack 7. Solder the green and maroon wire to the right hand terminal of by-pass condenser No. 3. The green and maroon wire is the only one left and this goes to the right hand terminal of by-pass condenser No. 5.

Now that the receiver is completely wired it should all be gone over and carefully checked. Make sure that every connection is made according to the directions, and that every soldered joint is perfect. Now let us put on the dials and knobs. The condenser dials should read 100 degrees when the plates of the condensers are fully interleaved. Set the knob on the balancing condenser so the arrow points to the right when the plates of this condenser are fully interleaved. The knob on the volume control is set so that the arrow is pointing directly down when the shaft of this control has been turned as far as possible to the left. This is the position for minimum volume.

To test out the receiver connect the solid yellow A+ wire and the black and yellow A- wire to a 6 Volt storage battery. Try a tube separately in each socket taking care to have the pin on the side of the tube pointing in the same direction as the arrow on the socket. When the filament switch is turned on the tube should light in all sockets except the last, and should light in this socket when a plug is inserted in the Max. jack. These tests will show if the filament circuit is correctly wired. The remaining wires in the cable are now connected as shown in the diagram, taking care to connect the B- to the A+ and the C+ to the A-. The maroon and white wire is B+22½. The solid maroon wire is B+90. The bright

(Please turn to page 67)

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WDBO Rollins College.....	Winter Park, Fla.	240	WHBA C. C. Shaffer.....	Oil City, Pa.	250
WDBZ Kingston Radio Club.....	Kingston, N. Y.	233	WHBC Rev. E. P. Graham.....	Canton, Ohio	254
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WDWF Dutee Wilcox Flint, Inc.....	Cranston, R. I.	441	WHBM C. L. Carrell (Portable).....	Chicago, Ill.	216
WDZ J. L. Bush.....	Tuscola, Ill.	278	WHBN First Ave. Methodist Church.....	St. Petersburg, Fla.	233
WEAF Broadcasting Co. of America.....	New York, N. Y.	491	WHBP Johnstown Automobile Co.....	Johnstown, Pa.	255
WEAI Cornell University.....	Ithaca, N. Y.	254	WHBQ St. John's M. E. Church South.....	Memphis, Tenn.	233
WEAM Bor. of N. Plainfield.....	North Plainfield, N. J.	261	WHBU Riviera Theatre & Bing's Clothing.....	Anderson, Ind.	219
WEAN The Shepard Co.....	Providence, R. I.	367	WHBW D. R. Kienzle.....	Philadelphia, Pa.	216
WEAO Ohio State University.....	Columbus, Ohio	294	WHBY St. Norbert's College.....	West de Pere, Wis.	250
WEAR Willard Storage Battery Co.....	Cleveland, Ohio	389	WHDI W. H. Dunwoody Institute.....	Minneapolis, Minn.	278
WEAU Davidson Bros. Co.....	Sioux City, Iowa	275	WHEC Hickson Electric Co., Inc.....	Rochester, N. Y.	258
WEBC Walter Cecil Bridges.....	Superior, Wis.	242	WHFC Hotel Flanders.....	Chicago, Ill.	258
WEBH Edgewater Beach Hotel.....	Chicago, Ill.	370	WHK The Radio Air Service Corp.....	Cleveland, Ohio	273
WEBJ Third Avenue Railway Co.....	New York, N. Y.	273	WHN George Schube!.....	New York, N. Y.	361
WEBL R. C. A. Show (Portable).....	New York, N. Y.	226	WHO Banker's Life Co.....	Des Moines, Ia.	526
WEBQ Tate Radio Corp.....	Harrisburg, Ill.	226	WHT Radiophone Broadcasting Corp.....	Deerfield, Ill.	238
WEBR H. H. Howell.....	Buffalo, N. Y.	244	WIAD Howard R. Miller.....	Philadelphia, Pa.	250
WEBW Beloit College.....	Beloit, Wis.	268	WIAS Home Electric Co.....	Burlington, Iowa	254
WEBZ Savannah Radio Corp.....	Savannah, Ga.	263	WIBA Capital Times-Strand Theatre.....	Madison, Wis.	236
WEEI The Edison Elec. Illuminating Co.....	Boston, Mass.	349	WIBG St. Paul's Protestant E. Church.....	Elkins Park, Pa.	222
WEHS Oliver G. Fordham.....	Evanston, Ill.	203	WIBH Elite-Radio Stores.....	New Bedford, Mass.	210
WEMC Emanuel Missionary College.....	Berrien Springs, Mich.	285	WIBI Frederick B. Zittel, Jr.....	Flushing, L. I., N. Y.	219
WENR All-American Radio Corp.....	Chicago, Ill.	266	WIBJ C. L. Carrell (Portable).....	Chicago, Ill.	216
WEW St. Louis University.....	St. Louis, Mo.	360	WIBM Pilly Maine (Portable).....	Chicago, Ill.	216
WFAA Dallas News & Dallas Journal.....	Dallas, Tex.	476	WIBO Nelson Brothers.....	Chicago, Ill.	226
WFAM Times Publishing Co.....	St. Cloud, Minn.	273	WIBR Thurman A. Owings.....	Weirton, W. Va.	246
WFAV University of Nebraska.....	Lincoln, Neb.	275	WIBS T. F. Hunter.....	Elizabeth, N. J.	203
WFBC First Baptist Church.....	Knoxville, Tenn.	250	WIBU The Electric Farm.....	Poynette, Wis.	222
WFBE J. V. De Walle.....	Seymour, Ind.	226	WIBW Dr. L. L. Dill.....	Logansport, Ind.	220
WFBG The Wm. F. Gable Co.....	Altoona, Pa.	278	WIBX WIBX, Inc.....	Utica, N. Y.	234
WFBH Concourse Radio Corp.....	New York, N. Y.	273	WIBZ A. D. Trum.....	Montgomery, Ala.	231
WFBJ St. John's University.....	Collegeville, Minn.	236	WIL Benson Radio Co.....	St. Louis, Mo.	258
WFBL Onondaga Hotel Co.....	Syracuse, N. Y.	252	WIOD Earl G. Fisher Co.....	Miami, Fla.	248
WFBM Merchants Heat & Light Co.....	Indianapolis, Ind.	268	WIP Gimbel Bros.....	Philadelphia, Pa.	508
WFBR Fifth Infantry National Guard.....	Baltimore, Md.	254	WJAD Jackson's Radio Eng. Laboratories.....	Waco, Texas	353
WFBZ Knox College.....	Galesburg, Ill.	254	WJAF J. A. Fernberg Radio Co.....	Ferndale, Mich.	400
WFCI Frank Crook, Inc.....	Pawtucket, R. I.	229	WJAG Norfolk Daily News.....	Norfolk, Neb.	270
WFDF F. D. Fallain.....	Flint, Mich.	234	WJAK Kokomo Tribune.....	Kokomo, Ind.	254
WFKB Vesta Battery Corp.....	Chicago, Ill.	217	WJAM D. M. Perham.....	Cedar Rapids, Iowa	268
WFL Strawbridge and Clothier.....	Philadelphia, Pa.	394	WJAR The Outlet Co.....	Providence, R. I.	306
WFRL Robert Morrison Lacey.....	Brooklyn, N. Y.	205	WJAS Pittsburgh Radio Supply House.....	Pittsburgh, Pa.	275
WGAL Lancaster Elec. Supply & Const. Co.....	Lancaster, Pa.	248	WJAX City of Jacksonville.....	Jacksonville, Fla.	337
WGBB H. H. Carman.....	Freeport, N. Y.	244	WJAZ Zenith Radio Co.....	Mt. Prospect, Ill.	329
WGBC First Baptist Church.....	Memphis, Tenn.	278	WJBA D. H. Lentz, Jr.....	Joliet, Ill.	207
WGBF Fink Furniture Co.....	Evansville, Ind.	236	WJBB Financial Journal.....	St. Petersburg, Fla.	254
WGBL Scranton Broadcasters, Inc.....	Scranton, Pa.	240	WJBC Hummer Furniture Co.....	LaSalle, Ill.	234
WGBR George S. Ives.....	Marshfield, Wis.	229	WJBI Robert S. Johnson.....	Red Bank, N. J.	219
WGBS Gimbel Brothers.....	Astoria, L. I., N. Y.	316	WJBK E. F. Goodwin.....	Ypsilanti, Mich.	233
WGBU Florida Cities Finance Co.....	Fulford By-The-Sea, Fla.	278	WJBL Wm. Gushard Dry Goods Co.....	Decatur, Ill.	270
WGBX University of Maine.....	Orono, Me.	234	WJBO Valdemar Jensen.....	New Orleans, La.	268
WGCP May Radio Broadcast Corp.....	Newark, N. J.	252	WJBR Omro Drug Stores.....	Omro, Wis.	227
WGES Oak Leaves Broadcasting Corp.....	Chicago, Ill.	250	WJBT John S. Boyd.....	Chicago, Ill.	238
WGHB Fort Harrison Hotel.....	Clearwater, Fla.	266	WJBU Bucknell University.....	Lewisburg, Pa.	211
WGHP G. H. Phelps.....	Detroit, Mich.	270	WJBV Union Course Laboratories.....	Woodhaven, N. Y.	470
WGM Verne and Elton Spencer.....	Jeanette, Pa.	372	WJBW C. Carlson, Jr.....	New Orleans, La.	341
WGMUA, H. Grebe & Co. (Portable) New York.....		236	WJBX Henderson & Ross.....	Osterville, Mass.	280
WGN The Tribune.....	Chicago, Ill.	303	WJBY Electric Construction Co.....	Gadsden, Ala.	270
WGR Federal T. and T. Co.....	Buffalo, N. Y.	319	WJJD Supreme Lodge, L. O. of Moose.....	Mooseheart, Ill.	370
WGST Georgia School of Technology.....	Atlanta, Ga.	270	WJR Jewett Radio & Phonograph Co.....	Pontiac, Mich.	517
WGY General Elec. Co.....	Schenectady, N. Y.	379	WJY Radio Corp. of America.....	New York, N. Y.	405
WHA University of Wisconsin.....	Madison, Wis.	535	WJZ Radio Corp. of America.....	Bound Brook, N. J.	454
WHAD Marquette University.....	Milwaukee, Wis.	275	WKAF WKAF Broadcasting Co.....	Milwaukee, Wis.	261
WHAMEastman School of Music.....	Rochester, N. Y.	278	WKAQ Radio Corp. of Porto Rico.....	San Juan, P. R.	341
WHAP W. H. Taylor Finance Corp.....	New York, N. Y.	431	WKAR Michigan State College.....	East Lansing, Mich.	286
WHAR F. D. Cooks Sons.....	Atlantic City, N. J.	275	WKAU Laconia Radio Club.....	Laconia, N. H.	224

red wire is B+135. The solid green wire is C—1½. The green and maroon wire is C—4½. The green and red wire is C—7½. All of these C— voltages may be obtained from one Burgess C Battery No. 5540.

Again insert a tube in each socket separately and it should light up as before. If it does not burn out in any socket it is safe to insert all of the tubes in their proper places, the 112 tube going in the fifth socket. Hook the antenna and ground to the binding posts and plug in the coils. The object of trying one tube at a time in the set when the B batteries are connected is to prevent the entire set of tubes from burning out in case a mistake was made in wiring. This procedure is always advisable when any receiver is being tried.

The volume control is turned half way on, and the balance is set so that the arrow points towards the letter E. Now turn on the switch, plug in a Western Electric cone or any other good cone type speaker in the Max. jack and rotate the dials slowly from 100 toward 0, keeping the reading of each dial about the same. If WEAf is on at the time you test out the receiver you will find them to come in around 80 on both dials. If WJZ is on they will come in around 70 or 72. We will assume that you are tuning in WJZ or any other station. Adjust the balance for clarity which will probably mean a very slight movement of the balance either one way or the other from the letter E of the word "Balance." The proper adjustment of this balance is such that it should not be necessary to change it for any station which comes in above 50 on the dials. For any stations below 50 on the dials a slight turn of the balance control is made so the arrow points to either A or N of the word "Balance." After the first trial of this receiver the user will find it a great pleasure to operate it. By adjusting the volume control for the desired volume the receiver is all set to be enjoyed for the evening.

(Please turn to page 69)

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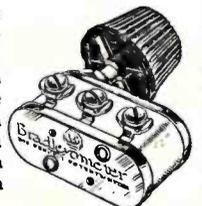
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WKBA Arrow Battery Co.....	Chicago, Ill.	210	WOAN J. D. Vaughn.....	Lawrenceburg, Tenn.	283
WKBB Sanders Bros.....	Joliet, Ill.	283	WOAW Woodman of the World.....	Omaha, Nebr.	526
WKBC H. L. Ansley.....	Birmingham, Ala.	225	WOAX Franklyn J. Wolff.....	Trenton, N. J.	240
WKBE K. & D. Electric Co.....	Webster, Mass.	270	WOC Palmer School of Chiropractic.....	Davenport, Iowa	484
WKBF N. D. Watson.....	Indianapolis, Ind	244	WOCL A. D. Newton.....	Jamestown, N. Y.	275
WKBG C. L. Carrell (Portable).....	Chicago, Ill.	216	WODA O'Dea Temple of Music.....	Paterson, N. J.	391
WKBH Callaway Music Co.....	LaCrosse, Wis.	250	WOI Iowa State College.....	Ames, Iowa	270
WKBI F. L. Schoenwolf.....	Chicago, Ill.	220	WOK Neutrowound Radio Mfg. Co.....	Homewood, Ill.	217
WKBJ Gospel Tabernacle Inc.....	St. Petersburg, Fla	280	WOKO Harold E. Smith.....	Peekskill, N. Y.	232
WKBL Monrona Radio Mfg. Co.....	Monroe, Mich.	252	WOO John Wanamaker.....	Philadelphia, Pa.	508
WKBM J. W. Jones.....	Newburgh, N. Y.	215	WOOD Grand Rapids Radio Co.....	Grand Rapids, Mich.	242
WKBO Camith Corporation.....	Jersey City, N. J.	309	WOQ Unity School.....	Kansas City, Mo.	278
WKBP Enquirer and News.....	Battle Creek, Mich.	265	WOR L. Bamberger and Co.....	Newark, N. J.	405
WKDR Edward A. Dato.....	Kenosha, Wis.	428	WORD People's Pulpit Assn.....	Batavia, Ill.	275
WKJC Kirk Johnson & Co.....	Lancaster, Pa.	258	WOS State Market Bureau.....	Jefferson City, Mo.	441
WKRC Kodel Radio Corp.....	Cincinnati, Ohio	422	WOWO Main Auto Supply Co.....	Fort Wayne, Ind.	227
WKY Hull and Richards.....	Oklahoma City, Okla.	275	WPAK N. D. Ag. College.....	Agricultural College, N. D.	275
WLAL First Christian Church.....	Tulsa, Okla.	250	WPAP (See WQAO).....	Cliffside, N. J.	361
WLAP Wm. V. Jordan.....	Louisville, Ky.	275	WPCC North Shore Cong. Church.....	Chicago, Ill.	258
WLB University of Minnesota.....	Minneapolis, Minn.	278	WPDQ H. L. Turner.....	Buffalo, N. Y.	205
WLBL Wisconsin Dept. of Markets.....	Stevens Point, Wis.	278	WPG The Municipality of Atlantic City.....	Atlantic City, N. J.	300
WLIB Liberty Weekly, Inc.....	Elgin, Ill.	303	WPRC Wilson Printing & Radio Co.....	Harrisburg, Pa.	216
WLIT Lit Bros.....	Philadelphia, Pa.	394	WPSC Pennsylvania State College.....	State College, Pa.	261
WLS Sears Roebuck & Co.....	Crete, Ill.	345	WQAA Horace A. Beale, Jr.....	Parkersburg, Pa.	220
WLSL Lincoln Studios.....	Cranston, R. I.	441	WQAC Gish Radio Service.....	Amarillo, Tex.	234
WLTS Lane Technical High School.....	Chicago, Ill.	258	WQAE Moore Radio News Station.....	Springfield, Vt.	246
WLW Crosley Radio Corp.....	Harrison, Ohio	422	WQAM Electrical Equipment Co.....	Miami, Fla.	285
WLWL Paulist Fathers.....	New York, N.Y.	288	WQAN Scranton Times.....	Scranton, Pa.	250
WMAC C. B. Meredith.....	Casnovia, N. Y.	275	WQAO Calvary Baptist Church.....	Cliffside, N. J.	361
WMAF Round Hills Radio Corp.....	Dartmouth, Mass.	441	WQJ Calumet Rainbo Broadcasting Co.....	Chicago, Ill.	447
WMAK Norton Laboratories.....	Lockport, N. Y.	266	WRAF The Radio Club (Inc.).....	LaPorte, Ind.	224
WMAL M. A. Leese Optical Co.....	Washington, D. C.	213	WRAH S. N. Read.....	Providence, R. I.	235
WMAN Haskett Radio Station.....	Columbus, Ohio	278	WRAC Economy Light Co.....	Escanaba, Mich.	256
WMAQ Chicago Daily News.....	Chicago, Ill.	447	WRAM Lombard College.....	Galesburg, Ill.	244
WMAY Kingshighway Presbyterian Church.....	St. Louis, Mo.	248	WRAV Antioch College.....	Yellow Springs, Ohio	263
WMAZ Mercer University.....	Macon, Ga.	261	WRAVAvenue Radio & Electric Shop.....	Reading, Pa.	233
WMBB American Bond & Mortgage Co.....	Chicago, Ill.	250	WRAX Beracah Church, Inc.....	Philadelphia, Pa.	268
WMBC Michigan Broadcasting Co., Inc.....	Detroit, Mich.	256	WRBC Immanuel Lutheran Church.....	Valparaiso, Ind.	278
WMBFFleetwood Hotel Corp.....	Miami Beach, Fla.	384	WRC Radio Corp. of America.....	Washington, D. C.	468
WMBI Moody Bible Institute.....	Chicago, Ill.	288	WRCO Wayne Radio Co.....	Raleigh, N. C.	252
WMC Commercial Pub. Co.....	Memphis, Tenn.	500	WREC Wooten's Radio Shop.....	Coldwater, Miss.	254
WMCAGreely Sq. Hotel Co.....	Hoboken, N. J.	341	WREO Reo Motor Car Co.....	Lansing, Mich.	285
WMRJ Peter J. Prinz.....	Jamaica, N. Y.	227	WRHF Wash. Radio Hospital Fund.....	Washington, D.C.	256
WMSGMadison Sq. Gard. Bdcast. Corp.....	New York, N. Y.	302	WRHM Rosedale Hospital, Inc.....	Minneapolis, Minn.	252
WNAB Shepard Stores.....	Boston, Mass.	280	WRK Doron Bros.....	Hamilton, Ohio	270
WNAC Shepard Stores.....	Boston, Mass.	430	WRM University of Illinois.....	Urbana, Ill.	273
WNAD University of Oklahoma.....	Norman, Okla.	254	WRMU A. H. Grebe & Co., Inc.....	Motor Yacht "MU-1"	236
WNAL Omaha Central High School.....	Omaha, Nebr.	258	WRNY Experimenter Publishing Co.....	New York, N. Y.	375
WNAT Lenning Brothers Co.....	Philadelphia, Pa.	250	WRR City of Dallas.....	Dallas, Tex.	246
WNAX Dakota Radio Apparatus Co.....	Yankton, S. Dak.	244	WRST Radiotel Mfg. Co., Inc.....	Bay Shore, N. Y.	216
WNBH New Bedford Hotel.....	New Bedford, Mass.	248	WRVA Larus & Brother Co., Inc.....	Richmond, Va.	256
WNJ Radio Shop.....	Newark, N. J.	252	WSAI United States Playing Card Co.....	Cincinnati, Ohio	326
WNOX Peoples Tel. & Tel. Co.....	Knoxville, Tenn.	268	WSAJ Grove City College.....	Grove City, Pa.	229
WNRC W. B. Nelson.....	Greensboro, N. C.	224	WSAN Allentown Call Publishing Co. Inc.....	Allentown, Pa.	229
WNYC Dept. of Plants & Structures.....	New York, N. Y.	526			
WOAI Southern Equipment Co.....	San Antonio, Texas	394			

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WSAR Daughty & Welch Electrical Co.....	Fall River, Mass.	254	WSSV Seneca Vocational School.....	Buffalo, N. Y.	219
WSAV Clifford W. Vick.....	Houston, Tex.	248	WSWS Illinois Broadcasting Corp.....	Wooddale, Ill.	275
WSAX Zenith Radio Corp. (Portable).....	Chicago, Ill.	268	WTAB Fall River Daily Herald Publishing Co.	Fall River, Mass.	266
WSAZ Chase Electric Shop.....	Pomeroy, Ohio	244	WTAD Robt. E. Compton.....	Carthage, Ill.	236
WSB Atlanta Journal.....	Atlanta, Ga.	428	WTAG Worcester Telegram.....	Worcester, Mass.	545
WSBC World Battery Co.....	Chicago, Ill.	61	WTAL Toledo Radio & Electric Co.....	Toledo, Ohio	252
WSBF Stix Baer & Fuller.....	St. Louis, Mo.	273	WTAM Willard Storage Battery Co.....	Cleveland, Ohio	389
WSBT South Bend Tribune.....	South Bend, Ind.	315	WTAQ C. S. Van Gordon.....	Eau Claire, Wis.	254
WSDA Seventh Day Adventist Church.....	New York, N. Y.	263	WTAR Reliance Electric Co.....	Norfolk, Va.	261
WSKC World's Star Knitting Co.....	Bay City, Mich.	261	WTAW Agricultural & Mech. Col. of Texas.	College Sta., Texas	270
WSM Nashville Life & Accident Ins. Co.....	Nashville, Tenn.	283	WTAX Williams Hardware Co.....	Streator, Ill.	231
WSMB Saenger Amuse. Co. & Maison B. Co.....	New Orleans, La.	319	WTAZ Thomas J. McGuire.....	Lambertville, N. J.	261
WSMH Shattuck Music House.....	Owosso, Mich.	240	WTIC Travelers Insurance Co.....	Hartford, Conn.	476
WSMK S. M. K. Radio Corp.....	Dayton, Ohio	275	WWAE Electric Park.....	Plainfield, Ill.	384
WSOE School of Engineering.....	Milwaukee, Wis.	246	WWJ Evening News Assn. (Detroit News)	Detroit, Mich.	353
WSRO Harry W. Fahrlander.....	Hamilton, Ohio	252	WWL Loyola University.....	New Orleans, La.	275
WSSH Tremont Temple Bap. Church.....	Boston, Mass.	261	WWRL Woodside Radio Labs.....	Woodside, N. Y.	258
WSUI State University of Iowa.....	Iowa City, Iowa	484			

Dominion of Canada

CFAC Calgary Herald.....	Calgary, Alta.	434	CJCL A. Couture.....	Montreal, Que.	279
CFCA Toronto Star Pub. & Prtg. Co.....	Toronto, Ont.	356	CJGC London Free Press.....	London, Ont.	329
CFCF Marconi Wireless Teleg. Co., (Ltd.)	Can. Montreal, Que.	411	CKAC La Presse.....	Montreal, Que.	411
CFCH Abitibi Power & Paper Co. (Ltd.)	Iroquois Falls, Ont.	500	CKCK Vancouver Daily Province.....	Vancouver, B. C.	397
CFCK Radio Supply Co.....	Edmonton, Alta.	517	CKCK Leader Pub. Co.....	Regina, Sask.	476
CFCN W. W. Grant (Ltd.).....	Calgary, Alta.	434	CKCL Dominion Battery Co.....	Toronto	357
CFCR Laurentide Air Service.....	Sudbury, Ont.	410	CKCO Ottawa Radio Association.....	Ottawa, Ont.	434
CFCT Victoria City Temple.....	Victoria, B. C.	329	CKCX P. Burns & Co. (Ltd.).....	Calgary, Alta.	434
CFCU The Jack Elliott (Ltd.).....	Hamilton, Ont.	341	CKFC First Congregational Church.....	Vancouver, B. C.	411
CFHC Henry Birks & Sons.....	Calgary, Alta.	434	CKLC Wilkinson Electric Co. (Ltd.).....	Calgary, Alta.	434
CFKC Thorold Radio Supply.....	Thorold, Ont.	248	CKNC Canadian National Carbon Co.....	Toronto, Ont.	357
CFQC The Electric Shop (Ltd.).....	Saskatoon, Sask.	329	CKOC Wentworth Radio Supply Co.....	Hamilton, Ont.	341
CFRC Queens University.....	Kingston, Ont.	450	CKY Manitoba Tel. System.....	Winnipeg, Man.	384
CFXC Westminster Trust Co.....	Westminster, B. C.	291	CNRA Canadian National Railways.....	Moncton, N. B.	312
CFYC Commercial Radio (Ltd.).....	Vancouver, B. C.	411	CNRC Canadian National Railways.....	Calgary, Alta.	436
CHBC The Calgary Albertan.....	Calgary, Alta.	434	CNRE Canadian National Railways.....	Edmonton, Alta.	517
CHCM Riley & McCormack (Ltd.).....	Calgary, Alta.	434	CNRM Canadian National Railways.....	Montreal, Que.	411
CHCS The Hamilton Spectator.....	Hamilton, Ont.	341	CNRO Canadian National Railways.....	Ottawa, Ont.	435
CHIC Northern Electric Co.....	Toronto, Ont.	357	CNRR Canadian National Railways.....	Regina, Sask.	476
CHNC Toronto Radio Research Society.....	Toronto, Ont.	357	CNRS Canadian National Railways.....	Saskatoon, Sask.	329
CHUC International Bible Ass'n.....	Saskatoon, Sask.	329	CNRT Canadian National Railways.....	Toronto, Ont.	357
CHXC R. Booth, Jr.....	Ottawa, Ont.	434	CNRV Canadian National Railways.....	Vancouver, B. C.	291
CHYC Northern Electric Co.....	Montreal, Que.	411	CNRW Canadian National Railways.....	Winnipeg, Man.	384
CJCA Edmonton Journal.....	Edmonton, Alta.	511			

Republic of Mexico

CYB Mexico City.....	380	CYL Mexico City.....	400	CZE Mexico City.....	350
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Republic of Cuba

PWX Cuban Telephone Co.....	Havana	400	5DW R. S. Calderon.....	Matanzas	200	6KW F. H. Jones.....	Tuinucu	272
2BY F. W. Borton.....	Havana	260	6VY Jose Ganduxe.....	Cienfuegos	260	7SR S. Rionda.....	Central Elia	350
20K M. G. Velez.....	Havana	360	6JK F. H. Jones.....	Tuinucu	340	8BY A. Ravelo.....	Santiago de Cuba	250
20L Oscar Collado.....	Havana	257						

Great Britain

2LO London.....	365	5XX Daventry.....	1600	2ZY Manchester.....	378
5IT Birmingham.....	479	2RN Dublin.....	390	5NO Newcastle.....	404
5WA Cardiff.....	353	6BM Bournemouth.....	386	5SC Glasgow.....	422
2BE Belfast.....	440			2BD Aberdeen.....	495

France

YN Lyons.....	550	FI Paris (Eiffel Tower).....	2,650	8AJ Paris.....	1,780	ESP Paris.....	458
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Short Wave Phone Broadcasting

		KC	Meters
2XK	Schenectady, N. Y.*	4600	65.16
KDKA	Pittsburgh, Pa.*	4760	63.00
KDKA	Pittsburgh, Pa.*	5100	58.79
2XAF	Schenectady, N. Y.*	9143	32.79

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Build the Quadraformer Super V. A real five tube set. Set of Genuine Quadraformers \$12.75 including instructions. Booklet 25c. Literature on request. R. P. Tomamichel, 2244 Seminary Avenue, Chicago, Illinois.

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Chokes for Speaker or Filter service, 20H—25MA \$1.00 —30H 50MA—\$1.75, 50H 60MA \$2.00 prepaid. Write for list of Audio Transformers impedance amplifiers, Raytheon transformers, etc. Radio Parts Sales Co., Box 24, Orange, N. J.

RADIO TROUBLES OVER. Hoff's trouble finder locates, explains Remedy, 103 radio ailments. Particulars free. Smith, 516 Main, St. John, N. B.

IVORY RADIO PANEL beats them all. Write for FREE Sample. Ivorylite Radio Panel Co., 3222 Ave. F, Fort Worth, Texas.

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Want to dispose of my Kennedy Universal Receiver type 110 and two stage Amplifier type 525. Excellent condition guaranteed. No reasonable offer refused. K. F. Gerlein, 2943 Cambridge St., Philadelphia, Pa.

ATTENTION SET BUILDERS. Increase efficiency and selectivity by installing a set of binocular type radio frequency coils. Set Builders use extensively. Set of three \$6.45. Money-saving price list mailed upon request. All articles sold on money back guarantee. Midwest Radio Supply, Dept. C., Box 222, Racine, Wisconsin.

Radio books—Construction of a modern Super Heterodyne Type Receiver including Testing and Operation \$1.00; Henley's 222 Radio Circuit Designs, 267 pages, \$1.00; The ABC of Vacuum Tubes used in Radio Reception 132 pages, 75 cents; Henley's Workable Radio Receivers 196 pages \$1.00; Experimental Wireless Stations 392 pages \$2.00; Wireless Telegraphy and Telephony Simply Explained 154 pages \$1.00. Sent prepaid on receipt of price. Send stamp for our 48 page catalog of latest and best practical, scientific, mechanical and industrial books. Midland Products Co., Dept. RA, 524 Courtland Ave., Park Ridge, Illinois.

SILICON Transformer Steel cut to order .014". 10 lbs. 25 cents, 5 lbs. 30 cents, less than 5 lbs. 35 cents per lb., 4 cubic inches to the lb. .007" for radio frequency transformers, 50c cubic inch, postage extra. At least 1/2 case with order—balance C. O. D. Geo. Schulz, Calumet, Michigan.

Bakelite subpanels with five built in X type sockets, connections marked size 7x23, five dollars by mail order. Subpanel brackets, seven inches long, two and half inches high, one dollar a set. Satisfaction guaranteed or money refunded. Arrow Radio Products, 350 Fifth Avenue, Venice, Calif.

99.7% Pure aluminum for Rectifiers, B Eliminators, Trickle chargers and transmitters 1-2" round, 1-4x1" rectangular 5c inch, 1-4"x3-4 4c inch. 3-8" round lead elements 3 1-2" long 15c, 7 for \$1.00 all with brass terminals, prepaid to 5 zone. No order less than \$1.00. Geo. Schulz, Calumet, Michigan.

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CONDENSERS. 800 VOLT FILTER .1 mfd 45c, .25 51c, .5 60c, 1. 75c, 2. \$1.20, 3. \$1.80, 4. \$2.40. 1500 VOLT FILTER. 1 51c, .25 60c, .5 75c, 1. \$1.05, 2. \$1.95, 3. \$2.70. 4. \$3.60. **ELIMINATOR BLOCKS.** 2, 2, and 8 \$5.70, 2, 2, 8, and 1 \$6.15, 2, 2, 8, 1 and 1 \$6.60, 1 and 1 in series 90c. Many other capacities. Acme transformers and chokes. THE RADIO CLUB, INC., La Porte, Ind.

3 element Rectifier jars for B eliminators, B battery chargers and transmitters, 1 jar takes the place of 2 ordinary jars, 1/4" x3/4" 99.7% pure aluminum, rubber covers binding posts 3" inside diameter \$1.00 each, 4 for \$3.00, prepaid to 5th zone, 1/2 cash with order balance C. O. D. Satisfaction or money back, George Schulz, Calumet, Mich.

Audio transformers 70c up. \$2.00 brings a 50 H 60 MA choke for use with your "B" eliminator or as a Bypass for your speaker. Write for list of transformers and parts. Radio Parts Sales Co., Box 24, Orange, N. J.

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Your aerial is only as good as your insulators. The famous air pocket blue porcelain Insulators have a 9" leakage path only 30c each, 4 for \$1.00 prepaid to 4th zone, 2c each extra beyond. Cash with order. Satisfaction or money back. Geo. Schulz, Calumet, Michigan.

SAVE MONEY on radio sets and parts. List free. All merchandise guaranteed. GEMRAD COMPANY, 631 E. Okmulgee, Muskogee, Okla.

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Make \$100 WEEKLY in spare time. Sell what the public wants—long distance radio receiving sets. Two sales weekly pays \$100 profit. No big investment, no canvassing. Sharpe of Colorado made \$955 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. OZARKA, INC., 431 N. LaSalle Ave., T. Chicago.

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An Index to the Best in Radio Hookups!

HOW long have you postponed making that favorite hookup of yours because you couldn't find reliable and clear diagrams? We have laid aside a limited number of back issues of RADIO AGE for your use. Below are listed hookups and diagrams to be found in them. Select the ones you want and enclose 30 cents in stamps for each one desired.

August, 1924

- Breaking Into Radio Without a Diagram.
- The English 4-Element Tube.
- Filtered Heterodyne Audio Stages.
- An Audio Amplifier Without an "A" Battery.

September, 1924

- How Careful Mounting Will Improve Reception.
- One Tuning Control for Hair's Breadth Selectivity.
- Four Pages of Real Blueprints of a New Baby Heterodyne.

November, 1924

- Blueprints of a Single Tube Loop Set and a Capacity Feed-back Receiver.
- A 3-Tube Low Loss Regenerator.
- Mastering the 3-Circuit Tuner.

January, 1925

- A Six-Tube Super-Het.
- An Efficient Portable Set.
- A Tuned Plate Regenerator.
- Making a Station-Finder.

February, 1925

- A Three Circuit Regenerator.
- A Real Low Loss Set.
- Blueprints of a 3-tube Reflex.

March, 1925

- A 5-Tube R. F. Receiver.
- How to Wind Low Loss Coils.
- A Short Wave Receiver.
- Blueprints of a Two-Tube Ultra Audion and a Regenerative Reflex.

April, 1925

- A 3-Tube Portable Set.
- "B" Voltage from the A. C. Socket.
- An Amplifier for the 3-Circuit Tuner.
- Blueprints of a Five-Tube Radio Frequency Receiver.

May, 1925

- A "Quiet" Regenerator.
- How to Make a Tube-Tester.
- A Unique Super-Het and an Improved Reintartz.
- A Six-Tube Portable Receiver Illustrated with Blueprints.

June, 1925

- Reducing Static Disturbances.
- A Seven-Tube Super-Heterodyne.
- Browning-Drake Receiver.
- Overcoming Oscillations in the Roberts Receiver.

July, 1925

- Learning Tube Characteristics.
- How Much Coupling?
- Blueprints of Conventional Radio.
- Symbols and Crystal Detector Circuit.

August, 1925—50c per copy

- How to Attain Smooth Tuning.
- Alternating Current Tubes.
- Deciding on a Portable Super.
- And a big 60-page blueprint section.

September, 1925

- Thirty-one ways to prevent self-oscillation.
- Tuning efficiency with two controls.
- Ideal Audio Amplifier Circuits.
- Blueprint section.

October, 1925

- Auto-Transformer Coupling.
- Some Facts about Quality.
- An Improved Slide-Wire Bridge.
- Blueprints of Circuits Using Single and Dual Controls.

November, 1925

- A Good Audio Oscillator.
- An Efficient Short-Wave Transmitter.
- Blueprints—Adding R. F. Stages.

December, 1925

- Tuned R. F. and Regeneration
- Radio Age Model Receiver.
- Inductive Gang-Control Receiver.
- Tuning with Chart Curves.

January, 1926

- Radio Age January Model Set.
- A Four-Tube Toroid Set.
- Power Supply Device—Blueprint Feature.
- Finishing Your Radio Cabinet.

February, 1926

- February Radio Age Model Set.
- Plug-in Coil Receiver.
- Universal Testboard—Blueprint.
- Eliminating Audio Distortion.

March, 1926

- Improving the Browning-Drake.
- Rheostatless Tubes in a Set.
- Which Type Intermediate?
- How to Make a Wavemeter—Blueprint.

April, 1926

- Shielding Your Receiver.
- Home Testing Your Tubes.
- Balanced Capacity Receiver.
- Several Sets on One Antenna.

May, 1926

- Short Wave Transmitter—Blueprint
- Simplifying Battery Charging.
- List of European Broadcasters.
- Protecting your Inventions.

June, 1926

- Antenna Design.
- Simple Crystal Set.
- Improving the Neutrodyne.
- Golden Rule Receiver—Blueprints.

July, 1926

- Compact Portable Super.
- Short Wave Receiver.
- Shielded Golden Rule Set.

August, 1926

- Receiver, Transmitter and Wavemeter.
- Beginners 200 mile Crystal Set.
- History of Amateurs.
- Changing to Single Control.

September, 1926

- How to Make a Grid Meter Driver
- Short Wave Wavemeter
- Power Amplifier for Quality (Blueprint)

October, 1926

- Crystal Control Low Power Transmitter (Blueprint)
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