Blueprint Section Every Month

RADIO AGE

The Magazine of the Hour

(See Story page 20)

November 1926

25¢

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

Complete Broadcast List

In Each Issue

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RADIO AGE

The Magazine of the Hour

Established March, 1922

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CONTENTS

FOR NOVEMBER ISSUE

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FREDERICK A. SMITH, *Editor*
F. A. HILL, *Associate Editor*
M. B. SMITH, *Business Manager*

Advertising Manager
HARRY A. ACKERBURG
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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.

Frederick Smith

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.

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LEFT—*Eveready Layerbilt No. 486.*

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

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$29.00

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

MODEL 200
with 22-inch Cone

The Cone Loudspeaker, with its Spruce sounding board, 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.

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This 22-inch Windsor Cone Loudspeaker, with its *spruce* sounding board, will reproduce the sofest 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.

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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 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.

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

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 selectivity, 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 other fellow paid for a single gallon of gas.

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

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 [illegible] courageously lead the [illegible] "Richard" into belli[illegible] waters, the aids the [illegible] to navigation were [illegible] primitive, the use of w[illegible] ended mostly on good judgme[illegible] 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 pre-determined 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 apparently realized the necessity of instrument of this type and the initiative as it has often 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.

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

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,

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 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.

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

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 and the Gulf of Mexico have been taken care of.

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

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

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

ALONG 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 marvellous 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—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 nightly for the white man's orchestra playing the best Charleston music. We did wonder several times about the compatability 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, Sy[illegible]tor, 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 WEAF, 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 faithfully 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 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 crepe-hanger, 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 district. 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 interest 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 yesteryears—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

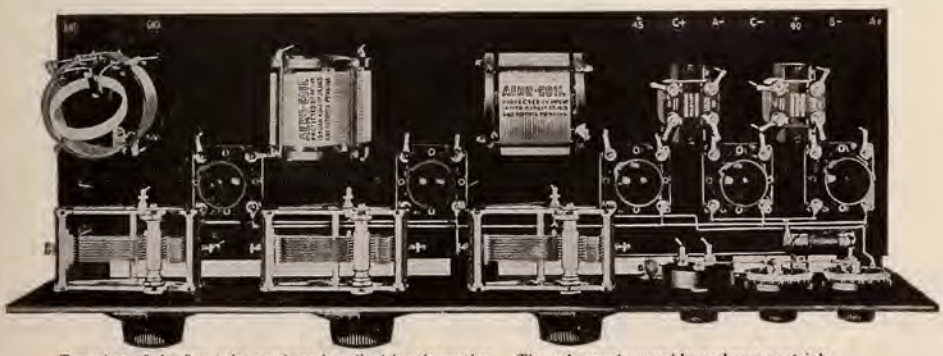
By H. A. FREDERICK

DID you ever start to read a technical article in a radio magazine, get halfway 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 principle, 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 immmediately 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



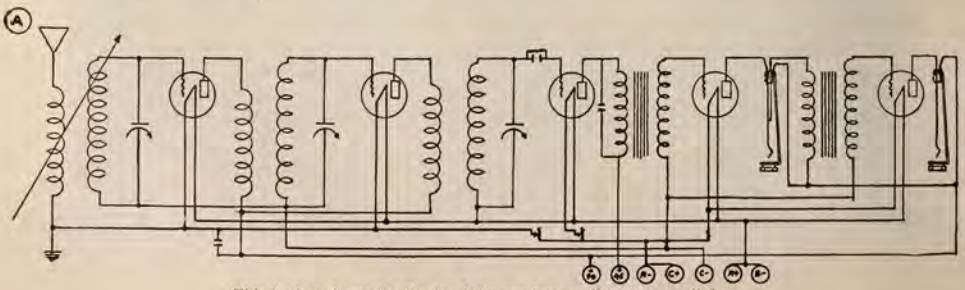
Top view of the five tube receiver described by the author. The sub-panel assembly makes a neat job

Front panel view of the receiver described by the author

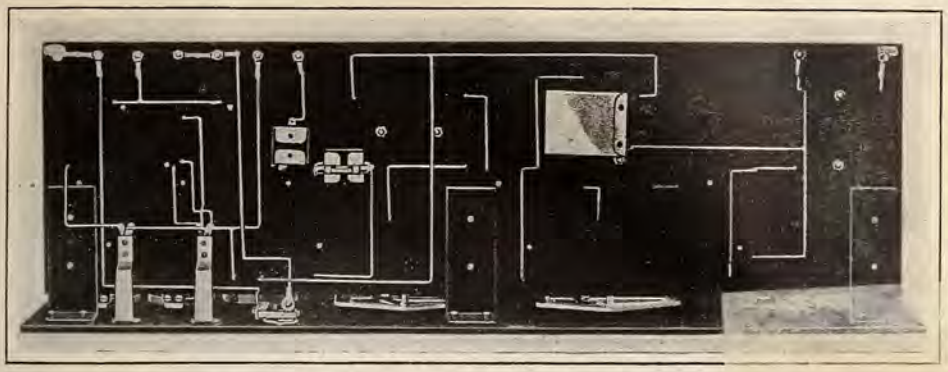
thing formerly realized only in high-priced, laboratory built receivers. The accompanying photographs and diagrams tell the story.

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 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.

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 vernier dials
9 X-L Push posts
1 ½ Amp. (No. 112 Amperite and mounting)
25 Ft. Bus Bar
1 4½ volt C battery
Solder lugs and mounting screws

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.

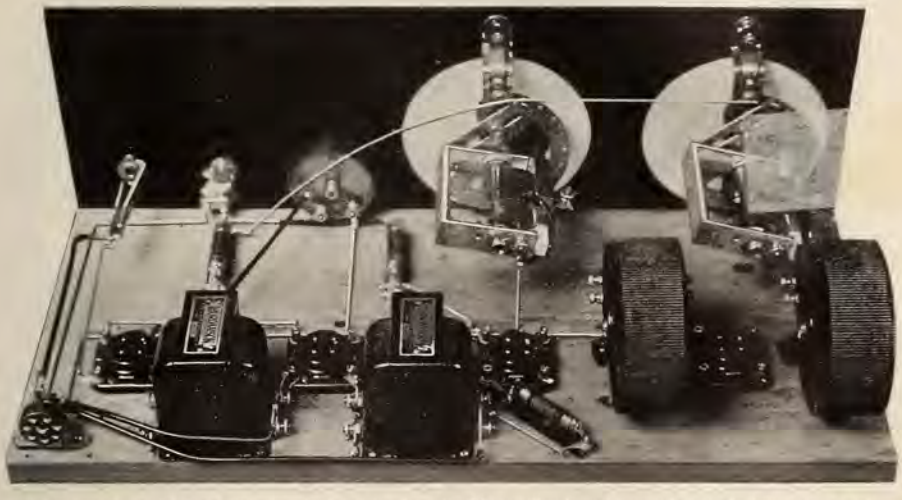
Both the radio booths and press box will be reached from the ground by a specially installed elevator which will be used only by pressmen and radio operators.

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 boring 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 condtion 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.

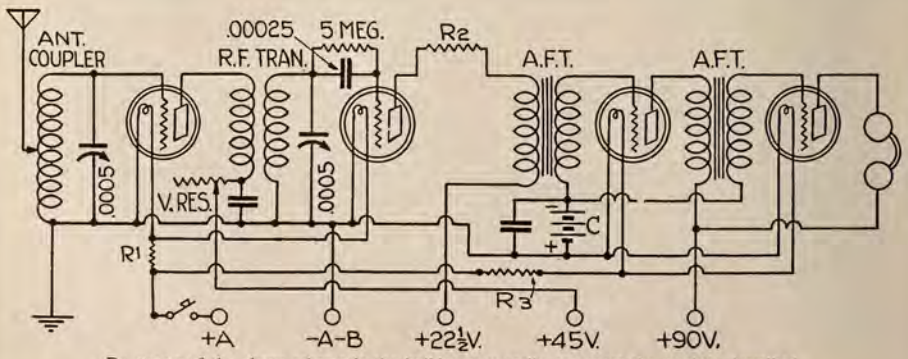
Audio transformers with generous windings and plenty of core material were used to maintain the quality of the output as high as possible. The ratio of the transformers is 2 to 1. Grid biasing is resorted to to operate the audio tubes at their best operating characteristic and to limit the amount of plate current consumed. For plate potential of about 90 volts a bias of 4½ 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 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 baseboard 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 theh 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 is it 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 photographer 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 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.

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 O-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 7½ volt C battery, Eveready.

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.

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 representative 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 revolutioning 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.

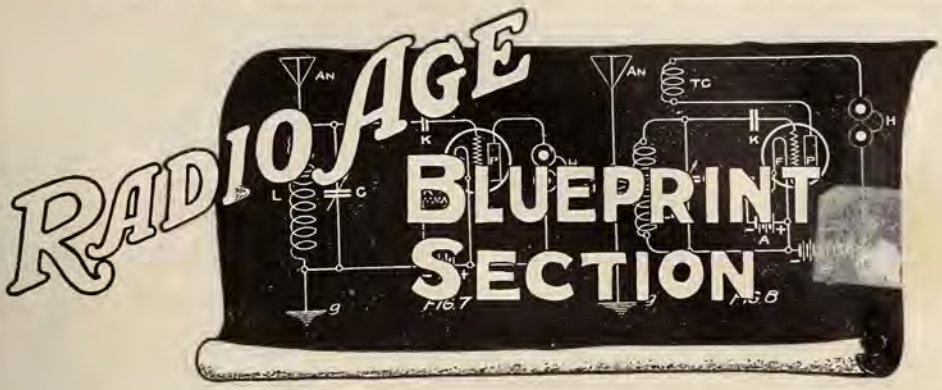
She does not enter the American home as a Liberator of Housekeepers, but rather as a next-door neighbor who has learned by experience a better-than-ordinary method of doing the family washing, making jelly, or decorating the living room. Her programs are as informal as it is possible to make them; indeed, 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 R F 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 satisfactory. 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.

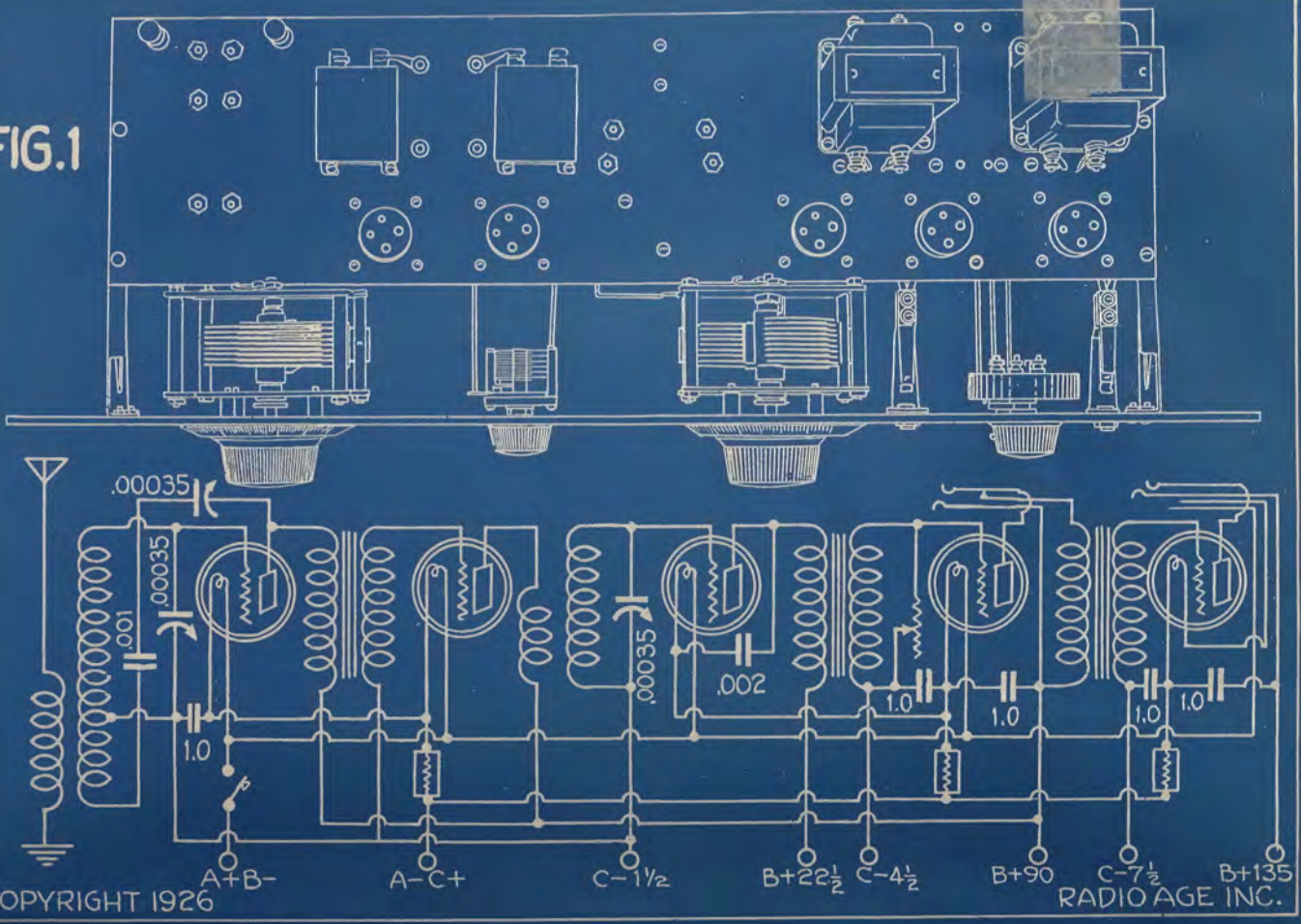
Combination Used

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.1



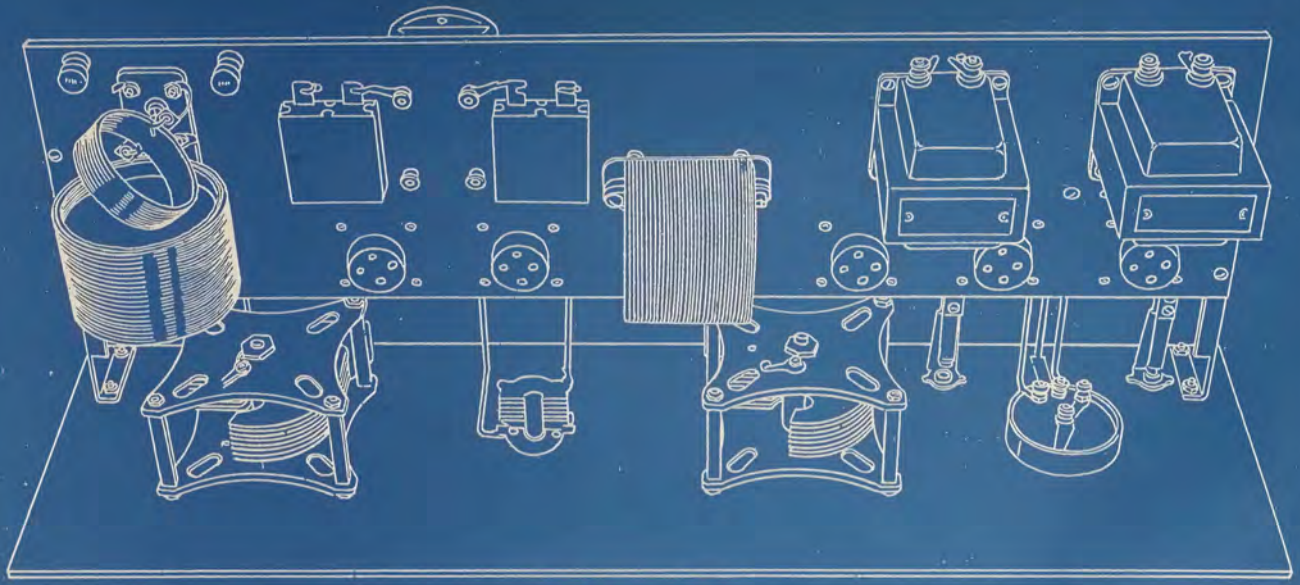


FIG. 2

REAR PANEL AND BASEBOARD VIEW

HENRY LYFORD RECEIVER

m. f. introduced by the tube capacity. The amount of counterbalancing 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.

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 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 provided 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)

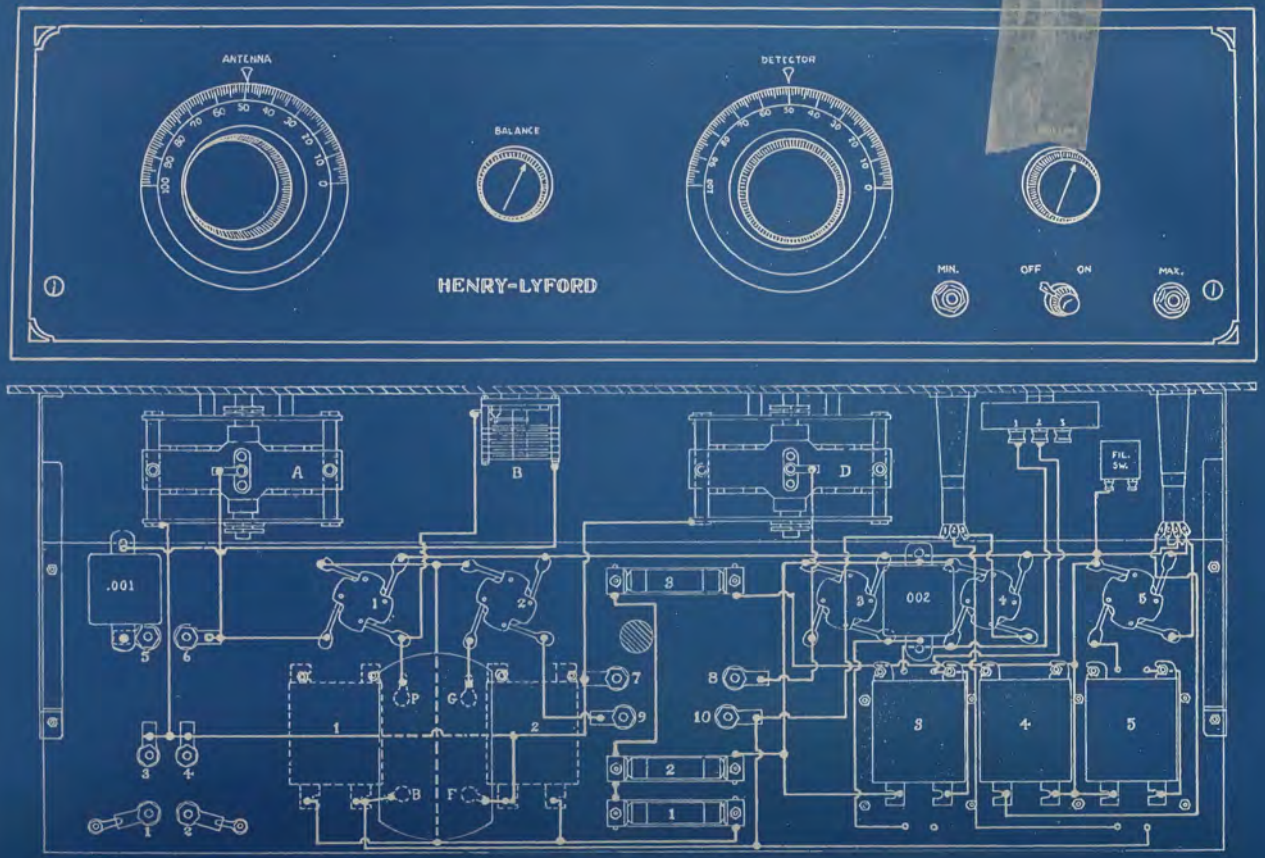


FIG. 3

RADIO AGE INC.

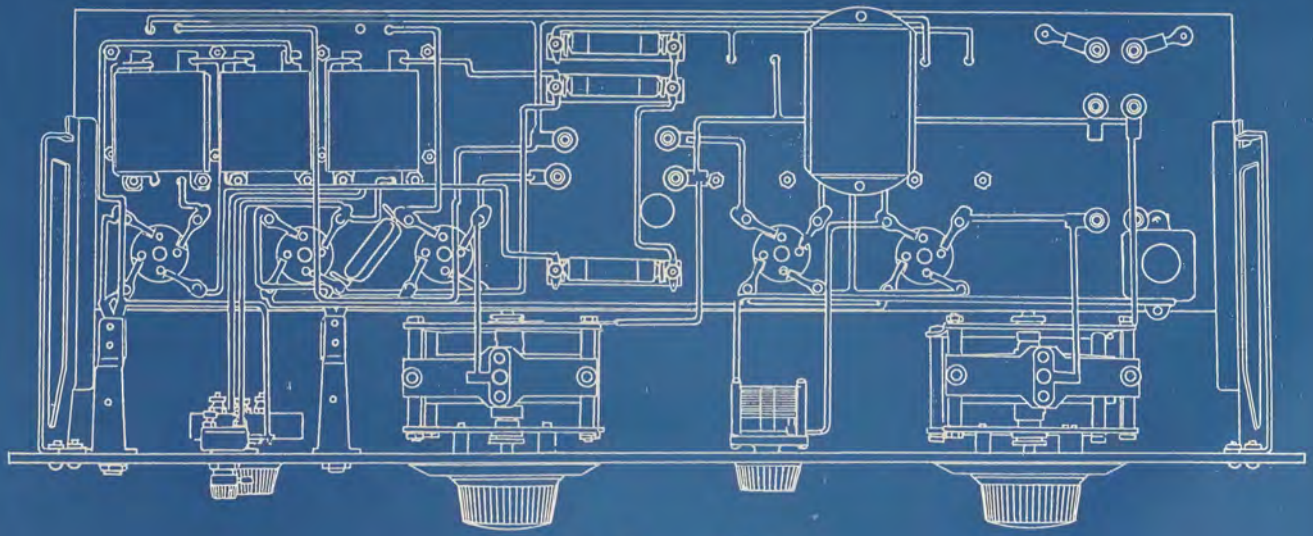


FIG. 4

UNDER PANEL VIEW OF

HENRY LYFORD RECEIVER

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 lower 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

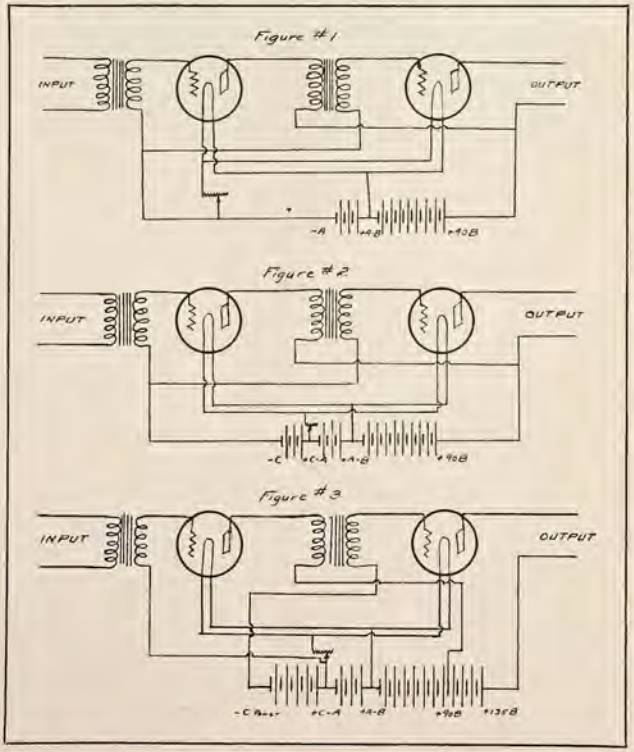
By H. MELCHIOR BISHOP

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 methods 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 of 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) (C or CX 301A)	5	0.25	22½ to 90	−4½ at 90 volts B
UX 112 or CX 212	5	0.50	135	−9
(UV or UX 199) (C or CX 299)	3	0.06	22½ to 90	−4½ at 90 volts B
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.

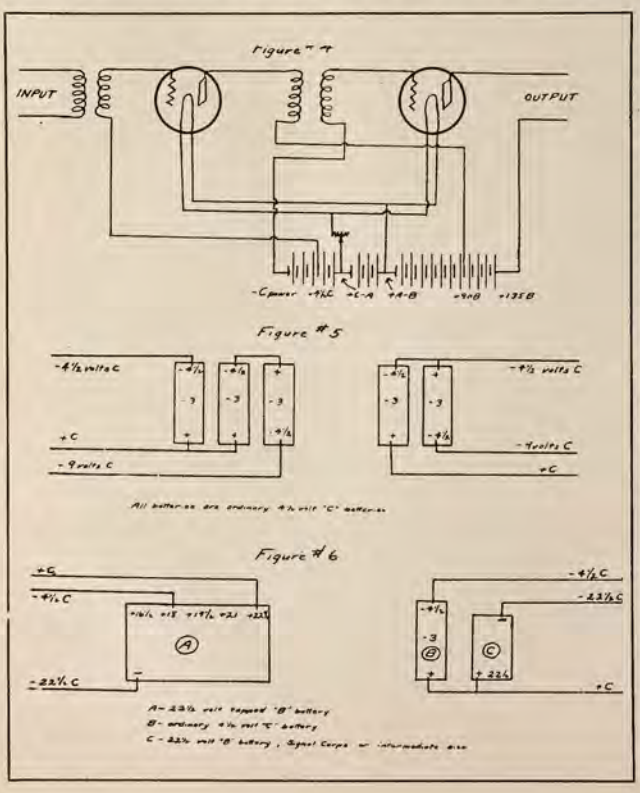


Figure No. 3 shows the same circuit as does Figure No. 1, with the last stage tube replaced by one of the new UX or CX type power tubes. This circuit is not recommended, as the tube in the first stage has insufficient grid bias and hence draws excessive "B" battery current. For this reason, if one has 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

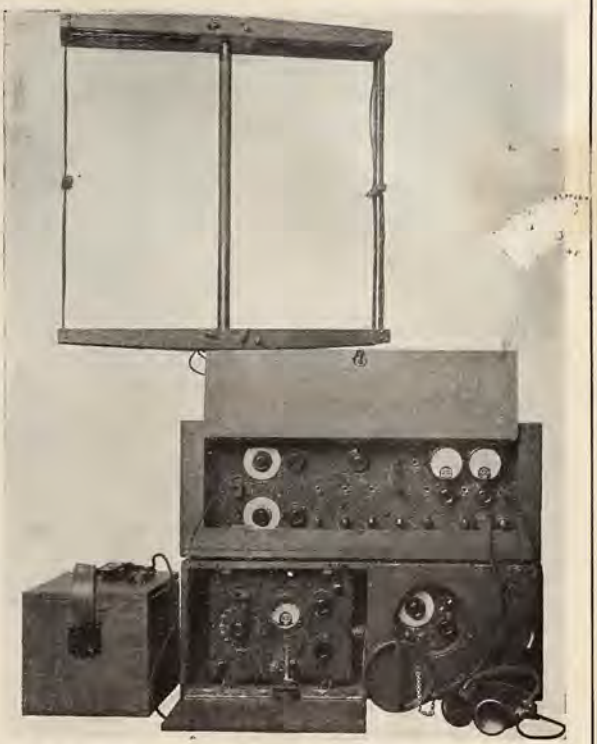
By
S. R. Winters

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 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.



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

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

Portable field intensity set in use afield

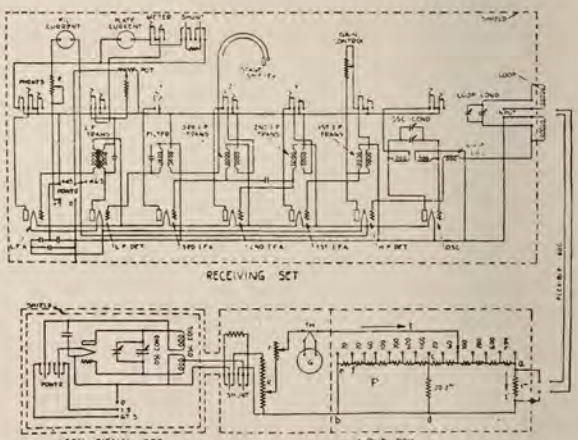
meter deflection as before, which means that the local signal voltage impressed upon the grid of the high frequency detector is the same as the voltage across half the loop due to the signal. This voltage is equal to the voltage across the entire non-inductive input shunt, as measured by a tube voltmeter, 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 effective height of the loop. The effective height of the loop is a 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.

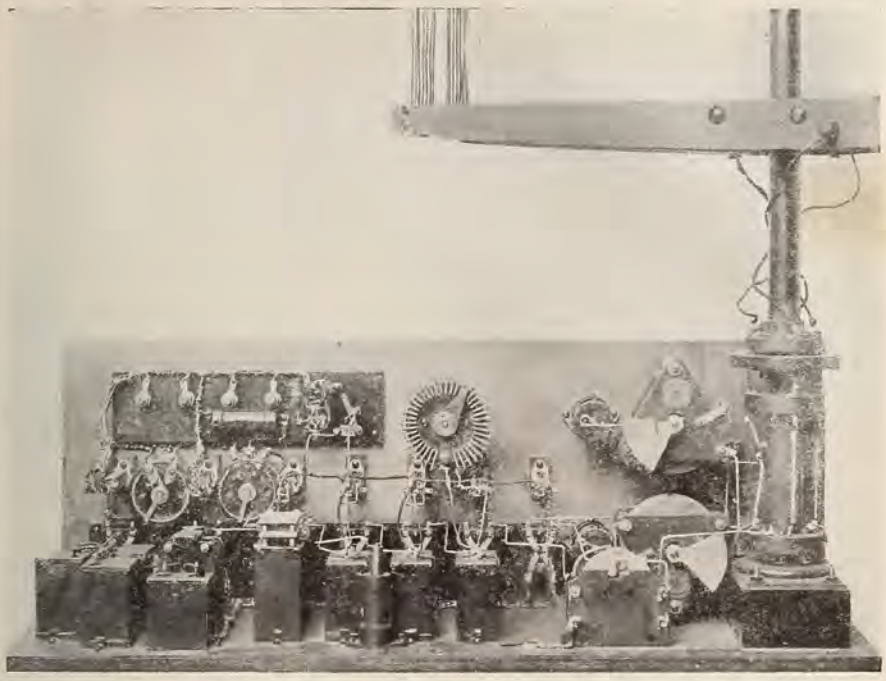
"The potentiometer shown in the diagram directly under the plate current meter is used for balancing out the initial plate current of the low frequency detector, in order that the entire scale of the meter may be made useful for indicating the increase in current due to a signal impressed upon the grid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



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.

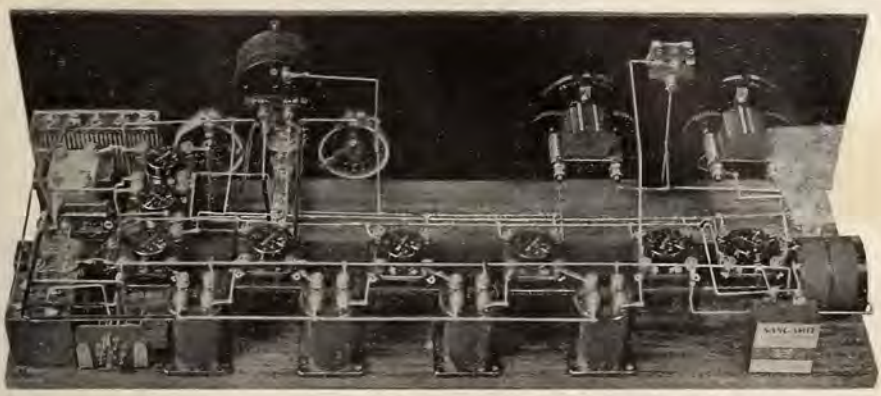
All of the stations received did not use high power. KNX at Hollywood was picked up on 20 different nights and at this time was using only 500 watts. Airline distance between Hollywood and New Zealand is 6,000 miles. When Mr. Scott returned to the United States he visited the KNX studio and astonished 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 facility 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 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) 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.

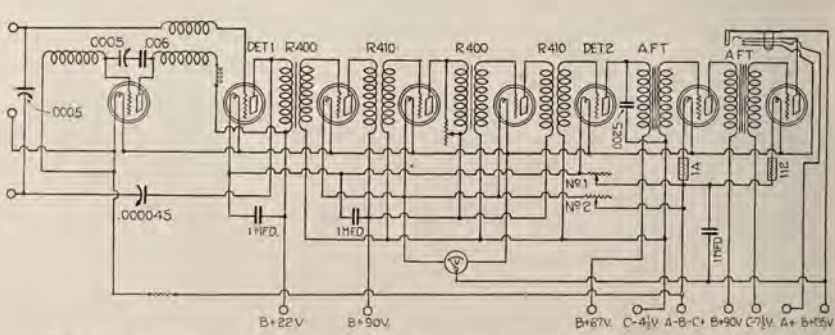
As is customary with any receiver using a loop, full advantage should be taken of its directional effects. In many cases a slight change in the position of the loop will mean the difference between an audible and inaudible signal. It is especially of advantage when the receiver is used very near the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

List of Parts

1 Bakelite panel 7x26x3-16
1 Wood baseboard 8½ x25
1 Piece Bakelite 16x2x3-16
1 Piece Bakelite 6x2x3-16
3 Pieces Bakelite 3x2x3-16
7 Small angle brackets, ¾ 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 7¼-0-150
1 Thordarson audio 3½-1
1 Thordarson audio 2-1
1 Yaxley plug
1 Thor coupling unit No. 460
3 X-L Pushposts
2 National vernier dials



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

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

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 handing 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 stand-and six-tube Isofarad 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.

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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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; Victoreen Super; Silver Marshal Six; Sargent's Infradyne; Remler Super; Short Wave Kits; 9-in-Line Super; New Acme Reflex; Cockaday; Neutrodyne; Browning-Drake;** all classes of radio frequency, Super Heterodyne and every other approved popular circuit.

Radio Parts and Supplies

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.

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.**

Randolph Radio Corporation

180 North Union Avenue • Dept. 99 • Chicago, Ill.

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.

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Please Mention Radio Age When Writing To Advertisers.

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 time a year: "What shall we have for dinner?"

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

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."

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.

$50.00 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.

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

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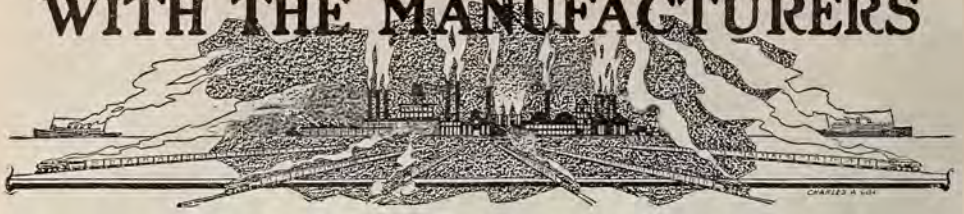


E. R. Hurley Jr., New Head of Walbert Manufacturing Co.

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?"

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"

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.

OZARKA
TRADE MARK REGISTERED

$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

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 be 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 be 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.

OZARKA
INCORPORATED
120 Austin Avenue B CHICAGO, ILL.

Abox is Real Filter

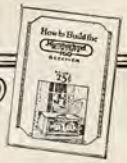
A BATTERY elimination has arrived with a bang if recent tests conducted in the Radio Age laboratory are any criterion. The new device, as developed by E. F. Andrews (of Deresnadyne fame) and Laurens Hammond, both of Chicago, comprises a filter and a choke, the former being the work of Mr. Andrews on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



"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)

Hammarlund-Roberts Performance Means A New Measure For All Radio

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

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.

Hammarlund ROBERTS Hi-Q

Hammarlund-Roberts · 1182-D Broadway : New York

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRUCLATION, 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, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

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

7 Tube Set
Single Dial Radio

30 DAYS FREE TRIAL

The Metrodyne

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, nickeled 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

6 Tube Set $48.50 RETAIL PRICE *Completely Assembled*

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.

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

2161-71 N. California Ave. • Dept. 118 • Chicago, Illinois

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

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.

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

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!

Brownsville Center

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 tha' area have often complained of in ability 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.

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 wholely 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.

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 spellbound 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.

Correct List of Broadcast Stations

KDKA	Westinghouse Electric & Mfg. Co.	East Pittsburgh, Pa.	309
KDLR	Radio Electric Co.	Devils Lake, N. D.	231
KDYL	Newhouse Hotel	Salt Lake City, Utah	246
KFAB	Nebraska Buick Auto Co.	Lincoln, Neb.	341
KFAD	Electrical Equipment Co.	Phoenix, Ariz.	273
KFAF	A. E. Fowler	San Jose, Calif.	217
KFAU	Independent School Dist.	Boise, Idaho	280
KFBB	F. A. Buttrey & Co.	Havre, Mont.	275
KFBC	W. Z. Azbill & Union League Club, San Diego, Cal.		380
KFBK	Kimball-Upson Co.	Sacramento, Calif.	535
KFBL	Leese Bros.	Everett, Wash.	224
KFBS	School District No. One	Trinidad, Colo.	238
KFBU	St. Matthews Cathedral	Laramie, Wyo.	375
KFCB	Nielson Radio Supply Co.	Phoenix, Ariz.	238
KFDD	St. Michael Cathedral	Boise, Idaho	275
KFDM	Magnolia Petroleum Co.	Beaumont, Texas	316
KFDX	First Baptist Church	Shreveport, La.	236
KFDY	South Dakota State College	Brookings, S. D.	306
KFDZ	Harry O. Iverson	Minneapolis, Minn.	231
KFEC	Meier & Frank	Portland, Ore.	248
KFEL	Eugene P. O'Fallon, Inc.	Denver, Colo.	254
KFEQ	Scroggin & Co.	Oak, Neb.	268
KFEY	Bunker Hill & Sullivan	Kellogg, Idaho	233
KFFP	First Baptist Church	Moberly, Mo.	242
KFGQ	Crary Hardware Co.	Boone, Iowa	226
KFH	Hotel Lassen	Wichita, Kans.	268
KFHA	Western State College of Colo.	Cunnison, Colo.	252
KFHL	Penn. College	Oskaloosa, Iowa	240
KFI	E. C. Anthony, Inc.	Los Angeles, Calif.	469
KFIF	Benson Polytechnic Institute	Portland, Ore.	248
KFIO	North Central High School	Spokane, Wash.	272
KFIQ	First Methodist Church	Yakima, Wash.	256
KFIU	Alaska Electric Light & Power Co.	Juneau, Alaska	226
KFIZ	Daily Commonwealth	Fond du Lac, Wis.	273
KFJB	Marshall Electric Co.	Marshalltown, Iowa	248
KFJC	R. B. Fegan	Junction City, Kans.	219
KFJF	National Radio Mfg. Co.	Oklahoma City, Okla.	261
KFJI	E. E. Marsh	Astoria, Ore.	246
KFJM	University of North Dakota	Grand Forks, N. D.	278
KFJR	Ashley C. Dixon & Son	Portland, Ore.	263
KFJY	Tunwall Radio Co.	Fort Dodge, Iowa	246
KFJZ	W. E. Branch	Ft. Worth, Tex.	254
KFKA	Colo. State Teachers College	Greeley, Colo.	273
KFKU	The University of Kansas	Lawrence, Kans.	275
KFKX	Westinghouse Elec. & Mfg. Co.	Hastings, Neb.	288
KFKZ	Chamber of Commerce	Kirksville, Mo.	225
KFLR	University of New Mexico	Albuquerque, N. M.	254
KFLU	San Benito Radio Club	San Benito, Texas	236
KFLV	Swedish Evangelist Church	Rockford, Ill.	229
KFLX	George Roy Clough	Galveston, Texas	240
KFMR	Morningside College	Sioux City, Iowa	261
KFMX	Carlton College	Northfield, Minn.	337
KFNF	Henry Field Seed Co.	Shenandoah, Iowa	461
KFOA	Rhodes Department Store	Seattle, Wash.	454
KFOB	KFOB, Inc.	Burlingame, Calif.	225
KFON	Echophone Radio Shop	Long Beach, Calif.	233
KFOO	Latter Day Saints' Union	Salt Lake City, Utah	236
KFOR	Tire & Electric Co.	David City, Neb.	226
KFOT	College Hill Radio Club	Wichita, Kans.	231
KFOX	Tech. High School	Omaha, Nebr.	248
KFOY	Beacon Radio Service	St. Paul, Minn.	252
KFPL	C. C. Baxter	Dublin, Texas	252
KFPM	The New Furniture Co.	Greenville, Texas	242
KFPR	Los Angeles County Forestry Dept.	Los Angeles, Calif.	231
KFPW	St. Johns M. E. Church	Carterville, Mo.	258
KFPY	Symons Investment Co.	Spokane, Wash.	273
KFQA	The Principia	St. Louis, Mo.	261
KFQB	The Searchlight Publishing Co.	Fort Worth, Texas	263
KFQD	Chovin Supply Co.	Anchorage, Alaska	227
KFQP	G. S. Carson, Jr.	Iowa City, Ia.	224
KFQU	W. E. Riker	Holy City, Calif.	231
KFQW	C. F. Knierim	North Bend, Wash.	216
KFQZ	Taft Products Co.	Hollywood, Calif.	226
KFRB	Hall Bros.	Beeville, Texas	248
KFRC	City of Paris	San Francisco, Calif.	268
KFRU	Stephens College	Columbia, Mo.	500
KFRW	Western Broadcasting Co.	Olympia, Wash.	219
KFSD	Airfan Radio Corp.	San Diego, Calif.	246
KFSG	Echo Park Evan. Assn.	Los Angeles, Calif.	275
KFUL	Thomas Groggan & Bros.	Galveston, Texas	258
KFUM	W. D. Corley	Colorado Springs, Colo.	240
KFUO	Concordia Seminary	St. Louis, Mo.	545
KFUP	Fitzsimmons General Hospital	Denver, Colo.	234
KFUR	Peery Bldg. Co., Inc.	Ogden, Utah	224
KFUS	Louis L. Sherman	Oakland, Calif.	256
KFUT	University of Utah	Salt Lake City, Utah	261
KFUU	H. C. Colburn and E. L. Mathewson,	Oakland, Calif.	220
KFVD	Chas. & W. J. McWhinnie	Venice, Calif.	205
KFVE	Benson Broadcasting Corp.	St Louis, Mo.	240
KFVG	First M. E. Church	Independence, Kans.	236
KFVI	Headquarters Troop, 56th Cavalry	Houston, Texas	240
KFVN	Carl E. Bagley	Fairmont, Minn.	227
KFVR	Moonlight Ranch	Denver, Colo.	244
KFVS	Cape Girardeau Battery Sta.	Cape Girardeau, Mo.	224
KFVY	Radio Supply Co.	Albuquerque, N. M.	250
KFWB	Warner Bros. Pictures	Hollywood, Calif.	252
KFWC	L. E. Wall	San Bernardino, Calif.	211
KFWF	St. Louis Truth Center	St. Louis, Mo.	214
KFWH	F. Wellington Morse, Jr.	Eureka, Calif.	254
KFWI	Radio Entertainments, Inc.	South San Francisco, Calif.	226
KFWM	Oakland Educational Society	Oakland, Calif.	207
KFWO	Lawrence Mott	Avalon, Calif.	211
KFWU	Louisiana College	Pineville, La.	238
KFWV	Wilbur Jerman	Portland, Ore.	213
KFXB	Bertram C. Heller	Big Bear Lake, Calif.	203
KFXD	Service Radio Co.	Logan, Utah	205
KFXF	Pike's Peak Broadcasting Co.	Colorado Springs, Colo.	250
KFXH	Bledsoe Radio Company	El Paso, Texas	242
KFXJ	R. G. Howell	near Edgewater, Colo.	216
KFXR	Classen Film Finishing Co.	Oklahoma City, Okla.	214
KFXY	Harry M. Costigan	Flagstaff, Ariz.	205
KFYF	Carl's Radio Den	Oxnard, Calif.	214
KFYJ	Houston Chronicle Pub. Co. (Portable)	Houston, Tex.	238
KFYÖ	Buchanan-Vaughan Co.	Texarkana, Tex.	210
KFYR	Hoskins-Meyer, Inc.	Bismarck, N. Dak.	248
KGAR	Tucson Citizen	Tucson, Ariz.	244
KGBS	A. C. Dailey	Seattle, Wash.	227
KGBU	R. R. Thornton	Ketchikan, Alaska	229
KGBW	Martin Brotherson	Joplin, Mo.	283
KGBX	J. B. Abercrombie	St. Joseph, Mo.	348
KGBY	Albert C. Dunning	Shelby, Nebr.	203
KGBZ	Federal Livestock Remedy Co.	York, Nebr.	333
KGCA	C. W. Greenley	Decorah, Iowa	280
KGCB	Wallace Radio Institute	Oklahoma, Okla.	331
KGCG	Moore Motor Co.	Newark, Ark.	234
KGCH	Wayne Hospital	Wayne, Nebr.	450
KGCI	International Radio Co.	San Antonio, Texas	240
KGCL	Louis Wasmer	Seattle, Washington	230
KGCM	Robert B. Bridge	San Antonio, Texas	263
KGCN	Alva E. Smith	Concordia, Kansas	210
KGCR	Cutler's Broadcasting Service	Brookings, S. D.	252
KGO	General Electric Co.	Oakland, Calif.	361
KGTT	Glad Tidings Tabernacle, Inc.	San Francisco, Calif.	207
KGU	Marion A. Mulrony	Honolulu, Hawaii	270
KGW	Morning Oregonian	Portland, Oreg.	492
KGY	St. Martins College	Lacey, Wash.	278
KHJ	Times-Mirror Co.	Los Angeles, Calif.	405
KHQ	Louis Wasmer	Spokane, Wash.	395
KICX	Atlantic Automobile Co.	Anita, Ia.	273
KJBS	J. Brunton & Sons Co.	San Francisco, Calif.	220
KJR	Northwest Radio Service Co.	Seattle, Wash.	384

Field Intensity Measuring Instruments.

(Continued from page 37)

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 laboratory 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)

KLDS	Reorganized Church of Jesus Christ,	Independence, Mo.	441
KLS	Warner Brothers	Oakland, Calif.	250
KLX	Tribune Publishing Co.	Oakland, Calif.	508
KLZ	Reynolds Radio Co.	Denver, Colo.	265
KMA	May Seed & Nursery	Shenandoah, Iowa	461
KMJ	Fresno Bee	Fresno, Calif.	234
KMMJ	M. M. Johnson Co.	Clay Center, Nebr.	229
KMO	Love Electric Co.	Tacoma, Wash.	250
KMOX	Voice of St. Louis	St. Louis, Mo.	280
KMTR	Echophone Mfg. Co.	Los Angeles, Calif.	238
KNRC	C. B. Juneau	Hollywood, Calif.	208
KNX	Los Angeles Express	Los Angeles, Calif.	337
KOA	General Electric Co.	Denver, Colo.	322
KOAC	Oregon Agriculture College	Corvallis, Oreg.	280
KOB	N. Mex. College of Agric.	State College, N. Mex.	349
KOCH	Omaha Central High School	Omaha, Neb.	258
KOCW	Oklahoma College for Women	Chickasha, Okla.	252
KOIL	Mona Motor Oil Co.	Council Bluffs, Iowa	306
KOIN	KOIN, Inc.	Portland, Ore.	319
KOMO	Birt F. Fisher	Seattle, Wash.	306
KOWW	Frank A. Moore	Walla Walla, Wash.	285
KPJM	Wilburn Radio Service	Prescott, Ariz.	215
KPO	Hale Bros., Inc.	San Francisco, Calif.	428
KPPC	Pasadena Presbyterian Church	Pasadena, Calif.	229
KPRC	Houston Printing Co.	Houston, Texas	297
KPSN	Star-News Publishing Co.	Pasadena, Calif.	316
KQW	First Baptist Church	San Jose, Calif.	333
KQV	Doubleday-Hill Electric Co.	Pittsburgh, Pa.	275
KRE	Berkeley Daily Gazette	Berkeley, Calif.	256
KSAC	Kansas State Agricultural College	Manhattan, Kans.	341
KSD	Pulitzer Publishing Co.	St. Louis, Mo.	545
KSL	Radio Service Corp.	Salt Lake City, Utah	300
KSMR	Santa Maria Valley Railroad	Santa Maria, Calif.	210
KSO	A. A. Berry Seed Co.	Clarinda, Iowa	242
KTAB	Associated Broadcasters	Oakland, Calif.	303
KTBI	Bible Institute	Los Angeles, Calif.	294
KTBR	M. E. Brown	Portland, Ore.	263
KTHS	New Arlington Hotel	Hot Springs, Ark.	375
KTNT	N. Baker	Muscatine, Iowa	333
KTUE	Uhalt Electric	Houston, Texas	263
KTW	First Presbyterian Church	Seattle, Wash.	454
KUOA	University of Arkansas	Fayetteville, Ark.	300
KUOM	University of Montana	Missoula, Mont.	244
KUSD	University of South Dakota	Vermillion, S. D.	278
KUT	University of Texas	Austin, Texas	231
KVOO	The Voice of Oklahoma	Bristow, Okla.	375
KWCR	H. F. Parr	Cedar Rapids, Iowa	278
KWG	Portable Wireless Telegraph Co.	Stockton, Calif.	248
KWKC	Wilson Duncan Studios	Kansas City, Mo.	236
KWKH	W. G. Patterson	Kennonwood, La.	312
KWSC	State College of Washington	Pullman, Wash.	349
KWUG	Western Union College	Le Mars, Iowa	252
KWWG	City of Brownsville	Brownsville, Texas	278
KYW	Westinghouse Electric & Mfg. Co.	Chicago, Ill.	535
KZM	Preston D. Allen	Oakland, Calif.	240
WAAD	Ohio Mechanical Institute	Cincinnati, Ohio	258
WAAF	Chicago Daily Drovers Journal	Chicago, Ill.	278
WAAM	Isaiah R. Nelson	Newark, N. J.	263
WAAT	F. V. Bremer	Jersey City, N. J.	235
WAAW	Omaha Grain Exchange	Omaha, Nebr.	278
WABB	Harrisburg Radio Co.	Harrisburg, Pa.	204
WABC	Asheville Battery Co.	Asheville, N. C.	254
WABI	1st Univeralist Church	Bangor, Me.	240
WABO	Hickson Elec. Co., Inc.	Rochester, N. Y.	278
WABQ	Haverford College Radio Club	Haverford, Pa.	261
WABR	Scott High School	Toledo, Ohio	263
WABW	College of Wooster	Wooster, Ohio	207
WABX	Henry B. Joy	Mt. Clemens, Mich.	246
WABY	John Magaldi, Jr.	Philadelphia, Pa.	242
WABZ	Colis Place Baptist Church	New Orleans, La.	275
WADC	Allen T. Simmons	kron, Ohio	258
WAFD	Albert P. Parfet	Port Huron, Mich.	275
WAGM	R. L. Miller	Royal Oak, Mich.	275
WAHG	A. H. Grebe	Richmond Hill, N. Y.	316
WAIT	A. H. Waite & Co.	Tuanton, Mass.	229
WAIU	American Insurance Union	Columbus, Ohio	294
WAMD	Raddison Radio Corp.	Minneapolis, Minn.	244
WAPI	Alabama Polytechnic Institute	Auburn, Ala.	461
WARC	American Radio & Research	Medford, Mass.	261
WATT	Edison Elec. Illum. (Portable)	Boston, Mass.	244
WBAA	Purdue University	W. Lafayette, Ind.	273
WBAC	James Milliken University	Decatur, Ill.	270
WBAK	Pennsylvania State Police	Harrisburg, Pa.	275
WBAL	Consolidated Gas & Power Co.	Baltimore, Md.	246
WBAP	Wortham-Carter Pub. Co.	Ft. Worth, Texas	476
WBAW	Braid Elec. Co. & Waldrum Dru. Co.	Nashville, Tenn.	236
WBAX	John H. Stenger, Jr.	Wilkes-Barre, Pa.	256
WBBC	P. J. Testan	Brooklyn, N. Y.	250
WBBL	Grace Covenant Presbyterian Church	Richmond, Va.	229
WBBM	Atlass Investment	Chicago, Ill.	226
WBBP	Petoskey High School	Petoskey, Mich.	238
WBBR	People's Pulpit Assoc.	Rossville, N. Y.	416
WBBS	First Baptist Church	New Orleans, La.	252
WBBW	Ruffner Junior High School	Norfolk, Va.	222
WBBY	Washington Light Inf.	Charleston, S.C.	268
WBBZ	C. L. Carrell (Portable.)	Chicago Ill.	216
WBCN	Foster & McDonnell	Chicago, Ill.	266
WBDC	Baxter Laundry Co.	Grand Rapids, Mich.	256
WBES	Bliss Electrical School	Takoma Park, Md.	222
WBNY	Baruschrome Corp.	New York, N. Y.	322
WBOQ	A. H. Grebe & Co., Inc.	Richmond Hill, N. Y.	236
WBRC	Birmingham Broadcasting Co.	Birmingham, Ala.	248
WBRE	Baltimore Radio Exchange	Wilkes-Barre, Pa.	231
WBRS	Universal Radio Mfg. Co.	Brooklyn, N. Y.	394
WBT	Charlotte Chamber of Commerce	Charlotte, N. C.	275
WBZ	Westinghouse Elect. & Mfg. Co.	Springfield, Mass.	333
WBZA	Westinghouse Elect. & Mfg. Co.	Boston, Mass.	333
WCAC	Connecticut Agricultural College	Mansfield, Conn.	275
WCAD	St. Lawrence University	Canton, N. Y.	263
WCAE	Kaufman & Baer Co.	Pittsburgh, Pa.	461
WCAJ	Nebraska Wesleyan University	University Place, Nebr.	254
WCAL	St. Olaf College	Northfield, Minn.	337
WCAM	City of Camden	Camden, N. J.	236
WCAO	Brager, of Baltimore	Baltimore, Md.	275
WCAP	Chesapeake & Potomac Tel. Co.	Washington, D. C.	469
WCAR	Southern Radio Corp.	San Antonio, Texas	263
WCAT	School of Mines	Rapid City, S. Dak.	240
WCAU	Universal Broadcasting Co.	Philadelphia, Pa.	278
WCAX	University of Vermont	Burlington, Vt.	250
WCAZ	Carthage College	Carthage, Ill.	246
WCBA	Charles W. Heimbach	Allentown, Pa.	254
WCBD	Wilbur Glenn Voliva	Zion, Ill.	345
WCBE	Uhalt Radio Co.	New Orleans, La.	263
WCBH	University of Mississippi	Oxford, Miss.	242
WCBM	Hotel Chateau	Baltimore, Md.	229
WCBR	C. H. Messter	Portable	210
WCBS	H. L. Dewing. Portable,	Boston Mass.	242
WCCO	Washburn-Crosby Co.	Anoka, Minn.	416
WCFL	Chicago Fed. of Labor	Chicago, Ill.	492
WCFT	Knights of Pythias Home	Tullahoma, Tenn.	252
WCLO	C. E. Whitmore	Camp Lake Wis.	231
WCLS	H. M. Couch	Joliet, Ill.	214
WCMA	Culver Military Academy	Culver, Ind.	258
WCOA	City of Pensacola	Pensacola, Fla.	222
WCRW	Clinton R. White	Chicago, Ill.	416
WCSH	Henry R. Rines	Portland, Maine	256
WCSO	Wittenberg College	Springfield, Ohio	248
WCWK	Chester W. Keen	Fort Wayne, Ind.	231
WCWS	Chas. W. Selene (Portable)	Mass.	210
WCX	Detroit Free Press	Pontiac, Mich.	517
WDAD	Dad's Auto Accessories, Inc.	Nashville, Tenn.	226
WDAE	Tampa Daily Times	Tampa, Fla.	273
WDAF	Kansas City Star	Kansas City, Mo.	366
WDAG	J. Laurence Martin	Amarillo, Texas	263
WDAH	Trinity Methodist Church	El Paso, Texas	268
WDAY	Radio Equipment Corp.	Fargo, N. Dak.	261

Building Henry-Lyford Tuned and Untuned R. F. Receiver

(Continued from page 32)

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 red 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)

WDBE	Gilham-Schoen Elec. Co.	Atlanta, Ga.	270
WDBJ	Richardson Wayland Elec. Corp.	Roanoke, Va.	220
WDBK	M. F. Broz	Cleveland, Ohio	227
WDBO	Rollins College	Winter Park, Fla.	240
WDBZ	Kingston Radio Club	Kingston, N. Y.	233
WDEL	Wilmington Elec. Specialty Co.	Wilmington, Del.	266
WDGY	Dr. George W. Young	Minneapolis, Minn.	263
WDOD	Chattanooga Radio Co., Inc.	Chattanooga, Tenn.	256
WDRC	Doolittle Radio Corp.	New Haven, Conn.	268
WDWF	Dutee Wilcox Flint, Inc.	Cranston, R. I.	441
WDZ	J. L. Bush	Tuscola, Ill.	278
WEAF	Broadcasting Co. of America	New York, N. Y.	491
WEAI	Cornell University	Ithaca, N. Y.	254
WEAM	Bor. of N. Plainfield	North Plainfield, N. J.	261
WEAN	The Shepard Co.	Providence, R. I.	367
WEAO	Ohio State University	Columbus, Ohio	294
WEAR	Willard Storage Battery Co.	Cleveland, Ohio	389
WEAU	Davidson Bros. Co.	Sioux City, Iowa	275
WEBC	Walter Cecil Bridges	Superior, Wis.	242
WEBH	Edgewater Beach Hotel	Chicago, Ill.	370
WEBJ	Third Avenue Railway Co.	New York, N. Y.	273
WEBL	R. C. A. Show (Portable)	New York, N. Y.	226
WEBQ	Tate Radio Corp.	Harrisburg, Ill.	226
WEBR	H. H. Howell	Buffalo, N. Y.	244
WEBW	Beloit College	Beloit, Wis.	268
WEBZ	Savannah Radio Corp.	Savannah, Ga.	263
WEEI	The Edison Elec. Illuminating Co.	Boston, Mass.	349
WEHS	Oliver G. Fordham	Evanston, Ill.	203
WEMC	Emanuel Missionary College	Berrien Springs, Mich.	285
WENR	All-American Radio Corp.	Chicago, Ill.	266
WEW	St. Louis University	St. Louis, Mo.	360
WFAA	Dallas News & Dallas Journal	Dallas, Tex.	476
WFAM	Times Publishing Co.	St. Cloud, Minn.	273
WFAV	University of Nebraska	Lincoln, Neb.	275
WFBC	First Baptist Church	Knoxville, Tenn.	250
WFBE	J. V. De Walle	Seymour, Ind.	226
WFBG	The Wm. F. Gable Co.	Altoona, Pa.	278
WFBH	Concourse Radio Corp.	New York, N. Y.	273
WFBJ	St. John's University	Collegeville, Minn.	236
WFBL	Onondaga Hotel Co.	Syracuse, N. Y.	252
WFBM	Merchants Heat & Light Co.	Indianapolis, Ind.	268
WFBR	Fifth Infantry National Guard	Baltimore, Md.	254
WFBZ	Knox College	Galesburg, Ill.	254
WFCI	Frank Crook, Inc.	Pawtucket R. I.	229
WFDF	F. D. Fallain	Flint, Mich.	234
WFKB	Vesta Battery Corp.	Chicago, Ill.	217
WFL	Strawbridge and Clothier	Philadelphia, Pa.	394
WFRL	Robert Morrison Lacey	Brooklyn, N. Y.	205
WGAL	Lancaster Elec. Supply & Const. Co.	Lancaster, Pa.	248
WGBB	H. H. Carman	Freeport, N. Y.	244
WGBC	First Baptist Church	Memphis, Tenn.	278
WGBF	Fink Furniture Co.	Evansville, Ind.	236
WGBL	Scranton Broadcasters, Inc.	Scranton, Pa.	240
WGBR	George S. Ives	Marshfield, Wis.	229
WGBS	Gimbel Brothers	Astoria, L. I., N. Y.	316
WGBU	Florida Cities Finance Co.	Fulford By-The-Sea, Fla.	278
WGBX	University of Maine	Orono, Me.	234
WGCP	May Radio Broadcast Corp.	Newark, N. J.	252
WGES	Oak Leaves Broadcasting Corp.	Chicago, Ill.	250
WGHB	Fort Harrison Hotel	Clearwater, Fla.	266
WGHP	G. H. Phelps	Detroit, Mich.	270
WGM	Verne and Elton Spencer	Jeanette, Pa.	372
WGMU	A. H. Grebe & Co. (Portable)	New York	236
WGN	The Tribune	Chicago, Ill.	303
WGR	Federal T. and T. Co.	Buffalo, N. Y.	319
WGST	Georgia School of Technology	Atlanta, Ga.	270
WGY	General Elec. Co.	Schenectady, N. Y.	379
WHA	University of Wisconsin	Madison, Wis.	535
WHAD	Marquette University	Milwaukee, Wis.	275
WHAM	Eastman School of Music	Rochester, N. Y.	278
WHAP	W. H. Taylor Finance Corp.	New York, N. Y.	431
WHAR	E. D. Cooke Sons	Atlantic City, N. J.	275
WHAS	Courier-Journal & Louisville Times	Louisville, Ky.	400
WHAZ	Rensselaer Polytechnic Institute	Troy, N. Y.	379
WHB	Sweeney School Co.	Kansas City, Mo.	366
WHBA	C. C. Shaffer	Oil City, Pa.	250
WHBC	Rev. E. P. Graham	Canton, Ohio	254
WHBD	Chamber of Commerce	Bellefontaine, Ohio	222
WHBF	Beardsley Specialty Company	Rock Island, Ill.	222
WHBG	John S. Skane	Harrisburg, Pa.	231
WHBL	C. L. Carrell (Portable)	Chicago, Ill.	216
WHBM	C. L. Carrell, (Portable)	Chicago, Ill.	216
WHBN	First Ave. Methodist Church	St. Petersburg, Fla.	233
WHBP	Johnstown Automobile Co.	Johnstown, Pa.	255
WHBQ	St. John's M. E. Church South	Memphis, Tenn.	233
WHBU	Riviera Theatre & Bing's Clothing	Anderson, Ind.	219
WHBW	D. R. Kienzle	Philadelphia, Pa.	216
WHBY	St. Norbert's College	West de Pere, Wis.	250
WHDI	W. H. Dunwoody Institute	Minneapolis, Minn.	278
WHEC	Hickson Electric Co., Inc.	Rochester, N. Y.	258
WHFC	Hotel Flanders	Chicago, Ill.	258
WHK	The Radio Air Service Corp.	Cleveland, Ohio	273
WHN	George Schubel	New York, N. Y.	361
WHO	Banker's Life Co.	Des Moines, Ia.	526
WHT	Radiophone Broadcasting Corp.	Deerfield, Ill.	238
WIAD	Howard R. Miller	Philadelphia, Pa.	250
WIAS	Home Electric Co.	Burlington, Iowa	254
WIBA	Capital Times-Strand Theatre	Madison, Wis.	236
WIBG	St. Paul's Protestant E. Church	Elkins Park, Pa.	222
WIBH	Elite-Radio Stores	New Bedford, Mass.	210
WIBI	Frederick B. Zittell, Jr.	Flushing, L. I., N. Y.	219
WIBJ	C. L. Carrell (Portable)	Chicago, Ill.	216
WIBM	Pilly Maine (Portable)	Chicago, Ill.	216
WIBO	Nelson Brothers	Chicago, Ill.	226
WIBR	Thurman A. Owings	Weirton, W. Va.	246
WIBS	T. F. Hunter	Elizabeth, N. J.	203
WIBU	The Electric Farm	Poynette, Wis.	222
WIBW	Dr. L. L. Dill	Logansport, Ind.	220
WIBX	WIBX, Inc.	Utica, N. Y.	234
WIBZ	A. D. Trum	Montgomery, Ala.	231
WIL	Benson Radio Co.	St. Louis, Mo.	258
WIOD	Earl G. Fisher Co.	Miami, Fla.	248
WIP	Gimbel Bros.	Philadelphia, Pa.	508
WJAD	Jackson's Radio Eng. Laboratories	Waco, Texas	353
WJAF	J. A. Fernberg Radio Co.	Ferndale, Mich.	400
WJAG	Norfolk Daily News	Norfolk, Neb.	270
WJAK	Kokomo Tribune	Kokomo, Ind.	254
WJAM	D. M. Perham	Cedar Rapids, Iowa	268
WJAR	The Outlet Co.	Providence, R. I.	306
WJAS	Pittsburgh Radio Supply House	Pittsburgh, Pa.	275
WJAX	City of Jacksonville	Jacksonville, Fla.	337
WJAZ	Zenith Radio Co.	Mt. Prospect, Ill.	329
WJBA	D. H. Lentz, Jr.	Joliet, Ill.	207
WJBB	Financial Journal	St. Petersburg, Fla.	254
WJBC	Hummer Furniture Co.	LaSalle, Ill.	234
WJBI	Robert S. Johnson	Red Bank, N. J.	219
WJBK	E. F. Goodwin	Ypsilanti, Mich.	233
WJBL	Wm. Gushard Dry Goods Co.	Decatur, Ill.	270
WJBO	Valdemar Jensen	New Orleans, La.	268
WJBR	Omro Drug Stores	Omro, Wis.	227
WJBT	John S. Boyd	Chicago, Ill.	238
WJBU	Bucknell University	Lewisburg, Pa.	211
WJBV	Union Course Laboratories	Woodhaven, N. Y.	470
WJBW	C. Carlson, Jr.	New Orleans, La.	341
WJBX	Henderson & Ross	Osterville, Mass.	280
WJBY	Electric Construction Co.	Gadsden, Ala.	270
WJJD	Supreme Lodge, L. O. of Moose	Mooseheart, Ill.	370
WJR	Jewett Radio & Phonograph Co.	Pontiac, Mich.	517
WJY	Radio Corp. of America	New York, N. Y.	405
WJZ	Radio Corp. of America	Bound Brook, N. J.	454
WKAF	WKAF Broadcasting Co.	Milwaukee, Wis.	261
WKAQ	Radio Corp. of Porto Rico	San Juan, P. R.	341
WKAR	Michigan State College	East Lansing, Mich.	286
WKAV	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)

WKBA	Arrow Battery Co.	Chicago, Ill.	210
WKBB	Sanders Bros.	Joliet, Ill.	283
WKBC	H. L. Ansley	Birmingham, Ala.	225
WKBE	K. & D. Electric Co.	Webster, Mass.	270
WKBF	N. D. Watson	Indianapolis, Ind	244
WKBG	C. L. Carrell (Portable)	Chicago, Ill.	216
WKBH	Callaway Music Co.	LaCrosse, Wis.	250
WKBI	F. L. Schoenwolf	Chicago, Ill.	220
WKBJ	Gospel Tabernacle Inc.	St. Petersburg, Fla	280
WKBL	Monrona Radio Mfg. Co.	Monroe, Mich.	252
WKBM	J. W. Jones	Newburgh, N. Y.	215
WKBO	Camith Corporation	Jersey City, N. J.	309
WKBP	Enquirer and News	Battle Creek, Mich.	265
WKDR	Edward A. Dato	Kenosha, Wis.	428
WKJC	Kirk Johnson & Co.	Lancaster, Pa.	258
WKRC	Kodel Radio Corp.	Cincinnati, Ohio	422
WKY	Hull and Richards	Oklahoma City, Okla.	275
WLAL	First Christian Church	Tulsa, Okla.	250
WLAP	Wm. V. Jordan	Louisville, Ky.	275
WLB	University of Minnesota	Minneapolis, Minn.	278
WLBL	Wisconsin Dept. of Markets	Stevens Point, Wis.	278
WLIB	Liberty Weekly, Inc.	Elgin, Ill.	303
WLIT	Lit Bros.	Philadelphia, Pa.	394
WLS	Sears Roebuck & Co.	Crete, Ill.	345
WLSL	Lincoln Studios	Cranston, R. I.	441
WLTS	Lane Technical High School	Chicago, Ill.	258
WLW	Crosley Radio Corp.	Harrison, Ohio	422
WLWL	Paulist Fathers	New York, N.Y.	288
WMAC	C. B. Meredith	Casenovia, N. Y.	275
WMAF	Round Hills Radio Corp.	Dartmouth, Mass.	441
WMAK	Norton Laboratories	Lockport, N. Y.	266
WMAL	M. A. Leese Optical Co.	Washington, D. C.	213
WMAN	Haskett Radio Station	Columbus, Ohio	278
WMAQ	Chicago Daily News	Chicago, Ill.	447
WMAY	Kingshighway Presbyterian Church	St. Louis, Mo.	248
WMAZ	Mercer University	Macon, Ga.	261
WMBB	American Bond & Mortgage Co.	Chicago, Ill.	250
WMBC	Michigan Broadcasting Co., Inc.	Detroit, Mich.	256
WMBF	Fleetwood Hotel Corp.	Miami Beach, Fla.	384
WMBI	Moody Bible Institute	Chicago, Ill.	288
WMC	Commercial Pub. Co.	Memphis, Tenn.	500
WMCA	Greely Sq. Hotel Co.	Hoboken, N. J.	341
WMRJ	Peter J. Prinz	Jamaica, N. Y.	227
WMSG	Madison Sq. Gard. Bdcast. Corp.	New York, N. Y.	302
WNAB	Shepard Stores	Boston, Mass.	280
WNAC	Shepard Stores	Boston, Mass.	430
WNAD	University of Oklahoma	Norman, Okla.	254
WNAL	Omaha Central High School	Omaha, Nebr.	258
WNAT	Lenning Brothers Co.	Philadelphia, Pa.	250
WNAX	Dakota Radio Apparatus Co.	Yankton, S. Dak.	244
WNBH	New Bedford Hotel	New Bedford, Mass.	248
WNJ	Radio Shop	Newark, N. J.	252
WNOX	Peoples Tel. & Tel. Co.	Knoxville, Tenn.	268
WNRC	W. B. Nelson	Greensboro, N. C.	224
WNYC	Dept. of Plants & Structures	New York, N. Y.	526
WOAI	Southern Equipment Co.	San Antonio, Texas	394
WOAN	J. D. Vaughn	Lawrenceburg, Tenn.	283
WOAW	Woodman of the World	Omaha, Nebr.	526
WOAX	Franklyn J. Wolff	Trenton, N. J.	240
WOC	Palmer School of Chiropractic	Davenport, Iowa	484
WOCL	A. D. Newton	Jamestown, N. Y.	275
WODA	O'Dea Temple of Music	Paterson, N. J.	391
WOI	Iowa State College	Ames, Iowa	270
WOK	Neutrowound Radio Mfg. Co.	Homewood, Ill.	217
WOKO	Harold E. Smith	Peekskill, N. Y.	232
WOO	John Wanamaker	Philadelphia, Pa.	508
WOOD	Grand Rapids Radio Co.	Grand Rapids, Mich.	242
WOQ	Unity School	Kansas City, Mo.	278
WOR	L. Bamberger and Co.	Newark, N. J.	405
WORD	People's Pulpit Assn.	Batavia, Ill.	275
WOS	State Market Bureau	Jefferson City, Mo.	441
WOWO	Main Auto Supply Co.	Fort Wayne, Ind.	227
WPAK	N. D. Ag. College	Agricultural College, N. D.	275
WPAP	(See WQAO)	Cliffside, N. J.	361
WPCC	North Shore Cong. Church	Chicago, Ill.	258
WPDQ	H. L. Turner	Buffalo, N. Y.	205
WPG	The Municipality of Atlantic City	Atlantic City, N. J.	300
WPRC	Wilson Printing & Radio Co.	Harrisburg, Pa.	216
WPSC	Pennsylvania State College	State College, Pa.	261
WQAA	Horace A. Beale, Jr.	Parkersburg, Pa.	220
WQAC	Gish Radio Service	Amarillo, Tex.	234
WQAE	Moore Radio News Station	Springfield, Vt.	246
WQAM	Electrical Equipment Co.	Miami, Fla.	285
WQAN	Scranton Times	Scranton, Pa.	250
WQAO	Calvary Baptist Church	Cliffside, N. J.	361
WQJ	Calumet Rainbo Broadcasting Co.	Chicago, Ill.	447
WRAF	The Radio Club (Inc.)	LaPorte, Ind.	224
WRAH	S. N. Read	Providence, R. I.	235
WRAK	Economy Light Co.	Escanaba, Mich.	256
WRAM	Lombard College	Galesburg, Ill.	244
WRAV	Antioch College	Yellow Springs, Ohio	263
WRAW	Avenue Radio & Electric Shop	Reading, Pa.	238
WRAX	Beracah Church, Inc.	Philadelphia, Pa.	268
WRBC	Immanuel Lutheran Church	Valparaiso, Ind.	278
WRC	Radio Corp. of America	Washington, D. C.	468
WRCO	Wayne Radio Co.	Raleigh, N. C.	252
WREC	Wooten's Radio Shop	Coldwater, Miss.	254
WREO	Reo Motor Car Co.	Lansing, Mich.	285
WRHF	Wash. Radio Hospital Fund	Washington, D.C.	256
WRHM	Rosedale Hospital, Inc.	Minneapolis, Minn.	252
WRK	Doron Bros.	Hamilton, Ohio	270
WRM	University of Illinois	Urbana, Ill.	273
WRMU	A. H. Grebe & Co., Inc.,	Motor Yacht "MU-1"	236
WRNY	Experimenter Publishing Co.	New York, N. Y.	375
WRR	City of Dallas	Dallas, Tex.	246
WRST	Radiotel Mfg. Co., Inc.	Bay Shore, N. Y.	216
WRVA	Larus & Brother Co., Inc.	Richmond, Va.	256
WSAI	United States Playing Card Co.	Cincinnati, Ohio	326
WSAJ	Grove City College	Grove City, Pa.	229
WSAN	Allentown Call Publishing Co. Inc.	Allentown, Pa.	229

For greatest volume and distance the antenna rotor coil should be set parallel to the fixed coil. The proper use of the balance control is important for best results. In looking for distant stations the procedure is as follows: Set the balance condenser slightly off of the neutralizing point. Rotate the tuning dials together slowly until the carrier wave of a distant station is tuned in. Now clear up the signal by resetting the balance condenser. Readjust the tuning dials for maximum volume and your station will come in as it should. Take note of these settings and it will be possible to retune to this station at any future time. Rotating the movable winding of the antenna coil toward a right angled position with respect to the fixed coil will give additional selectivity, with a slight decrease in signal strength.

Field Intensity Measuring

(Continued from page 63)

distance is not reduced by higher power and limits the zone of satisfactory reception.

"One of the greatest obstacles to good radio reception is fading. The Bureau of Standards in cooperation with about forty other laboratories has been making graphical records of fading on prearranged schedules to study the changes in fading during the sunset period. Accurate knowledge of the sunset-fading phenomena should throw light on the nature and causes of fading. These fading records give a comparative record of the variation of field intensity.

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4 Amplifiers
5 "B" batteries, all kinds
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  (a) Dry
  (b) Wet
7 Battery chargers
8 Battery substitutes
  (a) "A" battery
  (b) "B" battery
9 Battery supplies
10 Bezels
11 Binding posts
12 Books on radio
13 Broadcasting equipment
14 Buzzers
15 "C" batteries
16 Cabinets
17 Code practice sets
18 Coils, all forms
19 Condensers, fixed
20 Condensers, variable
21 Contact points
22 Cords, headset, etc.
23 Couplers, vario, etc.
24 Crystals
25 Desks
26 Detector (crystals)
27 Detector tubes
28 Detector units
29 Dials
30 Dies
31 Drills
32 Electrolyte
33 Fibre
34 Filters
35 Fuses, tube
36 Grid leaks
37 Ground clamps
38 Head phones
39 Horns, all types
40 Hydrometers
41 Inductances
42 Insulation
43 Insulators, all types
44 Irons, soldering
45 Jacks
46 Jars, battery
47 Keys, transmitting
48 Knobs
49 Laboratories, testing
50 Lightning arresters
51 Loud speakers
52 Lugs, battery
53 Meters, all types
54 Mica
55 Mountings
56 Nuts
57 Panels
58 Paste, soldering
59 Patent attorneys
60 Phone connectors
61 Phonograph adapters
62 Plugs
63 Pointers
64 Potentiometers
65 Rectifiers
66 Resistances, fixed
67 Rheostats
68 Scrapers, wire
69 Screw drivers
70 Screws
71 Schools, radio
72 Sets, transmitting
73 Sets, receiving
  (a) Factory Built (b) kits
  1 Crystal
  2 Radio Frequency
  3 Reflex
  4 Regenerative
  5 Super-heterodyne
74 Shellac
75 Sockets
76 Solder
77 Supports, aerial
78 Switches
79 Transformers, a. f.
80 Transformers, r. f.
81 Transformers, sending
82 Tubes, all types
83 Variometers
84 Wave meters
85 Wave traps
86 Wire, all kinds

RADIO AGE BUYERS' SERVICE 500 N. Dearborn St., Chicago, Ill.

Please see that I am supplied with buying specifications and prices on the articles numbered herewith:

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

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

My Occupation .....

My Name .....

Address .....

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

11-26

WSAR	Daughty & Welch Electrical Co.	Fall River, Mass.	254
WSAV	Clifford W. Vick	Houston, Tex.	248
WSAX	Zenith Radio Corp. (Portable)	Chicago, Ill.	268
WSAZ	Chase Electric Shop	Pomeroy, Ohio	244
WSB	Atlanta Journal	Atlanta, Ga.	428
WSBC	World Battery Co.	Chicago, Ill.	6
WSBF	Stix Baer & Fuller	St. Louis, Mo.	273
WSBT	South Bend Tribune	South Bend, Ind.	315
WSDA	Seventh Day Adventist Church	New York, N. Y.	263
WSKC	World's Star Knitting Co.	Bay City, Mich.	261
WSM	Nashville Life & Accident Ins. Co.	Nashville, Tenn	283
WSMB	Saenger Amuse. Co. & Maison B. Co.	New Orleans, La	319
WSMH	Shattuck Music House	Owosso, Mich.	240
WSMK	S. M. K. Radio Corp.	Dayton, Ohio	275
WSOE	School of Engineering	Milwaukee, Wis.	246
WSRO	Harry W. Fahrlander	Hamilton, Ohio	252
WSSH	Tremont Temple Bap. Church	Boston, Mass.	261
WSUI	State University of Iowa	Iowa City, Iowa	484
WSVS	Seneca Vocational School	Buffalo, N. Y.	219
WSWS	Illinois Broadcasting Corp.	Wooddale, Ill.	275
WTAB	Fall River Daily Herald Publishing Co.	Fall River, Mass.	266
WTAD	Robt. E. Compton	Carthage, Ill.	236
WTAG	Worcester Telegram	Worcester, Mass.	545
WTAL	Toledo Radio & Electric Co.	Toledo, Ohio	252
WTAM	Willard Storage Battery Co.	Cleveland, Ohio	389
WTAQ	C. S. Van Gordon	Eau Claire, Wis.	254
WTAR	Reliance Electric Co.	Norfolk, Va.	261
WTAW	Agricultural & Mech. Col. of Texas	College Sta., Texas	270
WTAX	Williams Hardware Co.	Streator. Ill.	231
WTAZ	Thomas J. McGuire	Lambertville, N. J.	261
WTIC	Travelers Insurance Co.	Hartford, Conn.	476
WWAE	Electric Park	Plainfield, Ill.	384
WWJ	Evening News Assn. (Detroit News)	Detroit, Mich.	353
WWL	Loyola University	New Orleans La.	275
WWRL	Woodside Radio Labs.	Woodside, N. Y.	258

Dominion of Canada

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

Republic of Mexico

CYB	Mexico City	480	CYL	Mexico City	400	CZE	Mexico City 350

Republic of Cuba

PWX	Cuban Telephone Co.	Havana 400	5DW	R. S. Calderon	Matanzas 290	6KW	F. H. Jones	Tuinucu 272
2BY	F. W. Borton	Havana 260	6VY	Jose Ganduxe	Cienfuegos 250	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						

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

*Crystal Control

CLASSIFIED ADVERTISEMENTS

If you have anything to buy or sell, don't overlook the value of RADIO AGE'S classified advertisements.

The classified advertising rates are but five cents per word for a single insertion. Liberal discounts are allowed on three, six and twelve-time insertions, making rate of 4 1-2, 4 and 3 cents a word per insertion respectively. Unless placed through an accredited advertising agency, cash should accompany all orders. Name and address must be included at foregoing rates. Minimum contract charge $1.00.

All classified ads for the December issue must be sent in by October 25.

AGENTS WANTED

Gold Wave Aerial. Greatest Side Line out. Guaranteed to bring in more stations—gives greater distance and selectivity. Reduces static to a minimum. Sells all dealers handling radio. Unlimited field. Big commissions and re-orders. Lutem and Davis Mfg. Co., 6231 Broadway, Dept. 61, Chicago.

MAN in each town to plate auto parts, reflectors, bath fixtures, silver mirrors, refinish beds, chandeliers by new method; $10 daily; no capital or experience required; outfits furnished; write today. Gunmetal Company, Avenue J, Decatur, Illinois.

SELLS for $9.75. Prints ad on wrapping paper, envelopes, etc. $1.00 commission. Send 10c for sample work. Automatic Ad-Stamper, Joplin, Mo.

Fifty weekly easy, circulating magazine clubs. Instruction list free. Spencer Shields Agencies, W. Los Angeles, Calif.

BOOKS AND MAGAZINES

What could be better than magazine subscriptions for holiday gifts. Send stamp for our special list of subscription bargains. Midland Products, Dept. R. A., 524 Courtland Ave., Park Ridge, Illinois.

TROUBLE-SHOOTING—Do it yourself. Just off the press, valuable 24-page booklet tells how to locate and clear radio trouble; What to Do When Set Goes Wrong; How to Test; written by nationally known authorities, ask your radio dealer for, "PRACTICAL GUIDE FOR EVERY RADIO OWNER AND BUILDER," or send 10c today to Universal Test Equipment Co., 2939 N. Oakley Ave., Chicago, Illinois.

Radio reading free—forming magazine circulating clubs. Many books as premiums—List free. Spencer-strain Agencies, West Los Angeles, Calif.

Twentieth Century Book of Receipts, Formulas and processes, an 807 cloth bound book containing 10,000 proven formulas for the manufacturer, workshop, laboratory, office and home. Sent prepaid upon receipt of $4.00. 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, Ill.

BUSINESS OPPORTUNITIES

LAND FREE if planted to bananas. Bananas bear a full crop the second year. $5.00 monthly will plant five acres, which should pay $1,500 profit annually. Reliable Companies will cultivate and market your bananas for 1/3. Bananas ripen every day and you get your check every 30 days. For particulars address National Development Company, Empire Building, Block 135, Pittsburg, Pennsylvania.

Make $20 hundred stamping names on checks. Send 25 cents for sample and instructions. R. Nixon Tag Company, Wisconsin Rapids, Wisconsin.

DOGS

BEAUTIFUL REGISTERED BULL PUPS $15. Bulldogs, 501 Rockwood, Dallas, Texas.

For Sale—Arkansas Hounds, trained and untrained, 30 years dog business, long trial, guaranteed, terms, list free. W. B. Carsway, Alma, Arkansas.

PERSONAL

LONELY HEARTS: Exchange letters; make interesting new friends in our jolly club. Particulars free. Eva Moore, Box 908, Jacksonville, Florida.

RADIO

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.

TROUBLE-SHOOTING. Do you know the key to the knowledge of any electrical circuit? You can find correct answer in a booklet written by nationally known authorities on Radio and Electricity. Ask your radio dealer for, "Practical Guide for Every Radio Builder and Owner" or send 10c to-day to Universal Test Equipment Co., 2939 N. Oakley Ave., Chicago, Ill. Sold at all news stands in the city of Chicago.

Buyers Service for Readers of Radio Age. I will buy for you standard radio merchandise if you cannot obtain same in your locality. Remit list price of articles wanted, and if same are not obtainable by me I will make refund. R. P. Tomamichel, 2244 Seminary Ave., Chicago, Illinois.

EXPERIMENTERS. Complete Chemical Apparatus and Radio Catalog. 1000 illustrations. Price 25c; refunded on $5.00 order. Laboratory Materials Company, 646 East 71st Street, Chicago.

End all your troubles and join the Questionnaire Club, something every radio fan should belong to, send stamp for full particulars. Web Radio Co., Box 849, Chicago, Ill., Dept. QC.

Guaranteed tubes, 199 and 201A types $1.00 each. $7.50 units to make a loud speaker of your Phonograph only $2.49. $4.00 list head phones going at $1.69. This is real value, a standard make 3 tube set with long range and lots of volume for $8.95, (less accessories), while they last. $12.00 loud speakers with genuine Bakelite Bell at $6.95. Write for our prices before you buy your radio parts. Outlet Sales, 112 Calvert Ave., Detroit, Michigan.

Do you want to build a real radio set at low cost? The circuit of the Web Wonder Four is just out, send stamp for full particulars, Web Radio Co., Box 849, Chicago, Ill. Dept. B. F.

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 rectifier tubes, 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.

A new circuit just out, something different. Send 2 cent stamp for information how to build your own set. Web Radio Company, Box 849, Chicago, Ill.

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. Oerlein, 2843 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 382 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 Av., 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 cash 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—1x1" 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.

CRYSTALS—NOT GALENA

CELERUNDUM—the most sensitive crystal rectifier in the world. It is non-metallic and sensitive all over; low resistance; greater volume. Will not burn out. Twelve crystals for $1.00 post paid.

De-Tex-It—A truly great fixed detector—Positive contact—Thousands in use. The best rectifier for Crystal Sets, Reflex T R Frequency and Super Hets 3 for $2.00 postpaid.

WE HAVE A BOOK THAT TALKS and sings, plays the piano and tells stories. Inside attractive covers is a compact, practical and complete radio outfit. No operating expense; no batteries or tubes to replace. Everything is included—crystal set aerial and ground leads indoor antenna and pair of phones. The Talking Book, $5.00 complete connect it in a second and it goes for a life time. No overhead. E. W. Pitt Company, 115 Federal St., Boston, Mass.

PURE ALUMINUM and lead rectifier elements, holes drilled, with brass screws and nuts per pair 1/16", 1"x4", 13c, 1x6, 15c, 1 1/4x6, 17c, 1 1/2x6, 19c, single elements half price. Sheet aluminum 1/16", $1.00 1/8" $1.90. Lead $1.00 square foot all prepaid. Geo. Schulz, Calumet, Michigan.

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, and 1 $6.60. 1 and 2 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, 4"x3/4"x3/4" 99.7% pure aluminum, rubber covers binding posts 12 inside diameter $1.00 each, 4 for $3.90, 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

Double spaced variable transmitting condensers, calibrated spaces, hard rubber end plates, 13 plates $3.00, 17 plates $3.50, 23 plate $4.00 prepaid, 1/2 cash with order, balance C. O. D. Satisfaction or money back. George Schulz, Calumet, Michigan.

4000 ohm N & K Head Phones, finest and most sensitive Phones out, list $8.50 sell for $6.25 while they last, prepaid cash with order, absolute satisfaction or money back. Geo. Schulz, Calumet, Michigan.

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.

SALESMEN WANTED

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.

Radio Age Classified Ads Bring Results

Please mention Radio Age when writing to advertisers

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 Reinartz.
—A Six-Tube Portable Receiver Illustrated with Blueprints.

June, 1925
—Reducing Static Disturbancec.
—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
—Raytheon Design for A B C Elimination
—What Type Loud Speaker to Use
—Nine Tube Super Brings Back Faith

Radio Age, Inc., 500-510 N. Dearborn St., Chicago

11-26

30 DAYS FREE IN YOUR HOME

Tested and approved by all of Radio's Highest Authorities

Send Coupon for Amazing Special Offer!

NOTE: This offer is made to prospective buyers by famous big Radio Corporation, one of America's oldest reliable manufacturers of fine sets—seventh successful year. Many satisfied users in every state. Postal or coupon brings testimony of nearby users and proof Miraco's outperform sets costing up to 4 times as much. Very easy to install and operate.

AMAZING SPECIAL OFFER to User-Agents who will allow friends to listen to their Miracos.

BEAUTIFUL-BIG-POWERFUL
Ultra Selective MIRACO Ultra 5

Retail $ LIST Price now only 49.75 — GET SPECIAL OFFER — one year GUARANTEE

Built like—to look like—and perform like $200 sets

Real Single Dial Control!

Magnificent Big Powerful Miraco "Unitune-5" Retail List price only $87.50—get special offer

The celebrated Miraco Ultra-5—U.S. Navy type circuit, has also been adapted to Single Dial Tuning—**without sacrifice of selectivity, volume, clearness, power, tone, or distance getting qualities!** In the magnificent big Miraco Unitune-5, above shown, you turn one vernier knob for stations everywhere. Beautiful hand-rubbed, piano hinged, solid walnut cabinet, 28 in. long, 15 in. deep, 10 in. high. Sloping Bakelite panel is walnut finished to match. Also **offered on 30 days free trial!**

Coast to Coast and Foreign Reception Certified by Miraco users

MIRACO RADIO GETS 'EM COAST to COAST

Send for Proof!

Notice! Enormous sales of the celebrated Miraco 5-tube Receivers resulting from delighted users so highly endorsing them to friends again enable us to add hosts of costly new features, latest refinements and up-to-the-minute improvements such as you might expect to find only on much higher priced sets. Miraco's this year are still better—more beautiful—more selective—more powerful for less money than ever before.

USER-AGENTS WANTED . . WRITE!

Reports from users everywhere leave little for us to add. These are only a few of the many in our files and which we receive daily. Send coupon for plenty of additional proof and testimony of nearby users.

CUTS OUT LOCAL, GETS PROGRAMS EVERYWHERE. Meridan, Miss. Everyone says my Miraco 5 is the best set they have heard. It gets stations all over the states, also Mexico, Cuba. Have a broadcasting station next door but it doesn't matter with the Miraco 5. I get them just the same. H. R. Hendrick.

COAST TO COAST THRU LOCALS

Omaha, Nebraska. Miraco is a wonder for distance, volume, tone. We have 5 local broadcasting stations here and she goes right thru and brings them from coast to coast. No trouble at all. H. N. Elber.

BEATS OTHERS FOR SELECTIVITY. Cleveland, O. Have been up against some pretty good radio men with other sets and this receiver has them guessing. In selectivity, volume and range it has outdone several. We were able to cut out WTAM (powerful local station) to 3 points, to bring in other stations. W. C. Pike.

"UNITUNE" SEPARATES CHICAGO LOCALS. Chicago, Ill. With 4 local stations broadcasting less than a mile away, one after another I can tune and keep separated as high as 18 Chicago stations on your "Unitune-5". Even during the summer I frequently got stations clear and loud on speaker as far away as Colorado, New Jersey, New Orleans and many others. With the single dial I switch from one to another station in an instant. The selectivity is amazing, the set is a beauty and the tone is perfect. W. H. Schneider.

FLORIDA GETS CAL. FIRST NIGHT. Daytona Beach, Fla. Tuned in 45 stations the first night ranging throughout Florida, Cuba and as far as California with Miraco 5. Monte Rankin.

OHIO HEARS THEM COAST TO COAST. Westerville, O. We have to our credit about 85 stations from CFCF Montreal, Canada to British Columbia, Canada, WIOD Miami Beach Fla., two stations in California; a station at Seattle, Wash. We are more than pleased with the Miraco 5. Dan Groce.

HONOLULU TO LONDON FROM IOWA. Anthon, Iowa. Here are some of the stations we picked up on the Miraco 5 Sunday Jan. 24 between 10 and 11 P. M.: 2LO London, KYO Honolulu, Hawaii; WKAQ San Juan, P. R. and one station in Ireland; could not get call letters. John Kuhn.

NEW YORK LOGS 163 STATIONS. Buffalo, N. Y. I received 2LO London, 11:05 on Monday night but there was so much interference it was not very plain. I also have logged 163 stations in U. S. and Canada. A satisfied user of Miraco. Norman W. Ives.

NEBRASKA HEARS PORTO RICO ON SPEAKER. Spencer, Nebr. Using the Miraco 5 we have often heard Mexico City, Porto Rico, Miami, Florida, Ottawa, Canada and Vancouver, B. C., Canada and all along the Pacific Coast. All the above stations on the speaker. Have also heard Lima, Peru, South America. H. J. Schmidt.

TEXAS GETS 'EM N. Y. TO CAL. Waco, Texas. In less than a week after I installed the Miraco-5 I tuned in on the loud speaker New York City; Oakland, Calif.; Minneapolis, Minn., Mexico City, several stations in Florida and many others. E. E. Sitz.

TONE, VOLUME, DISTANCE. Elbing, Kans. We like our Miraco fine especially because of its volume, tone and its freedom from howling. Although I do not try much for distance we received programs from Oakland, Cal.; Los Angeles, New York, Miami and Havana. Mrs. E. A. Regier.

MIRACO EQUALS $240 SET. Onaka, S. D. Miraco works fine. Selective and plenty of volume. Stations logged include Winnipeg, Canada; PWX, Havana, Cuba; and CYL, Mexico City, Mexico. Have heard quite a few sets, one costing as much as $240, but can't see where it is any better. Clarence Roach.

NO HOWLS—SUPERIOR TO COSTLY SETS. Modoc, Ind. We certainly enjoy our Miraco-5. Results equal to any radio I ever heard and far superior to most radios costing a great deal more. All stations come in loud and clear on the loudspeaker. James Dillie.

OUTPERFORMS 6 AND 8 TUBE SETS. Duncansville, Pa. I don't think there is a better receiving set made than a Miraco-5. Stations received—all on the loudspeaker—include KFI, Los Angeles, Calif.—distance, 2,250 miles. I got this on loudspeaker plain, when others couldn't get it with 6 and 8 tube sets. Also have heard Can., Colo., Fla., Cuba, Neb. and many other states. S. D. Fowkes.

OREGON HEARS 'EM FAR AND CLEAR. Chiloquin, Ore. A few stations I have heard very clear on Miraco include California, Denver, Colorado; Hasting, Lincoln, Nebraska, Chicago, Louisville, Kentucky; also Catalina Islands. Cyril W. Benson.

CALIFORNIA HEARS PENNA. ON SPEAKER. San Rafael, Calif. I have purchased three of your sets and will give you an idea of what the Miraco-5 does out here. I have logged 86 stations, which I can get nearly any time I try, Mexico City on the South to CFCN, Calgary, Canada, on the North, with Honolulu to the West and E. Pitts., Pa., to the East. All on loud speaker, clear and plain. Roy L. Sharp.

CUTS THRU POWERFUL LOCAL. Pontiac, Mich. The Ultra-5 is sure a wonder. I live 1-4 of a mile from WJR a 5000 Watt Station and can cut through with ease and receive distant stations. During the International Test Week I received 2LO London, England; also CZE Mexico City, Mex. I have received stations from WMBF Miami Beach, Florida to KFI Los Angeles, Calif. In conclusion I'll say it's everything you claim it to be. Very truly yours, Edward J. Elkins.

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Each Miraco comes completely assembled, rigidly tested, splendidly packed and factory guaranteed for one year. Easy to install and operate—full instructions supplied. A big, handsome, expensive-looking radio—one you'll be proud to have friends see and hear. Stylish, sloping front cabinet of solid walnut, handsomely gold illustrated genuine Bakelite front panel and genuine Bakelite knobs—finished in walnut. In construction, too, like high-priced sets. Finest parts obtainable—and many exclusive features. Literature describes them fully—send for it, testimony of nearby users and Special Offer!

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4. Deals direct by mail with its users, agents and dealers, thereby effecting great savings which are reflected in amazingly low prices.
5. Keeps all promises to the letter. Highest references from users, bank officials and all concerns with whom we have dealings. We have been customers of a big $3,000,000 Cincinnati bank for many years. In our literature read what they say about our responsibility and reputation for square dealings.

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