THE RADIO EXPERIMENTER'S MAGAZINE

SHORT WAVE CRAFT

Edited by
HUGO GERNSBACK

IN THIS ISSUE:

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Herman Bernard
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Sept.

50¢

HOW TO BUILD A SIMPLE PHONE TRANSMITTER

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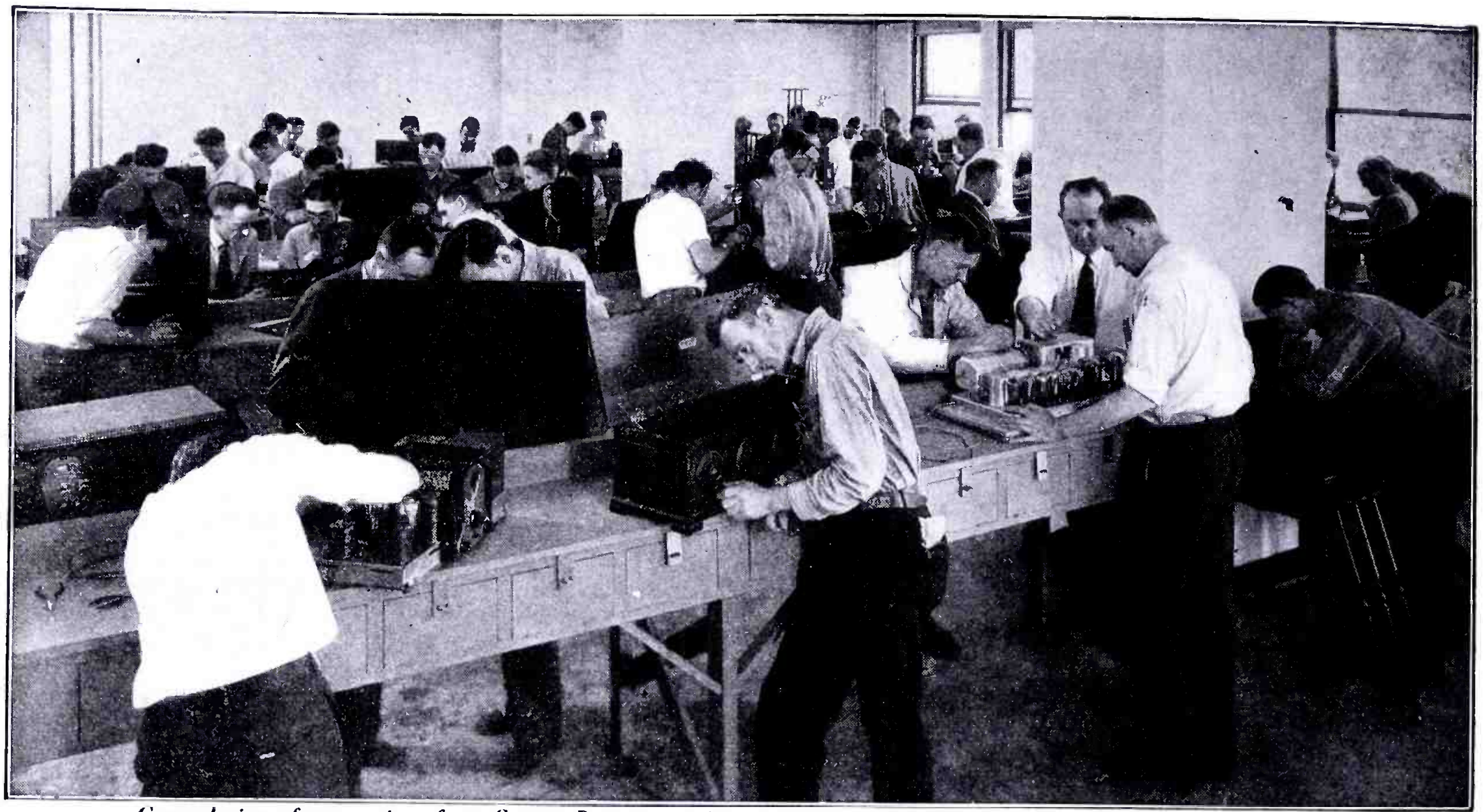

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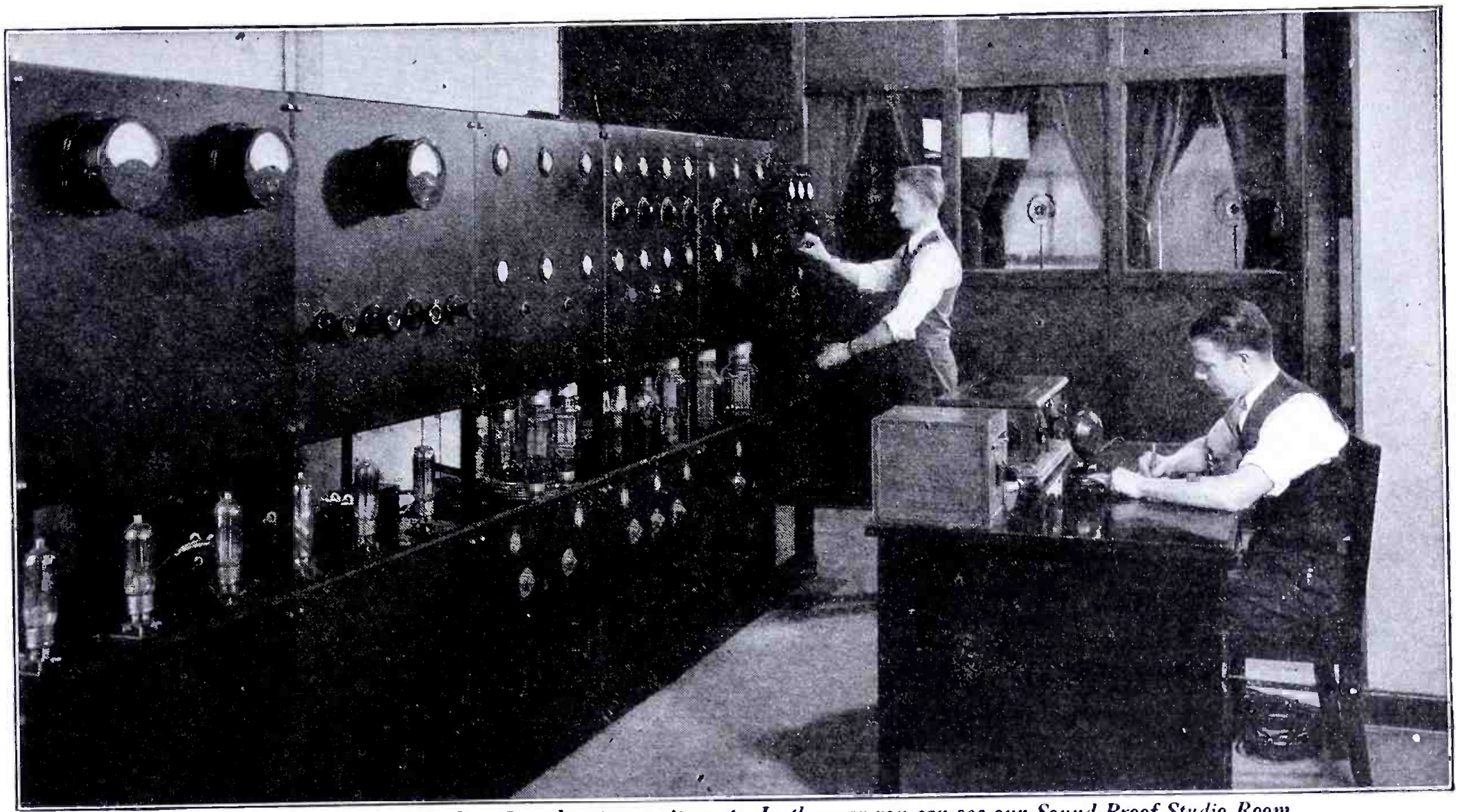

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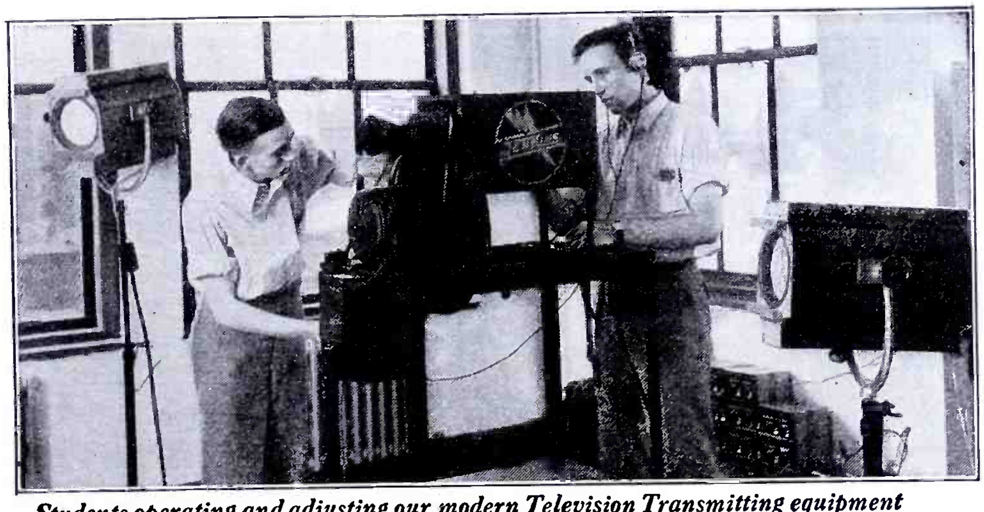

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Vol. II **SHORT WAVE CRAFT** No. 2

HUGO GERNSBACK, Editor H. WINFIELD SECOR, Managing Editor

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SHORT WAVE CRAFT

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Short Waves and Food

By HUGO GERNSBACK

THE accomplishments of short waves have been so many and varied, that we are no longer surprised at any announcement of an extraordinary new use to which these waves have been put.

As a matter of fact, even with the amazing discoveries that have been made during the last few years by the use of short waves, it should be understood that the surface has not even been scratched, and that the greatest surprises will come later.

Dr. Karl F. Kellerman, of the United States Department of Agriculture, has for some time been experimenting with extremely short waves in the treatment of foodstuffs, but the results which the Department has observed were not of an effective nature.

Very recently, however, a seemingly new method has been devised in Holland, using short waves in a different manner; whereby it is now possible to kill bacteria by means of short waves and thereby to safeguard the preservation of food for human consumption, over a long period of time. It is well known that, if food articles contain no bacterial life and are hermetically sealed from the atmosphere, at normal temperatures they will last practically forever.

The Dutch experimenters, for instance, were able to take an ordinary egg, open it, and treat it with short waves. This effectually killed all bacterial life; and such a treated egg, left in the open air for weeks, showed no signs of decay, and was just as fresh at the end of six weeks as it was before—a condition impossible to achieve heretofore.

The United States Department of Agriculture, in reporting upon this discovery, made the following statement:

"The apparatus used generates ultra-short waves in the area of 25 centimeters to one meter (*wavelength*) and these waves form an electromagnetic field within a radius of approximately 20 meters from the machine, in which, after about 10 days, no organic product is allowed to decompose. Everything in this field—a globe of about 30,000 cubic meters (a million cubic feet)—is penetrated, including stone walls, lead, iron, wood and glass indoors and outdoors in any atmosphere or temperature.

"The machine, which occupies only a few cubic meters, uses up only as much electricity as an ordinary 200-candlepower electric bulb; and the results are claimed to be much better than those of a modern cold-storage warehouse."

Previous to the Dutch discovery, the Department of Agriculture, on its own accord and independently, had carried out some experiments with a similar purpose in mind, using short waves; but evidently the method of application differed, as it was here found impossible to discover any influence, either on the fungi, vegetables or higher plants. It is impossible to foresee what a tremendous influence this discovery will have on our entire economic condition; that is as far as food supply is concerned.

For instance, the amount of spoilage of green vegetables by decay is nowadays titanic; a spoilage of as high as 40% in such items is quite the usual thing during the hot season. If some means can be found to treat such vegetables cheaply by means of short waves, it can be seen what a tremendous amount of saving will be achieved in this line of food alone. Then, there are, of course, besides the vegetables, all sorts of foods which, today, must be shipped—usually in an unripe condition—in refrigerator cars, and kept under refrigeration until they leave for the market. It is, of course, well known that fruit taken from the tree in a green condition, to ripen afterwards, never has the flavor of full ripe fruit as it is taken from the trees or bushes.

It is conceivable that the fruit packing industry will, in the future, avail itself of this new discovery. This should bring down, immediately, the cost of the fruit; and make people consume more, because such food, will, of course, be better-tasting than it is nowadays.

The same observation holds true, in perhaps a less degree, for such foods as meats, eggs, and even cereals.

It will also be found, probably, as soon as the movement gets under way, that the vitamin contents of the short-wave treated foods will be increased in direct proportion; and again, therefore, the advantage will be a big one if all points are considered.

The possibilities along these lines seem infinite. There is, for instance, our water supply, which annually causes a great deal of sickness and untold thousands of deaths, due to pollution and disease-carrying bacteria. It seems possible that the drinking water can easily be treated by short waves by our municipalities. Today, it is the custom to introduce a small percentage of chlorine into all drinking water in order to safeguard communities. The chlorine is there, of course, to kill off bacteria; and, even though the percentage of chlorine is quite small, nevertheless we take it into our bodies every time we drink water. The short wave treatment should do away with this most effectively.

Then there is the tremendous canned-food industry, which should be benefited to an undreamt-of degree. People are today loath to eat canned foods because, not infrequently—no matter how great a care is used in the preparation of such canned food—there will be a microscopic air leak and the unfortunate persons who partake of such food may acquire ptomaine poisoning. In the future this will, of course, not happen; because, if all bacterial life has been effectually killed, the ptomaine poisoning is automatically prevented.

It would seem that here is a virgin field in which our experimenters should be tremendously interested; because a new technique will be evolved shortly, and there will be a great demand for men who know how to apply this new art effectively.

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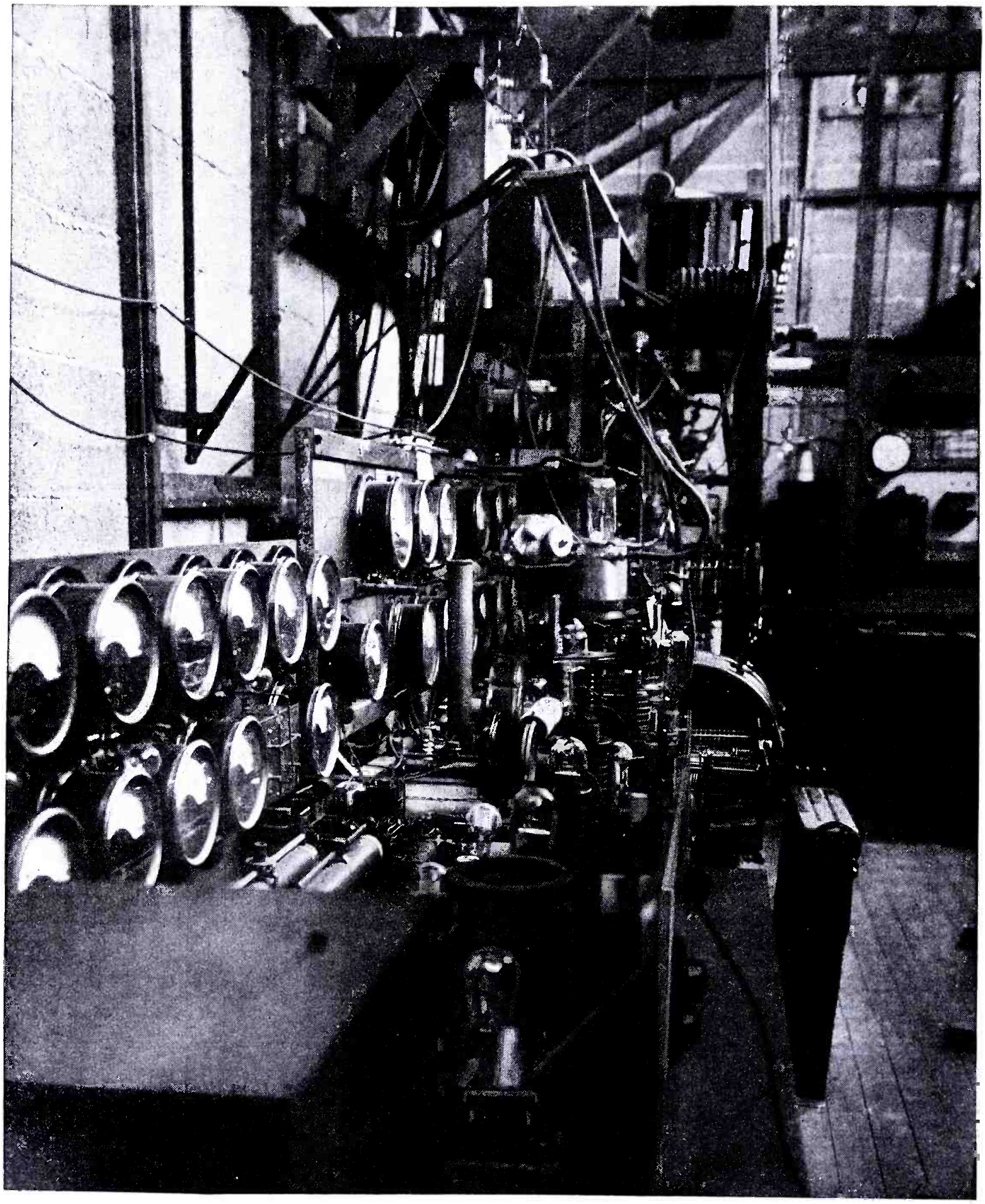
THE NEXT ISSUE COMES OUT SEPT. 15th

P.C.J.—Holland's S-W Voice Girdles Globe



VIEW of transmitting room at P. C. J.—the famous short-wave phone transmitting station located at Eindhoven, Holland. This station is operated by the Philips Research Laboratories and among other famous personages who have had their voice carried half-way around the world, is her Majesty the Queen of Holland. The particular apparatus shown in the very interesting photograph above is the crystal oscillator and multiplying stages. One of the objects of station P. C. J. is to provide communication with the Dutch East Indies, a span of about 12,000 miles from the home station. Over 20 different languages have been spoken before the P. C. J. microphone at one time or another; America's short-wave listeners are well acquainted with the famous announcements from P. C. J. made in the following five languages, Dutch, English, French, Portuguese and Spanish.

"P. C. J."—HOLLAND --SPEAKING

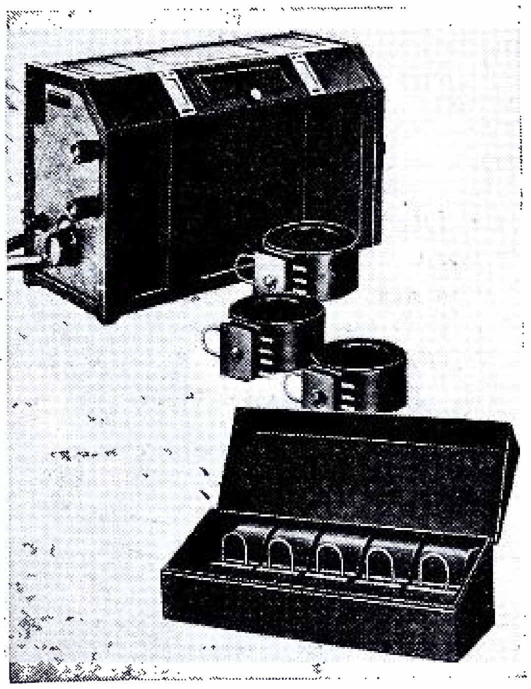
Some interesting details of the famous Philips radio station located at Eindhoven, Holland, the short wave transmitter of which has been heard in practically every country on the globe.

Meet the famous "five language" announcer of P. C. J. He is seen standing before the microphone—the call of this station is announced in five languages.

ONE of the European stations most frequently heard in America is P. C. J., located at Eindhoven, Holland. This station has been highly perfected and developed under the watchful eye of some of the foremost radio experts of the old world, this station being operated by the famous Philips Research Laboratories, of which Dr. A. F. Philips is the director.

The very first transmissions of P. C. J. during March, 1927, became a huge success, as the morning following, a telegram was delivered in Eindhoven stating that the transmission was received with incredible strength, steadiness and purity by a radio-amateur at Bandoeng (Dutch East Indies). Subsequent transmissions proved that this result was not due to sheer luck, but that a really reliable communication was established.

The stream of reports which has not ceased even now, began to flow to the short wave transmitter at Eindhoven. During 1927 several relays of the Daventry station, specially intended for the British Dominions, were successfully carried out.



The Philips short and long wave receiver.

Holland Linked with Duth East Indies

During June, 1927, the P. C. J. station had the great honor of receiving H. M. the Queen of Holland and H. R. H. Princess Juliana in its studio. The royal address to the Dutch East and West Indies was received with perfect clearness as stated in a radiogram received at Eindhoven exactly eight minutes after the last word was spoken. On April 28th of that year, Beethoven's 9th symphony, played by the Amsterdam orchestra and conducted by Dr. William Mengelberg, was broadcast to the world. In the course of time many prominent personages entered the studio of P. C. J. to address the world and invariably with the same success.

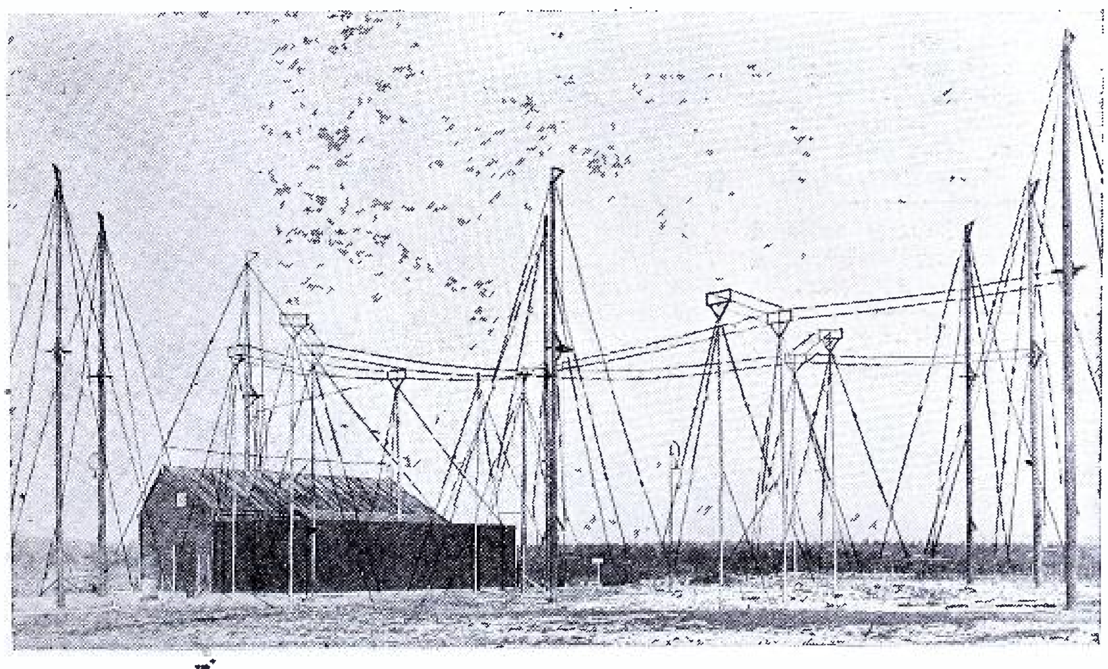
Telephony transmissions on ultra short wavelengths are often unsuccessful, because of the inconsistency of the transmitted wavelength. With the usual modulating and receiving systems the speech currents delivered by the microphone are intended solely to vary the amplitude and not the frequency of the oscillations generated by the transmitter. Unfortunately, if no special precautions are taken, there will be "frequency-modulation," as it is called by the engineers, and this would cause a very bad distortion.

Oscillating Quartz Crystal Used

In the Philips transmitter this difficulty has been overcome by the use of an oscillating quartz-crystal, which keeps the transmitting frequency constant between very close limits. Some crystals show the so-called piezo-electric effect, discovered by Madame Curie. If such a crystal is compressed, an electromotive force is generated on its surfaces; the reverse is true, too, if an e. m. f., is applied, the crystal contracts.

In a crystal-oscillator this property of a thin plate of quartz-crystal, capable of oscillating mechanically at a very high

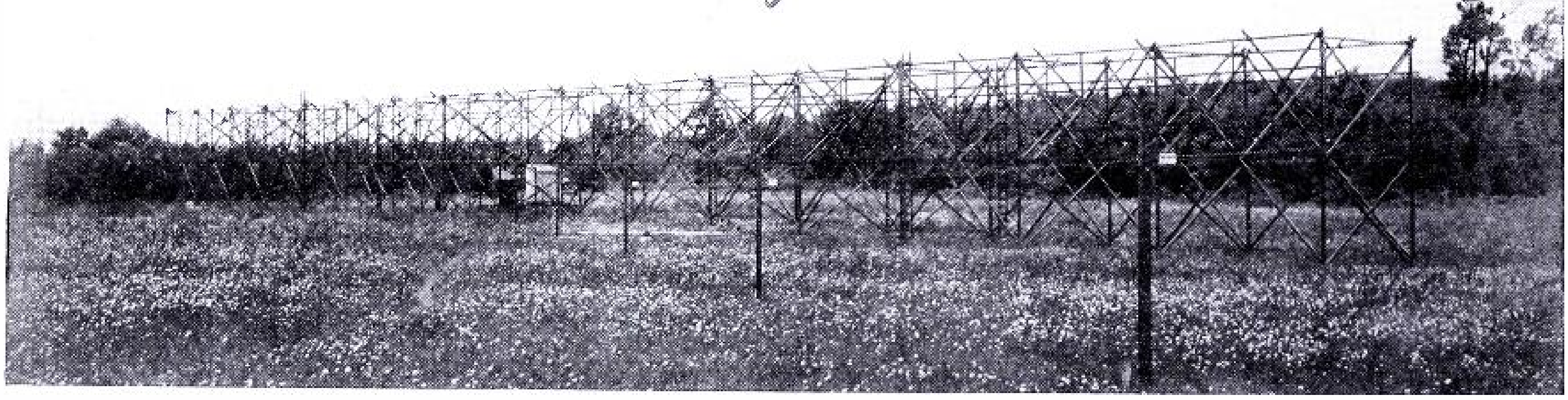
(*Continued on page* 141)



The new 31.28 meter beam antenna system at station P. C. J., Eindhoven, Holland.

EUROPE SPANS the ATLANTIC ON SHORT WAVES VIA-COLUMBIA NETWORK

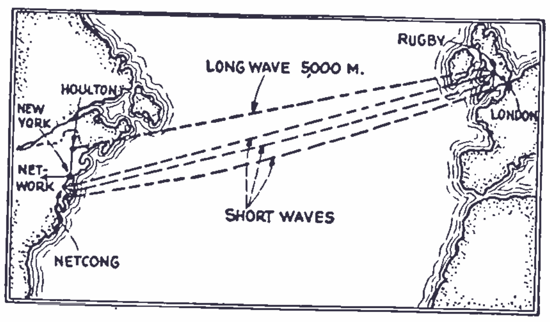
By—Marcellus H. Gernsback



WHEN the announcer of Columbia is heard saying: "The next program comes from London, England"—few listeners realize the complex arrangements necessary to insure the success of the program.

The speaker on the program (Columbia usually presents only speeches on its international relays) stands before a microphone in the studios of the British Broadcasting Corporation at Savoy Hill in London. From this microphone the impulses are carried by special telephone lines to a group of high-power short-wave transmitters located at Rugby, England. These transmitters (usually three in number) operate on different wavelengths, which are determined by the time of day, the season of the year, and the atmospheric conditions. For the rebroadcasts heard in New York at 12:30 P.M., during the summer, the waves used are generally around 16 meters, while in winter months a group of waves such as 16.38, 16.54, 20.7, and as high as 24.68 meters are used. During unusual weather conditions it may be necessary to use a long wavelength (about 5,000 meters) to bridge the ocean.

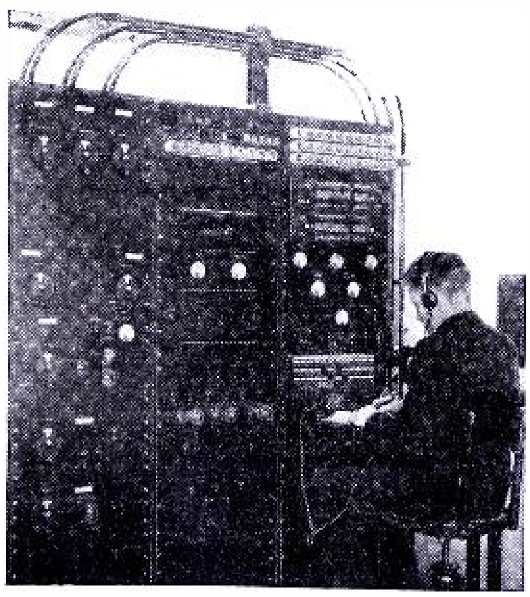
Some interesting side-lights on short-wave transmission between Europe and America are herewith described by Mr. Gernsback, Jr., who is an ardent short-wave fan; he listens to European short-wave stations daily.



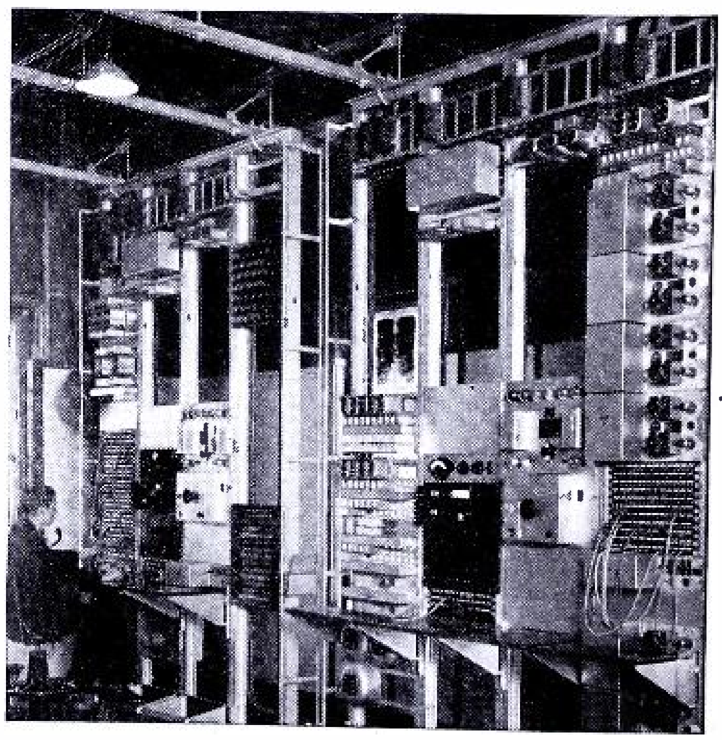
After the signals are fed into the group of radio transmitters they travel across the ocean and are intercepted by the highly sensitive, short-wave super-heterodyne receivers operated by the American Telephone and Telegraph Company. These short-wave receivers are located at Netcong, N. J., and the long wave receiving station at Houlton, Maine. In order to afford maximum signal pick-up with each receiver, there is used a selective aerial system which automatically feeds to its receiver the signal from the aerial furnishing the

The photo at the top of the page shows the antennas used for receiving from England, at the short wave radio telephone receiving center of the American Telephone & Telegraph Company, at Netcong, N. J.

Map above shows short and long wave links between Europe and America.



Left—A corner of the A. T. & T. Co.'s short wave radio receiving station at Netcong, N. J. The young man is busy monitoring an incoming conversation.



Right—Another unit of the Netcong, N. J., short wave receiving center; board at which wire lines from New York "long distance" center terminate; to the right, a test board.

strongest signal strength at the moment. Automatic volume controls are incorporated in the receivers to aid in overcoming fading. These rather extensive receiving station arrangements in this way insure loud and clear signals with absence of fading.

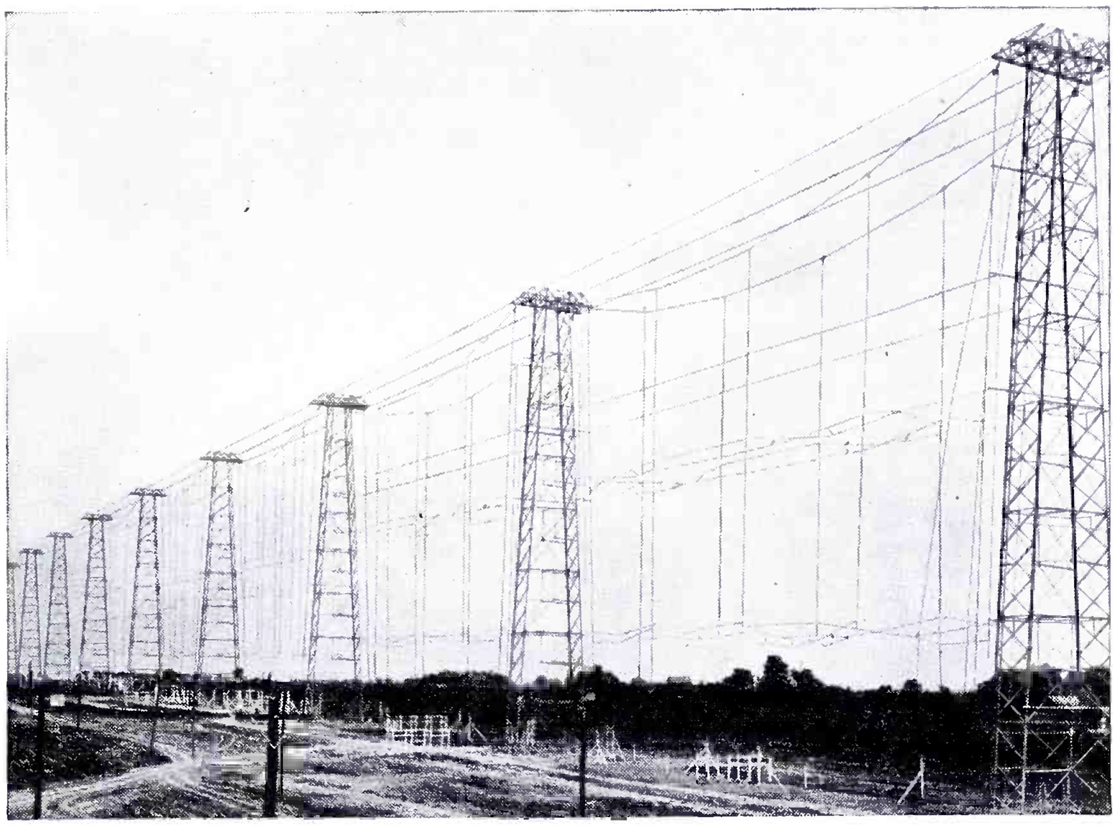
There is thus a choice of four different stations bringing the same program over the Atlantic. At any moment the signal from one station may be very weak, while the signals from the other three may be very strong. As the signals from all four are fed into one amplifier, it is evident that the amplifier's output will be nearly level in signal intensity.

The output of this amplifier is then fed into a telephone line and sent to the main studios of the Columbia Broadcasting System in New York City. From that point the signal is relayed in the usual manner over wire circuits to the associated stations of the Columbia System.

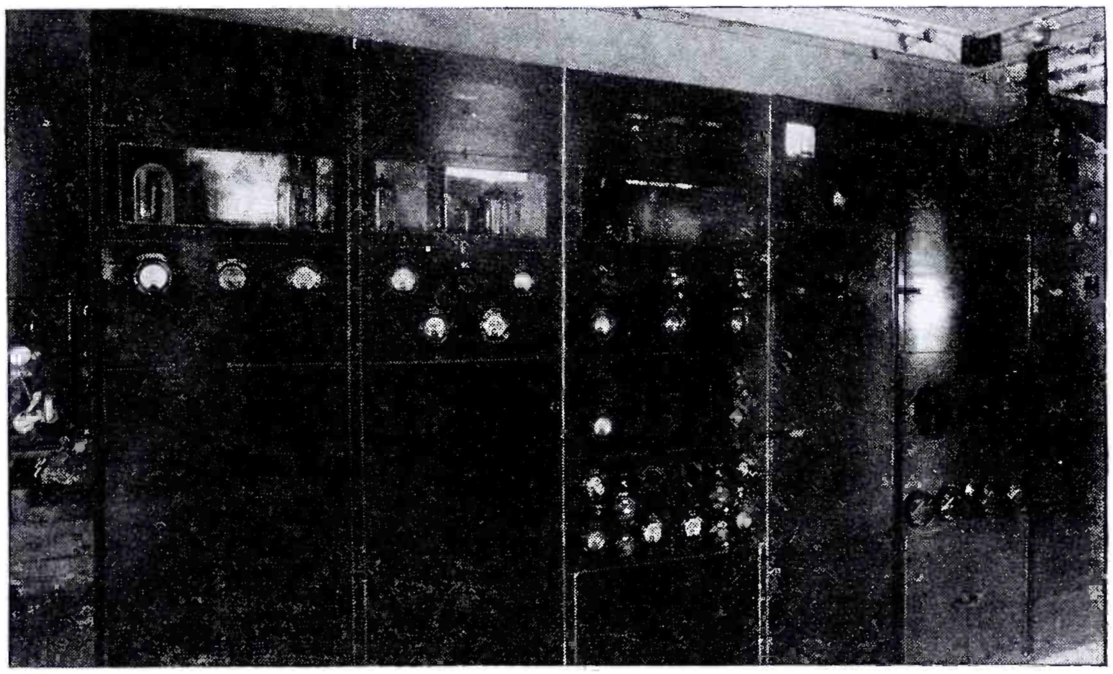
The long wave circuit is often used during magnetic storms, when long wave transmission comes through much better than short wave. Also there are certain times of the year when long waves are quite superior to the short ones for such long distance transmission as across the ocean. Transmission conditions for long waves are generally better throughout the winter. With the long wave the frequency band is not as wide as that of the short wave, for one thing, and also the *noise background* of the short wave signals is appreciably less disturbing.

In America the program transmission is assured as nearly one hundred per cent success as becomes possible, by the utilization of multiple circuits (regular and emergency) between the receiving stations, the transoceanic control room, and the broadcasting control room. All circuits are brought to a single switchboard in the transoceanic control room and here special equipment provides the operator complete flexibility of control. So accurate and smooth-working is this control that a shift can be and frequently is made from one receiver to another, or from one line to another, without so much as a click being heard in the listener's radio set.

West-East transmissions start at Rocky Point, Long Island, for the long wave signals; the short wave signals for Europe originate at Lawrenceville, New Jersey. The long wave signals are intercepted at Cupar, Scotland, and the short wave messages at Baldock, England.



Short wave antennas used by A. T. & T. Co. at Lawrenceville, N. J., in transmitting to England.



One of the short wave transmitters used by the A. T. & T. Co. at Lawrenceville, N. J. Here are speech amplifier, modulator, oscillator and final stage amplifier, including coupling and output circuits.

Right—Short wave transmitter working to Europe from Lawrenceville, N. J., showing control turret at which operator makes necessary adjustments to transmitter.

It is interesting to note in passing that the voice is magnified over one billion times the original energy set up by the diaphragm of the microphone in the studio.

These programs are naturally arranged in advance, and have to be very carefully timed. The London announcer is told in advance to start at a certain time; say 30 minutes and thirty seconds past the hour. As an extra precaution his watch is compared with the New York announcer's in advance. It is the New York announcer's duty to see that the London studio is connected to the New York end of the broadcasting sys-

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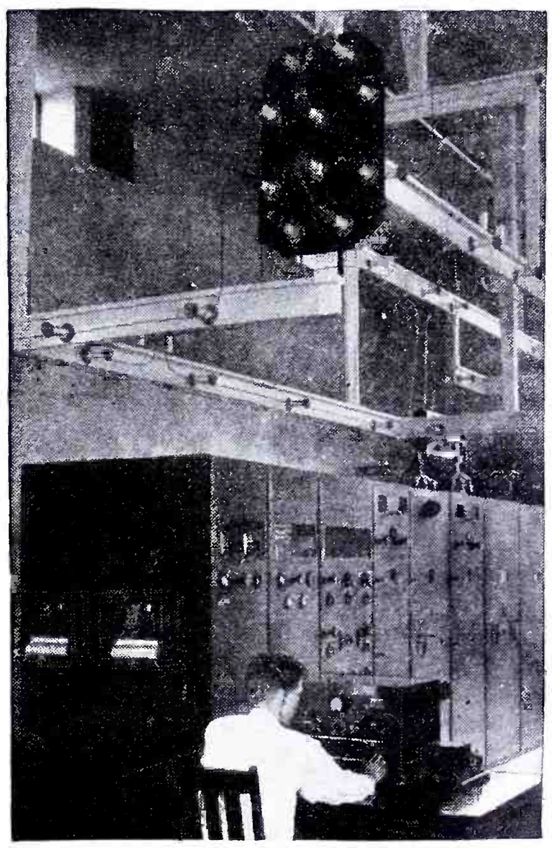
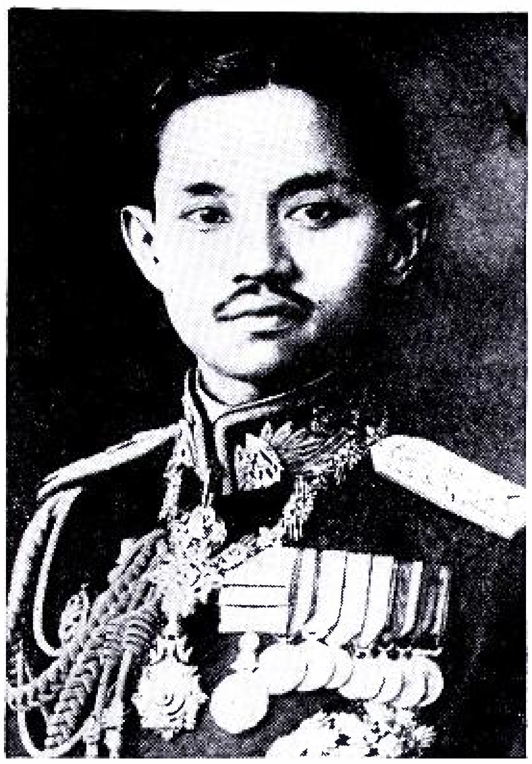


Photos courtesy Am. Tel. & Tel. Co.

KING *of* SIAM *Uses*
14 Tube Short Wave Set

The American - built 14 tube All - Wave super-heterodyne here illustrated and described was used by the King during his visit here. By simply changing a few coils any wave between 18 and 550 meters can be tuned in. The King uses a set of this type in his palace at Bangkok.



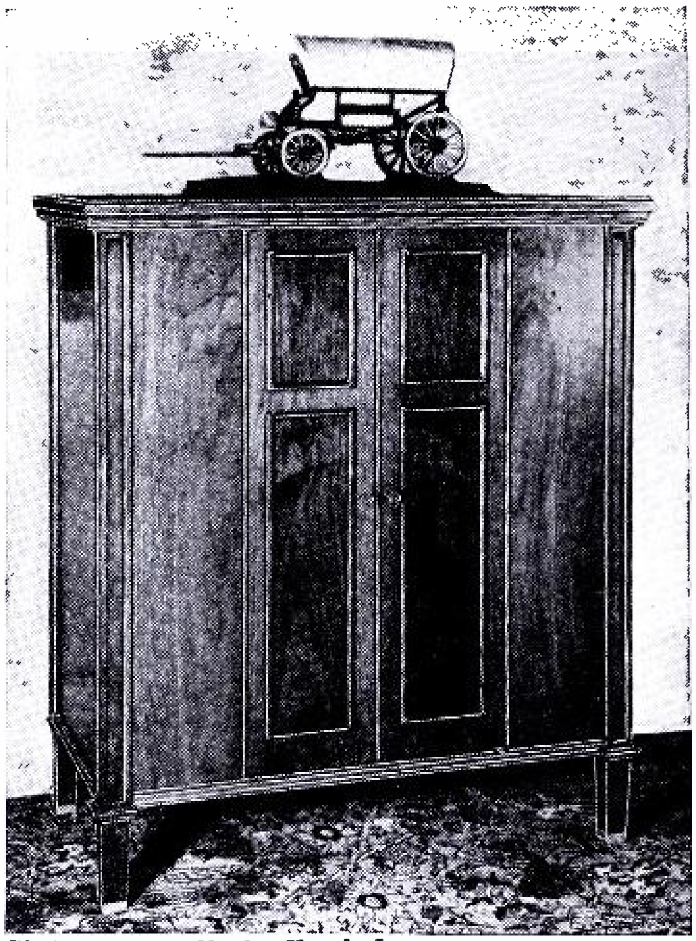
His Majesty, King Prajadhipok of Siam, who enjoys short and long wave reception on a 14 tube set of the type here described.

THE fourteen tube *all-wave* radio receiver, having a range from 18 to 550 meters, here illustrated, was used by His Majesty, the King of Siam, while sojourning recently in this country. When he is at home in his Palace at Bangkok, he uses a duplicate of this 14 tube receiver. This very interesting and super-sensitive long range receiver was designed by the engineers of an American concern,* and it has among other qualities the following features:

By simply changing three coils, various wave bands from 18 up to 550 meters can be tuned in. This set has a conservative distance range of about 2,500 miles, using a short indoor antenna, but with an outside antenna of regulation size and with favorable receiving conditions, it is possible to receive up to several thousand miles. This set has positive 10 kilocycle separation on the broadcast band and is free from harmonics. Another feature is pre-selector tuning. Other fine points are complete freedom from hum, faithful frequency response in the audio frequency amplifier from below 100 cycles up to and beyond 5000. The audio frequency amplifier may be used separately for phonograph pick-up. The Admiralty Super-12 receiver, here illustrated, is provided with an automatic volume control, operated by a vacuum tube, as the diagrams indicate and a predetermined level is maintained on both weak and strong signals alike, with visual operation of this circuit indicated by the tuning meter at all times.

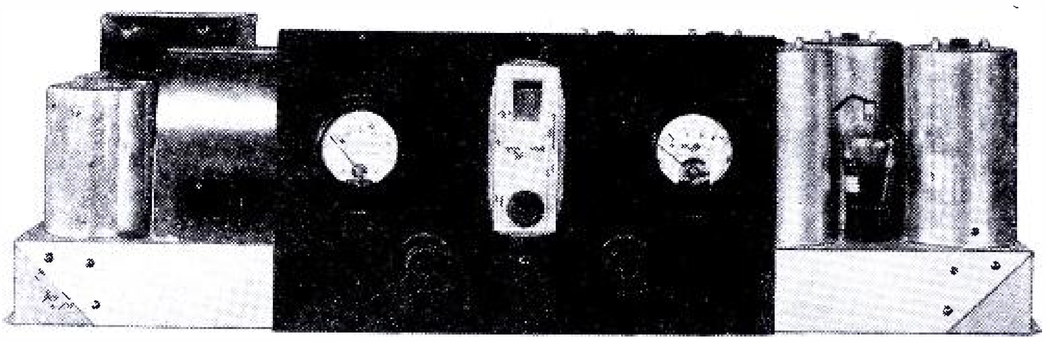
The Admiralty Super-12 receiver employs a super-heterodyne circuit, with

(*Continued on page* 94)

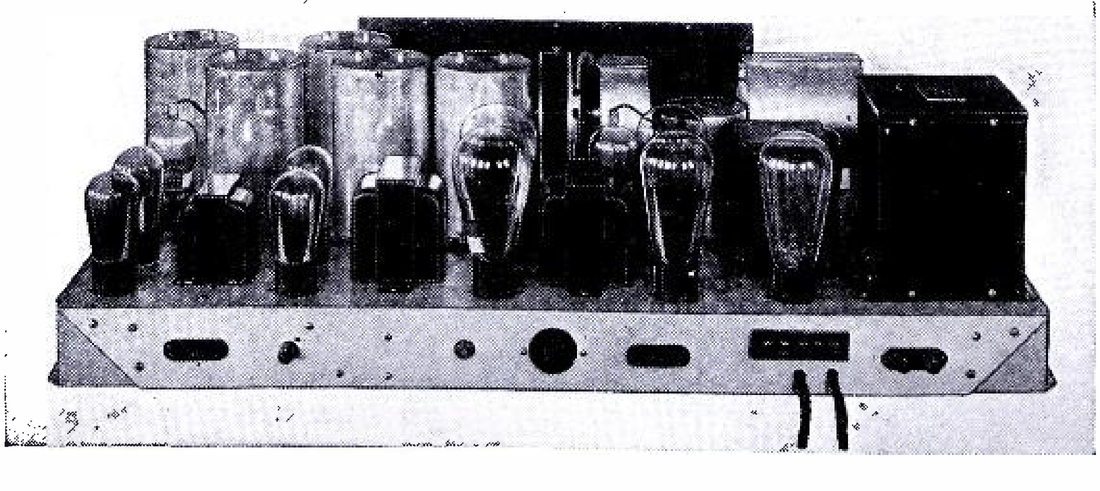


Handsome appearance of the Norden-Houck Admiralty Super-12 All-Wave super-het used by the King.

Photos courtesy Norden Hauck, Inc.

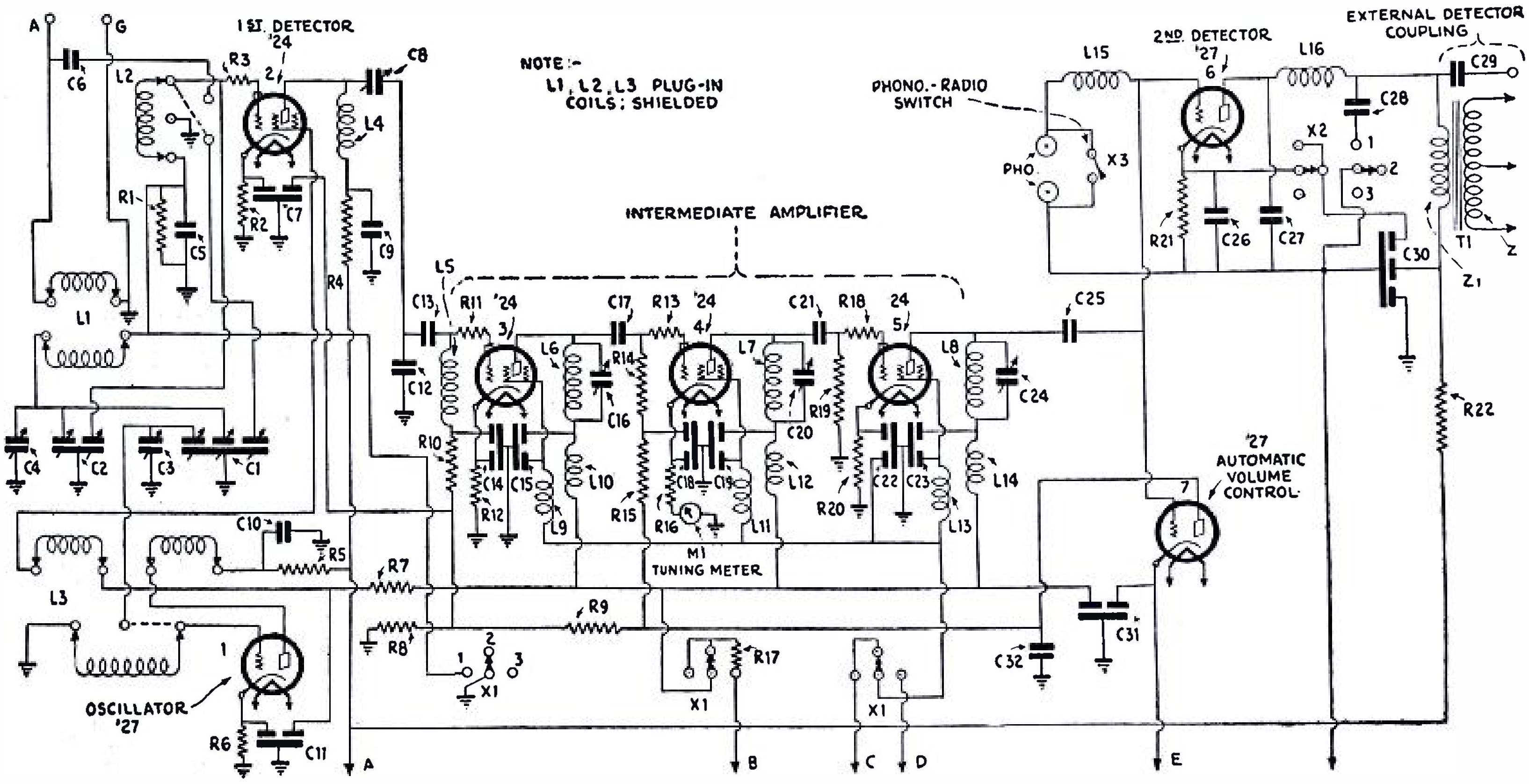


Above—Front view of chassis of the Admiralty Super 12. (super-heterodyne). At right—Rear view of super-het chassis showing shielded coils.

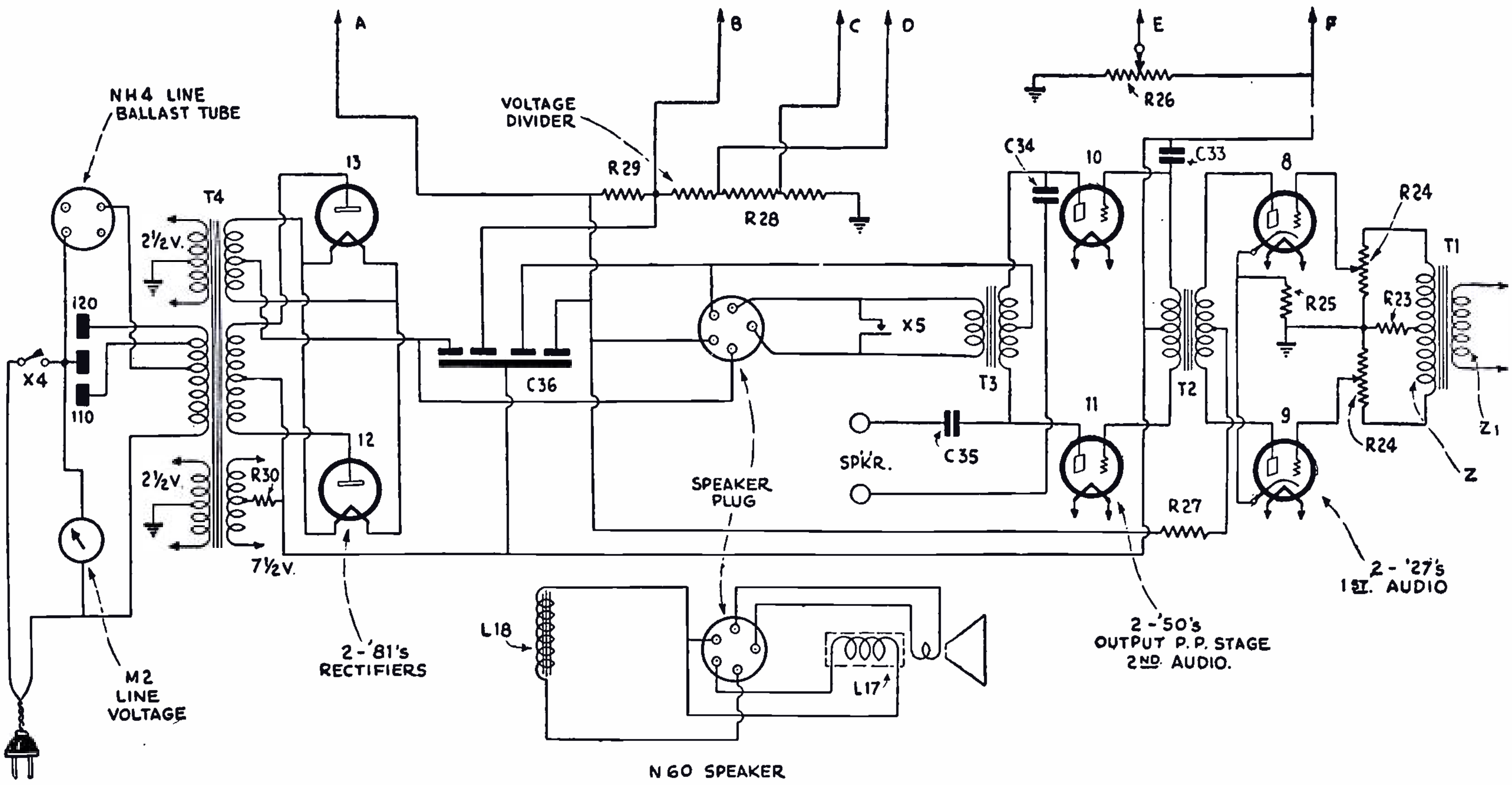


*Norden-Hauck, Inc., Philadelphia, Pa.

American-built 14-tube All-Wave Super-Het Used by King



Above—Hook-up of Admiralty Super-12; a screen-grid super-heterodyne.



Wiring of power supply and push-pull audio-frequency amplifier.

General List of Parts

L 1—Ant. coil—plug-in shielded.
L 2—Det. coil—plug-in shielded.
L 3—Osc. coil—plug-in shielded.
L 4—1st det. plate coil.
L 5—1st int. grid coil.
L 6—1st int. plate coil
L 7—2nd int. plate coil.
L 8—3rd int. plate coil.
L 9—1st int. s.g. choke.
L10—1st int. plate choke.
L11—2nd int. s.g. choke.
L12—2nd int. plate choke.
L13—3rd int. s.g. choke.
L14—3rd int. plate choke.
L15—2nd det. grid choke.
L16—2nd det. plate choke.
L17—Speaker field (5,000 ohms) (60 mills) used as second filter choke.
L18—1st filter choke (300 ohms) (175 mills)
X 1—Radio switch—3-pole 3-position.
X 2—Audio switch—2-pole 3-position.
X 3—Phonographs—radio switch—S.P.S.T.
X 4—Power switch—S.P.S.T.
X 5—Speaker mute switch—S.P.S.T. open.
M 1—Tuning meter—0-5 mills.
M 2—Line voltage meter 0-150 V.A.C.

Tubes Used

#1, 6, 7, 8, 9—UX-227 Heater type.
#2, 3, 4, 5 —UX-224 S.G. Heater type.
#10, 11 —UX-250 Power Output tubes.
#12, 13 —UX-281 Half-wave Rectifier tubes.
#14 —Special Voltage Regulator tubes (15 volts at 2.3 amperes).

(*Continued from page* 92)

extraordinary high gain or amplification, as a result of using shield grid tubes in the first detector and the three intermediate amplifier stages. A separate oscillator is used and the intermediate amplifier has tunable stages. Among other interesting features of value, are a power detector and double push-pull audio amplifier system, tuning compensator, a control to provide exact resonance of all circuits on distant weak signals and on short waves, regardless of variation of antenna capacities.

The variable condensers used are specially built with brass plates and the rotors and stators have the plates soldered in position, for lowest possible electrical resistance. The condensers are entirely shielded, and will withstand tropical climate and moisture without any deterioration. The dynamic type loud speaker supplied by the builders of this set is perfectly matched with the output transformer in the receiver itself. The radio frequency transformer coils are wound on natural bakelite tubing of the proper size and each coil is individually shielded. The removable transformers and coils, for changing the wavelength, have very smooth action plug contacts. Each receiver is given an air test at night by the engineers and a test log is supplied with each set.

Fourteen tubes are used. First detector UY-224, oscillator UY-227, intermediate stages UY-224's, UY-227 second detector, two UY-227's in first audio stage, two 250's in audio output stage, UY-227 automatic volume control, two UX-281's for Rectification, and one NH-4 line ballast tube. Only standard tubes are used which may be readily obtained anywhere.

List of Parts—Admiralty Super-12

Condensers

C 1—3 section, air, Ant., 1st det., osc., tuning.
C 2—2 section, air, Ant., det., tuning.
C 3—65-mmf., air, Osc. trimmer.
C 4—65-mf., air, Ant. trimmer.
C 5—.01, mica, Ant. to det. coupling.
C 6—15-mmf., mica, Ant. coupling (S.W.).
C 7—2 ¼-mfd., paper, 1st det. cathode; 1st int. grid; by-pass; rated 500V.
C 8—100-mmf., air. 1st det. plate tuning.
C 9—.1-mfd., paper. 1st det. plate by-pass; rated 700V; worked 100V.
C10—.1-mfd., paper. Osc. plate; rated 500V; worked 50V.
C11—2 ¼-mfd., paper, Osc. cathode; 1st det. s.g.; by pass; rated 500V; worked 30V.
C12—.03, mica, 1st det. to 1st int. coupling.
C13—100-mmf., air. 1st int. grid tuning.
C14—2 ¼-mfd., paper. 1st int. grid; 1st int. cathode; by-pass; rated 500V.
C15—2 ¼-mfd., paper, 1st int. plate; 1st. int. s.g.; by-pass; rated 500V; worked 200V.
C16—100-mfd., air, 1st int. plate tuning.
C17—100 mfd., mica, 1st int. to 2nd int. coupling.
C18—2 ¼-mfd., paper, 2nd int. cathode; 2nd int. grid; by-pass; rated 500V; worked 200V.
C19—2 ¼-mfd., paper, 2nd int. plate; 2nd int. s.g.; by-pass; rated 500V.
C20—100-mmf., air, 2nd det. plate tuning.
C21—100-mmf., mica, 2nd to 3rd int. coupling.
C22—2 ¼ mfd., paper, 3rd int. cathode; s.g. voltage; by-pass; rated 500V; worked 75V.
C23—2 ¼-mfd., paper, 3rd int. plate; 3rd int. s.g.; by-pass; rated 500V; worked 200V.
C24—100-mmf., air, 3rd int. plate tuning.
C25—100-mmf., mica, 3rd int. to det. coupling; rated 500V; worked 250V.
C26—.03, mica, 2nd det. cathode by-pass; rated 500V; worked 35V.
C27—.00025, mica, 2nd det. plate by-pass; rated 500V; worked 250V.
C28—.01, mica, tone control; rated 500V; worked 250V.
C29—.002, mica, Ext. det. coupling; rated 500V; worked 200V.
C30—3 1-mfd., paper, 1st det. plate; 1st det. cathode; 1st det. grid; by-pass; rated 500V; worked 250V.
C31—2 ¼-mfd., paper, voltage control cathode; plate voltage; by-pass; rated 500V; worked 200V.
C32—1-mfd., paper, voltage control plate by-pass; rated 500V; worked 50V.
C33—500 mfd., mica, 2nd audio by-pass; rated 700V.
C34—.1-mfd., paper, ext. speaker; rated 700V.
C35—.1-mfd., paper, ext. speaker; rated 700V.
C36—4 2-mfd., paper, filter cond.; rated 1000V; worked 600V.

Resistors

R 1—2-meg., moulded, 1st det. grid return; rating 1 watt.
R 2—3500, wire wound, 1st det. cathode; rating 1 watt.
R 3—10,000, moulded, 1st det. grid; rating 1 watt.
R 4—150,000, moulded, 1st det. plate; rating 1 watt; dissipation .5 watt.
R 5—50,000, moulded, osc. plate; rating 1 watt; dissipation .52 watt.
R 6—850, wire wound, osc. cathode; rating 1 watt.
R 7—250,000, moulded, 1st det. screen grid; rating 1 watt; dissipation .1 watt.
R 8—100,000, moulded, vol. control plate; rating 1 watt; dissipation .05 watt.
R 9—100,000, moulded, vol. control plate; rating 1 watt; dissipation .05 watt.
R10—100,000, moulded, 1st int. grid return; rating 1 watt.
R11—10,000, moulded, 1st int. grid return; rating 1 watt.
R12—300, wire wound, 1st int. cathode; rating 1 watt.
R13—10,000, moulded, 2nd int. grid; rating 1 watt.
R14—2 meg., moulded, 2nd int. grid return; rating 1 watt.
R15—100,000, moulded, 2nd int. grid return; rating 1 watt.
R16—400, wire wound, 2nd int. cathode; rating 1 watt.
R17—30,000, moulded, (compensating resistor int. plates); rating 1 watt; dissipation .27 watt.
R18—10,000, moulded, 3rd int. grid.; rating 1 watt.
R19—2 meg., moulded, 3rd int. grid; rating 1 watt.
R20—750, wire wound, 3rd int. cathode; rating 1 watt.
R21—20,000, moulded, 2nd det. cathode; rating 1 watt; dissipation .25 watt.
R22—125,000, moulded, 2nd det. plate; rating 1¼ watts; dissipation .15 watt.
R23—50,000, moulded, 1st audio grid return; rating 1 watt.
R24—250,000, dual section variable, audio vol. control.
R25—1,400, wire wound, 1st audio cathode bias; rating 1 watt; dissipation .12 watt.
R26—1,500, wire wound variable, cathode bias auto. vol. control tube; rating 5 watts; dissipation 1.35 watts.
R27—15,000, moulded, 1st audio plates; rating 3 watts; dissipation 1.5 watts.
R28—14,000, wire wound, voltage divider; rating 10 watts; dissipation 3.0 watts. Tapped 6,500, 12,500.
R29—6,000, wire wound, voltage divider; rating 25 watts; dissipation 6.0 watts.
R30—775, wire wound, 2nd audio bias; rating 15 watts; dissipation 9.0 watts.

Here's That 1-Tube S-W Receiver

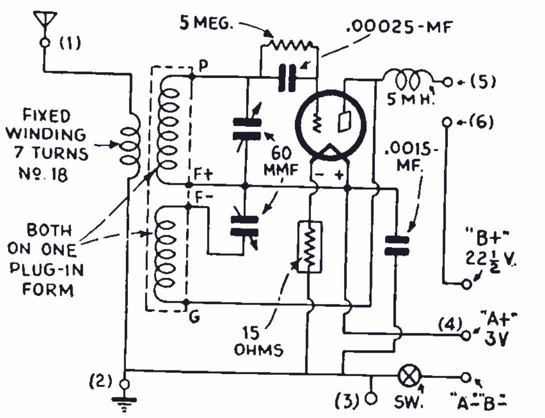
By J. P. LIEBERMAN

ONE of the attractive aspects of short-wave reception is that you can enjoy it without much cost, by building or buying a one-tube battery-operated set. This has excellent sensitivity; it is selective enough for short-wave use and it joins with its more imposing brethren in bringing in foreign stations.

So we now measure the sensitivity of a receiver by the response, in respect to a known gain, and the answer is stated in "microvolts per meter". A three-tube broadcast R.F. tuner, using a four-gang condenser and '27 tubes, with leak-condenser detector, was measured. It had a sensitivity of 15 microvolts per meter. There was no regeneration.

Now, here comes the big surprise. In the 80-meter band the one-tube device diagrammed in Fig. 1 had a sensitivity of 12 microvolts per meter! It does not seem possible, but it is so.

The antenna-ground circuit receives all waves; the secondary is tuned by a variable condenser of 60 mmf. (.00006 mfd.),



Hook-up of 1-tube S-W receiver of exceptional sensitivity.

which selects the desired wave; while the feedback condenser, of the same capacity, sensitizes the circuit enormously, besides greatly building up selectivity.

The coils used are of the tube base plug-in type, and have secondary and tickler windings only. The 7-turn primary is wound with No. 18 wire to a diameter of 1½ inches, and removed from the form; being then slid between the coil-receptacle socket (UX) and the top panel. Thus the coil socket is depressed below the panel, from which it is held at the correct distance by using two ⅝-inch (long) threaded brass bushings, engaged on both sides by 6/32 machine screws.

The diameter of the coil forms for plugging in is 1 5/16 inches, the base having four prongs just like a UX tube. There are four coils to cover the bands from 18 to 210 meters; the data on these coils are:

No. 1 has a 5-turn secondary, 7-turn tickler, without any between windings; as one is begun ¼-inch from where the other ends. The form is pierced to bring the leadin wires to the prongs inside.

No. 2 has a 12-turn secondary, 9-turn tickler.

No. 3 has a 24-turn secondary, 12-turn tickler.

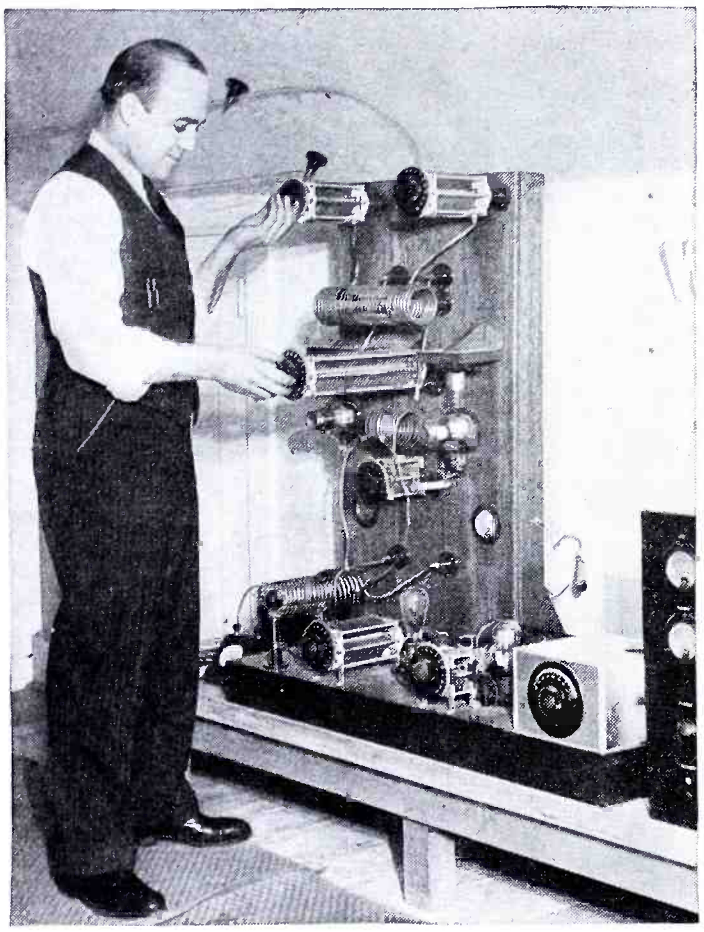
The wire on the foregoing coils is No. 24, single-cotton-covered.

No. 4 has a 50-turn secondary, 15-turn tickler; of No. 28 enamel wire.

(*Continued on page* 150)

ANDY SANNELLA
Becomes a "HAM" OPERATOR *and* *Likes It*

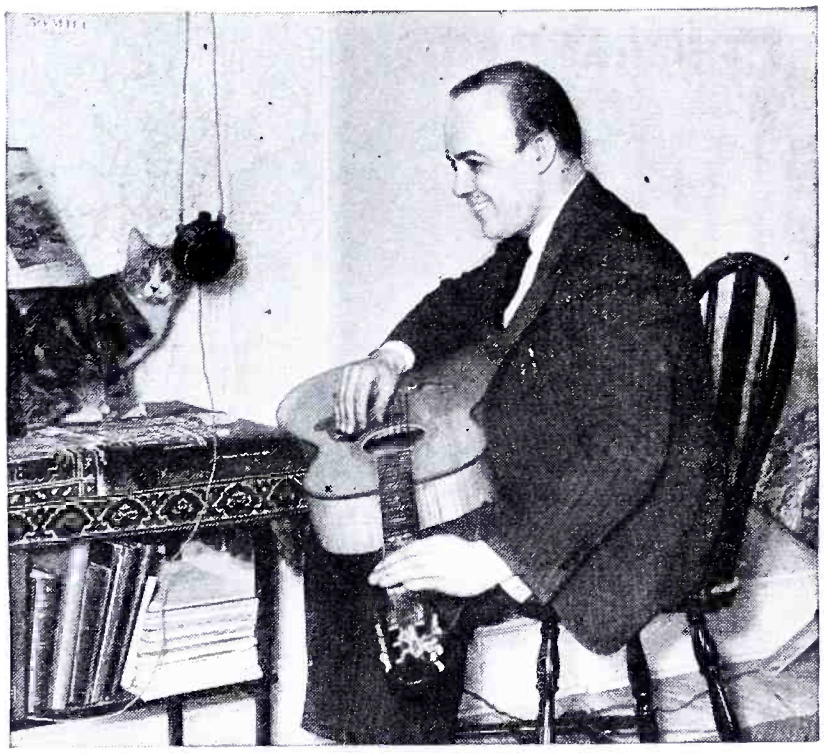
Andy Sannella, versatile radio broadcast musician, has become a proficient "ham" operator, and may be heard nightly pounding the key of his 150 watt transmitter. His call is W2AD.



Mr. Sannella is here shown tuning his short wave transmitter.

MUSIC and short wave radio have proved a happy combination to the versatile and well-known broadcasting musician, Mr. Andy Sannella, who has installed a complete radio transmitting and receiving station, all garnished with an official government license 'n everything, as the photographs portray. Frequently, when Mr. Sannella signs off in the "dot and dash" language with his name in addition to the official call letters of his station, W2AD, a fellow short wave operator will flash back—"Are you the Andy Sannella who broadcasts from N.B.C."

"Sure," answers Mr. Sannella, "but don't think about that, for right now I am just as much a ham operator as you are."



Mr. Andy Sanella, in front of microphone of his private short wave transmitting station, and at left his pet cat, which answers to the name of "Sax."

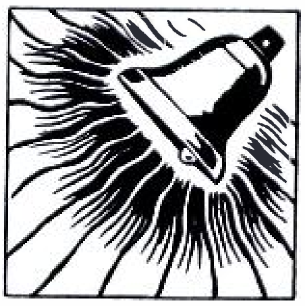
The ranks of the radio amateurs are rapidly expanding, as the short waves permit transmitting and receiving over great distances with but slight power in the transmitter. Take, for example, Mr. Sannella's station, rated at 150 watts, and yet with its nominal amount of power, the operator, Sannella, has carried on nightly communications from his home in Scarsdale, N. Y., with other radio amateur stations located in such distant lands as Australia, New Zealand, England, Cuba, Mexico, and other various parts of the United States and Canada. Mr. Sannella operates on a schedule of his own and has become a proficient technician in radio matters, as the neat arrangement of his apparatus shown by the accompanying photographs testifies.

The receiving equipment used at this station comprises a National Thrill-box with screen grid R.F. stage and push-pull output stage. Note the neat arrangement of the control switches on the bakelite panel on the front of the library table, on which the receiver rests. Mr. Sannella has a loud speaker and two pairs of phones, either of which may be used at will for "listening in." A small model of the earth has proven very handy in computing the mileage to some of the distant stations which Mr. Sannella works with.

Photo at right shows Andy Sannella relaying a radio message by short wave to a brother "Ham."

HOW RESEARCH *and* INDUSTRY

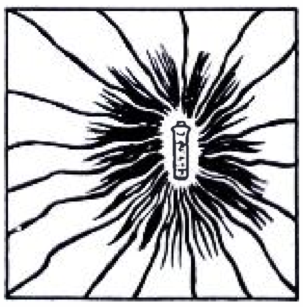
IN science, the mathematicians are now in the saddle. It is no longer necessary that a thing should exist in a form suitable for our imagination; if we know mathematical equations, we may proceed systematically to the utility, trusting that the understanding will advance with later familiarity. Most of our basic facts are quite beyond pictorial analogy. For example, the fundamental mechanics of light, of heredity, of thinking, of destruction, and of creation are being left for the millennium. Meanwhile, the pure mathematician is directing our groping steps and suggesting many experiments.



Bells — all their sounds radiate through air, but not empty space, at 1,100 feet a second. The vibration range of bells is really very small.

So, for this hour, I am playing a game of mere numbers. I name some number. Someone adds to it. Someone else multiplies it by something, and someone may subtract something from it. Let us say the result is number 49. So far that is nothing but a number. But, multiplied by the right idea, it becomes perhaps a market price, or your age, the year of the California gold rush, the area of some strip of land, or the size of a suit of clothes. You know at once that its names may be infinite. You were taught not to add numbers of different things, like horses and wagons, but you may do so, and you may multiply numbers by anything if you are so minded.

Let us, then, observe the wonderful complexities which are multiplying in the electromagnetic field, where infinite possibilities in the radiations, or rays, promise countless new technical and social changes. I shall illustrate what I mean by the use of simple units, though I do need about all the numbers.



Next to the cosmic numbers 1 to 10, come those from 10 to 1,000. This group represents the gamma rays of radium and similar messages from inside heavy atoms.

*(A talk presented under the title of "Research and Industry" by Dr. Whitney at a meeting of the Chamber of Commerce, Boston, Mass., May 7, 1931.)

.4 of a Trillionth of An Inch

No one cares particularly what unit was used in labelling his radio dial, providing the numbers are useful. So I select corresponding and reasonably correct numbers without full explanation of the unit (call it a ten-thousandth of one Angström, or four tenths of a trillionth of an inch). But while the numbers on your dial may extend from 500 to 1,500, my new numbers, covering all conceivable rays, extend from unity to infinity. Moreover, the same peculiar unexpectedness of service and message appears throughout the whole series, just as is found in the narrow range of the parlor radio set. In other words, within a little group of numbers on a radio dial we find utility or advertising, music or pictures, and messages of all sorts. Moreover, if we stick to a single number, we may get all sorts of information in time, and all the other numbers may treat us similarly. Even in the narrow range of radio, the possibilities are enormous, and it is a very young product. But contemplate for a moment what may be the possibilities between number one and infinity.

The Lesson of the Bell

For analogy, consider bells. All their messages radiate through air (but not empty space) at 1,100 feet a second, regardless of the size of the bell. The utility or message of the tiniest bell on some kitten's neck is distinct from that of the fire alarm or church bells; but, from the smallest to the largest of bells, the range is really very small. Representative numbers based on weight of the bells, frequency of the vibrations or wavelength of the air waves, would hardly extend from unity to a million.

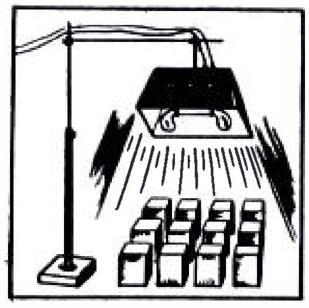
The Infinite Range of Wavelengths

But the numbers applicable to electromagnetic possibilities, on the other hand, extend from one, clear through the quintillions of ordinary alternating current, on to infinity. Thus I have numbered from one to infinity all the different forms of available energy which radiate at the velocity of 186,000 miles per second—what I call, practically, infinitely fast—for nothing will ever go faster. My numbers are not quite individualistic, but are like population statistics. For example, the inhabitants of one farm may be roughly between one and ten, of villages from 10 to 1,000, cities from 10,000 to ten million, etc. But behind both systems lies a certain possible effect of each individual. Number 3 on the farm may be a potential president, number 999 in a village may do his service in jail.

So what I am numbering from one to infinity are the different electrical possibilities. I have chosen the numbers to correspond to what I will call a kind of length, just as the men in a city might be consecutively numbered as to height, weight, or skill. There may be no wavelengths to rays, but we can still use the numbers; and the main point is that the scale is infinite and each unit has many possibilities.

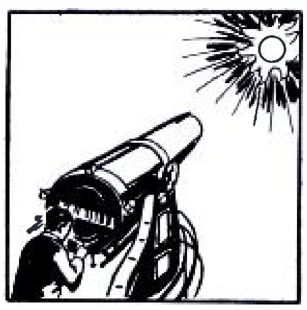
It was only a few years ago that this completeness of our electromagnetic numbers was first recognized; and now the greatest sport in physical science or in electricity is experiencing the surprises of new numbers. New groups of numbers, like safe-combinations, turn out to be combinations for unlocking unexpected utilities. One may say that every novel combination so far has opened some surprise which only subsequent research has deciphered. For example, after we first saw our bones through our bodies, it took years of work to learn the numbers we had used. The safe, so to speak, was opened by accident; and no one at the time even suspected that the combination consisted of electromagnetic numbers rather than dynamite.

Another part of the vibration spectrum put to work—the radiation of food by ultra-violet rays.



Birth and Death of Matter

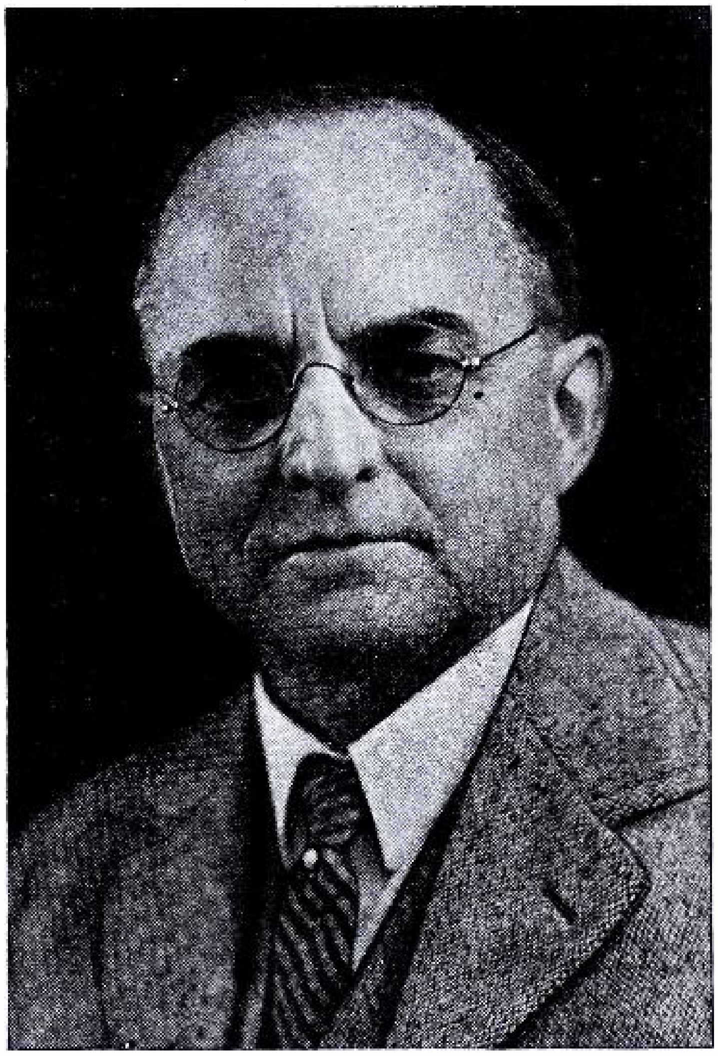
Cosmic rays at present fit the lowest numbers, which I start at unity. The numbers of these radiations, which Dr. Millikan is studying, range from 1 to 10, at once suggest some ultramicroscopic electromagnetic sender and, consequently, complete wireless station of inconceivably short wavelength, like some bell which is far too small to be seen by any microscope. The messages in this numerical range seem to be telling us about the formation of matter, the birth of stuff, the click of energy.



Helium was discovered in the sun long before its discovery on earth — thanks to a study of vibrations.

You know there is a discussion going on among astronomers and physicists as to whether the universe is really running down, or just running around. Men had

DEPEND on Vibrations*



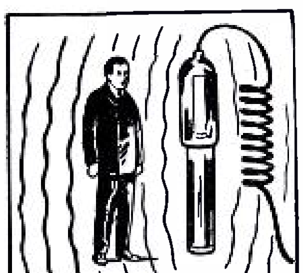
By DR. WILLIS R. WHITNEY
Director, Research Laboratory, General Electric Company

Helium, discovered in the sun by a study of vibrations and the spectrum, on down to the recent production of "electric fever" or artificial heating effect in the body when subjected to high frequency vibrations, all help to show the importance of the theory and application of vibrations in our modern scientific scheme of things. Do you know that light and heat rays vibrate at a certain number of vibrations per second and that vibrations are concerned with myriads of everyday phenomena such as the rays emanating from radium; the sound you hear from a bell, et cetera. The interrelation of all these different vibrations are interestingly discussed by Dr. Whitney.

Dr. Willis R. Whitney, director of the world-famous Research Laboratory of the General Electric Co., located at Schenectady, N. Y. Dr. Whitney is one of the outstanding scholars of the world and in view of his high position in the world of modern science, what he has to say on vibrations as the basis of modern research and industry is very important to all of us.

thought it was running down. Everything that we can do to keep the Humpty Dumpty universe on the wall really seems to lower the wall a little. We apparently cannot do anything, and still leave the outfit quite as well off in energy as it was before. Moreover, we know now that some of our elements are just naturally falling apart and decaying in a way that has seemed to have no reconstructive counterpart, and there appears no way of even delaying the decay.

But, out of cosmic space somewhere, there are coming rays of numbers one to ten and, if our ideas of these little numbers are correct, they may be a kind of space-reverberation of riveting, of the constructional mechanics by which our



High frequency vibrations from a large radio tube produce heat in the human body.

smallest atoms are being built from nothing. This *nothing* has emphasis on the final syllable; for they seem built of energy and not things. And so our first electromagnetic numbers represent rays that will penetrate many feet of the densest substances and still record themselves on little electrical counters, just like the devices used for handling the much larger numbers.

Next to the cosmic numbers 1—10 come those from 10 to 1,000. This group represents the gamma rays of radium, and similar messages from inside of heavy atoms. They tell us of the gradual destruction of matter under local conditions, and the history of our elements. That is, we have thereby learned the intermediate ancestors of matter. These rays have the power of making air conducting for electricity, just as do the cosmic rays and adjacent higher so-called X-rays, Here again each individual number will some day prove to carry a special message and, as in other cases, it will probably be found that many different services can be performed by each one; just as each apparently tells us now of some greater or lesser earthquake in atoms.

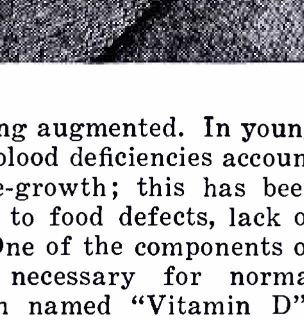
Rays That Concern Our Growth

The common X-rays are numbered from 10,000 to 100,000. Nothing would have seemed more unlikely, a few years ago, than that this invisible light would usefully shine through our bodies as well as through bodies of wood and iron. It took several years to discover that these rays were also in the electromagnetic series. Still newer messages are now being received from them constantly. Without referring to therapeutic uses of both radium and X-rays, we should note that pollen, seed and plant, sperm, egg-cell and animal are all affected by this group of numbers. Recent biological work seems to promise new types or forms of plant and animal through action of these rays upon the mechanics of plant and animal heredity. They seem to affect all living things, just at the time when they have not completely determined what they want to become.

Just as unbelievable service is coming from the numbers 1 million to 35 million; this has been called the ultra-violet range. They are invisible in the ordinary sense, but living nature seems to be particularly sensitive to this group. Here, too, the messages are quite unforeseen, and are daily being augmented. In young animals, certain blood deficiencies account for lack of bone-growth; this has been shown to be due to food defects, lack of light, or both. One of the components of food which is necessary for normal growth has been named "Vitamin D"; and it has been shown that this is producible, by our numbers one million to thirty million, from materials which contain certain organic compounds part way up the scale towards this vitamin. Here, as elsewhere, it is clear that numbers very nearly equal to one another do not serve this purpose equally well, and are in some cases even antagonistic,—again a proof that these individuals are highly individualistic.

Recent work on the radiation of food by a moderate ultra-violet range has shown the need of selecting within that range certain numbers, and omitting, actually cutting out others. Perhaps as

"Lydia", a pup, was subjected to high frequency vibrations, producing an "electric fever" which cured her mange.



remarkable as anything in this group of rays is that they may be applied directly to the diseased animal and cause the same bone-growth and recovery of normal

(*Continued on page* 153)

Baird Combination Short Wave and

TELEVISION RECEIVER

THE new design of universal television and short-wave receiver here illustrated and described is the work of Hollis S. Baird, famous Boston television and short-wave specialist, and unlike many "television receivers", it is especially designed to pass a wide band of frequencies in the R.F. tuning stages as well as in the audio amplifier stages. This receiver can be used to pick-up short-wave phone and code signals on any wave length from 16 to 200 meters.

By JOSEPH CALCATERRA,

(*Designed by Hollis S. Baird, Chief Engineer, Shortwave & Television Corp.*)

Fig. 2—Front view of the new Baird universal short-wave and television re-receiver, showing the extremely simple controls and the single tuning dial.

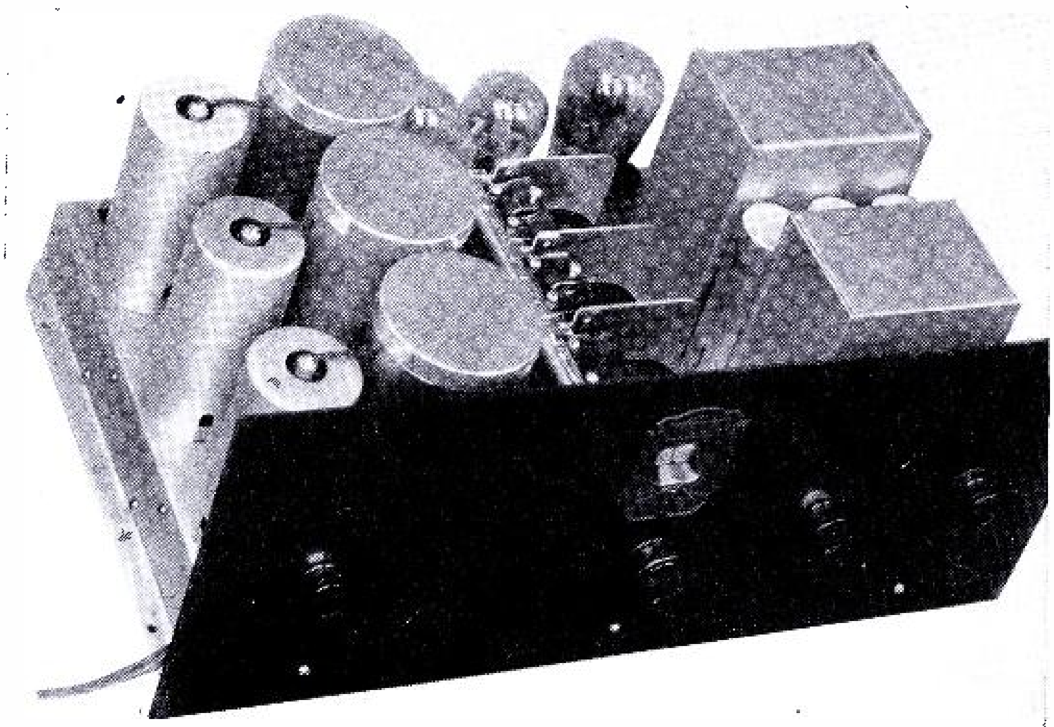


Fig. 2A—Another view of the new Baird combination television and short-wave receiver, covering all wavelengths from 16 to 200 meters. Note the well-designed shielding of all coils and tubes.

WHILE the average broadcast listener, using a standard broadcast receiver is finding it almost impossible to cut through the barrage of local and nearby stations, owners of efficient short-wave receivers are tuning in short-wave transmitters located half way around the world, at all hours of the day and night and during seasons when static interference makes reception of regular broadcast stations almost impossible.

There are now over 200 short-wave stations all over the world which are broadcasting voice programs on regular schedules, the most important stations received regularly in the United States being located in Winnipeg, Canada; London, England; Paris, France; Berlin, Germany; Rome, Italy; Mexico City, Mexico; Buenos Aires, Argentina and Sydney, Australia.

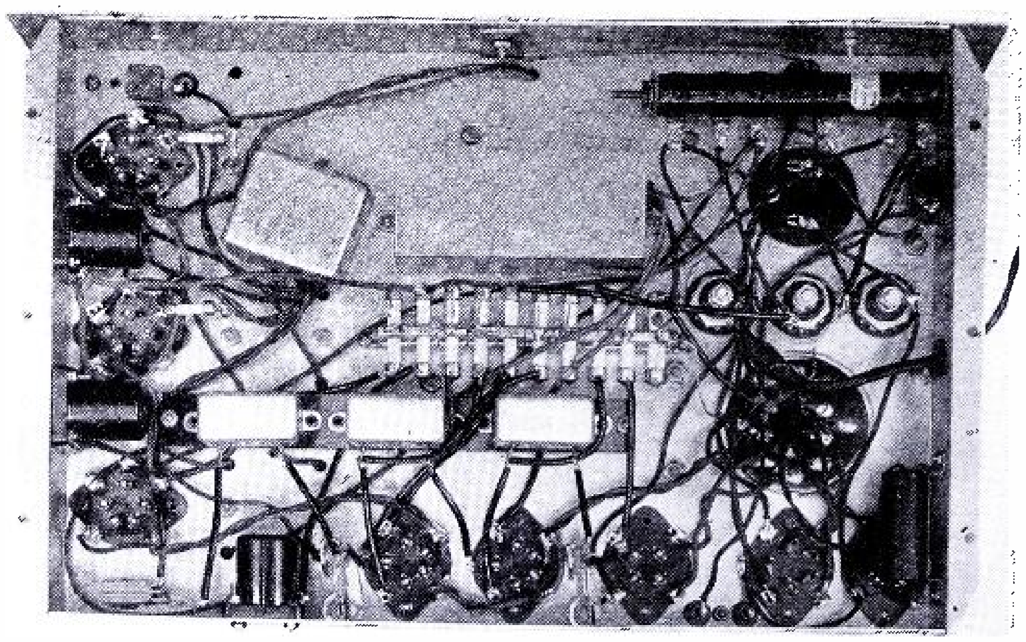


Fig. 5—Here we have a bottom view of the sub-panel of the receiver, revealing the neat arrangement of the apparatus and wiring.

Short-wave radio has removed the barriers of space between the peoples of every corner of the world. News from polar expeditions, long distance flyers and events all over the world are received by owners of short-wave receivers as the events happen.

Short waves are now carrying on regularly, communication and entertainment over distances far beyond the dreams of the most hopeful visionaries of a few years back.

The development which has taken place in the transmission and reception of short waves over the range of 16 to 200 meters has been phenomenal in the past few years and much interesting and valuable information has been discovered regarding the efficiency and peculiarities of such wavelengths for long distance transmission and reception.

Careful and painstaking experimentation and testing has proved that the use of low power on the very low wavelengths (high frequencies) provides much greater carrying power than considerably higher

Of New Design

power at higher wavelengths (lower frequencies).

The circuit and construction of the remarkably efficient Baird Universal Shortwave Receiver, one that opens up this big field of radio reception, are described in detail here.

The picture diagrams and schematic diagrams referred to in the text of this book are shown on the enclosed blueprints, which may be identified as follows:

Fig. 1 is the large Wiring Schematic Diagram.

Fig. 6 is the smaller Picture Wiring Diagram of the top of the chassis.

Fig. 7 is the large Picture Wiring Diagram of the bottom, or subpanel of the chassis.

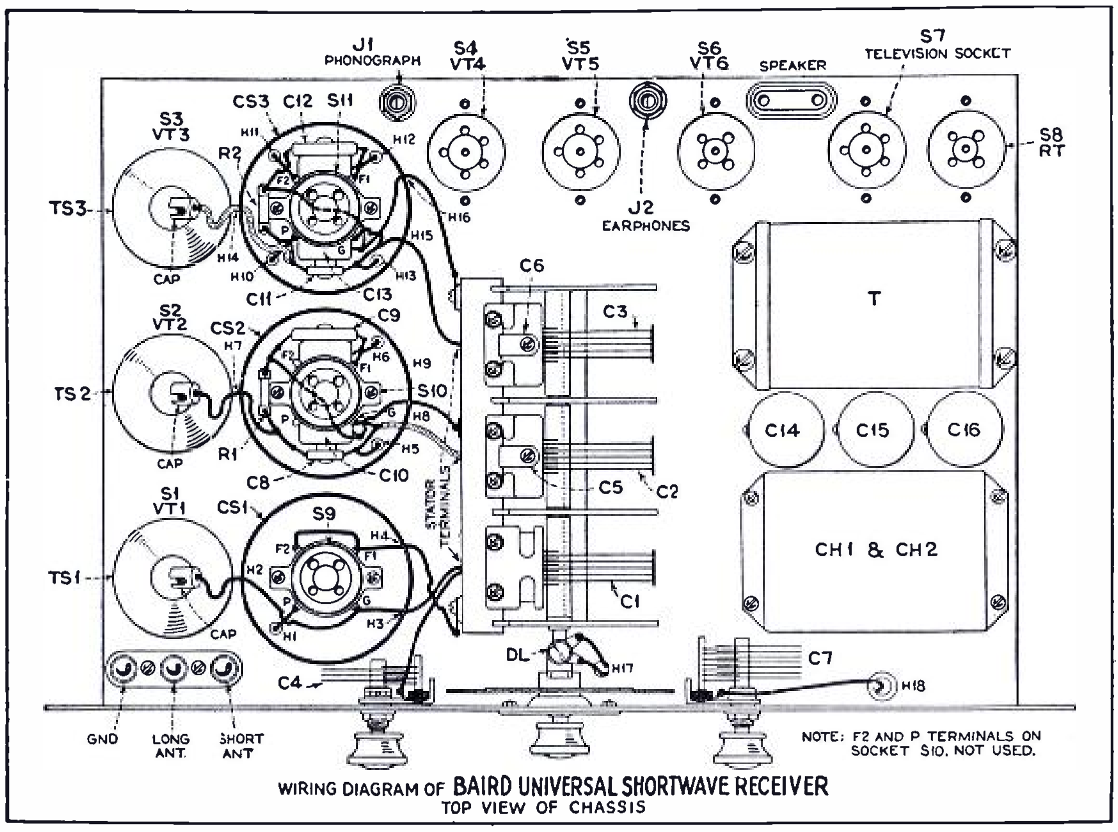


Fig. 6—Pictorial wiring diagram of the top of the new Baird chassis.

¶ This receiving set is ideal for television reception—its audio amplifier passes all frequencies from 15 to 40,000 cycles.

¶ The receiver is all A.C. 110 volt, 60 cycle operated—no batteries required.

¶ A '45 power tube is used in last stage.

The Baird Receiver is universal in its application, since it is not limited to the reception of short-wave stations transmitting voice and instrumental programs. It has been ingeniously designed to serve many other purposes in the whole range of short-wave and regular broadcast reception.

In addition to bringing in the short-wave telephone signals, it can be used for code and Television reception in the range of wavelengths from 16 to 200 meters (approximately 18,740 to 1,500 kilocycles respectively), by simply changing the plug-in Octocoils especially designed for use with this type of receiver, and the operation of the simple switching arrangements provided. Its excellent audio amplifier system can also be used for phonograph reproduction by plugging a phonograph pickup into jack *J1*. For operation direct into the input

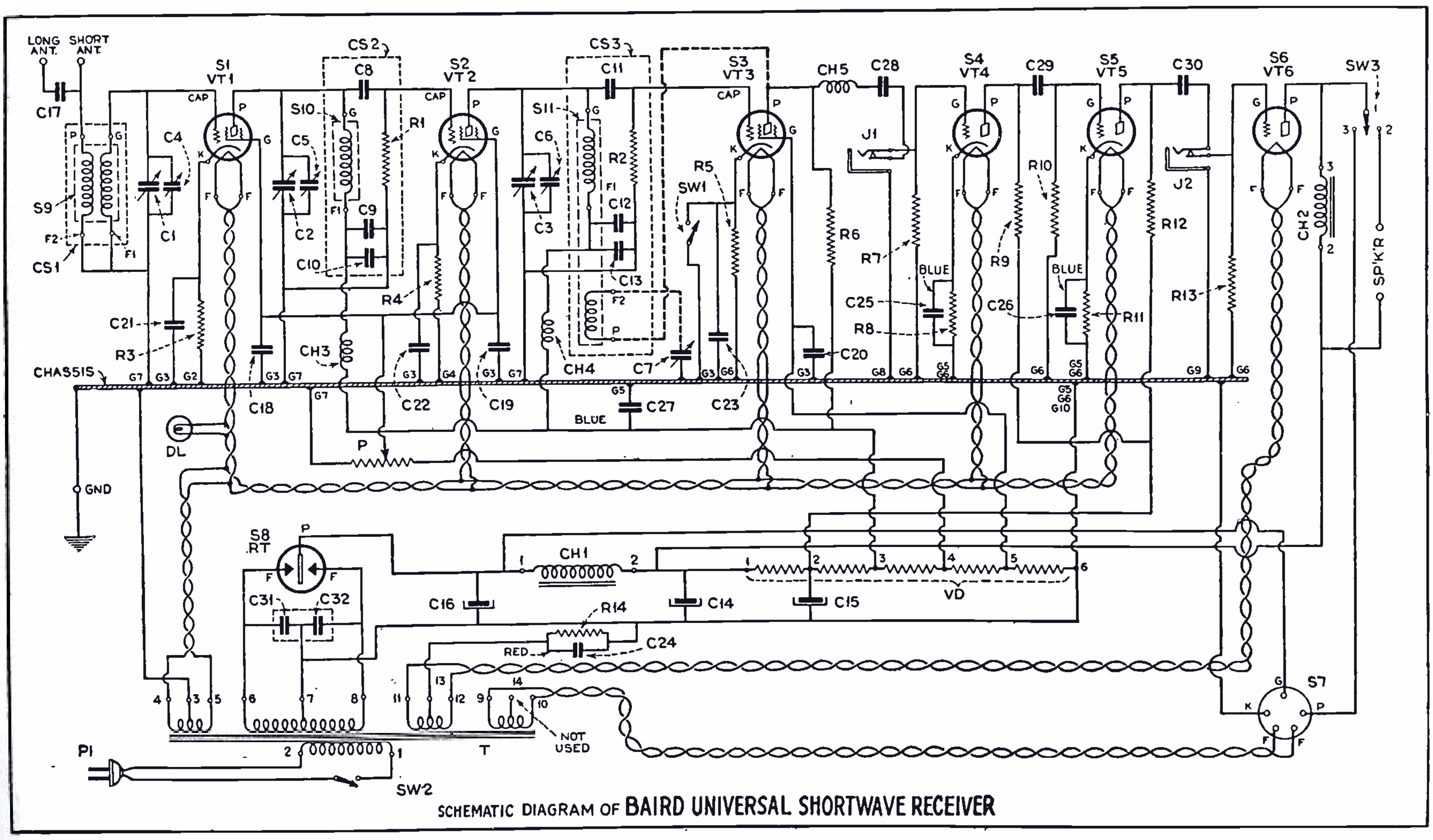


Fig. 1—Complete schematic circuit diagram of the new Baird universal short-wave and television receiver, tuning to all wavelengths from 16 to 200 meters; the audio amplifier has unusually broad frequency characteristics, so essential to perfect television reception.

of this amplifier, a standard pickup having an impedance of 2,000 ohms at 1,008 cycles should be employed. If a pickup having other characteristics is used, a matching transformer will be necessary to complete the pickup to the input of the amplifier. Earphones can be plugged into jack *J2*.

Radio listeners who have never used a short-wave receiver have a real thrill in store for them when they find how easy it is to tune in distant foreign stations with the receiver described here.

The schematic wiring diagram of the circuit used in this receiver is shown in Fig. 1. It consists of two stages of tuned radio frequency amplification using screen grid AC tubes, a screen grid detector, and two stages of resistance coupled audio frequency amplification with a Type —45 power tube in the last stage.

Since one of the most important uses of this receiver will be in connection with Television reception, it has been designed with a resistance coupled amplifier system capable of providing uniform audio amplification over a range of from 15 to 40,000 cycles.

Short-wave receivers equipped with transformer coupled audio amplifiers which cut off frequencies above 8,000 cycles or thereabouts are not suitable for television reception, since they do not pass the audio frequencies so necessary to give good detail to the picture.

Great care has been taken in the design of the circuit and the arrangement

(*Continued on page* **147**)

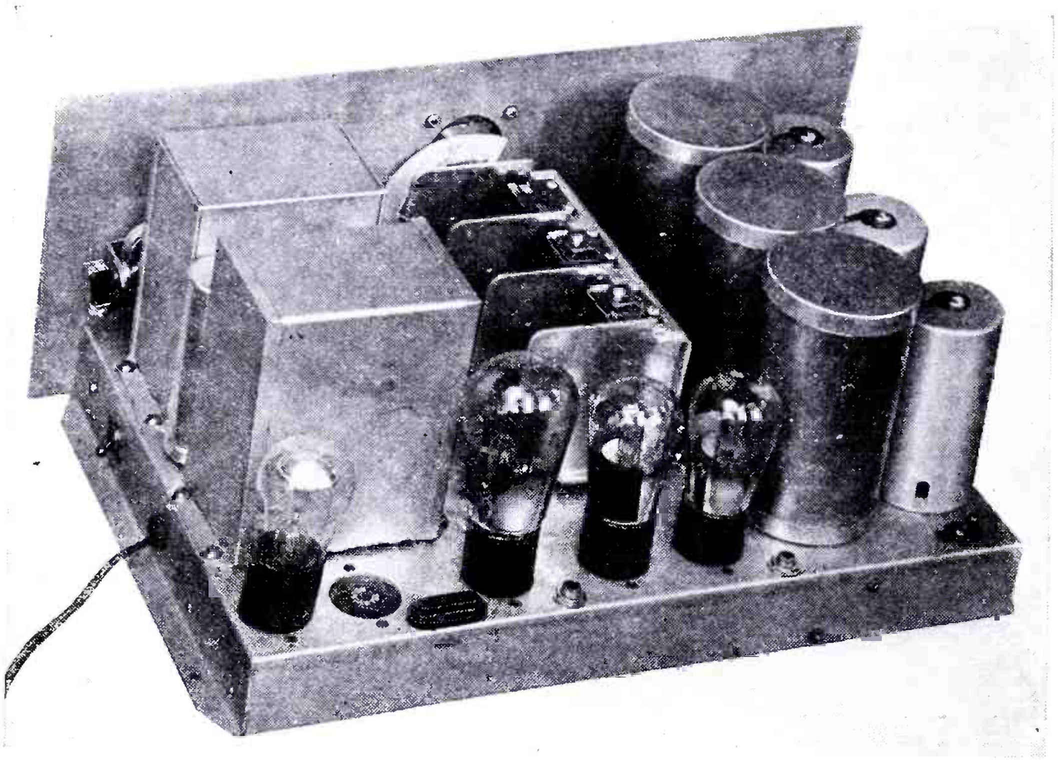
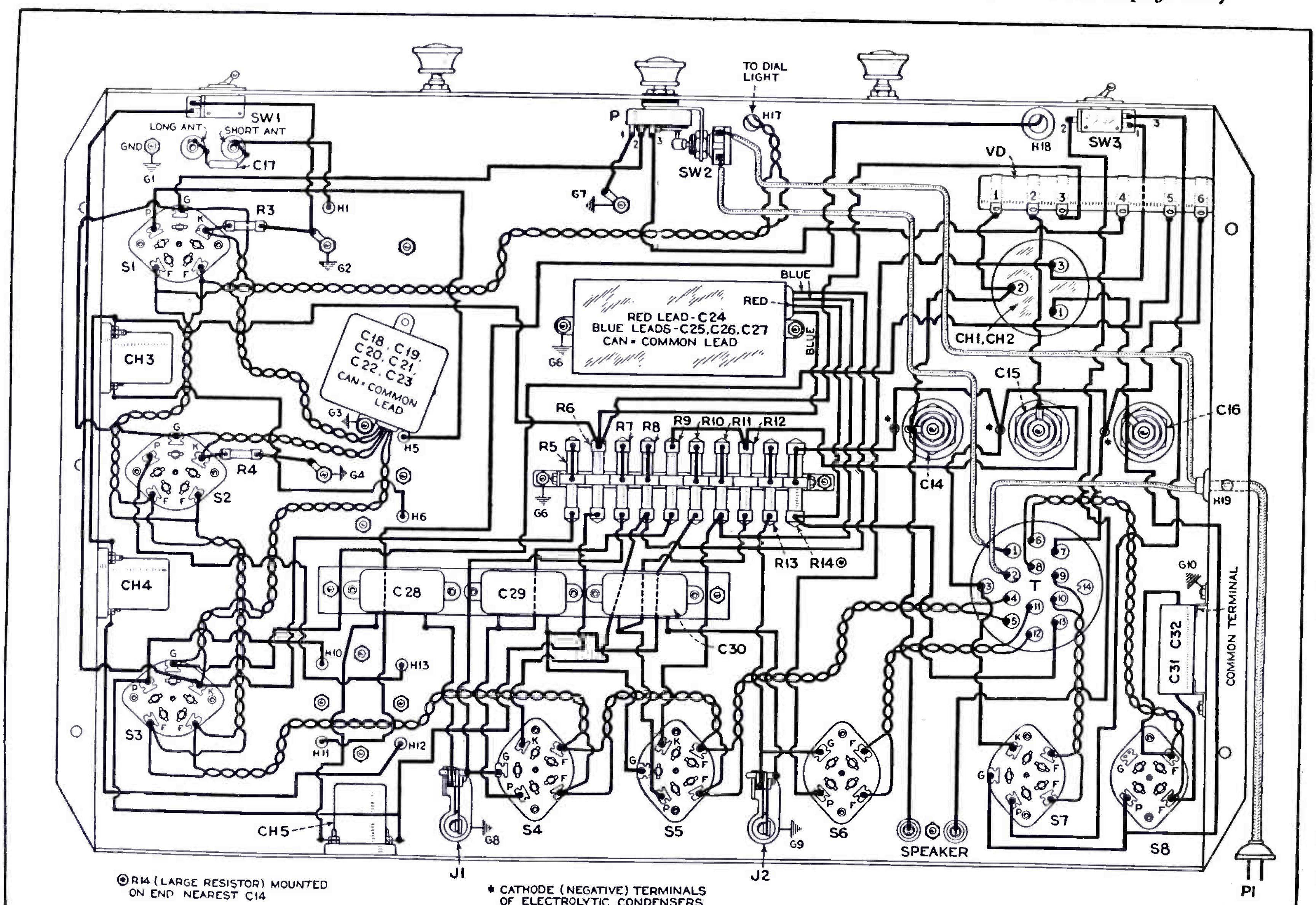


Fig. 3—Rear view of the new universal short-wave and television receiver chassis with tubes in place. The resistance-coupled audio frequency amplifier provides uniform amplification over a range of 15 to 40,000 cycles.



WIRING DIAGRAM OF BAIRD UNIVERSAL SHORTWAVE RECEIVER
VIEW OF SUB - PANEL

Fig. 7—Picturized wiring diagram of the new Baird universal short-wave and television receiver, the relative location of the various parts on the under side of the sub-panel being clearly shown.

Short Waves for the Broadcast Listener

New KENNEDY SHORT WAVE SUPER-HET CONVERTER

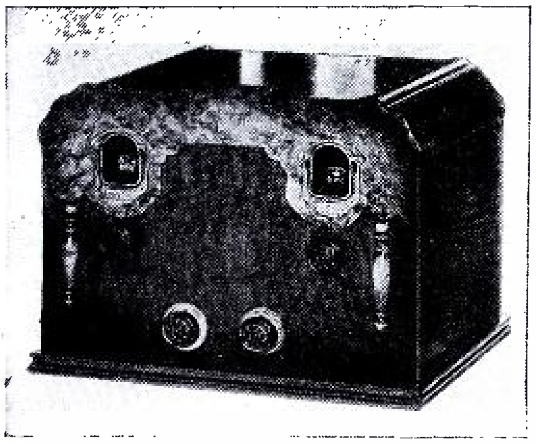
Enables You to Receive Short Waves on Your Broadcast Receiver

THE Kennedy Globe Trotter is a short wave receiver of the type frequently called a converter or adapter. It operates on the super-heterodyne principle, and by its use any good broadcast receiver may be made to operate as a short wave super-heterodyne. If used with a broadcast receiver already employing the super-heterodyne circuit, it then becomes a "double converter" for short wave operation, and performs with full efficiency.

This converter may be used with any good broadcast receiver, and when once properly connected up, it may be left so. The switching from long wave reception to short wave, or vice versa, is accomplished by using the switches provided for this purpose on the panel of the short wave unit.

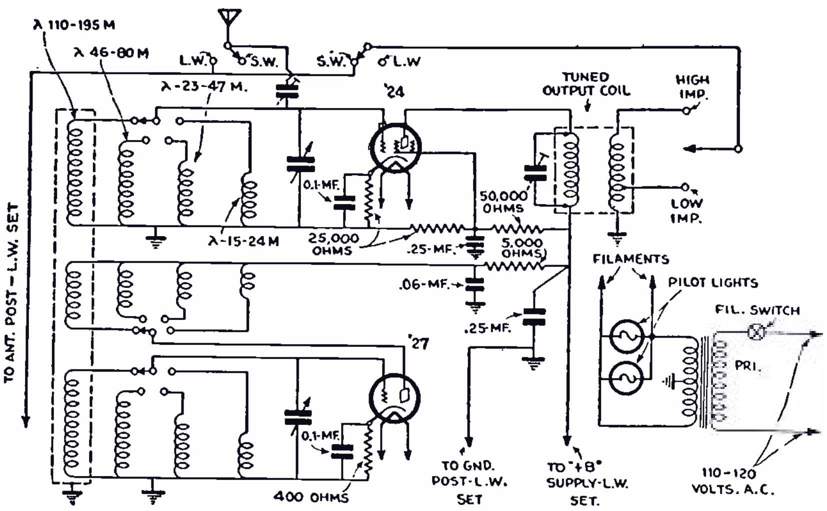
The unit has a cord which is to be plugged into a 110-120 volt A.C. line in addition to the cord from the long wave receiver. This supplies filament current to the tubes of the short wave unit. This current is turned on and off by means of the switch knob. This switch is the lower left-hand knob on the panel and should be turned on only when the short wave unit is in operation.

The plate current, or B supply, for the short wave receiver is obtained from the long wave set. This plate current is very small and adds no noticeable burden to the power supply of this set. Two wires, for supplying this power, come out from the side of the short wave unit, and are to be connected to the long wave receiver. The black wire is connected to the "ground" binding post of the long wave set, and the red wire to the negative side of the speaker field coil (dynamic speaker), or, inside the set, to the positive end of the voltage divider resistor. Any source of B voltage of from 150 to 250 volts is suitable.



Left: Front panel appearance of Kennedy short wave Super-Het converter, which enables one to receive short wave stations on their regular broadcast receiver.

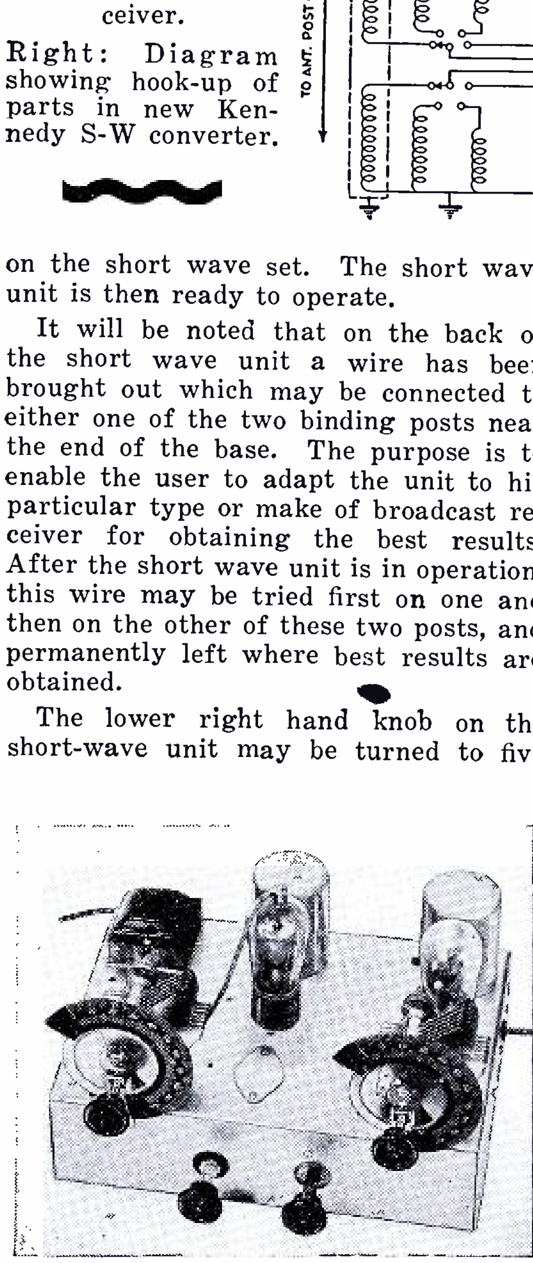
Right: Diagram showing hook-up of parts in new Kennedy S-W converter.



The antenna and ground wires are entirely disconnected from the long wave receiver. They are to be connected to the posts marked "antenna" and "ground" of the short-wave unit, and left there permanently. A wire is then connected from the antenna post of the long wave receiver to the post marked "L.W. ANT." on the short wave set. The short wave unit is then ready to operate.

It will be noted that on the back of the short wave unit a wire has been brought out which may be connected to either one of the two binding posts near the end of the base. The purpose is to enable the user to adapt the unit to his particular type or make of broadcast receiver for obtaining the best results. After the short wave unit is in operation, this wire may be tried first on one and then on the other of these two posts, and permanently left where best results are obtained.

The lower right hand knob on the short-wave unit may be turned to five different positions. One of these positions is marked "long wave" and when the switch is turned to this position, the antenna is automatically connected directly to the long-wave receiver and the output of the short-wave unit is disconnected. The broadcast receiver may then be operated exactly as though the short-wave set or converter were not there at all.



Chassis of new Kennedy S-W Super-Het converter.

When short-wave stations are desired, this switch is turned to the particular point, which includes the desired wave-length, and the filament switch is turned (lower left hand knob) to the "on" position, which will turn on the short-wave unit tubes and light up the dials.

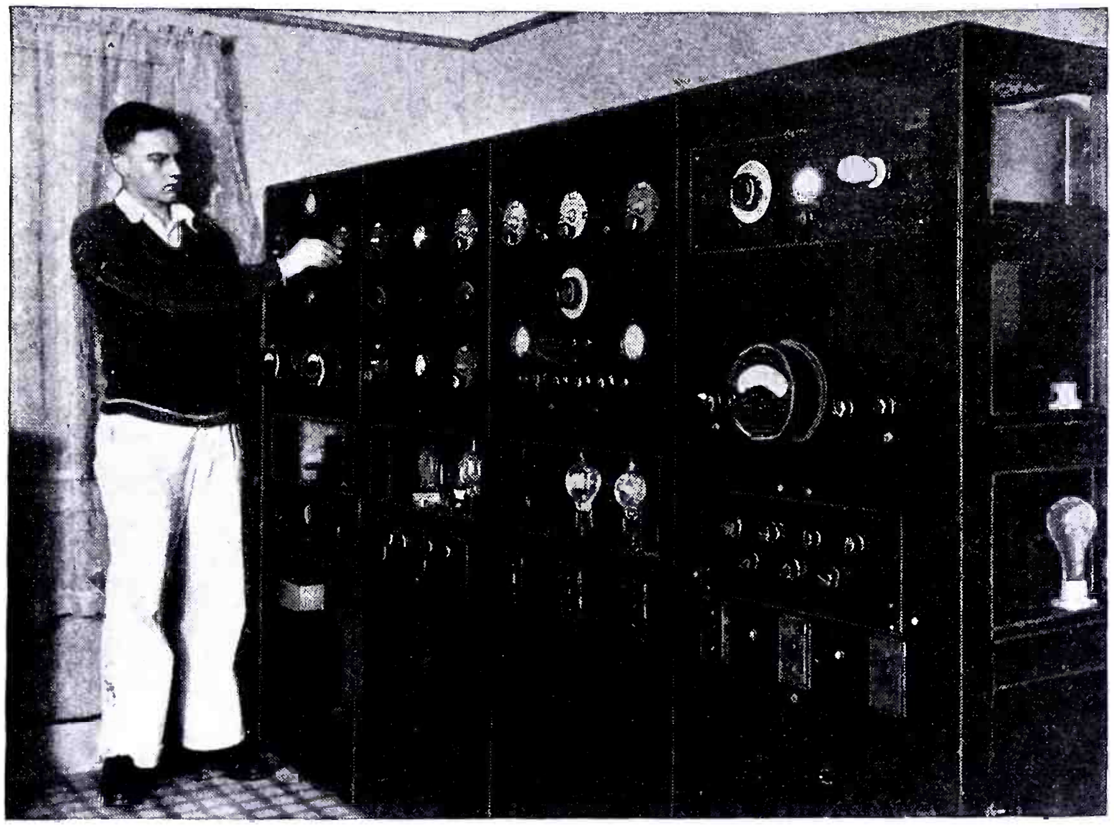
The long wave receiver dial must then be turned to the end of the scale, or 1,500 kilocycles.

When the short wave unit is tested at the factory, it is adjusted for use with an average antenna. Improved results can sometimes be obtained by re-adjusting to the antenna actually used. The procedure for this adjustment is as follows:

Almost exactly in the center of the back of the short wave unit is an adjustment screw which can be operated through a hole provided for it. This screw should be turned with a bakelite screwdriver, which most service men carry. A metal screwdriver will interfere with the adjustment.

Set the switch on the position marked "15-25 meters"—tune in a station (music or code) at about 50 on the right hand dial. Then adjust by means of the screw described above until the left hand dial also reads approximately 50 when tuned in properly.

WINNERS in $2000.00 "AMATEUR STATION" CONTEST



HEREWITH we present the prize winners in our $2,000.00 Amateur Radio Station and Q.S.L. card contest. The conditions of the contest were published in the past several issues, the closing date having been June 10th; the radio apparatus presented to the prize-winners was donated by many well-known radio manufacturers whose names appear in connection with the awards.

The prizes were awarded for the best amateur radio station, photograph and description, together with the most novel or attractive Q. S. L. card.

After the editors, who acted as judges, had waded through the many excellent descriptions of the stations and considered the photographs and Q. S. L. cards sent in by the contestants, the judging of the awards settled down practically to a consideration of the best station and description, for the particular reason that no especially ingenious, novel, or out-of-the-ordinary Q. S. L. cards were submitted. Most of the Q. S. L. cards followed the familiar style, well-known to the radio amateur. Although this contest was open to radio amateur station owners and operators for several months, only thirty entries were received and each one of these radio station owners or operators were awarded a prize as shown in the accompanying list. The editors have selected and published herewith the descriptions of the first five prize winners; also a photograph of the eighth prize winning station, owned by Mr. F. M. Whitaker, which deserves special mention.

The first prize winner is Mr. Gale B. Sells, of Portland, Oregon. Mr. Sells certainly deserves a lot of credit as he has designed and built a very fine station, which looks to be the equal of many a commercial station. Mr. Sells wins a Pilot "Super-Wasp" A.C. Receiving set.

First Prize—Pilot A.C. Super-Wasp Receiver

Owned and Operated by Gale B. Sells, W7AMQ, Portland, Oregon

HAVING first become interested in radio in 1922, Gale B. Sells, operator of amateur radio station W7AMQ, has at last completed a transmitter whose plans have been in his mind for several years. He first went on the air in 1928, using a type 210 tube, and has constantly increased his power and equipment until now he has a transmitter whose appearance and operation is better than the ordinary amateur layout and equal to a commercial's.

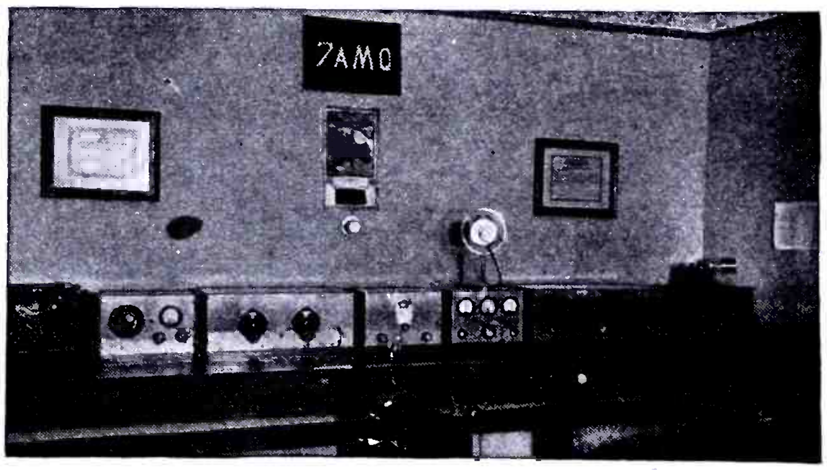
The transmitter is a crystal-controlled job using a temperature-controlled box, with an approximate output of 200 watts, working on 10, 20, 40, and 80 meters with code and on 80 meters with radiophone; the entire transmitter being built into a unit 5 feet 4 inches high and 8 feet 4 inches in length with four polished set in panels. To observe the high voltage rectifying tubes, windows are built into the panels.

10 TO 80 METER OSCILLATOR AND AMPLIFIER

The oscillator consists of a 112A tube in a high C oscillator with the crystal temperature-control. The output of the oscillator feeds into a 245 tube amplifier, which can be used as a "buffer" for phone work, or to provide a strong harmonic for frequency doubling, as the oscillator is high C. For operation on the 10 and 20 meter bands, there is a 210 tube amplifier used as a frequency doubler. Following this, there is another 210 tube amplifier which is used as a buffer in 80 meter phone work or as a straight amplifier for 20, 40, and 80 meter code work or as a frequency doubler for 10 meter code operation. This is followed by a 510 used as a modulated amplifier for 80 meter phone work or as a straight amplifier for 10, 20, 40, and 80 meter code work. The final amplifier is next, with two 852 tubes in a push-pull T.P.T. G. circuit, being used as a linear stage for 80 meter phone work and as a straight amplifier for 10, 20, 40 and 80 meter code work. The input to this final stage is 450 watts.

80 METER PHONE

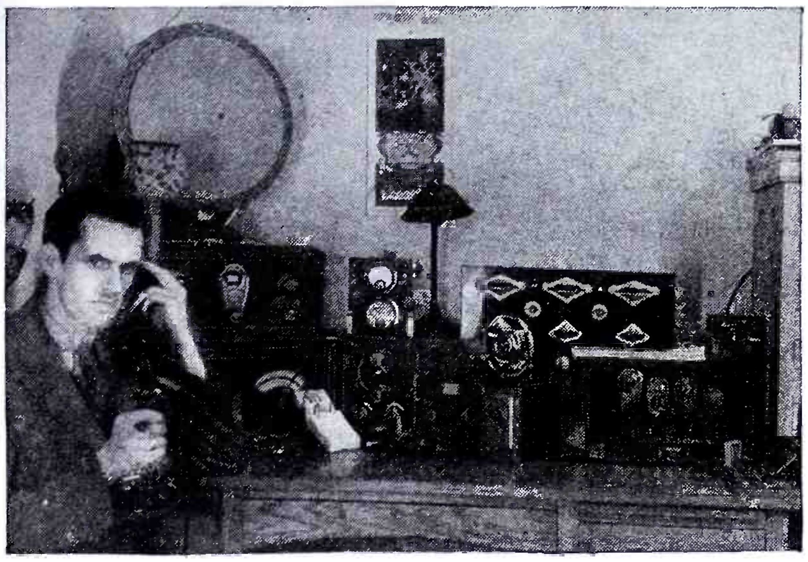
For the 80 meter phone operation, a Universal two-button microphone is used, which is fed into a 227 tube stage, then into a two 227 tube push-pull stage, which is then fed into two 245 tubes in another push-pull stage. The final output of this amplifier is fed into a 211-D modulator tube, which modulates the transmitter's 510 tube stage.



Above we see Mr. Gale Sells' short-wave receiver line-up and control panel, from which point he has control of the powerful short-wave transmitter shown in photograph at top of page.

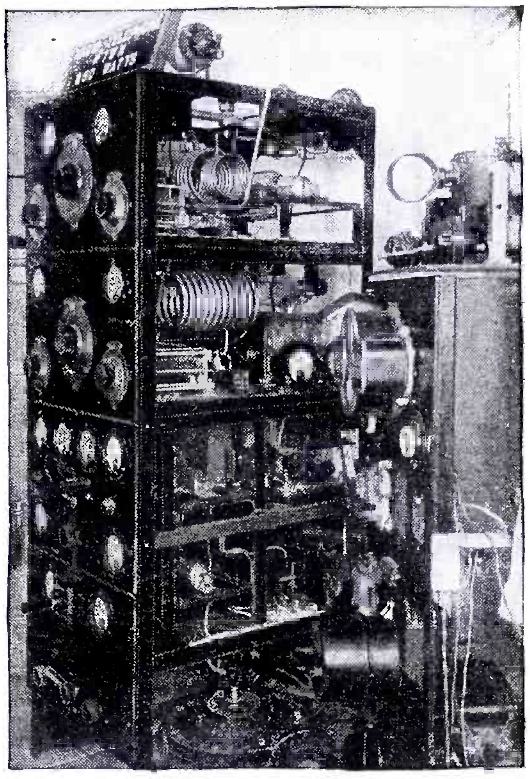
Right: Rear view of Mr. Sells' powerful short-wave transmitter. Note the neat arrangement of each stage.

Second Prize Won By K. B. Aldrich, W7WN



Left: Receiving apparatus in the short-wave station of Mr. K. B. Aldrich. Note the "mike" at center of desk and control panel for transmitter illustrated at right.

Mr. Aldrich's powerful short-wave transmitter of business-like appearance. The transmitter is rated at 250 watts and has a crystal-controlled oscillator.



Second Prize—3 Hammarlund S.W. Coil Sets; 3 MLW125 Condensers

Won by K. B. Aldrich, W7WN, Portland, Ore.

IT IS with pleasure that I have this opportunity to herewith submit to you photographs and description of my amateur radio station for entrance in your *radio contest.*

The transmitter is rated at 250 watts, employing a 5 watt Western Electric crystal-controlled oscillator, operating on 350 volts, and at a frequency of 3518KC, coupled to a 15 watt buffer, a 50 watt intermediate R.F. amplifier, exciting a 50 watt modulated amplifier, which in turn excites a 204A (250 watt) linear amplifier, which has a modulated output of practically 1,000 watts when operating at 100 per cent modulation.

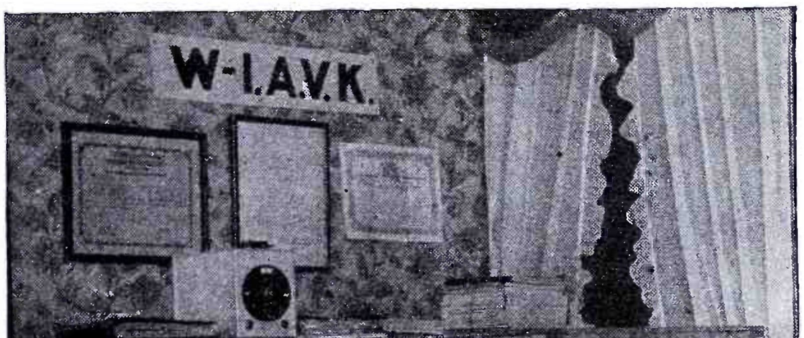
The modulation system consists of 2 204A (250 watt) tubes in parallel and using RCA modulation chokes.

The power supply is from two motor generator sets operated by remote control. One 1,000 volt set supplies the crystal oscillator and 1st buffer—the second m.g. set—a 4,000 volt, 1,500 watt, 3 unit job—operates the RF amplifiers—modulators and linear amplifier.

Operating control of the equipment is by special time delay relays throughout the entire transmitting system. Negative bias for the tubes is obtained from a 500 volt m.g. set and a full wave tube power supply.

A two button Western Electric microphone is used and is built up in a single unit with the 1st stage of speech amplification, which in turn is amplified through a 227 to a '45 tube and to a final audio amplifier at 50 watts output to the modulators. The antenna system used is a voltage feed of 132 ft. 10 in. in length for the radiated frequency, with 12 amps. in the tank circuit.

Two short-wave receivers are used, one reconstructed Aero AC and a Westinghouse screen-grid job—also a Grebe broadcast receiver for BC programs.



Third prize-winning station owned by Mr. L. A. Richmond.

Third Prize—A de Forest Type 560 Transmitting Tube and 2 No. 566 Tubes

Won by W1AVK—Louis A. Richmond, So. Manchester, Conn.

W1AVK is owned and operated by Louis A. Richmond, 65 Spruce Street, So. Manchester, Conn.

The equipment pictured here is the evolution of a simple outfit, using one 210 tube in a self-excited circuit C.W. telegraph transmitter, to an ultra-modern, crystal-controlled oscillator, buffer amplifier, modulated oscillator, linear amplifier combination C.W. telegraph and telephone transmitter.

The superstructure of the transmitter and operating panels are almost identical. The transmitter being 54" high, 21" wide and 30" deep, whereas the receiver is 54" high, 21" wide and 15" deep. The depth of the operating shelf, which contains all switches, makes up for the discrepancy in depth of the operating structure. The transmitter has three shelves. The lower shelf contains all the power apparatus; the center shelf contains the crystal oscillator, the buffer amplifier, the modulated amplifier, and the modulator; the top shelf contains the linear stage with its associated apparatus.

A fundamental crystal frequency of 3518 k.c. has been used at W1AVK for one year in the telephone band and several crystals have been used in the C.W. telegraph band.

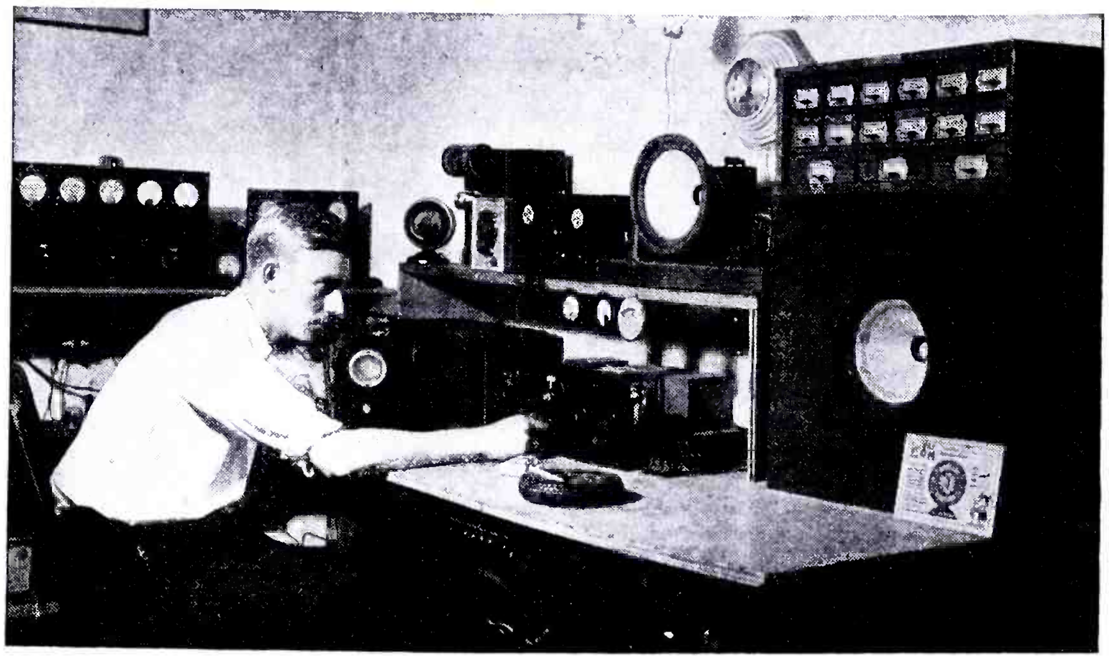
A UX210 type tube is used in the crystal oscillator which is self contained in a 9"x6"x5" shield. This crystal circuit is capacitively coupled to the buffer amplifier stage, also a 210 tube with a plate potential of 400 volts which acts as an amplifier for the crystal energy, and also tends to isolate the crystal circuit from the last amplifier, with consequent increased frequency stability.

The buffer circuit is capacitively coupled to the modulated amplifier which is a 210 tube operated as a class "C" amplifier, with 200 volts on the plate. The modulated amplifier is modulated by a UV845 modulator tube, with 1000 volts plate potential in a double choke, Heising 100 per cent modulation system. To amplify this already modulated energy to a fair-sized amateur signal, two UX853 tubes in a linear push-pull amplifier circuit with 2000 volts plate supply, is used as a class "B" amplifier, which is inductively coupled to the modulated amplifier.

The plate tank circuit of the linear stage is inductively coupled to the antenna circuit, by using a split antenna coil each side of the tank inductance.

The antenna coil is fed into a pair of feeder wires 50 feet long, and tuned with a series condenser in the center of the antenna inductance. These feeders are connected to a half-wave zeppelin antenna 133 feet long.

The plate power is derived as follows: A separate supply is used for the crystal oscillator. Two 281s in a full-wave circuit, delivering 250 volts, is used.



Fourth Prize—One de Forest No. 560 Transmitting Tube

Won by Marcus L. Potter, W9FQU, Park Ridge, Ill.

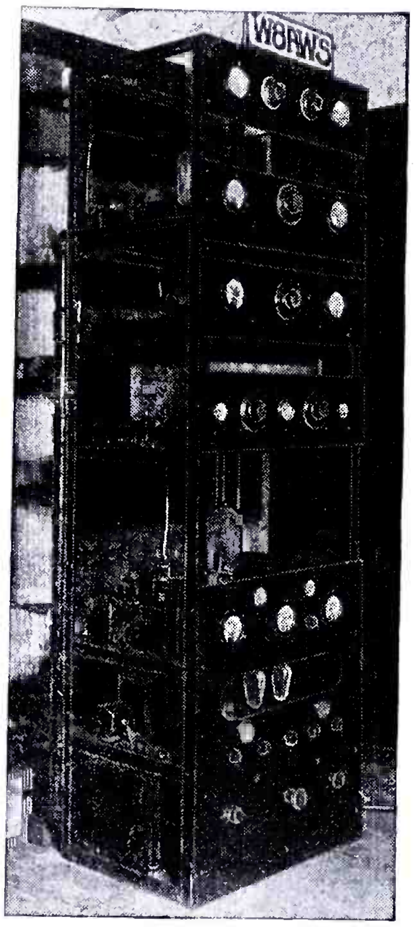
W9FQU, as evidenced by the QSL card, is a crystal controlled four stage push-pull transmitter operating on any one of four frequencies—3550 KC, 3523 KC, 3508 KC, and 3581 KC; the first three being used for phone work and the latter for CW.

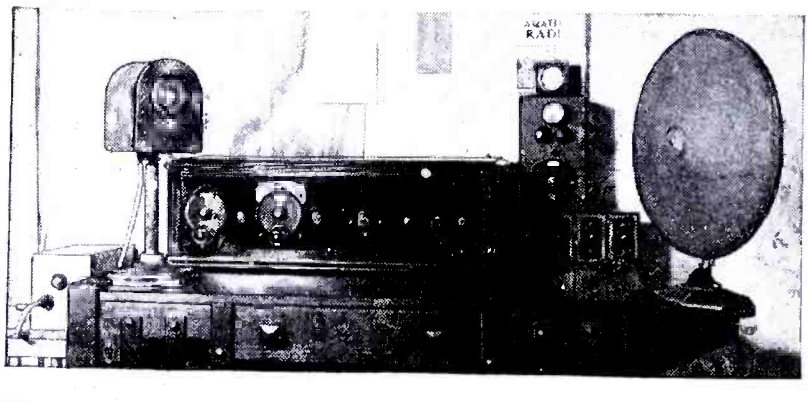
Two type 45 tubes are used in the crystal oscillator; two type 24's in the second stage or Class B buffer amplifier; two type 10 tubes in the third stage or Class C modulated amplifier, and two WE212D tubes in the output stage, which is operated as a Class B linear amplifier. Power output to the antenna counterpose system is approximately 250 watts peak on phone (80% modulation measured by a vacuum tube voltmeter).

A two stage transformer coupled speech amplifier using type 27 tubes feeds a 50 watt modulator unit which in turn modulates the type 10 Class C amplifier.

Four separate rectified A.C. units are used for plate voltages; 180 volt supply for the crystal and buffer stages; 1000 volt supply for the modulator and modulated amplifier.

Fifth Prize—2 Sets Ken-Rad Tubes





Fifth prize-winning station owned by W. W. McKinley, W8AWS of Youngstown, Ohio. Transmitter is at left and receiver above.

Fifth Prize

Won by W. Ward McKinley, Amateur Station W8AWS

W8AWS is a call familiar to the short wave listener and the phone HAM operating in the 3500 k.c. band. The station is owned and operated by W. Ward McKinley and is located at 2129 South Buckeye Ave., Youngstown, Ohio. The owner has been in the HAM game for the last ten years and has experimented wtih practically every type of transmitter. The present transmitter is push-pull throughout and either phone or CW. can be used. The outfit is a multi-stage affair and starts out with 227 Crystal oscillators feeding into a pair of 224 screen grid tubes, acting as first buffers. This feeds two 210 tubes which excites the two fifty watt UV211 tubes in the class C modulated amplifier. The modulator is a 250 watt tube and is fed by a four stage amplifier and an ASTATIC condenser microphone. The transmitter is usually run with an input of 200 watts to the final stage and with 90% to 95% modulation. The antenna is of the popular ZEPP type and is 135 feet long with 60 foot feeders. It is supported by two 50 foot lattice masts.

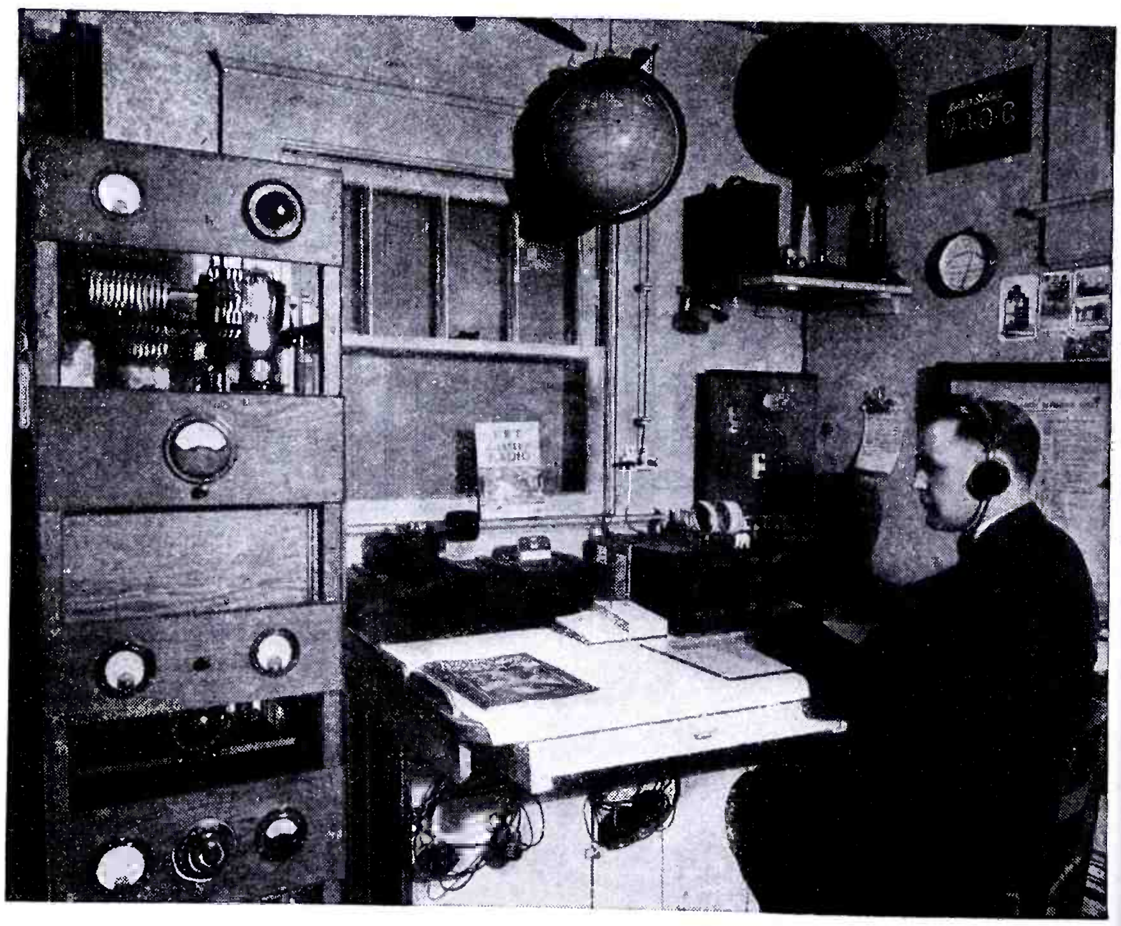
The receiver is A.C. throughout and uses a 224 tube for tuned R. F., a 224 detector, 227 first audio and a 245 in the final audio stage.

As for results—W8AWS in the last twelve months on "phone" has worked 44 states, four Canadian Districts and Mexico. W8AWS can be heard on 3505 k.c. or 3544 k.c. almost any week-end after 0400 G.M.T.

(*Continued on page* 156)

Eighth Prize—5 Power Clarostats

Won by F. M. Whitaker, W4OC, Durham, N. C.



The Short Wave Beginner

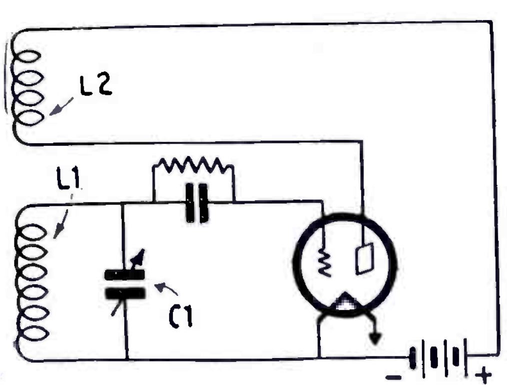


FIG. 1

Fig. 1—Shows simple regenerative receiver circuit, basis of transmitter circuits.

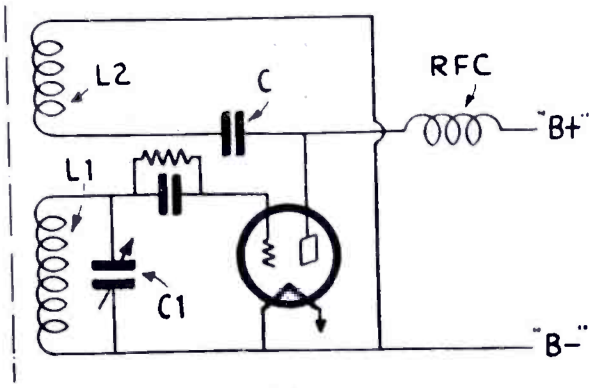


FIG. 2

Fig. 2—Quite similar to the "blooper" at left.

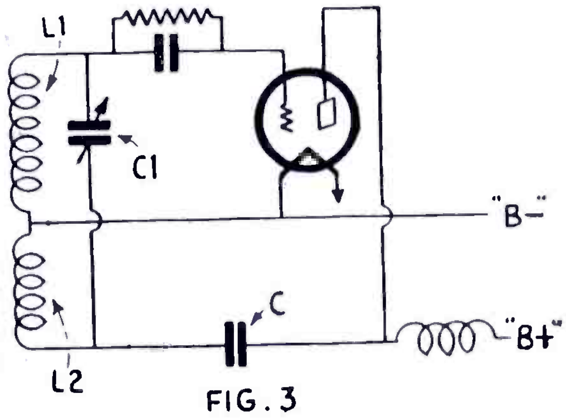


FIG. 3

Fig. 3—The Hartley circuit which resembles the regenerative receiver.

How The *Transmitter* Circuit Is Related to The "Blooper"

By WALTER C. DOERLE

The author shows how transmitter circuits were evolved from the simple regenerative receiving circuit or "blooper".

EVERY radio fan is familiar with the simple, so-called "three-circuit regenerative," receiving hookup; all the familiar transmitting circuit arrangements can be derived from this simple circuit. Short-wave transmitters usually employ either the "Hartley," the "Colpitts," or the Armstrong "tuned plate-tuned grid circuits." The following discussion shows how easily the transmitting circuits so commonly used today can be derived from the simple regenerative receiving circuit of Fig. 1.

If energy in the plate circuit of a tube is fed back into the grid circuit, the tube amplifies to a greater degree. If the feed-back is increased beyond a certain critical point, oscillation is produced in the receiver circuit, and a transmitter results. A receiving tube can furnish only a limited amount of energy, but this may be sufficient to be heard in nearby sets, thus causing interference.

The transmitting circuits are easily derived, once the simple receiving circuit of Fig. 1 is understood. The coil L_2 in the plate circuit feeds back the energy into the grid circuit of the tuned circuit L_1 C_1. If the feedback is sufficient, oscillations are produced in L_1 C_1.

Fig. 2 is quite similar to that of Fig. 1; the only difference is that a plate blocking condenser C is used in the plate supply lead (to prevent the plate supply from being "shorted") and a radio-frequency choke (RFC) is also used. Chokes keep the R.F. energy confined to its proper paths.

If, in the Hartley circuit (Fig. 3), coil L_2 is coupled to the filament end of the oscillating circuit which consists of the coil L_1 and variable condenser C_1, then the variable condenser will tune across both coils, because the filament lead is common to both coils.

There is no marked difference between the Hartley and Colpitts circuits. If the reader will examine the circuits of Fig. 4 (Hartley and Colpitts arrangements stripped to bare necessities) it will be found that the tuning coils and condensers have simply been interchanged.

The evolution of the Hartley and Colpitts transmitting circuits from the old "three-circuit" tuner has been shown. The Armstrong "tuned grid-tuned plate" can also be evolved from Fig. 1.

The tuned grid-tuned plate transmitting circuit is a sort of a combination of the Hartley and Colpitts circuits (Fig. 5). Fig. 6 illustrates the recognizable tuned grid-tuned plate circuit.

By using the entire coil AB (Fig. 5) and condenser C, we have the Hartley oscillating circuit; but by parting the coil at the filament point F, and using two condensers D and E, we have the Colpitts circuit. When the grid coil FB and its associated condenser E are separated far enough from the plate coil AF and its condenser D (as shown by the dotted arrow line (Fig. 6), we have the tuned grid-tuned plate circuit. There is very little coupling between the coils but, at

(*Continued on page* 151)

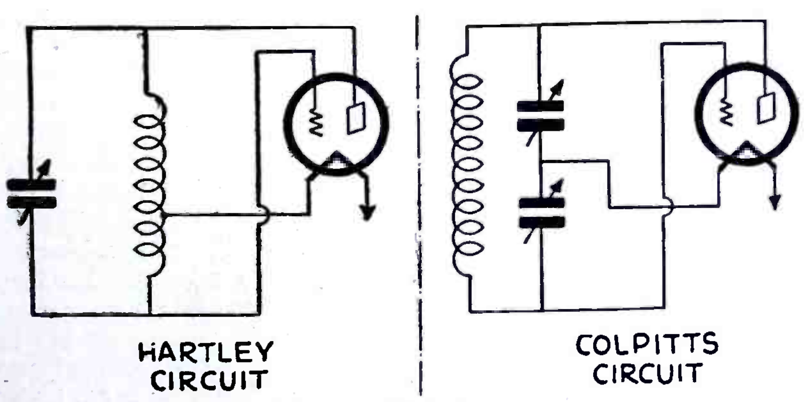


FIG. 4

Fig. 4—Show that there is no marked difference between the Hartley and Colpitts, which are shown above "stripped to fundamentals".

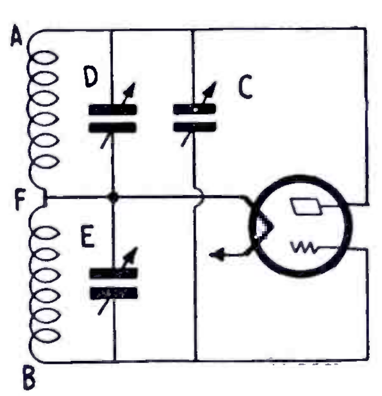


FIG. 5

Fig. 5—The tuned-grid tuned-plate transmitter, a combination of those in Fig. 4.

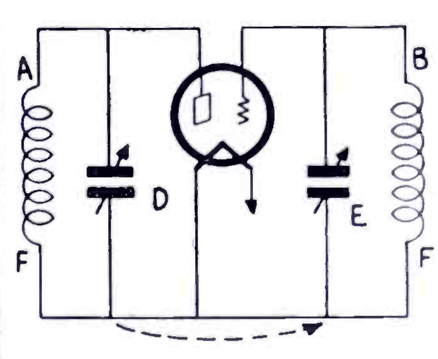
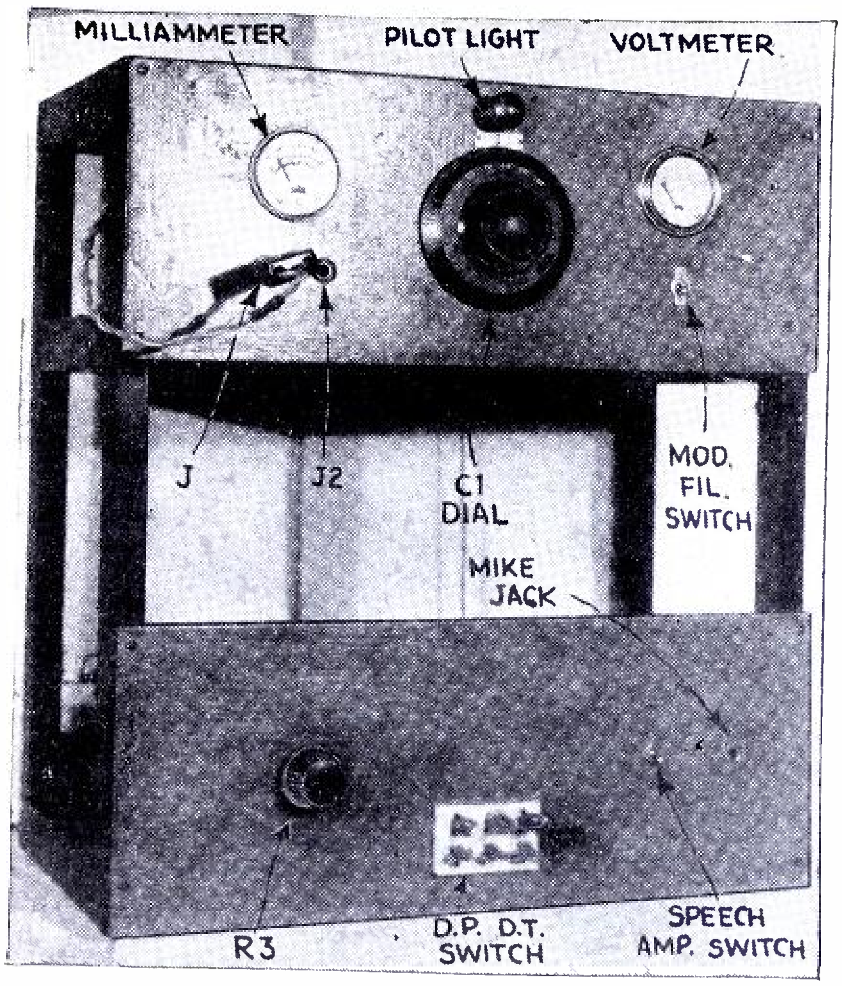


FIG. 6

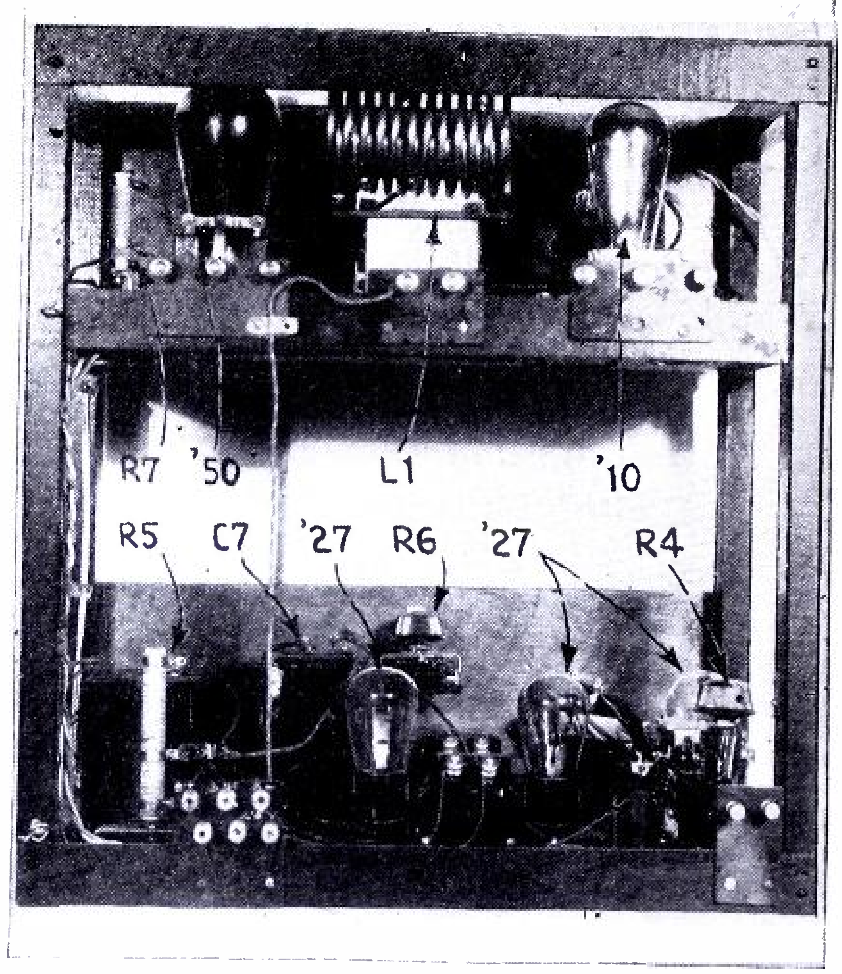
Fig. 6—Illustrates the recognizable diagram of the tuned-grid, tuned-plate circuit.

How To Build Your Own PHONE TRANSMITTER

By LAWRENCE B. ROBBINS



Front view of Mr. Robbins' phone transmitter showing tuning dial, microphone jack, also meters, switches, pilot light, etc.



Rear view of the Robbins' phone transmitter, which uses a '10 tube in the oscillator and a '50 tube for the modulator.

WHEN the amateur graduates from a simple code transmitter, he usually wants to get into phone transmission. This, of course, calls for more complicated apparatus and finer adjustments. Today's tendencies lean towards crystal-controlled outfits and high power; but, for a starter, a fine little phone transmitter can be constructed after the plans shown in this article. While crystals, buffer stages, etc., are not included, this transmitter will give excellent service and have a range of from 100 to 200 miles under good conditions. The frequency holds steady, the modulation is clean and, for a simple job, it will be found to compare favorably with the more expensive outfits.

Oscillator Uses '10 Tube

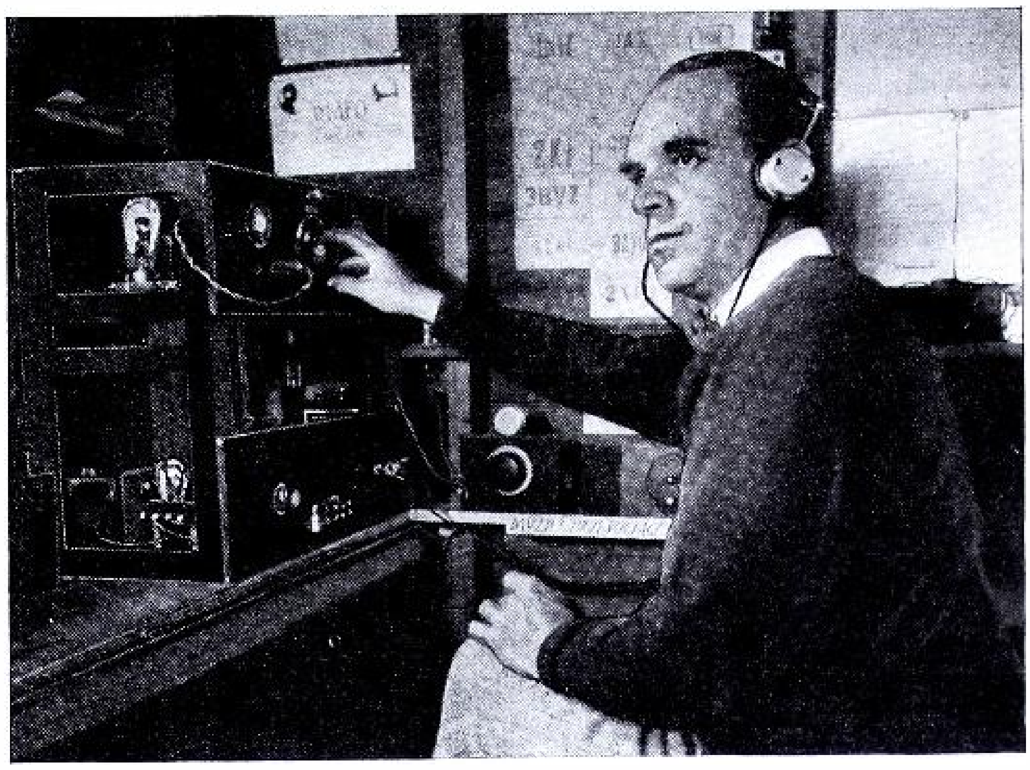
By following the schematic diagram alone, one will be easily able to build the transmitter successfully but the additional details will help greatly. The oscillator consists of a '10 tube operating in a high-"C" Hartley circuit. This is modulated by a single '50 type tube working out of a two-stage speech amplifier, using three '27 type tubes; two of them working in push-pull. A single-button microphone is employed, but such a speech amplifier will easily handle a double-button mike if later desired.

From 500 to 700 volts of pure D.C. will be ample power for good operation and you can use either the power supply shown or, perhaps, one of the many high-power packs that can be so cheaply purchased at the present time for broadcast amplification. Bias voltage, etc., are all supplied from 110 A.C.; the only battery necessary being that used in the microphone circuit.

The Cabinet

To start at the beginning, build a cabinet similar to that shown in the drawings. This is constructed of pine 1½ in. wide by ¾ in. thick; it is 20 in. high, 10 in. deep, and 18 in. across front and back. The top deck may be of ½ in. stock, placed 7 in. below the top; and the bottom deck of same stock raised about ½-in. from the base. Fasten guard strips at the back and ends. The panels are of ½-inch pine, 7 in. wide by 18 in. long and screwed to front uprights as indicated. Cut holes as indicated in each panel. The top one takes an 0- to 100-milliammeter at the left, and an 0- to 10-voltmeter at the right. Then come the two holes below the milliammeter opening, for jacks connected to the plate circuits of both oscillator and modulator tubes. At the right, below the voltmeter, is fitted a toggle switch for the modulator filament and, in the center, the dial for tuning condenser control. The hole at the left of the bottom panel is for the *gain control* of the microphone circuit; while at the right are holes for *microphone jack* and *filament switch* for the speech amplifier. Paint the cabinet to suit, and shellac the panels. Binding-post strips are fastened to the back as shown in the rear view. The tuning inductances are made of ⅛-inch diameter, soft-drawn copper tubing, wound 3 inches in diameter with turns spaced about ⅜ in. apart. For 80-meter operations use 12 turns; for 40 meters, 7 turns; and for 20 meters, 3 turns; the latter to be spaced ½-inch apart. The ends of the tubing

THE editors are glad to present herewith this very excellent description of "how to build and put on the air" an amateur phone transmitter, capable of carrying the voice 200 miles and more. This transmitter can be built easily at a very small cost. The oscillator employs a '10 tube, modulated by a '50 tube, which works out of a two-stage speech amplifier, employing three '27 tubes, two of them working in "push-pull". All voltages are supplied from any 110-volt A.C. 60-cycle circuit, except for a small battery used with microphone. This set has been built and tested by the author with excellent results, which he describes in the accompanying article.



Mr. Robbins at the tuning dial of his low-power, yet extremely well designed and highly efficient phone transmitter, which he here explains how to build.

are flattened, bent horizontal, and slotted to fit over binding posts in the coil support. This last consists of a strip of bakelite about 4½ inches long by 1 inch wide, fastened horizontally to a vertical piece of wood attached to the upper deck, behind the tuning condenser C1. The detail sketch and photo show this clearly.

Assembly of Apparatus

Now for the assembling: First study the table of constants and parts, and procure them all before starting in. Use plenty of good rubber-covered hook-up wire, and be sure to make a good job of soldering all necessary joints. Following the schematic diagram and photos carefully, you should experience no difficulty. Attach C1 to the rear of top panel, and fit on the dial. Behind that is L1 on its mount. Then, to the left, is mounted the tube socket and around it are assembled C4-C4, C2, C3 and R1. L3 stands vertically in front of socket and R2 is attached to the end of the cabinet. J1 and J2 are below the milliammeter in front of panel.

Arrange a binding-post strip for the oscillator filament terminals at the rear of that tube. Then, at the right side, fasten the modulator socket, and behind this its binding-post strip, C8 and R7. Below the voltmeter, in the panel, put the modulator tube filament switch, and behind L1 place a pair of binding posts on a strip for key connections.

~ TRUE COPY OF STATION LOG AT W1AFQ ~

(QSA, QSA, TONE, AC or DC, FCY: STATION WORKED)

DATE + TIME	FREQUENCY	STATION CALLED	STATION CALLING	QSA	QSA	TONE	AC or DC	FCY	REMARKS	
Jan 21-31 4 P.M	3600 KC		W2ABW	5/6	5/5	fb	pdc	3900	100% QSO	CW
1/23/ 10.35 AM.	3560	W1CRZ		4/5	3/5	"	dc	3600	Seem QSS but nearly 100%	cw
1/24. 9.30 am	3550	W1ADZ		?	3/4	"	"	3575	Conditions N.G.	fone
1/25 6.45 a.m.	3525	W4PW		4/7	5/4	"	pdc	3520	Seem QRM but gud QSO	"
1/29 10.45 am	3610	W2ASF		3/5	3/6	ruff	RAC	3700	Rpt me 100% but slite chirp	cw
Feb. 1-31 12 Noon	3610	W1AFF		5/6	4/6	ruffle	dc	3600	He using 201a tube wid ripple but FB	"
2/5 4.P.M.	3525	W1NH		5/7	5/7	gud	pdc	3530	Much QRM	fone
2/13 ?	3525		W1BNR	5/6	4/6	"	"	"	3 way wid 8CCC	"
2/17 5.20 P.M	3525	?	4-???	?	2/4	"	"	3500	QRN es QRN	"
2/22 7.20 am	3525	W2BXO		5/7	5/6-8	"	"	3540	100% 280. FB	"
5/11 7.05 PM	14200	W9AUH		4/8	4/7	"	DC	14350	QSO short but FB.	Cw
" 7.15 PM	14200	W9COW		5/8	5/5	"	rac	"	QRM but 100%	"

QSA — 5/6 · MEANS QSA-5 READABILITY ——— R6 AUDIBILITY

Herewith is an actual "log" of stations called and "worked" by Mr. Robbins, with the phone transmitter here described.

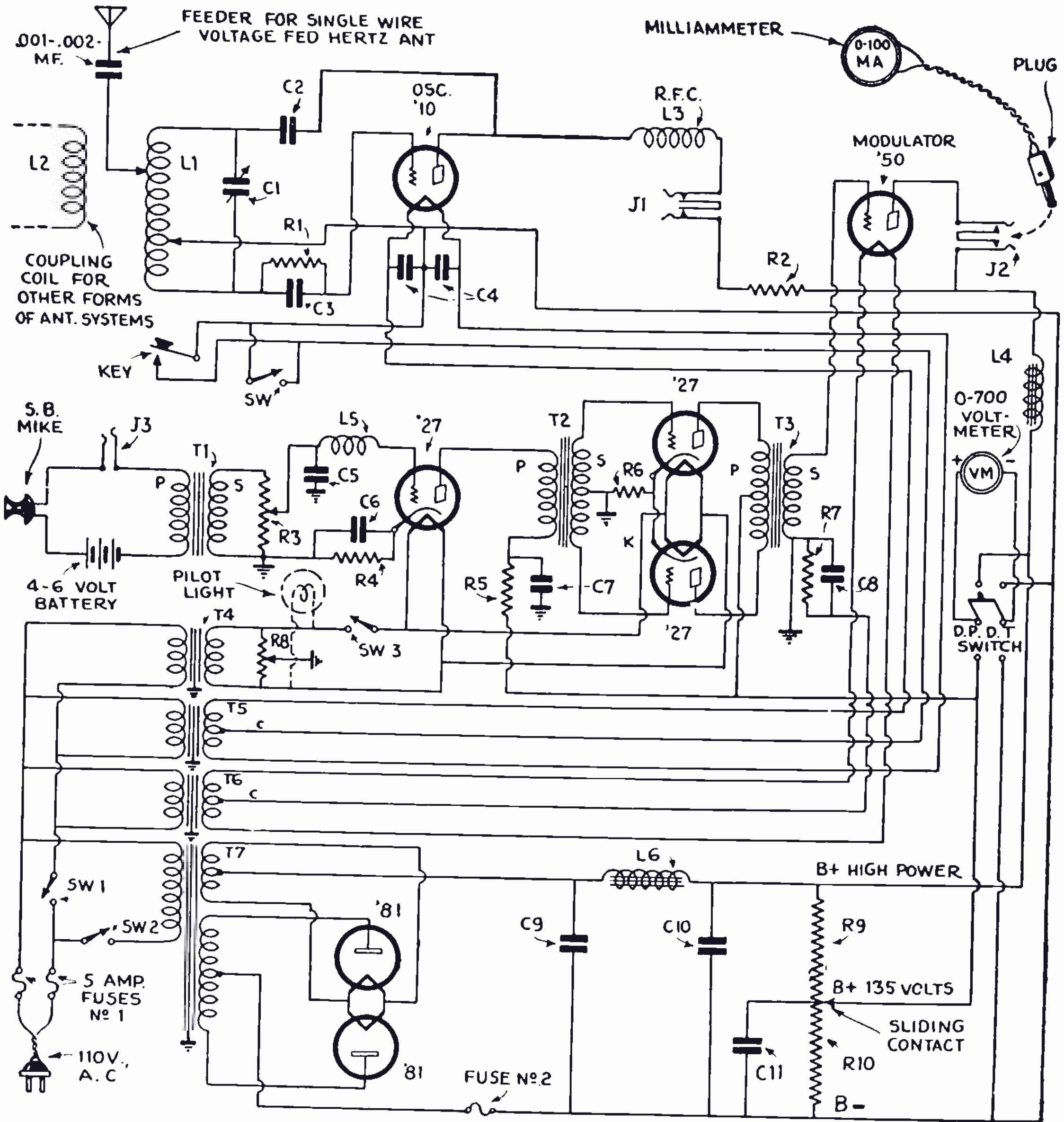
The Speech Amplifier

Now comes the *speech amplifier*. As everyone has his own ideas about arrangements, the builder can use his own judgment; but the layout shown in the rear view photo will do as a tentative guide. Facing the lower panel, the microphone transformer T1 is at the left; the battery binding post strip at the rear, and R3 in the panel. The first UY socket (for the first '27 tube) is then installed, and its resistors and condenser, etc., L5, C5, C6 and R4 are assembled around it. Then mount two more UY sockets in position and the push-pull audio transformers T2 and T3; at convenient points place R5 and R6 and C7.

There should then be plenty of room for L4 and any other minor accessories that might be later installed. Then place the amplifier filament switch S3 in the panel, and the microphone jack J3. The D.P.D.T. switch controlling the voltmeter readings is then fastened to the center of the bottom panel. A second binding-post strip, for connections to "B —", "B + 135", "B" high power, the 2½-volt filament connections, and ground, can then be placed behind L4. If desired, a pilot and dial light can be wired direct from these 2½-volt binding posts to a suitable socket set in the top panel, directly over the dial, as shown.

Power Pack

The best type of power pack is one containing separate transformers for every job. In the one diagrammed are included four transformers: namely, T4, 2½ volts for the '27 filaments; T5, the oscillator filament transformer delivering



Complete wiring diagram for the phone transmitter here described by Mr. Robbins. This set has been tried out in actual practice with excellent results.

7½ volts; T6, also 7½ volts for the modulator tube; and T7, the power transformer, with a filament winding for lighting the rectifiers. If desired, a separate filament transformer can be used for the last purpose, with the expectation of even better power regulation.

Assemble the entire power equipment on a separate baseboard, and place it two or three feet away from the transmitter. Ground all transformer cores, and center tap T4 with a suitable potentiometer R8. Two '81 tubes are used as rectifiers, with a suitable filter consisting of L6, C9, C10 and C11. The switch S1 turns on the 110-volt line to the filament transformer primaries, while S2 starts the power transformer. Two 5-amp. fuses should be inserted in each side of the 110-volt line, to take care of possible shorts at that end. The center tap from the power transformer should also be fused (with a flashlight bulb) in case trouble should occur at the tubes or power secondary. R9 and R10 are two parts of a 100-watt resistor, used as a voltage divider to provide the 135 volts necessary for the speech amplifier. A sliding contact for that tap should be provided.

Testing and First Operation

Wire up exactly as diagrammed; using your own judgment as to where leads should go, but keeping all wires as short as consistent with looks and efficiency. Twist all filament leads, and use well-insulated wire for all high-power connections.

Place the key on a solid bench, with plenty of arm room; and shunt across it a switch to close for phone work, if the key is not already provided with one.

It will be well to wire up all filament circuits first and test them out; then hook up the power circuits and, lastly, the bias circuits and the power unit. If a manufactured power unit is used, it will, of course, be necessary only to make connections from it to the binding posts on the transmitter.

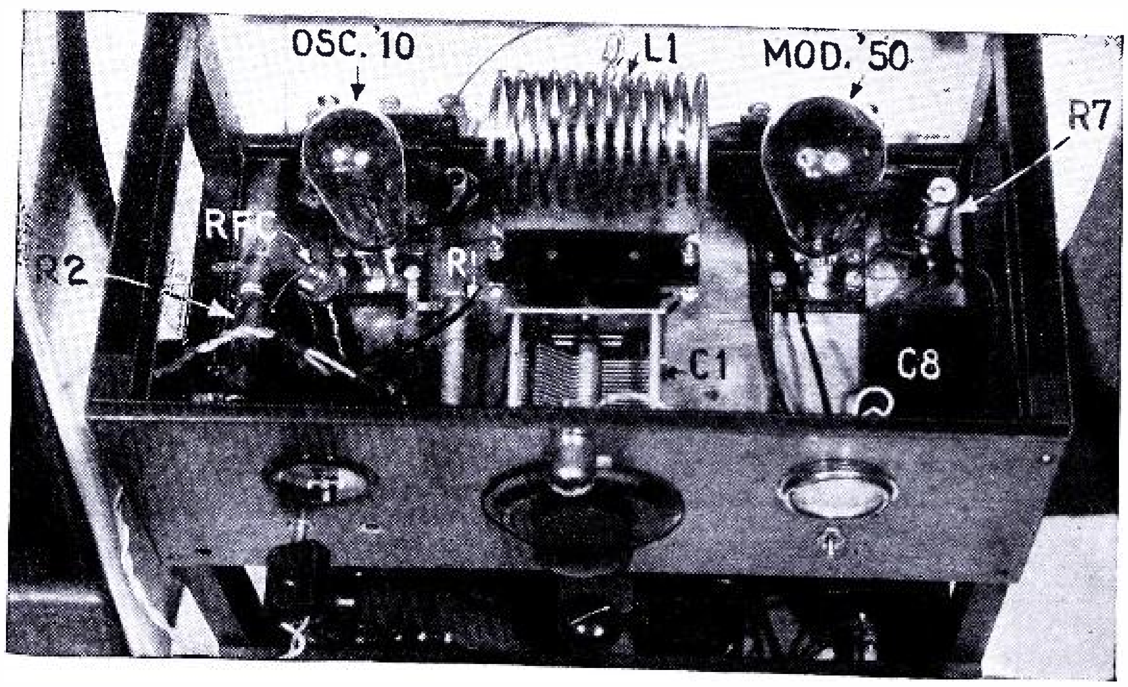
With the transmitter wired up, the power unit in place, and the tubes in the sockets, you are ready to operate. For code work, keep S3 and S4 turned off. Plug in the power pack and turn on S1; this lights the filament of the oscillator tube. Now, assuming that you are using a single-wire voltage-fed antenna, suitable for the wave you intend using (for example 80 meters), set the filament tap about 4 turns from the grid end of L1 and tap the antenna feeder on about the second or third turn from the plate end of L1. Throw S2, which cuts in the power transformer T7 and also lights the rectifiers; and press the key. Oscillation should take place; this can be tested with a wavemeter, and the frequency adjusted by operating C1. Code work can then be carried on; in that band or any other for which suitable coils (L1) have been wound.

Phone Operation

For phone work with L1 at 80 meters, turn on S3 and S4; which lights the speech amplifier tubes and the modulator tubes. Plug the microphone into the jack and then close the key switch; this sets the entire outfit operating on phone. Modulation can be adjusted by operating the knob R3 until best results are obtained on the monitor. Also, try both 4 and 6 volts from microphone battery.

Before any operation, however, test out the output voltages to the set, and adjust the slider on R9 and 10 until approximately 135 volts is going into the speech amplifier's plate circuit. This can be done by throwing the D.P.D.T. switch to each side.

During the use of this transmitter over a period of about six months, the aver-



View of the Robbins phone transmitter, showing the oscillator and modulator tubes. It is well to have a heavy cloth covering to throw over the set when not in use, to keep the dust out of the apparatus.

age range for phone has been in the vicinity of about 150 miles with good reports ranging from R9 to R7. Excellent modulation and little if no wobbulation, or variation of frequency. Best phone work has been as far as Saginaw, Mich., and North Carolina in the early hours of the morning. Owing to QRM (interference) very little night work has been done; but what contacts were made have received good reports. This was on the 80-meter band.

CW or code communication has been done on 80, 40 and 20 meters with excellent results; working consistently up to 300 miles on 80 meters, and all but the 6th and 7th districts on 40 and 20 meters. The latter bands, however, have been used but little. On the 160-meter band a few local contacts have been accomplished with both code and phone.

To operate for phone, first the filaments are lighted, on all tubes; the microphone is plugged in and the high power turned on. Then the key (or key switch) is closed and the mike spoken into. When through, the high power is turned off but the filaments are kept burning all the time when listening; the key is also, of course, raised. All frequency tuning is done with the single dial. Modulation is governed by the "gain" control on lower panel. Plate readings, to either oscillator or modulator tubes, are taken by plugging in the meter as described. The best results seem to be gained here by clipping the antenna feeder on two turns back from the left end of coil, and the "A—" lead wire about 4 turns in from the grid end of coil. If the oscillator tube blocks, move the "A—" clip one more turn towards center.

Hints for the Operator

When calling another amateur or for traffic on CW, you call CQ three times, then give your call three times; repeat three times and then sign. In answering a call, you give the answering station two or three calls, then your own call as often, and proceed. "Break in" operation of course has to be arranged after a QSO is established, but makes communication much faster.

Calling on phone is much the same except that it is wise occasionally to emphasize your call letters by substituting words with first letters like your call (such as, for W1AFQ, "W1 Africa—France—Quebec"). This helps the other fellow to read your call through bad interference. Get in touch with the Amateur Radio Relay League at Hartford, Conn.; their handbook costs only a dollar and gives all necessary information regarding transmitters, receivers and operating etiquette.

Obtaining a License

To operate a transmitting station you must apply for both a station license and an amateur operator's license. Write to the Radio Supervisor in your own district for application papers; you can get either Extra First Grade Amateur license, First Grade or Temporary Amateur.

Learn the code; *this is necessary to operate either a C.W. station or Phone.* You must be able to send and receive at least ten 5-letter words per minute, and up to 20 words, according to the grade license you desire. Then fill out the papers and send them is as requested. In about thirty days, if you pass, your station license together with the assignment of call letters and your operator's license will arrive. You must not use your transmitter, however, until you do get the permit.

Better send to the Government Printing Office first, however, for the laws governing amateur operation before you attempt to go on the air at all. Knowing the code is absolutely necessary before any type of license is issued. No license is required to use a *short-wave receiver,* however.

List of Parts

While the transmitter described was built of many parts, obtained from cast-off receivers, there are portions that will probably have to be purchased. If you have some of them, well and good. If not, get the following or their equivalent:

List of Parts for "Robbins" Phone and C. W. Transmitter

All fixed condensers are Pilots such as in the speech amplifier, plate blocking condenser, filament condensers, etc.

All resistors in amplifier, modulator and oscillator circuits are Electrad wire wound. Microphone transformer is an Acme A3 for single button Mike. If for a two button Mike request it in your order.

In any event the microphone or modulation transformer should be so selected that its primary or input impedance is approximately the same as that of the microphone used. The Acme A3 modulation transformer has a fairly low impedance primary, suitable for microphones having an impedance of from 200 to 300 ohms, such as that possessed by the Miles or Universal microphones. For transverse current microphones of the Amplion type, having an impedance of 500 ohms, it is well to use a modulation transformer having a higher impedance input winding; some modulation transformers (Miles, etc.) are built with several taps on the input winding, so that various impedances are available.

The Push-Pull stage of the speech amplifier uses Amertran audio Push-Pull transformers.

The Heising choke to the modulator tube is a Majestic power pack choke although any good 30 Henry choke will suffice.

Ammeter and Voltmeter are Jewels.

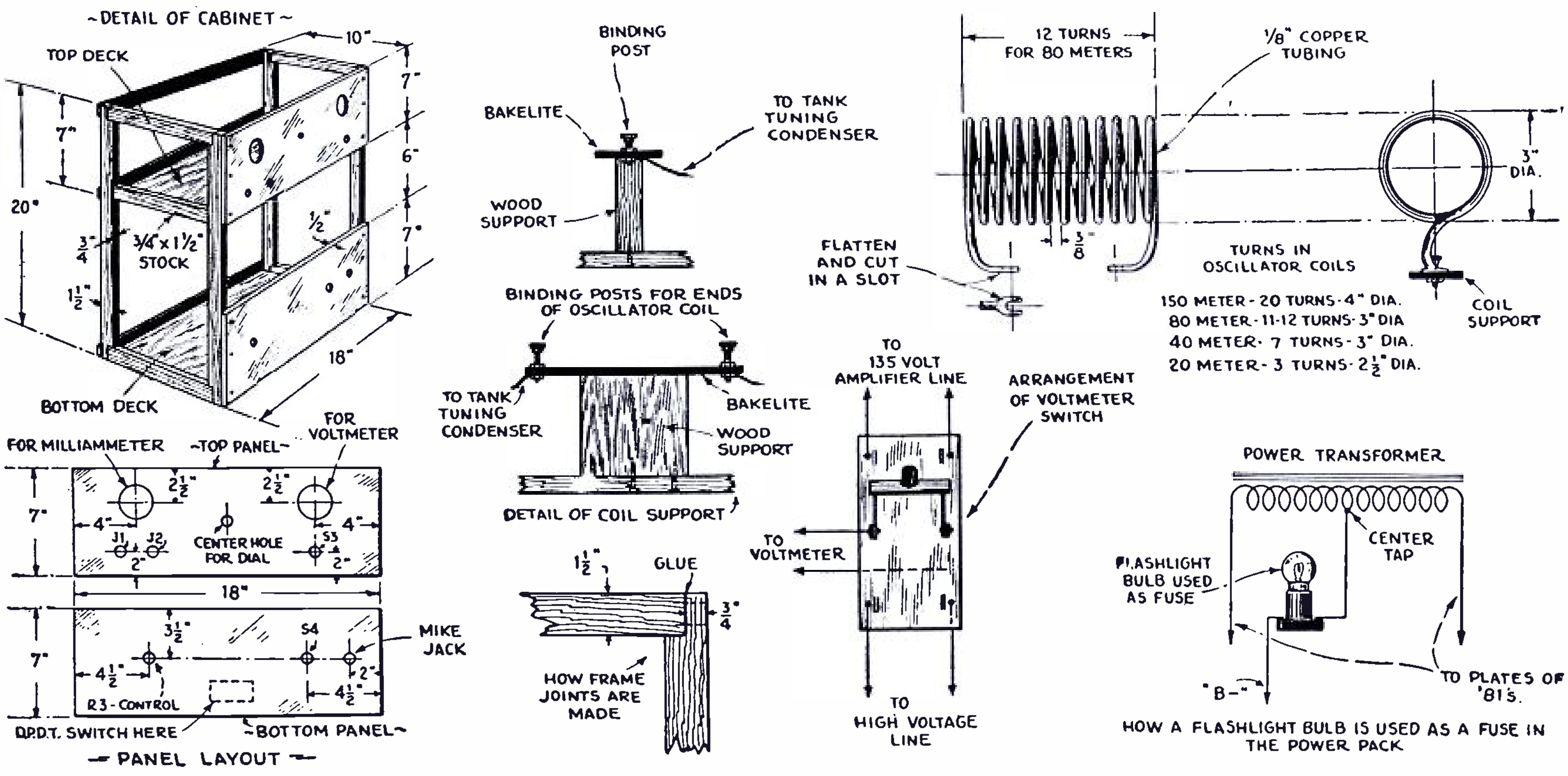
The .0005 variable tuning condenser is a National receiving type.

Federal UX sockets for the oscillator and modulator tubes and Federal UY sockets for the speech amplifier tubes.

The jacks are Yaxley.

Microphone gain control is a Centralab 500,000 ohm potentiometer.

(*Continued on page* 145)



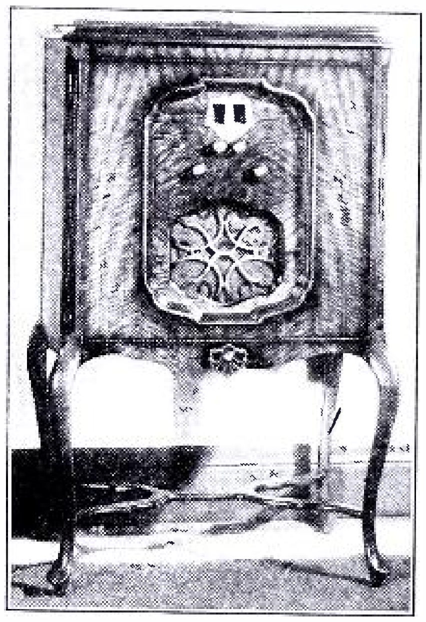
This illustration shows arrangement of the parts in the frame cabinet and also a detail of inductance coil, together with circuit showing how flashlight bulb is used as a fuse in the power-pack.

SCOTT "All-Wave"

The latest super-heterodyne receiver designed for reception of all wave lengths from 15 to 550 meters. It employs 12 tubes, providing high gain and smooth, accurate tuning.

By H. WINFIELD SECOR,

Associate Member A. I. E. E., I. R. E. Member R. C. of A.



Front panel appearance of the Scott All-Wave Superheterodyne in a Scott console.

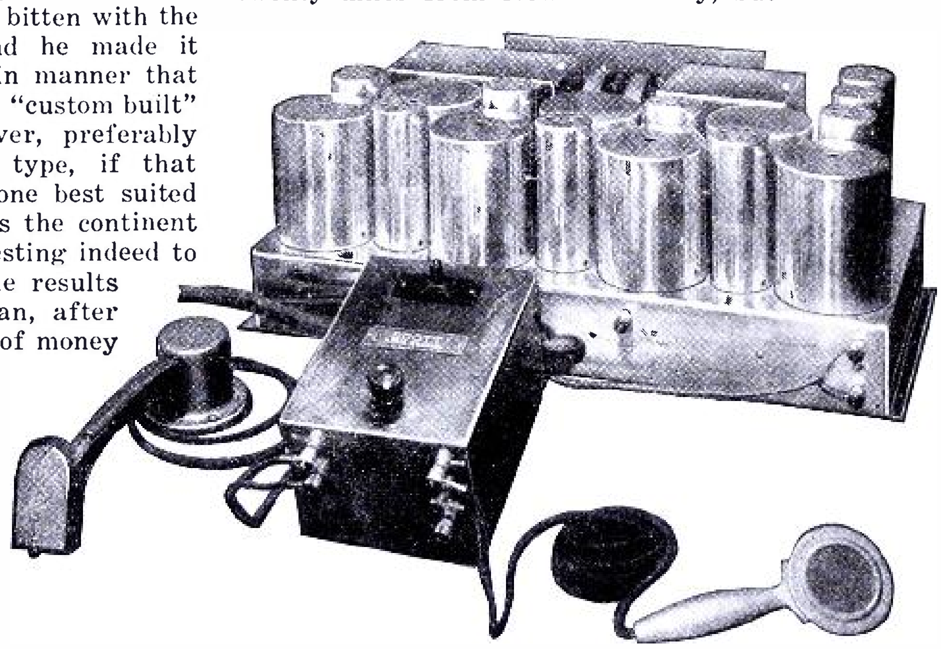
IT IS only a few years ago that a prominent man I know was bitten with the radio "DX" bug, and he made it known in no uncertain manner that he was in the market for a "custom built" *long-distance* radio receiver, preferably of the super-heterodyne type, if that form of circuit was the one best suited to bring in stations across the continent and overseas. It is interesting indeed to compare for a moment the results obtained by this gentleman, after he had spent a large sum of money for the building and testing of several massive super-heterodynes, each one of which measured about five feet long and which required a peculiar knack of tuning which was quite difficult for an ordinary "listener-in" to acquire.

To the best of the writer's recollections a single west coast station was heard while "listening-in" in the vicinity of New York City, and no transoceanic stations were ever picked-up. The tuning of the oscillator dial was of hair-like precision and a very difficult matter for an ordinary "broadcast fan" to become accustomed to. Moreover every one of these early super-heterodynes fairly bristled with various control knobs and gadgets. When tuning in on a distant station the operating of one of these old model super-heterodynes was just about equal to playing a three manual organ.

Contrast this picture with the present-day super-heterodyne of the 12-tube type here illustrated, with its greatly simplified control panel, comprising but two dials side by side and the tuning of each not at all difficult, even when bringing in the *short-wave* stations from across the Atlantic, which was accomplished in a test made by the writer with this set.

This last word in ultra-modern super-heterodyne design and construction was conceived and built by Mr. E. H. Scott, a well-known radio engineer of Chicago, and whose name this super-heterodyne bears. The writer has always been interested in a receiving set which boasted of a sufficient number of stages to be highly sensitive, in so far as its pick-up range was concerned, and especially so if the set could demonstrate that it could live up to its reputation as a "DX" go-getter.

The writer's test with Mr. Scott's latest brain-child, was conducted at a point twenty miles from New York City, but only about 10 miles from a powerful broadcast transmitter using 50,000 watts, and this broadcast station together with about twenty others in New York and vicinity, generally build up such a "barrage" in the ether, that it is usually difficult if not quite impossible with some radio receivers, to tune in a distant station. Even some of the more powerful ones in Chicago and those from other distant points, 600 to 1,200 miles away (let alone a transatlantic station), prove quite elusive during the evening, when the New York "barrage" is in full activity.



Here we see the switch control box which enables the operator to record and reproduce his own phonograph records. Hand "mike" at right; magnetic recorder and reproducer at left.

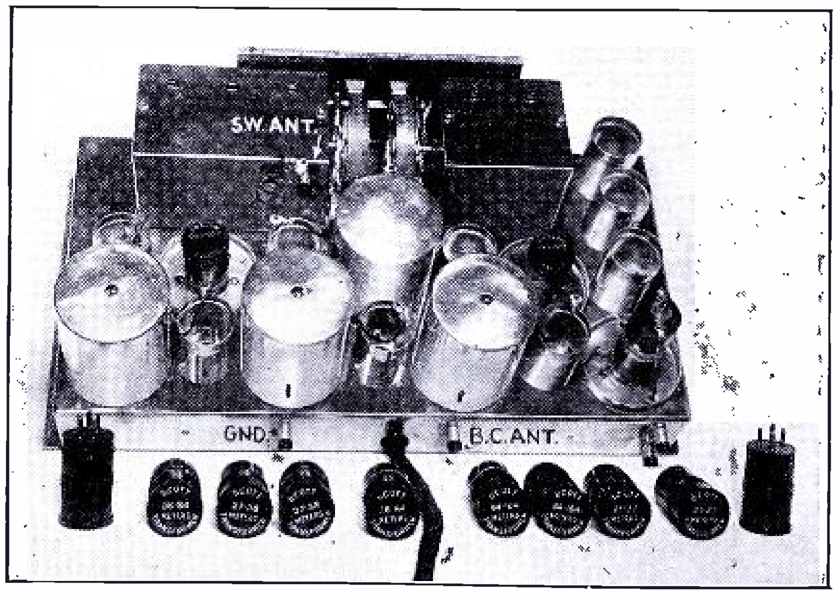
Handsome Appearance

Several of the writer's friends who saw the new Scott super-heterodyne for the first time were greatly impressed by its handsome appearance, fine design and excellent workmanship. It is interesting to note that all the parts, including the coil and tube shields, as well as the chassis frame of both the receiver and power amplifier, are chromium plated and highly polished.

Another point noticeable to any radio shark when he examines Mr. Scott's latest addition to his long line of laboratory-built de luxe radio receivers, is that no pains or expense have been spared in providing a good heavy metal for shielding those parts where shielding is required, *i.e.*, from the viewpoint of good wholesome radio and electrical design.

The Broadcast Stations Roll In

With the proper coils plugged in for *broadcast band* reception (200 to 550 meters), local stations were tuned in



A rear view of the Scott tuner chassis, with all coils. It is unnecessary to shield the short-wave coils, which are therefore easily exchanged.

Super-Het Provides World-wide Reception

with excellent quality and tremendous volume on the dynamic speaker provided with the set, and which demonstrated that not only was this speaker exceptionally well designed but that it was accurately matched in its electrical constants such as inductance and resistance, with the push-pull output stage of the super-heterodyne. No baffle board was fitted on the dynamic speaker, but the quality was surprisingly fine—another surprise.

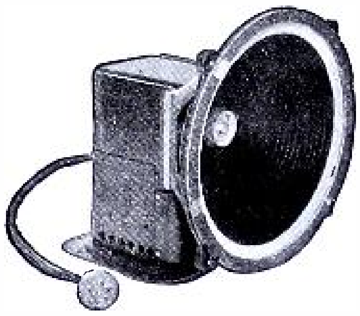
It is interesting to consider at this point that a great deal of the fine quality can be ascribed to the thoughtful inclusion by Mr. Scott of a push-pull *first audio stage.*

Yes, Sir—10 K.C. Selectivity

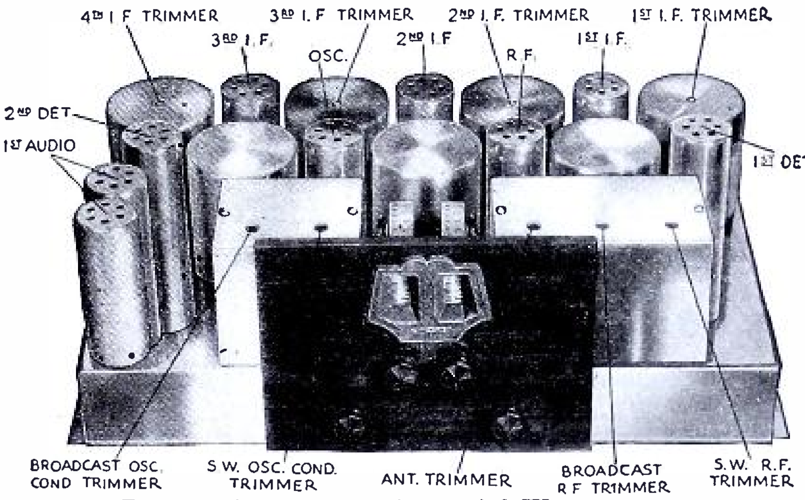
Running up and down the scale of broadcast wavelengths soon proved to the satisfaction of all those present, that here at last was a receiver which lived up to the builder's specification — 10 *kilocycle selectivity on the tuning dials.* The writer has built and experimented with over two dozen different designs of super - heterodynes during the past few years and he does not hesitate to say that this latest receiver of Mr. Scott's is far superior in selectivity and quality of voice reproduction (as well as tremendous volume) to any super-heterodyne he has heretofore played around with.

Why Other Super-Hets Often Fail

Many mistakes have been made by commercial manufacturers of super-heterodyne in the past, both with regard to design and quality of construction of the sets. Some of the super-heterodynes have the intermediate amplifier stages so sharply tuned, that *cutting of the side bands* results, and the voice reproduction is very unnatural, to say the least. Usually one had no alternative but to become accustomed to that particular set. Other super-heterodynes had a poorly designed oscillator stage, so that no matter how carefully one tuned the oscillator dial, it was practically impossible to get a *natural sounding voice* from all the tones and overtones being reproduced by the loud speaker. If there is one cranky spot in the engineer's mind, who has had anything to do with super-heterodynes, especially one of the type here illustrated and employing intermediate amplifier stages utilizing shield grid tubes, it concerns the design of the intermediate transformers.

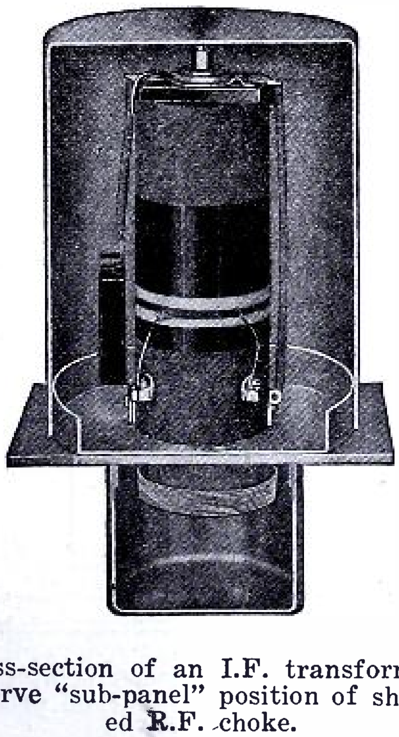


The specially built and accurately matched dynamic speaker.

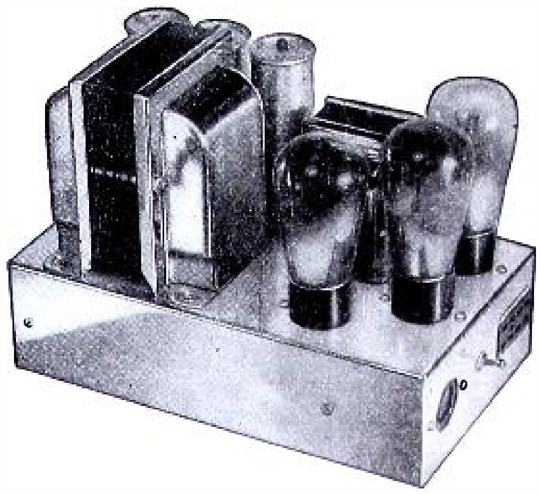


Perspective view of Scott All-Wave chassis.

After listening to about a dozen broadcast stations, which were tuned in very easily, and also having the satisfaction of listening to several California stations on the loud speaker, there was only one answer to all this modern magic—Mr. Scott had indeed solved the secret of how to use to the maximum advantage, the screen grid tube, and he could only have done this by the most careful research and the testing of hundreds of different intermediate amplifier transformers.



Cross-section of an I.F. transformer; observe "sub-panel" position of shielded R.F. choke.



The massively built power amplifier and pack of the Scott All-Wave super-heterodyne.

All super-heterodyne fans have heard the old "sales talk"—"Oh. yes, our intermediate amplifier transformers are all accurately matched to within .1 of 1%," or some other equally imposing figures. It is one thing to make such a statement, but another to prove it by sharp selective tuning at every point along the dials on the receiver, and by the next important checking point—*well rounded qualtiy of music and voice reproduction.* Finally, as every radio expert knows, all of the parts of a super-heterodyne must be carefully designed and built so as to balance up with the other component parts of the receiver. Any one who has ever played around with super-heterodynes, knows how difficult it is to match up an audio amplifier. The quality of voice and music obtained with this set answers the question positively as to intermediate transformer design.

Bringing In the Short Waves

A complete set of coils covering the short waves between 15 and 184 meters are provided and to change from one band to another, two coils are removed and replaced by two new ones, bearing on their labels the wavelength in meters desired. There are six pairs of plug-in-coils supplied with the set and these coils are especially treated by dehydration and impregnation, to stand the most humid weather, even that encountered in the tropics and along the seaboard.

G5SW-Chelmsford, England, as well as PCJ, Eindhoven, Holland, and a German station were brought in on the loud speaker in excellent fashion. One of the interesting things about this "all-wave"

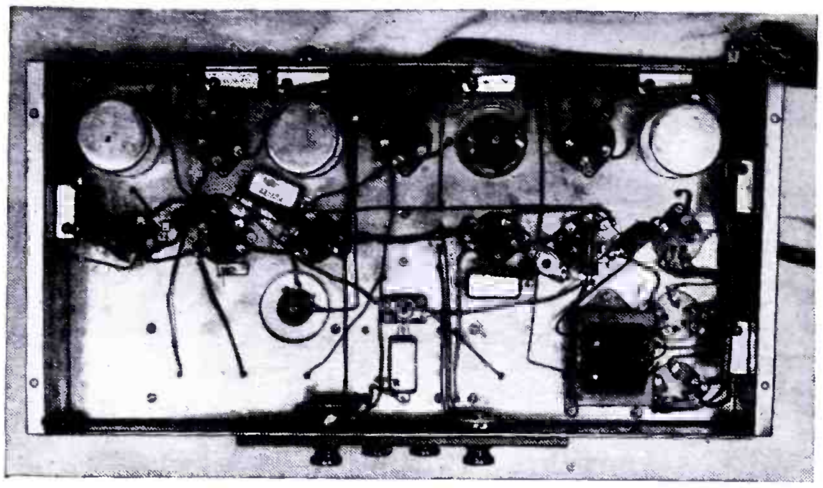
OUTSTANDING FEATURES OF THE SCOTT ALL-WAVE SUPER

¶ Positive 10 K.C. selectivity.

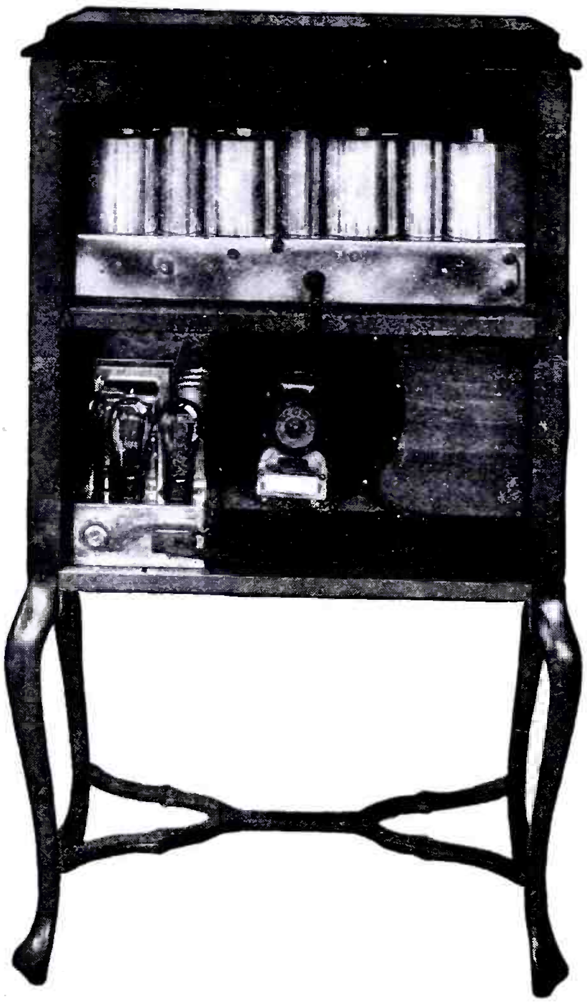
¶ Simple but ideal wave change method.

¶ All stages accurately matched to each other, including speaker impedance.

¶ Excellent design of intermediate transformers.



Right — Bottom view of the Scott All-Wave super-het chassis.



Rear view of Scott All-Wave receiver, with power pack and amplifier, also dynamic speaker mounted in console cabinet.

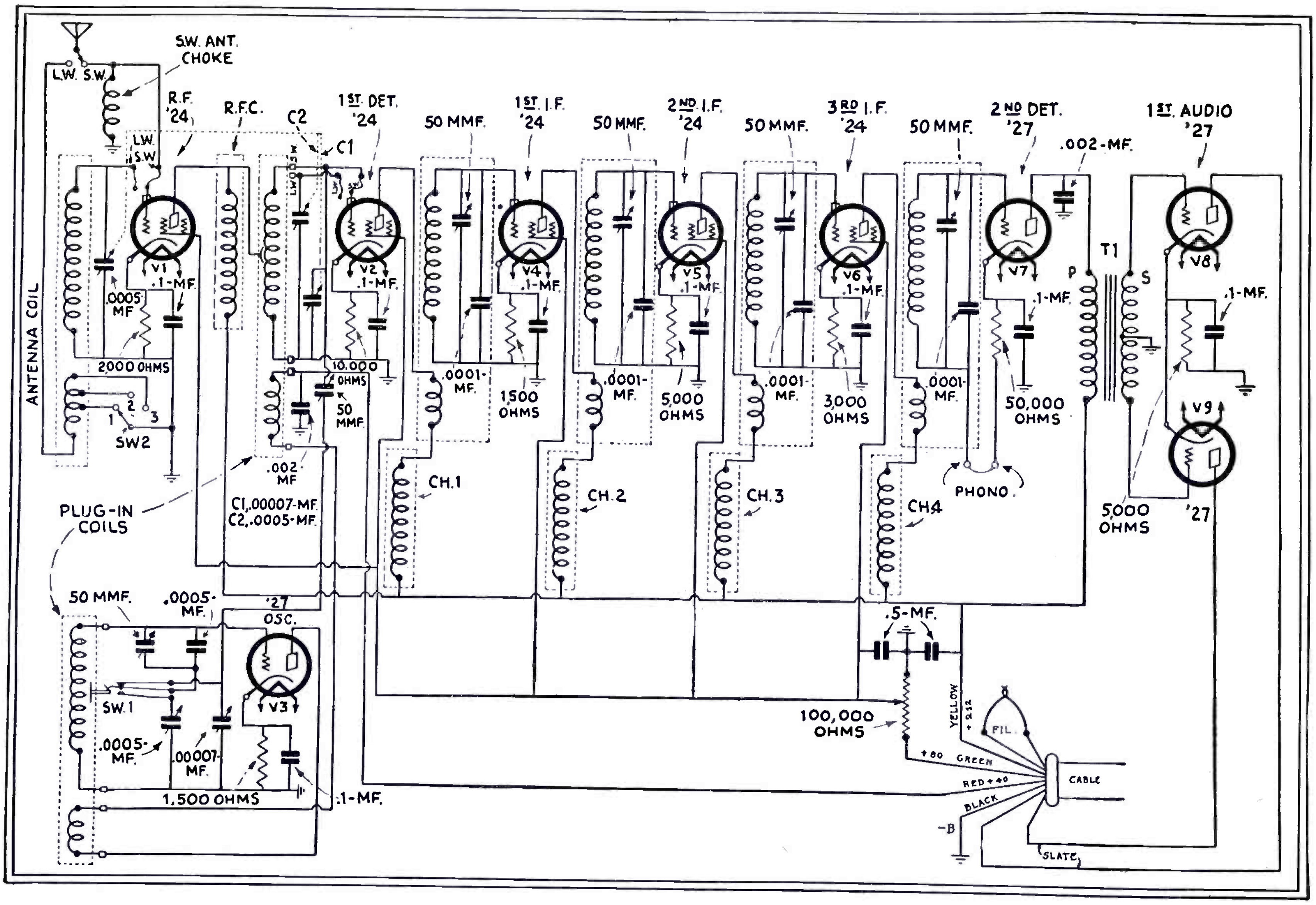
receiver is that the designer has fully considered the desires and the tuning abilities of the *average broadcast listener*, who might want to use a set of this type. He has, for one thing, arranged an automatic switching scheme, whereby changing from one set of plug-in-coils to another, causes smaller or larger tuning capacities to be switched into or out-of circuit. As each coil is plugged in, it automatically makes its own connection to the condenser capacity suited to that particular inductance.

A great number of amateur short-wave operators were heard on both code and phone and one of the most interesting events was, that in many instances by a little careful tuning the amateur at the other end of the "radio circuit" could be heard answering the first operator. Amateurs 1,200 to 1,800 miles away were picked up several times.

Tubes Used in the Various Stages

As the diagram of the Scott "All-wave" receiver indicates, there are nine tubes in the main receiver chassis, while the power pack contains 2 '45 audio amplifier

(*Continued on page* 141)



Schematic circuit of the receiver chassis of the Scott "All-Wave" superheterodyne. The long-wave antenna post is at the rear of the chassis; and the short-wave post on the shield over the tuning gang. The output feeds a push-pull '45 pack; a push-pull '50 unit is also obtainable.

Television

New Frictionless Commutator *for* Big Television Screen

By WOLF S. PAJES

This invention provides a novel way of utilizing a light beam for switching television screen lamps into and out of circuit. The revolving light ray acts upon light-sensitive elements arranged in a ring, inside of which the light beam revolves.

At present, the size and detail of large television screen composed of numerous light sources is limited by mechanical (commutation) difficulties. In the year 1927 the Bell Laboratories demonstrated a unique television system, using at the reception end a large luminous screen, composed of 2,500 light elements. This screen was visible throughout a large audience. It consisted of a long neon tube, bent 50 times back and forth, to form a luminous grid. The tube had one common interior electrode, and 2,500 exterior electrodes fastened along the rear of the glass tubing. A high-frequency voltage, applied to the interior electrode and any one of the exterior electrodes, caused the tube to glow in front of that particular electrode.

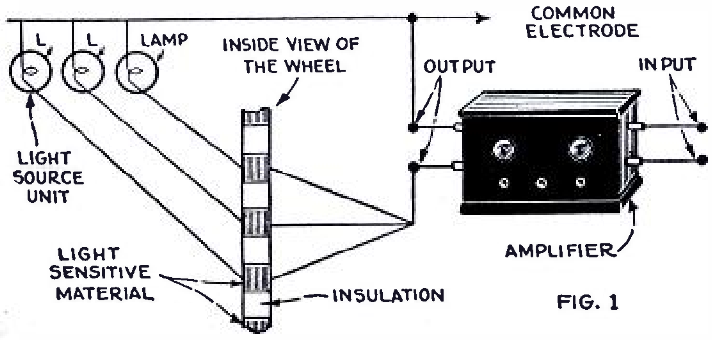


FIG. 1

Left: Diagram shows but three of possibly hundreds of lamps in large television projection screen, each lamp being switched into and out of circuit by light beam rotating past light-sensitive elements.

Right: Detail of light beam switch for television screen.

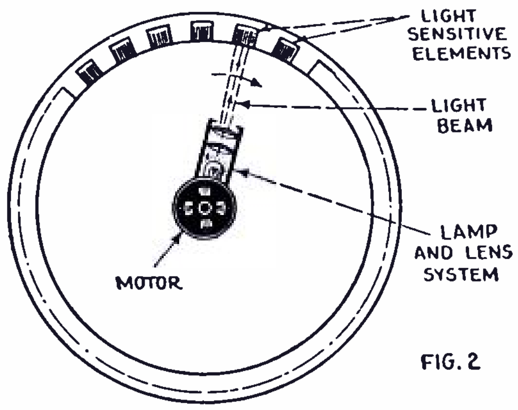


FIG. 2

This high frequency voltage was commutated to the electrodes in succession, from 2,500 bars on a distributor, by means of a brush rotating synchronously with the disc at the transmission end.

Recently London witnessed a similar television demonstration, but with the difference that the large screen consisted of a ground-glass sheet behind which 2,100 tungsten filament lamps were arranged in rows and columns.

This method of presenting television images is very efficient, since there is no loss of light-energy after the picture current has been converted into light.

The only difficulty which this, otherwise excellent scheme, presents is in the mechanical commutator, which requires great care and carries a high maintenance cost; since frequent replacement of parts is necessary. These operating difficulties increase rapidly with the number of commutation elements, as the length of the brush arm becomes proportionately greater, making its circumferential velocity and the power required for driving it prohibitively great. To avoid this the author proposes the following: Commutator arrangement which, in his opinion, does away with all the above-mentioned difficulties, rendering the large-screen arrangements practical.

Fig. 1 presents a rough scheme of the invention, which makes possible current commutation without a material contact. All the incandescent lamps, L, of which the large screen consists, are connected in parallel to the output of a common amplifier, A. Into each unit circuit there is introduced a light-sensitive element, which keeps the circuit open in the absence of light. All those light-sensitive elements are placed in grooves, within an annular ring, inside of which a light-beam revolves. The grooves are insulated from each other by thin layers of mica, or simply air.

Fig. 2 presents a front view of this wheel. A small motor, to the shaft of which a constant source of light (fed with D.C. local power) is attached, is placed in the center of the wheel. Its number of revolutions corresponds to the number of complete pictures being transmitted per second. By means of a lens system revolving together with the constant light-source, a narrow beam of light is directed upon the light-sensitive elements, upon one at a time, and renders each in turn conductive, thus closing the particular circuit, and setting aglow the corresponding lamps on the screen.

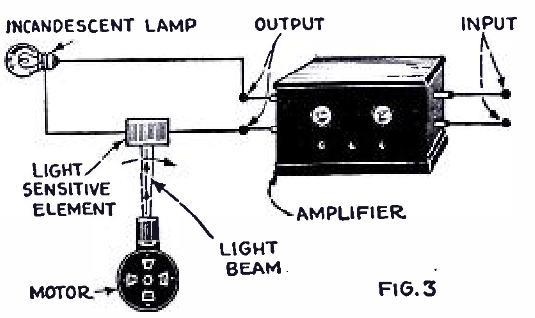


FIG. 3

"Unit" circuit employing author's new light beam switch for television, the incoming television signal being impressed on the amplifier terminals marked "input".

When the motor, M, revolves, the narrow beam of light moves along, over the different light-sensitive elements, changing their conductivity in rapid succession.

The writer thinks it appropriate to remark that the intensity of glow of each individual lamp will be regulated by the common amplifier, of the received television signal, and not by the narrow beam of light, the only function of which is to lower the resistance of each successive light-sensitive element, by an amount constant for all light-sensitive elements.

The requirements which the light-sensitive elements must fulfill are: that when illuminated they must transmit sufficient current to set the small lamps glowing; and that their time-lag should not be greater than 1/20 of a second. As we see, these requirements can be easily fulfilled with the present means.

It is obvious that the limitations imposed by material contact commutator do not exist in the use of this system. The wheel can be made as big as we please, affording on its circumference space for more and more light-sensitive elements. Our moving beam of light will take care of this.

The summary of my invention is that the sliding material contact is replaced by a rotating beam of light and that the copper segments of the ordinary commutator are replaced by light-sensitive elements.

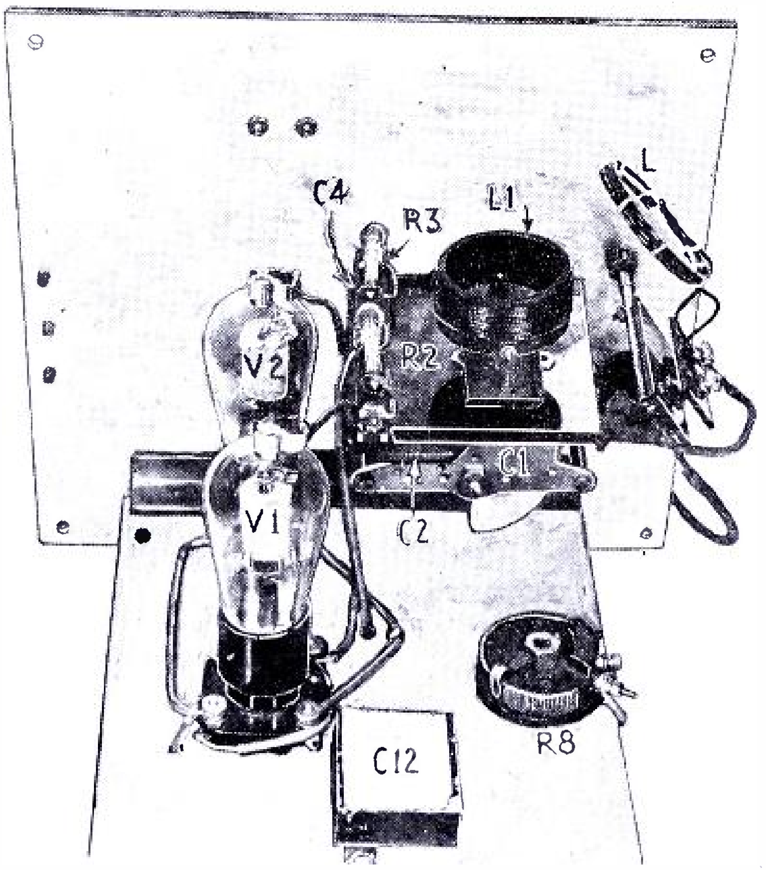


Fig. 2—Close-up of first R.F. stage in Mr. Marshall's S.W. receiver.

A SUPER-SENSITIVE Short Wave RECEIVER

By THOMAS A. MARSHALL,

Chief Radio Electrician, U. S. Navy, Assistant to Battle Fleet Radio Officer

DEMANDS for an increase in sensitivity and selectivity have caused the writer to develop a push-pull receiver suitable and adaptable for reception of frequencies between 500 and 75,000 kilocycles. The complete receiver as described in this article gives a noticeable increase in amplification over the entire band.

While at San Pedro, California, he successfully communicated with an eastern station on 6.6 meters.

To the many experimenters who have been delving into the mysteries surrounding reception of extremely short wavelengths, we are pleased to present to our readers a complete description of Mr. Marshall's receiver which holds the world's record for reception of the shortest wavelength at the greatest distance.

Features

The receiver comprises several unique features, one of which is the symmetrical push-pull circuit throughout the radio-frequency amplifier stages and the detector stage. Another is the simplicity of tuning in a given station. In fact, the receiver is easier to handle than any conventional type. As a result of the performance of the push-pull circuits as described in this article, the sensitivity

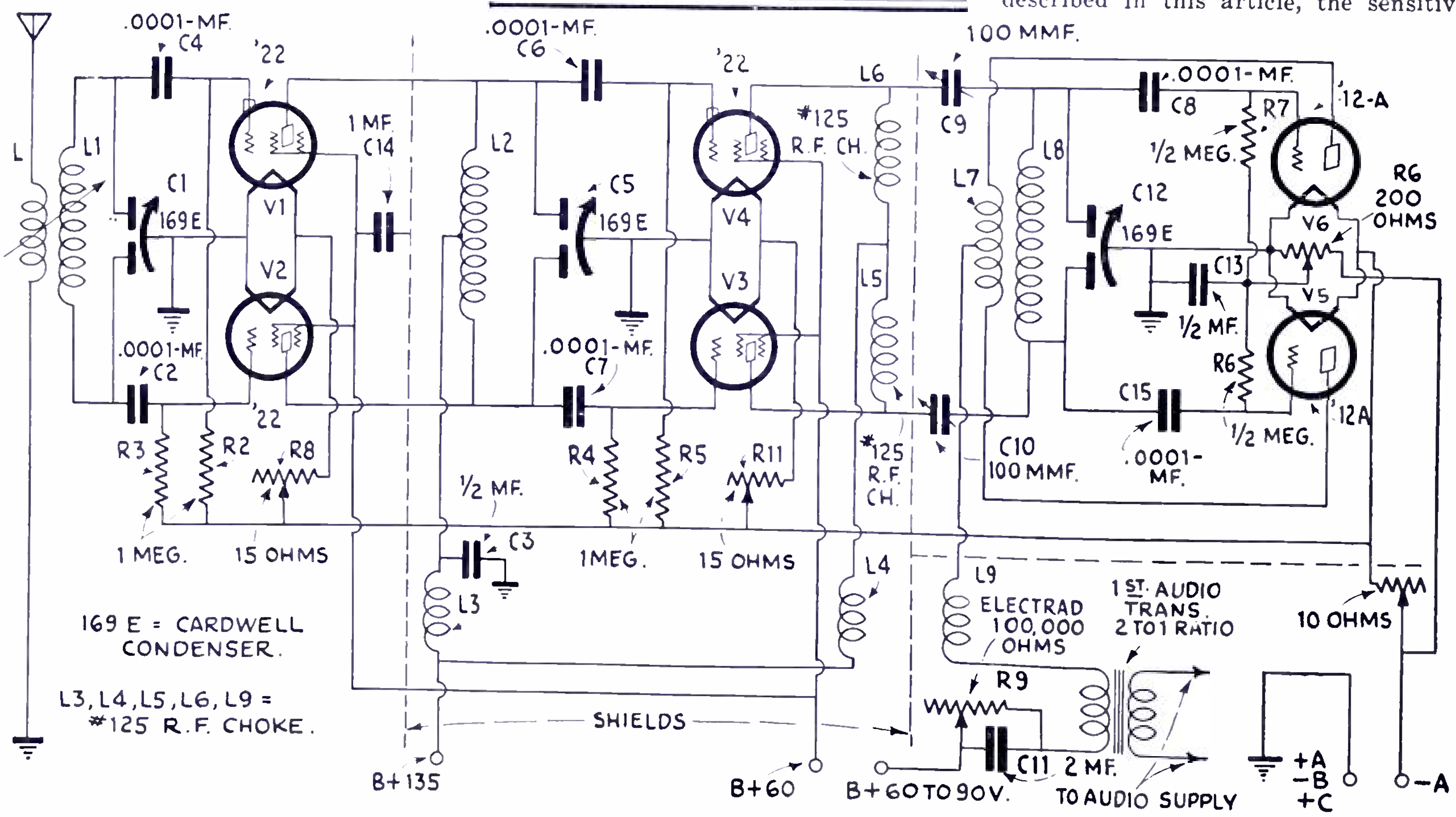


Fig. 1—Wiring diagram for Mr. Marshall's receiver, utilizing two push-pull R.F. stages, feeding into a push-pull detector stage, providing superior sensitivity and selectivity in short-wave reception.

This Letter Speaks for Itself

UNITED STATES FLEET
BATTLE FLEET
U. S. S. California, Flagship

Balboa, Canal Zone.

SHORT WAVE CRAFT,
96-98 *Park Place*
New York, N. Y.

Attention Mr. Gernsback.

DEAR SIR:

There is enclosed herewith an article on the Marshall Push-Pull Receiver for SHORT WAVE CRAFT.

While you were on board the "California" last year you probably saw this type of receiver. It is our standard short-wave set and was demonstrated to radio engineers at Riverhead, New York. I refer you to Mr. H. H. Beverage as to the efficiency of the complete set.

I hope you can find space in SHORT WAVE CRAFT *for this article.*

Yours very truly,
THOMAS A. MARSHALL.

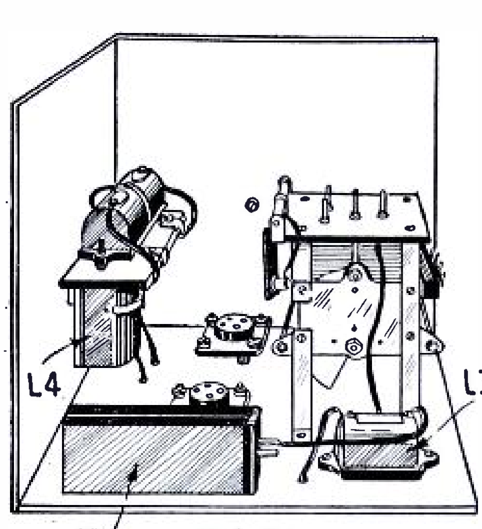
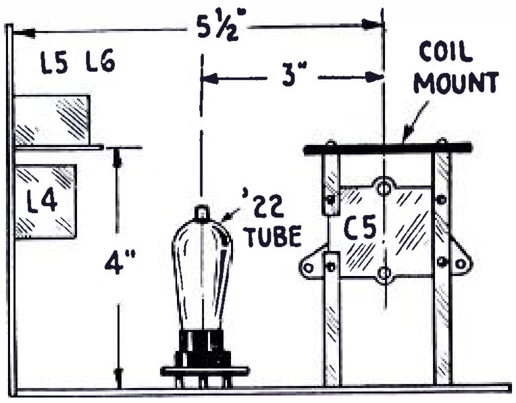


FIG. 3A



DIMENSIONS 2ND R.F. AMPLIFIER

FIG. 3

Figs. 3 and 3A—Fig. 3 snows dimensions of 2nd R.F. amplifier stage. Fig. 3A: It is very important that the three R.F. chokes L4, L5 and L6 be mounted as illustrated.

of the receiver in general is materially better than that of a plain regenerative type, so much in use at present.

The Possibilities

The average short-wave receiver covers a band of from 50 to 15 meters. Below 15 meters is another band in which many stations may be heard operating by tuning in on the second harmonic value of the main transmitting frequency. An example of this condition may be given by receiving "WIY" on 13,880 kilocycles, and on 27,760 kilocycles. No better example of the sensitivity of the receiver could be given than to tell the reader that the writer, while at Port of Spain, Trinidad, received "KKP" (Honolulu, Hawaii) on 27,410 kilocycles. The distance is about 5,700 miles. There are a very great many more stations which can be heard. In fact, any station may be received, and distance takes on an entirely new meaning to the fan. Aside from the reception of many foreign stations, Rome and elsewhere, reliable reception of such short wave stations as "WENR," "WLW," "KDKA," "WGY," "WABC," and "KGO" may be enjoyed.

By carefully studying the diagram as shown in Fig. 1, one will readily see how the symmetrical push-pull circuit plays stellar roles in making it possible to tune very short waves. With '99 type tubes in the detector circuit, 100,000 kilocycles may be tuned with ease. For this reason, the receiver will do all that is expected of any type of circuit and, in addition, will enable any desired frequency to be received.

Method of Operation

As disclosed in the schematic diagram, Fig. 1, the circuit has two stages of tuned radio-frequency amplification, a tuned regenerative detector circuit, and two stages of audio-frequency amplification. The antenna coupling-coil system gives uniform results as to signal intensity, along with any desired degree of selectivity. Theoretically, the closer the coupling between the antenna and the first radio-frequency amplifier stage, the larger the fraction of signal energy which is transferred to the secondary. However, as the coupling is increased, the resistance of the primary is increased, resulting in a decrease in power taken by the first stage. In fact, the maximum power is transferred to the secondary when the increase in resistance of the primary, due to the coupling, is equal to the resistance of the primary by itself. Therefore, there is always an optimum coupling where the greatest signal strength is obtained along with increased selectivity. As the coupling is decreased, the first radio-frequency amplifier stage has a greater tendency to go into oscillations. Thus, regenerative properties are increased many fold.

In practice, the antenna coupling coil is set at a maximum coupling position, which has the effect of increasing the resistance of the first amplifier tuned stage. Thus, poor selectivity is made possible, which has the effect of broadening the circuit. Stations may, therefore, be heard when within 10 to 15 degrees of the point of resonance. For this reason, the first amplifier stage's tuning dial is not used when hunting for a given station; which reduces the receiver to two dials for tuning. After a station has been tuned to resonance on the detector and second radio-frequency amplifier stages, the antenna coupling is reduced and the first amplifier stage tuned to resonance. This procedure is followed until the greatest signal strength is obtained, with the noise level reduced to zero.

Features of the Circuit

The first radio-frequency amplifier stage employs tuned grid and tuned plate circuits, which increase the selectivity. The tuned plate circuit increases the plate load impedance, making it possible to get a much larger proportion of the voltage generated. The output of the plate circuit utilizes the input of the second radio-frequency stage through the

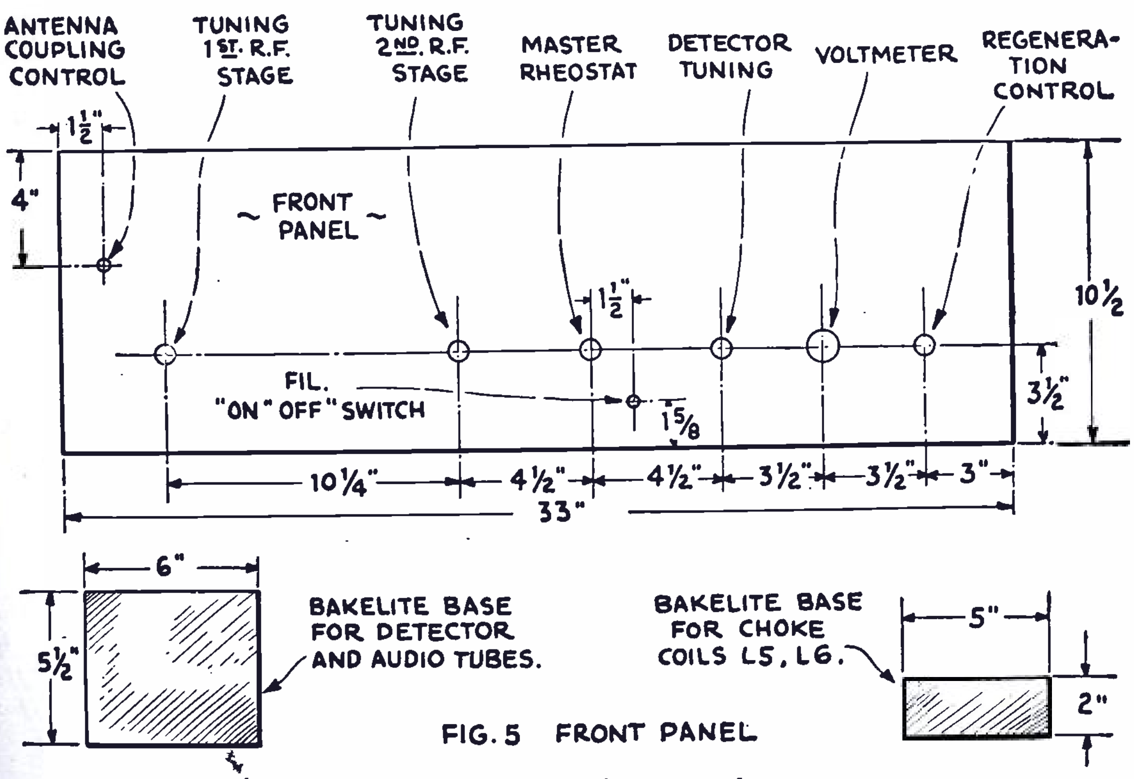


Fig. 5—View of front panel.

condenser-coil combination L2 and C5. The plate voltage is fed at the center of the coil. The radio-frequency choke L3 serves to prevent the radio frequency energy from entering the battery supply system. C3 serves to bypass the radio-frequency energy to the ground.

L5, L6 and L4 are Samson No. 125 chokes. L4 is connected to the junction of the two plate chokes and in series with the plate voltage supply; this choke isolates the junction of the two chokes L5 and L6, permitting the output circuit to find its own electrical center. The three chokes are mounted inside the compartment for the second radio-frequency amplifier stage, and permit a certain amount of feedback to take place. Regeneration is therefore made possible, which increases the signal strength and selectivity of the receiver. Fig. 3 shows the arrangement of the second radio-frequency amplifier stage. The height of L5 and L6 corresponds very nearly to that of the tubes. The arrangements of the circuit are critical. For this reason, the dimensions as given in Fig. 3 should be followed carefully.

It is to be noted that radio-frequency energy is fed to the detector circuit through the two condensers C9 and C10; these are approximately 70 micromicrofarads each. About 50 mmf. is required to pass the radio-frequency energy to the detector circuit without causing interaction between the two circuits. The value of capacity selected must be determined by trial, and not changed after the receiver has been calibrated. Where too much capacity is used at C9 and C10, the coupling between the stages becomes too great, resulting in unpleasant reaction. Not only will the reaction be too great, but it will also be difficult to keep the detector circuit oscillating when tuning the second radio-frequency amplifier to resonance.

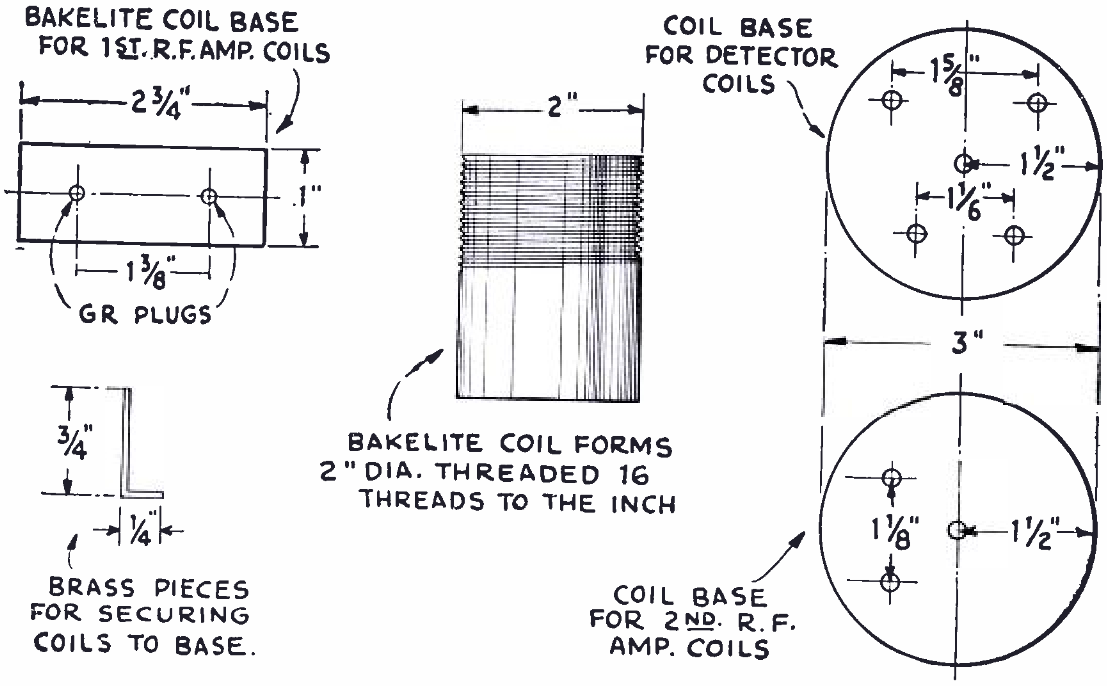


Fig. 6—Details of coils and coil bases.

Smooth Regeneration Control

The tickler inductance L7 is tapped in the center, and the two ends are connected to the plates of the detector tubes. The plate voltage is fed through the radio-frequency choke L9, through the primary of the first audio stage, and through the high resistor R9. This method of regeneration control does not change the calibration of the receiver nor change the settings for a given station.

The resistor R9 is a wire-bound resistor (Electrad type) not less than 100,000 ohms. The resistor is bypassed by a 2-mf. capacity C11. Do not substitute other resistors for R9 as the detector stage is super-sensitive and will respond to irregular voltage supply, which will cause a high noise level.

R6 is a 200-ohm Electrad potentiometer, used to obtain the correct bias for the detector tubes; with the proper bias, the detector will go in and out of oscillations without any trace of hang-over effect. The condensers C1, C5 and C12 are Cardwell "169-E type", and are split by sawing out a section of the side

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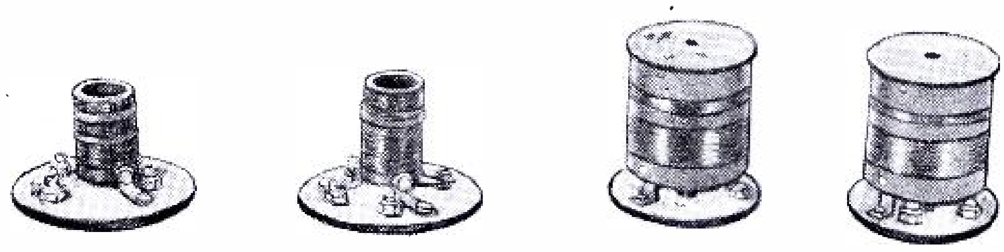

Fig. 6A—Photo of short-wave coils for Marshall receiver.

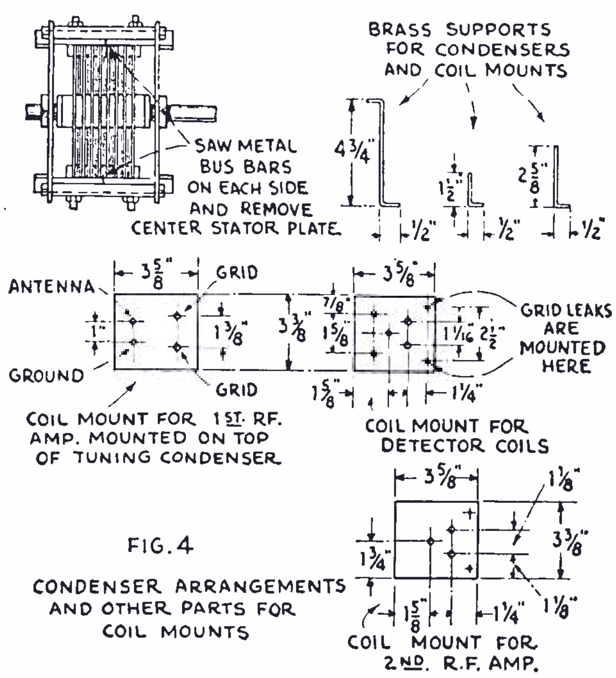

Fig. 4, at left—Detail of variable tuning condenser and brass supports for condensers and coil mounts.

Fig. 7, right—Shows how top panel, parts, and sub-panel shielding are arranged.

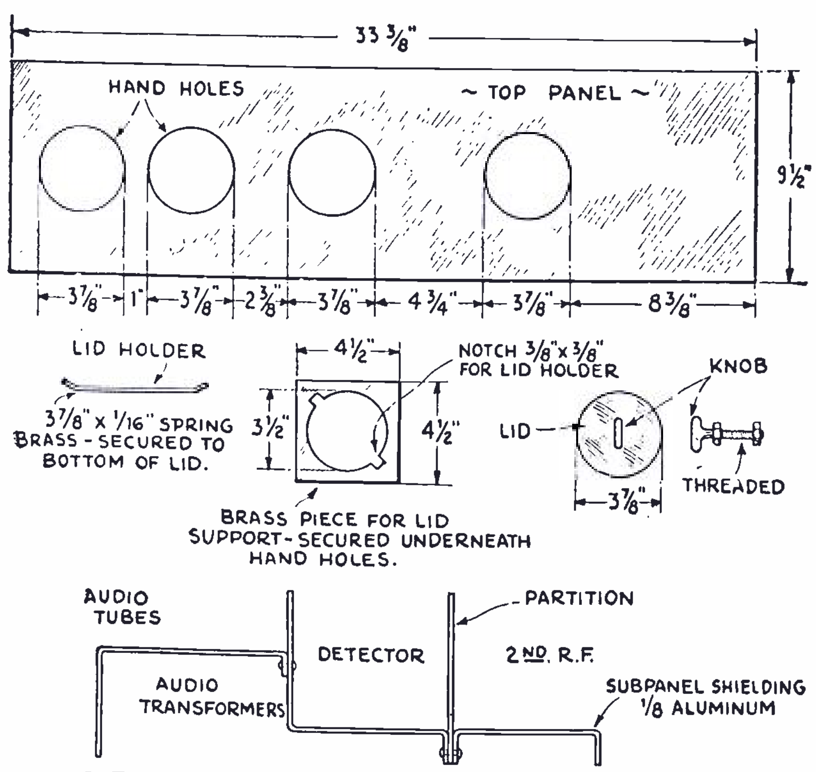

FIG. 7 ~ TOP PANEL, PARTS AND SUBPANEL SHIELDING.

Working *the* 56 M. C. Band

Practical Operating Hints for the "5 meter" Boys

By HARRY D. HOOTON
W8BKV

Questions answered: Best tube to use; wiring 5-meter receiver; the 5-meter antenna and reflector; frequency measurement.

THE necessity for improving our technique on the longer-wave amateur bands has more or less distracted attention from the "five-meter" band during the last few years.

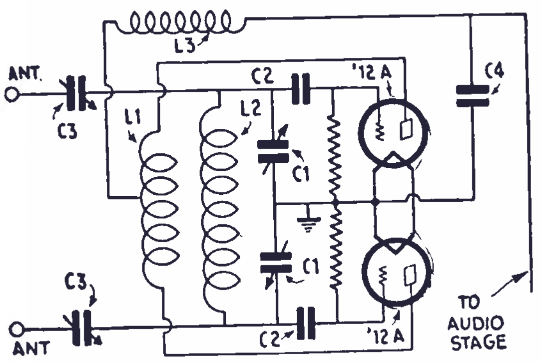

FIG. 1

Fig. 1—The Push-Pull Receiver.
C1—Two section tuning condenser. About 20-m.m.f., each section.
C2—Grid condensers, 100-m.m.f.
C3—"Midget" variable condenser, 2 plates each.
C4—Not smaller than .005-mf.
L1—Tickler, to be determined experimentally.
L2—5 turns No. 20 D.C.C. wire, ¼" in diameter.
L3—R.F. choke, about 15 to 20 turns wound No. 38 on ¼" tube.

This band has not been entirely neglected, however, and a small group of experimenters have been doing fine work on it. It offers tremendous promise as a useful band for directive transmission and radio telephone work. As any development work in radio communication requires the cooperation of several experimenters, the primary purpose of this article is to stimulate the interest in this band, and to present some practical suggestions that may be helpful to the five-meter experimenter.

The 5-Meter Receiver

Let us consider the 5-meter receiver. It will need special design and construction, but there is no reason for it to be a freak. The requirements are similar to a 20-meter receiver, for example, except that the leads must be shorter and the distributed capacity reduced before it will oscillate. Careful workmanship counts in the successful work on this band. The straight regenerative set will work on 56 Mc.; but it is not to be recommended because of the high background noise. The usual regenerative "hiss" is sometimes so loud that weak signals are drowned out entirely. A much better arrangement is to use a push-pull detector regenerative circuit. This type of receiver works very well on ultra high frequencies and has the added advantage of being quiet in operation; the noise mentioned above being extremely low or entirely absent. A push-pull radio-frequency stage may be added to this receiver if desired.

The Best Tube For 5 Meters

What will probably interest the amateur most are the constants for the five-meter receiving set. At W8BKV we had some difficulty in finding a suitable detector tube. Among the tubes we tried were the types '99, '01a, '24, '27, '12A and the '30; the most satisfactory were the '27 and the 12A, although the 01a and '30 types performed very well. A battery is used on the heater of the '27 instead of the A.C. filament supply.

The circuit for the push-pull receiver is shown in Fig. 1. The coils are self-supporting, being made of No. 20 D.C.C. wire and wound ¼-inch in diameter. It is necessary to use a coil of small diameter in order to reduce its field. Wind five turns on the grid coil if a 15 mmf. tuning condenser is used; if a larger ca-

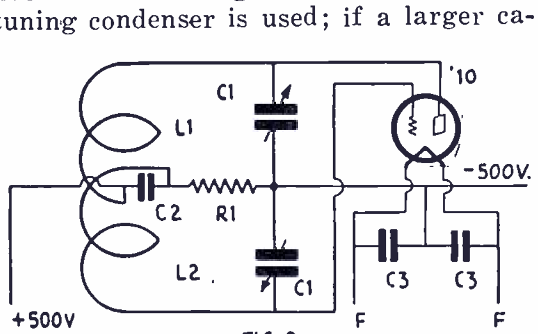

FIG. 2

Fig. 2—The Colpitts Transmitter.
C1—Two section transmitting condenser, 25-m.m.f., each section.
C2—Blocking condenser, .01-mf.
C3—Bypass condenser, .01-mf.
L1—1½ turns, 2⅜" in diameter, copper tubing.
L2—Same as above.
R1—15,000 ohm transmitting grid leak.

pacity is used, use about four turns. The plate coil will have to be determined experimentally; as the correct number of turns is almost certain to vary with the different tubes; about five turns should start the receiver oscillating.

The tuning condenser is composed of two insulated stators and one rotor. The large "cut down" type of variable condenser should not be used; a remodeled "midget" tuning condenser of the proper capacity (about 15 to 20 mmf. each section) is desirable. Two small condensers of this type can be used, instead of the one two-gang midget, if desired. If a socket is used, solder the grid condenser (.0001 mf.) to its grid terminal, keeping the lead as short as possible; as this is very important. In some cases it is advantageous not to use a socket, but to solder directly to the terminals of the tube.

How to Wire the Receiver

The next step is to wire the set, getting leads as short as possible, and, at the same time, reducing the capacity between the various parts of the receiver. One stage of audio is usually enough, unless loud speaker operation is desired.

It is best to use separate batteries on the amplifier until the detector circuit has been adjusted, as this centers the trouble-hunting in the oscillating circuit. The detector will require a higher plate voltage than that commonly used on lower-frequency sets, because of the greater losses at five meters. About 90 volts should serve.

The 5-Meter Antenna

Almost any antenna will serve for reception of the five-meter signals, but the coupling must be less than that used on the longer waves. If too much coupling is used, the set will often become "cranky," and body capacity will be troublesome. An antenna is not especially necessary, on either receiver or transmitter, for distances up to five miles and possibly further. *We have heard our signal over twenty miles without any antenna on the receiver and with an eight-foot current-fed radiator on the transmitter.* The transmitting antenna was in the house at the time. The transmitting antenna shown in Fig. 3 is useful for receiving also; it gives quite a bit of gain over the plain type for use in receiving and, if it is used at both the transmitting and receiving stations, a high degree of efficiency is possible.

Transmitting on 5 Meters

Now with regard to the transmitter: the circuit shown in Fig. 2, is the split-coil Colpitts, which is especially fine for five meter work. The power for the plate and grid of the tube is fed at practically zero points of R.F. voltage, thus eliminating both plate and grid R.F. chokes which are very critical on the ultra short

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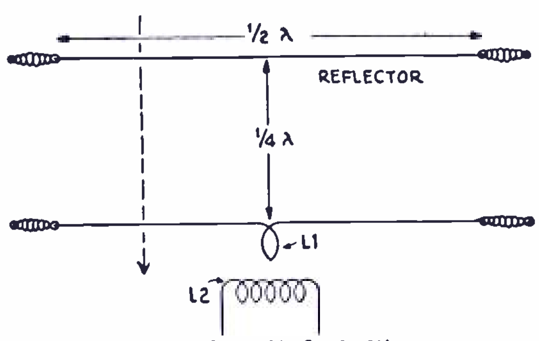


FIG. 3

Fig. 3—The Directive Antenna System.
Reflector: 7 feet 10 inches long.
Antenna: same length as reflector, including the single turn of the inductance.
L1—Single turn about 4 inches in diameter.
L2—One or two turns of wire.
Transmission Line: Can be twisted lamp cord 20 to 50 feet in length.

Ultra Short Waves

The new TELEFUNKEN ULTRA SHORT WAVE RECEIVER

By DR. FRITZ NOACK
(*Berlin, Germany*)

What is being done abroad in the transmission and reception of ultra-short waves and a description of the new Telefunken S-W Adapter and Receiver.

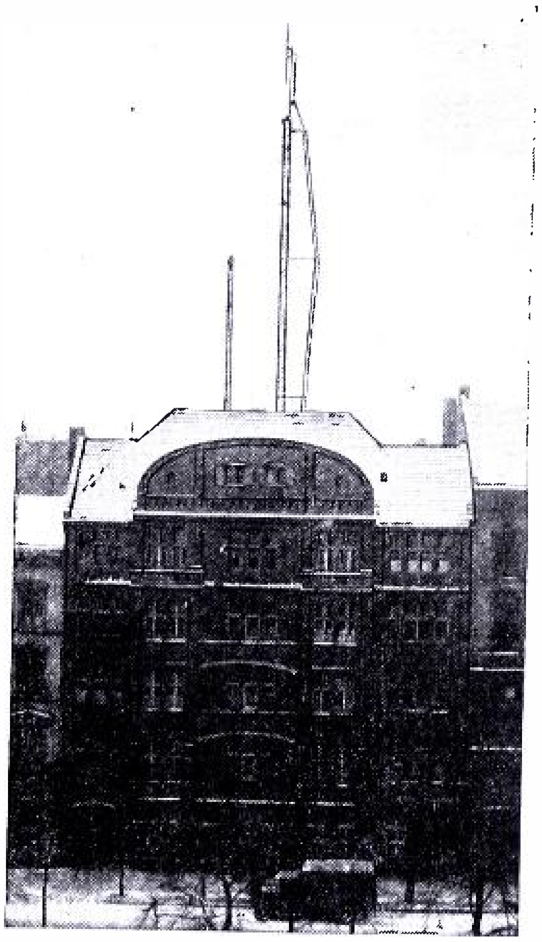


Fig. 4—Shows dipole antenna at top of mast, joined by feeder to ultra short wave sender, located on top floor.

ULTRA-SHORT-WAVE radio is making more and more progress. Today we have so far progressed in covering the area of a large city (*e.g.*, Berlin) completely with the wave of an ultra-short wave transmitter that everywhere—even in the outlying districts—loud-speaker reception of great clearness can actually be obtained. At the same time, it is absolutely unnecessary to use complicated receiving sets; on the contrary, it is quite satisfactory to operate with a properly-connected detector tube. Since modern radio receivers are, in large measure, provided with a connection for phonograph-record amplification, the audio frequency amplifier can be used very efficiently after the output of the ultra short wave detector; it is sufficient to connect the detector, by means of a two-wire cable, to the phonograph terminals of an ordinary radio set.

Limits of Ultra Short Wave Reception

Besides this adapter type, other receiving sets have been evolved; the so-called superregenerative receivers. Yet these show no such advantage over the simple regenerative detector that it is necessary to give up the latter, which can, of course, be made much more cheaply than the superregenerative set. The reason for this is, mainly, that the range of such a receiver is practically limited to the field of optical vision. No receiver, no matter how sensitive, helps to increase the range; and, within a radius of at least 12 miles, one gets along perfectly with a simple detector-adapter.

It will be objected that, just now, ultra-short-wave reception is possible (in Germany) only in Berlin; and, for other countries, in only a few places where such transmitters are installed. This is perfectly true; yet it seems to me very important for the inhabitants of all other cities and districts to familiarize themselves now with ultra-short-wave reception, even if only theoretically; for we can count with assurance on the installation of ultra-short-wave stations in many places within a short time.

6 to 8½ Meter Waves Used

The wavelength hitherto generally found most suitable lies, approximately,

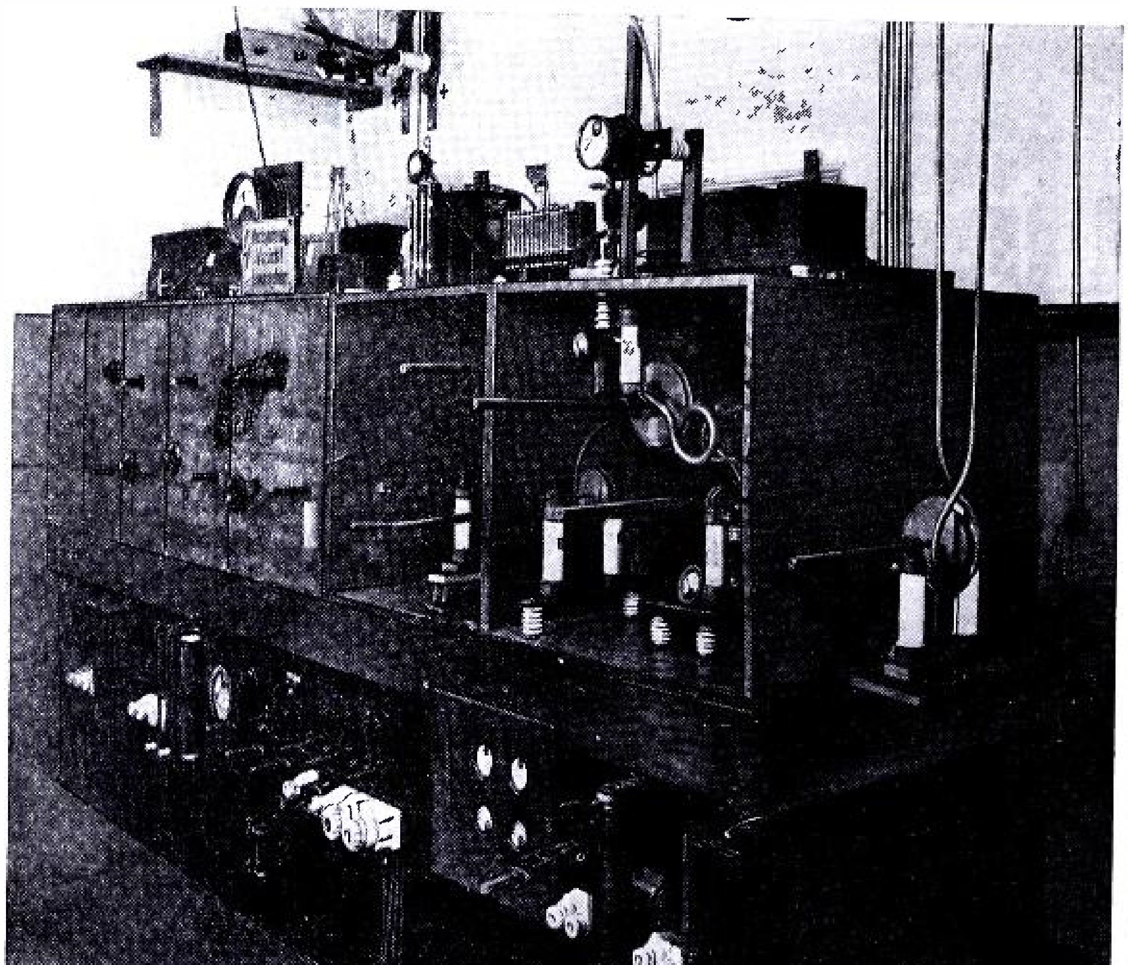


Fig. 5—Above shows the Telefunken ultra short wave transmitter; at right vertical feeder to antenna, with tuning condenser.

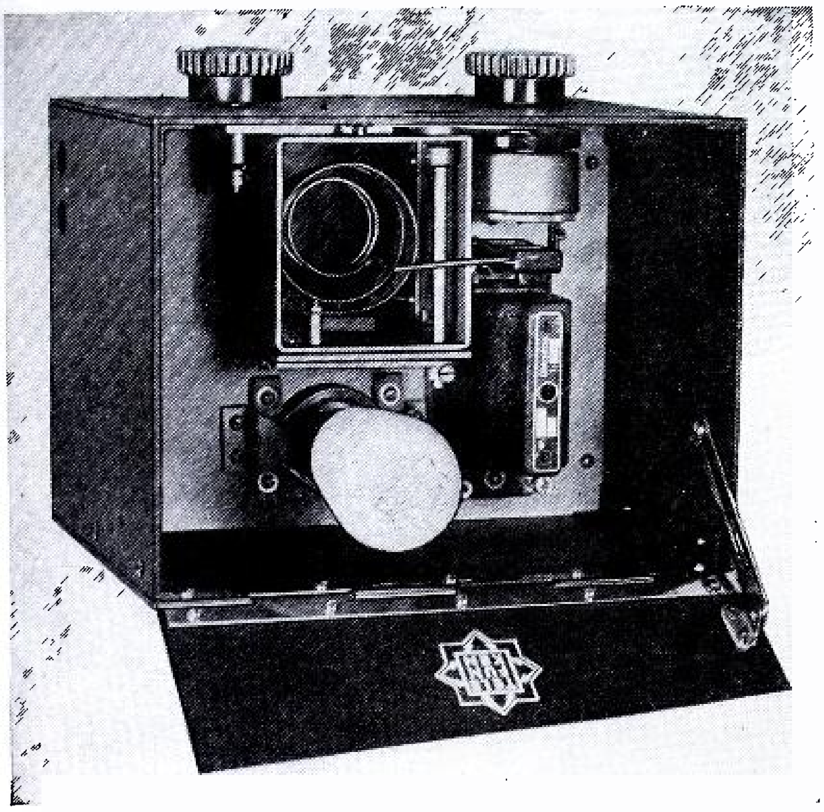


Fig. 2—At left, shows the Telefunken ultra short wave adapter; knob at left used for tuning; knob at right controls variable high resistance (P of Fig. 1); the ribbon coil is the tuned inductance, and the wire coil is the tickler. Single plate tuning condenser appears at rear of coil shield.

in the range between 6 and 8½ meters. In this band the ultra-short wave is perfectly free from fading; because there is no "space radiation" but only the ground wave. Above 8½ meters, fading at once sets in perceptibly. One does not want to go below 6 meters; because, below this band, the absorption of the waves by houses, etc., at once becomes so considerable that there can be no general assurance of good reception under all conditions. Right now, let it be noted that, even with waves between 6 and 8½ meters, parts of buildings and other bodies can produce strong absorption.

Thus, for example, when to check up the strength of field within the area of Greater Berlin, experiments were undertaken with a portable ultra-short-wave measuring set, it was established that even a street light can produce strong absorption. Still greater is the difference, when one passes a street crossing; here the screening by buildings can be 20 per cent., and even more. Yet there still remains so much field strength, that good reception with a regenerative detector is possible within the limits above indicated—a circle about 25 miles across. Certainly, it will generally be advisable to use an outside antenna in unfavorable locations. For this purpose, to be sure, long wires are not needed; generally, the metal frame of the window, or a short wire hung out of the window, is sufficient.

Not Every Tube Oscillates at Low Wave Lengths

Although, in general, an ultra-short-wave detector can hardly be distinguished from one used for longer waves, there are a few peculiarities to be noted. First, it is to be stated that not every tube will oscillate readily at the higher frequencies. Thus far the best results have been obtained with the Telefunken "RE 084." Then, it is also to be noted that the antenna can easily absorb so much energy from the plate circuit that so-called "resonance points" ("dead spots") result. For this reason, it is desirable to connect a resistor between the antenna and the receiver.

Furthermore, under certain circumstances, the hand capacity is so annoying that, because of the great sharpness of tuning of the ultra-short-wave detector, correct adjustment is impossible. Against this fault, two measures are especially helpful: first, the use of fixed regeneration, or regulation of the plate

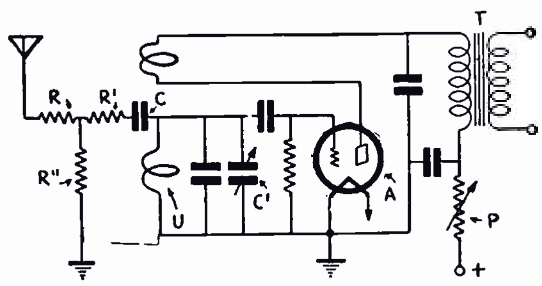


Fig. 1—Hook-up of Telefunken ultra short wave adapter. R and R", 500 ohm resistances; R', 300 ohm resistance; C, 17 mmf., condenser; C', fixed and variable condensers, each 55 mmf.; A, tube; T, audio transformer 1:4 ratio; P, 50,000 ohm variable resistor.

current by a variable resistor; and, second, connecting a series of resistances in the antenna. If these resistances are of the proper values, one can approach the antenna and ground wires closely without the receiver's being put off resonance. The third means is complete shielding of the receiver and careful grounding of all parts which come into immediate contact with the hand, or into its vicinity.

Hook-Up of Telefunken Receiver

Fig. 1 is the schematic diagram of a modern ultra-short-wave regenerative detector, as it has been developed by Telefunken as an adapter for an ordinary radio receiver. Fig. 2 shows the set from within; all parts are plainly visible. From Fig. 1 it is evident that the antenna is coupled through three resistances R, R', and R", and a condenser C, with the tube. The two resistors R and R" have, preferably, a value of 500 ohms; while R' is to have a resistance of 300 ohms (or thereabouts). Condenser C is to be very small, around 16 mmf. One can easily make such a condenser by covering two No. 22 copper wires (bare), about 2 inches long, with so-called "ruche" tubing and then twisting them. For condenser plates, there suffice two brass screw heads about ⅜-inch in diameter. It is important only that the leads to this condenser do not run parallel, and, above all, that the leads to the resistors R, R', and R" are sufficiently separated from one another and from those to condenser C. Also, these leads must not couple with inductances. The tuned circuit consists of a coil U of, say, two turns 3 inches in diameter; it is best to select, as may be seen from Fig. 2, a copper ribbon with the surface silvered. This coil is carefully encased in a shield can which is connected with the ground; one terminal of this coil connects directly to the shield, while the other leads to the grid condenser. For tuning, a fixed condenser is used in shunt with a variable condenser C'. Both are to have, at most, a capacity of some 55 mmf.

This variable condenser C' is represented in Fig. 2; in the coil shield at the left a shaft can be seen, passing through back from the front plate. This shaft is connected with the left control knob by a transmission drive which moves a plate, located at the back of the shield can, which itself serves as one plate (of the condenser). Naturally, one can also choose another form for the condenser.

But, under all circumstances, the greatest stress is to be laid on the ex-

(*Continued on page* 146)

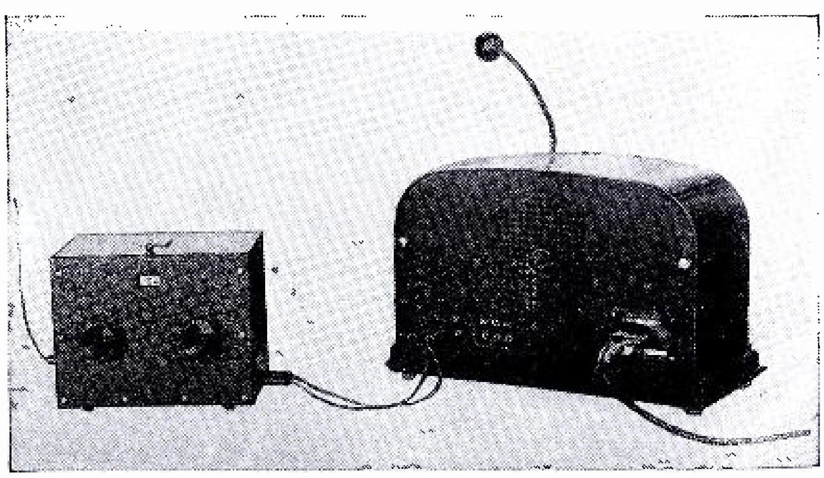


Fig. 3—At right, shows adapter connected to the phonograph terminals of an ordinary receiver.

PRACTICAL R. F. CHOKE CONSTRUCTION

By A. BINNEWEG, Jr.

Some very practical and valuable hints on radio frequency choke coil design and construction, are offered in the following article by Mr. Binneweg, Jr. Theory, as well as practice, is explained in simple terms by the author.

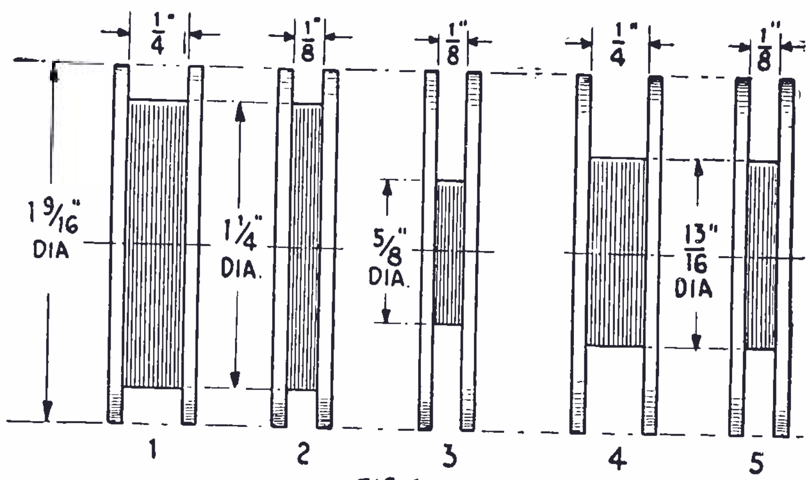


FIG. 1

Fig. 1—Winding forms used in tests over a 50 to 200-meter range. Each form was wound with 200 turns of No. 34 D.C.C. wire. All of these chokes gave essentially the same results. Form No. 2 with 300 turns of the same wire was somewhat better over this range.

VERY little has appeared in radio publications on the general subject of R.F. choke design; each writer seems to have his own choke specifications, or else he uses the product of a given manufacturer. Both home-made and manufactured chokes are sometimes near, but more often far, from the ideal construction, taken in the light of systematic measurements and practical requirements.

Outwardly, an R.F. choke appears to be quite simple; but, at the higher radio frequencies, where capacitative effects become important, the actions become quite complex. The results of measurements, the methods of measurement, and the practical construction of the simpler types of chokes for use at short waves, will be considered.

Complicated choke windings never have appealed to the home constructor, so only the simpler windings will be considered here. The single-layer solenoid is easy to wind. Chokes wound on spools are also quite simple in construction. If a small wood-turning lathe is handy, forms for many chokes can be constructed in a short time.

The forms shown in Fig. 1 were each wound with 200 turns of No. 34 D.C.C. wire; where tested in the shunt-fed Hartley oscillator arrangement they gave results which compared quite closely. Form No. 2 wound with 300 turns, was somewhat better over the same 50- to 200-meter range, although the difference was slight. Chokes of this kind will be found to operate quite well over a large range.

Single-layer solenoids .are also quite effective but are more open to resonances or "hollows," at which the impedance falls to exceptionally low values. The chokes mentioned above were simply scramble-wound in the grooves and it is possible that the way the turns are wound in the grooves has some effect on the results; although no marked changes are noted, for a given choke, after a certain minimum number of turns is wound on. For operation at extremely high frequencies, any small differences in construction have relatively great effect on the curves taken. A simple method of comparing chokes at various frequencies is described later.

Simple Method of Testing

The home constructor is naturally interested in a simple method for comparing chokes, which requires no extra apparatus not already available. An ordinary regenerative receiving circuit can be used to measure the efficiency of choke coils. The circuit is shown in Fig. 2.

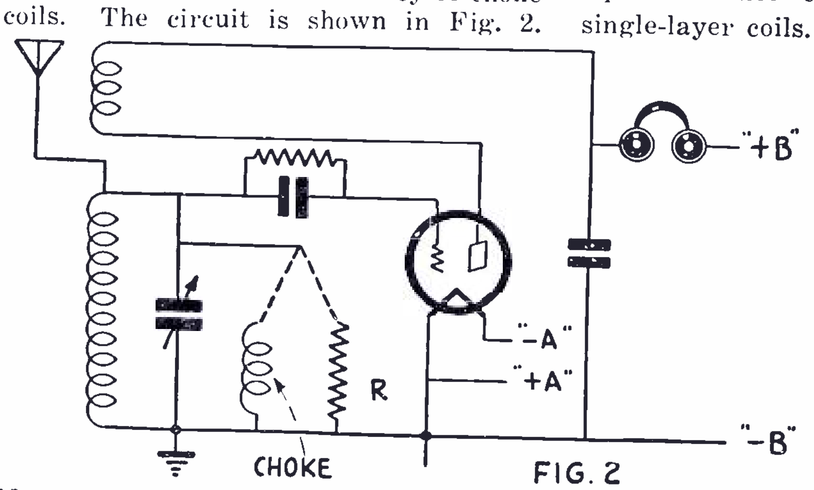


FIG. 2

Fig. 2—Simple receiving circuit used for comparing results from a given choke at various frequencies.

More feedback is required from plate circuit to secondary circuit, when the losses in the secondary circuit are increased. Hence, if the choke is shunted across the secondary condenser, it will be necessary to increase the coupling between secondary and tickler coils to compensate for the losses introduced by the choke. In a receiver employing capacitative control of regeneration, it will be necessary to increase the capacity in the throttle control.

With the choke across the secondary condenser, the receiver is brought again to the point of oscillation, and the setting of the regeneration control is noted. The choke is then removed, and ordinary grid-leak resistors of various values (see Fig. 3 for approximate resistance values) are shunted across the secondary condenser until the receiver is restored to the same condition as with the choke in place. The value of the resistance required is then the effective value offered by the choke.

This procedure can be repeated, at various frequencies; and a curve is thus plotted, showing the resistance required as a function of frequency. Such a curve is shown in Fig. 3. It is simple to obtain a fairly accurate curve by using this method. Note the "mountain range" effect and the gradual decrease in height as the frequency increases. This multiple-resonance effect is obtained with single-layer coils.

"Pie-Wound" Chokes

Another type of winding which is simple to construct, and yet gives good results for home-made *short-wave* sets, is a winding composed of "pies" wound on a ¼-inch dowel and separated by about ¼ inch. Such a choke is not good

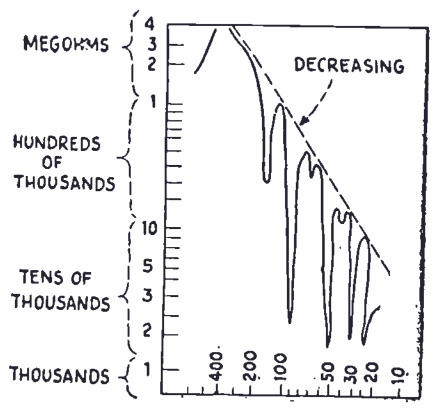


FIG. 3

Fig. 3—Shows the approximate resistance value of grid-leak resistors to be used in making choke coil tests.

over the entire short-wave range, but gives exceptional results in separated ranges, such as the amateur bands. A choke consisting of 5 pies of 20, 40, 60, 80 and 100 turns of No. 36 wire, connected in series on a ¼-inch dowel, when tested in an oscillator circuit, gave the curve shown in Fig. 4. The "natural" decrease in grid current, as the L/C ratio in the oscillating circuit is decreased, should not be confused with that due to the choke. The curve showing the decrease in grid current when the choke is not connected, is shown dotted.

Although "hollows" appear at certain frequencies, this choke works exceptionally well in the 20- and 40-meter bands for which it was designed. If it is found that a hollow appears in a region in which it is desired to receive, the turns in the pies are altered so as to shift the hollows. It is usually possible to receive at frequencies at which hollows appear, but not quite so effectively; since the regeneration control must be adjusted beyond a convenient value.

Transmitting-Type Chokes

Chokes for transmitters differ in some respects from chokes designed for receiving. A choke for a transmitter usually requires a certain current-carrying capacity, to prevent overheating when carrying the relatively high currents. The voltages are much higher, and relatively high currents will flow through the choke unless high impedance values are used.

One immediately thinks of a parallel circuit of inductance and capacity, operated at its resonant frequency, to supply the desired high impedance. Such a trap, however, may have induced into it large circulating currents, and large losses will result unless special precautions are taken. The circulating currents will depend upon the value of capacity used in the trap; the use of small capacity with relatively large inductance (which suggests the use of a coil "tuned" by its distributed capacity) will reduce the losses to reasonable values.

A transmitter is not required to operate at all wavelengths, like a receiver; so that a coil can be constructed of suitable proportions to give a certain impedance value at the desired frequencies. In general, a long solenoid of small diameter, employing a small size of wire, should be used. As in any coils used at high frequencies, a small size of wire may heat less than a larger size, because the effective resistance is less.

There have been opinions unfavorable to the operation of a choke at its natural period; but there appears no case where it is not better than operation off resonance, if the choke is otherwise properly designed. This statement may require modification at extreme voltages, using high power. In certain regenerative connections, a resonant choke may have an undesirable effect on regeneration, but resonant peaks are, for ordinary constructions, usually "broad"; in any case, a "peak" is preferable to a hollow, the latter giving usually the effect of an antenna resonance.

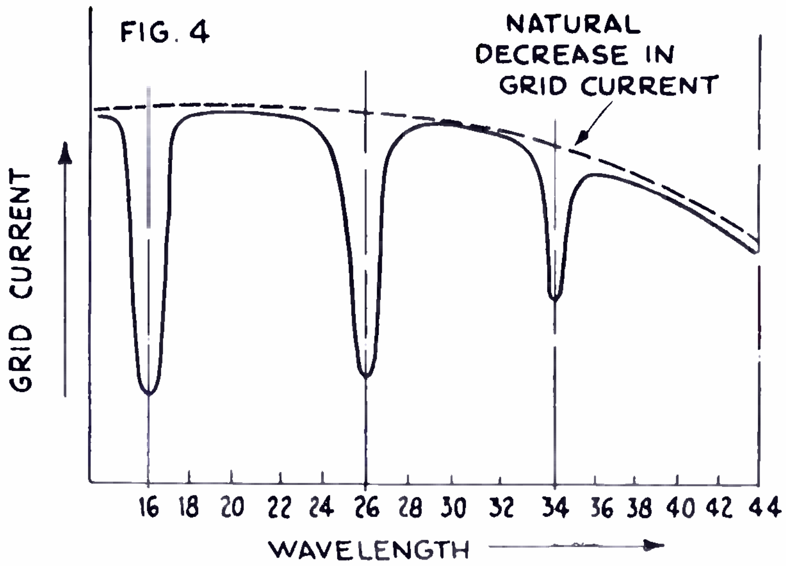


Fig. 4—At right, shows change in grid current with variation in wavelength.

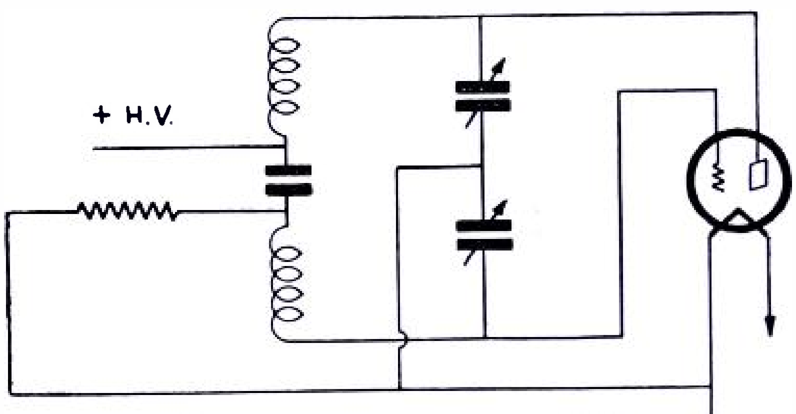


FIG. 5

Fig. 5—At right, illustrates a radio transmitter circuit which requires no choke coil.

Ultra-Short-Wave Work

Chokes become a real problem below 15 meters, with the apparatus commonly used. The capacities introduced by improper spacing of parts and mechanical construction may offset the effect of an otherwise fair choke. It is difficult, at these frequencies, to obtain a ratio of inductance to capacity which will give fair efficiency with common tubes and parts. It is probably best to employ circuits requiring few, if any, choke coils (such as Fig. 5) or to connect the chokes used at positions of low potential.

Where chokes are required, special precautions are necessary to reduce the capacity between the chokes and neighboring parts. Small basket-weave coils have proved fairly satisfactory at wavelengths of the order of 5 meters. It has been found that coils of only 6 turns, on a 1-inch form and larger, are effective; but the important thing is to use spaced windings of sufficient length to reduce the end-to-end capacity.

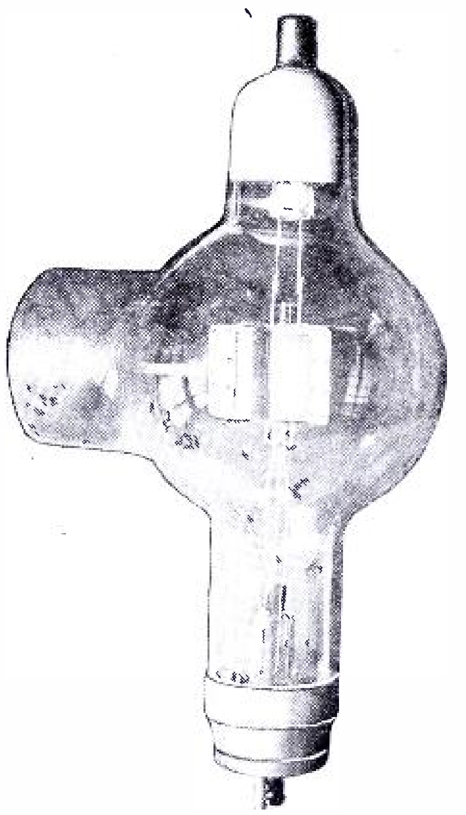
Filament Chokes

It has been found that the high-frequency limit of oscillation of some tubes is dependent upon the use of good R.F. chokes, especially in the positive plate lead and in the lead-to-filament connection. If poor chokes are used, the transmitter will not oscillate at all, or high plate potential will be necessary for oscillation.

Chokes for use at very high frequencies should be "wound on air" as nearly as possible. *Filament chokes* for ultra-high frequency oscillators are often required. One effective type is constructed as follows: Cut some auto side-curtain celluloid into very narrow strips, about 4 or 5 inches long, and about 1/16 to ⅛ inch wide. Place three of these strips around the circumference of a smooth, round rod, about ¼-inch in diameter, and hold the strips at the ends with small rubber bands. Start winding the wire (about No. 24), for a few turns, spacing about ¼-inch; then solder a piece of No. 40 (for lower power or receiving use), enameled, to the No. 24 wire. Wind on about 15 or 20 turns, spacing them about ¼-inch or so. To the end of the No. 40 wire, solder some No. 24, as at the start of the winding, and secure by turning it around the end of one of the celluloid strips. Paint the wire and celluloid underneath, with collodion. When dry, remove the rubber bands, twist the coil at the ends and slip off. The heavier wire supports the winding and also furnishes leads.

There is much experimental work to be done yet, with R.F. chokes, but with the test results and testing methods herein described, any reader of SHORT WAVE CRAFT should be able to design effective chokes for his own particular needs and with apparatus already available. It is interesting work for, especially at the higher frequencies, small changes give marked variations in characteristics and results, taxing one's ingenuity.

We shall be glad to hear more about "CHOKES" from our Readers



The type 571 transmitting tube, rated at 750 watts.

TRANSMITTING TUBES

TO FIT YOUR *SHORT WAVE PROBLEM*

By ALLEN B. DuMONT
Chief Engineer, DeForest Radio Company

(Specially written for SHORT WAVE CRAFT.)

Herein Mr. DuMont, an expert on transmitting tubes, tells you of the advances in their design and manufacture; also how special tubes meet short-wave problems when the ordinary tubes will not function properly.

SOMEONE has remarked that the black magic of today becomes the commonplace science of tomorrow. The truth of that statement has been demonstrated time and again in radio. Yesterday we were dealing with the mysteries of short-wave communication. Standard receiving tubes were carefully selected for their high-frequency characteristics; and usually "unbased" to eliminate the radio-frequency losses present in their bakelite bases, quite as much as to eliminate troublesome capacity between prongs. Likewise with transmitting tubes; many of which had to be altered to meet high-frequency requirements. In fact, the advancement of short-wave communication has largely depended on the necessary tube developments as a foundation upon which to evolve satisfactory transmitting and receiving equipment. Today, fortunately, suitable tubes are available for receiving and transmitting purposes, in standard and special types.

It is not the purpose of this discussion to delve into short-wave reception requirements, since ample material has appeared in these columns on that side of the question. Rather, it is the purpose to discuss briefly the peculiar requirements of short-wave transmission, and to describe the tubes available for those requirements.

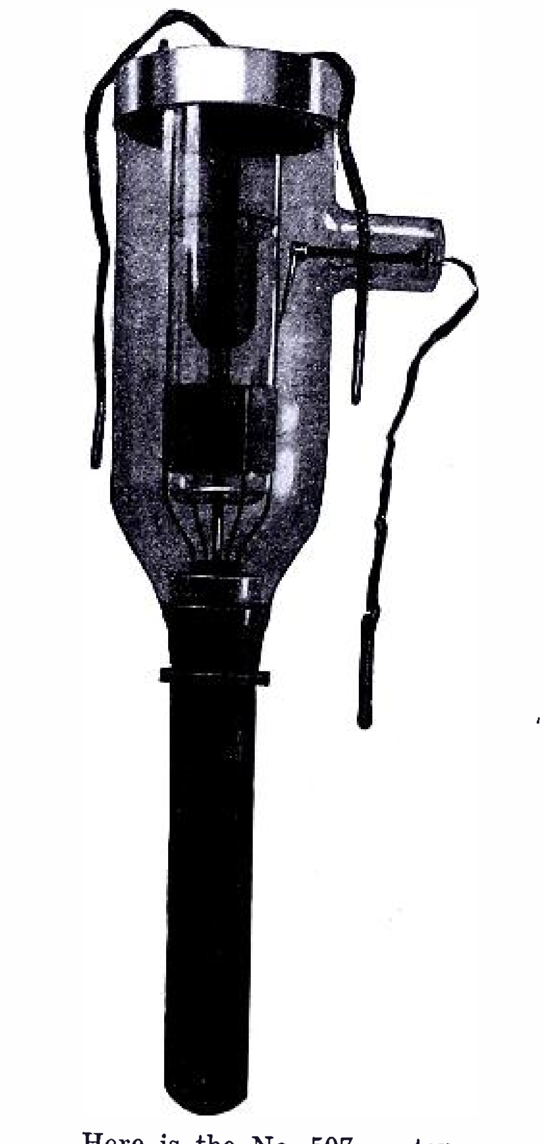
Importance of Inter-Electrode Capacity

The main difference between short-wave transmission, and that on broadcast and longer wavelengths, is in the matter of the relative importance of the inter-electrode capacity of the tube. This factor is of minor importance in transmitting circuits operating on 1500 kilocycles or less; but in short-wave work, above 1500 kilocycles, the inter-electrode capacity assumes prime importance. In fact, this factor determines the upper limit of frequency with any given type of tube; since the tube has a given capacity value which is a limiting factor in the frequency or wavelength that can be attained by a circuit employing that tube.

The '10 Power Tube

Another important factor in tubes for high-frequency operation is that of suitable insulation. The insulation requirements of high-frequency operation are quite different from those of lower frequencies. For instance, the standard 410 DeForest power tube, which is widely employed in power amplifiers and in the more powerful types of home broadcast receivers, can be employed for transmitting purposes on frequencies below 1500 kilocycles. For short-wave applications, however, this tube must be redesigned with special insulator supports of special ceramic materials; thereby reducing radio-frequency losses and increasing the breakdown-voltage value. The resulting 510 DeForest Audion is an extremely stable oscillator of high output up to and above 30 megacycles, being exceptionally efficient in crystal controlled oscillators; it is rated at 15 watts output. The specially-treated plate makes for high plate dissipation and, consequently, small expansion and contraction; thus overcoming "creeping" when it is employed as a self-excited oscillator. This tube is interchangeable with the 210 type, for heavy-duty operation. It is especially popular for use in the crystal oscillator and buffer stages.

The larger short-wave transmitting tubes are immediately identified by the terminal arrangements. Instead of metal terminals at top and bottom, as in tubes for broadcast and long-wave work, the short-wave tubes have a standard prong base at the bottom for the filament terminals, while the other terminals take

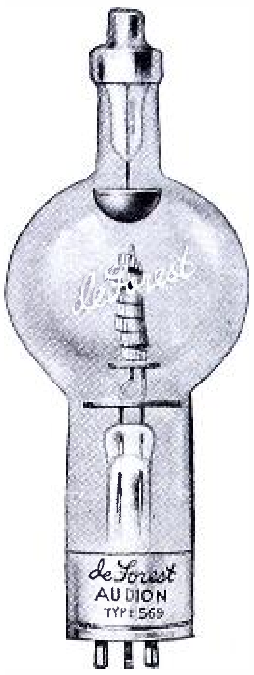


Here is the No. 507, water cooled, 10,000 watt transmitting tube.

the form of flexible leads at top and side. The round bulb is provided with projections or arms at top and side, so that the terminals may be widely separated to minimize the inter-electrode capacity—not to overlook radio-frequency leakage.

The 75-Watt Transmitter Tube

The DeForest 552 Audion, of 75-watt rating, is typical of the short-wave transmitting tubes. It has a standard four-prong base at the bottom for the filament connections, a projection at the side with flexible leads for plate connection, and a projection at the top with flexible leads for the grid connection. It is interesting to note that, because of the differences in potential between portions of plate and the grid, the terminals are taken from both the top and the bottom of the plate,



The type 569 mercury vapor rectifier tube, designed for heavy duty service. It is rated at 20,000 maximum peak inverse volts and 5 max. peak amperes.

and from both sides of the grid; the straight wire leads being joined to the flexible leads which are then twisted for a common terminal connection. The 552 is a three-element tube for use as an oscillator or radio-frequency power amplifier up to frequencies as high as 30 megacycles. Because of the low internal capacity, any shifting of the elements due to heating effects does not alter the frequency to any great extent. This is an ideal tube for 14-megacycle operation; it is interchangeable with the UX-852.

Jumping from 75 watts to 750 watts for more ambitious requirements, we come to the overgrown 571 type, which is practically the same thing on a larger scale. This tube, as well as the 552, requires neutralization for radio-frequency amplification, which is accomplished in much the same manner as in the radio-frequency amplifier of a receiver.

Screen Grid Used for Neutralization

In cases where neutralization is to be avoided, a screen-grid is introduced for that purpose (under type number 560, which is practically the same as the 552 except for the additional element or screen-grid); this 75-watt tube is designed for use primarily as a radio-frequency power amplifier, particularly at frequencies in excess of 3000 kilocycles. Because of its extremely low control-grid—plate capacity, which is inherent, there is no necessity for neutralizing, since this is taken care of by the internal shielding. It is interchangeable with the UX-860.

The same description applies to the 561 or 500-watt screen-grid tube, which is the same as the 571 except for the additional element of screen grid. It is also designed for operation on frequencies above 3000 kilocycles and requires no neutralization. It is interchangeable with the UV-861.

Water Cooled Tubes

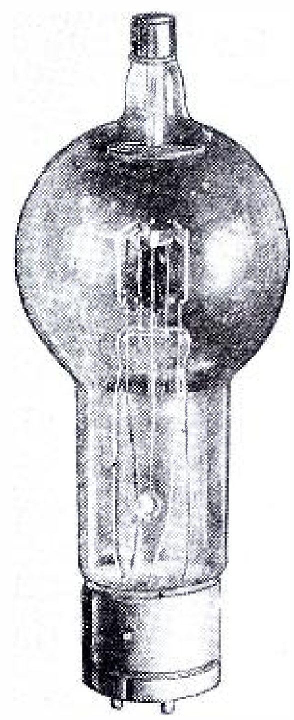
The larger water-cooled tubes, such as the DeForest 520B tube rated at 5000 watts, or again the 507 rated at 10,000 watts, are also available for high-frequency operation, provided the plate voltage is lowered and the output consequently reduced.

A very popular practice in short-wave transmitting work is frequency-doubling for very high frequencies. Down to a frequency of about 7 megacycles, almost any standard transmitting tube will serve the purpose; but beyond that point special tubes are required.

The modulator requirements are of course met by the usual standard tubes, as is also the case with the power supply. It is interesting to note that, in modern transmitting work, the batteries and motor generator sets have given way to the mercury-vapor rectifier. In a compact assembly which forms an entire panel or bay in the larger transmitters, or again a single shelf or section in the smaller transmitter, the plate and grid biasing requirements of the transmitter are met by a battery of mercury-vapor tubes.

For the small transmitter, particularly the amateur installation, the DeForest 566 serves the purpose; this is a half-wave, hot-cathode, mercury-vapor rectifier of about the same dimensions as a 450 power tube. However, a study of the internal arrangements discloses a heavy zigzag ribbon filament above which is a disc serving as the plate. A supply of mercury within the tube is converted into mercury vapor when the tube is put into operation. The tube operates at a dull heat; while the bulb is filled with the bluish mist typical of a mercury-vapor conductor. This rectifier is also applicable to theatre amplifying equipment.

The maximum inverse peak voltage applied to the anode or filament is 7500 volts. The filament must be lighted 30 seconds before applying the plate voltage; in order to secure the necessary conduction and therefore not strain the associated equipment in the meantime. Because of its special cathode construction, this particular rectifier has a much higher flash-over voltage than the usual '66 type rectifier, with which it is interchangeable.



The new de Forest type 575 mercury vapor rectifier. Rated at 15,000 volts inverse peak and 2.5 amps., peak current.

Mercury Vapor Rectifiers

Another step brings us to the DeForest 572 Audion, or mercury-vapor rectifier designed for heavier service conditions than the preceding tube. Here again, special construction raises the flash-over breakdown point beyond the usual -72 type.

Still another step brings us to the DeForest 569, rated at 20,000 maximum peak inverse volts and 5 maximum peak amperes. It is interchangeable with the UV-869.

Quite recently, the 575 DeForest mercury vapor rectifier has been introduced. It is rated at 15,000-volt inverse peak and 2.5 amperes peak current. The design of this rectifier is such as to make it readily usable in standard 572 power units when increased output voltage is required.

So far as suitable tubes are concerned, there is no longer any mystery or uncertainty about short-wave transmission of the commercial variety. The ultra-high-frequency transmitters now in the laboratory are still a problem; but in due course their peculiar requirements will be met by suitable tubes for the purpose.

SHORT WAVE TUNING LESS PLUG-IN COILS

The old "bogey man", the tapped coil and switch arrangement, for changing from one waveband to another, has had its ailments cured by the radio doctor, Mr. Bernard. Let's go! Boys—here's how to tune in all the various short-wave bands "without benefit of plug-in coils"!

By HERMAN BERNARD
Managing Editor of "Radio World"

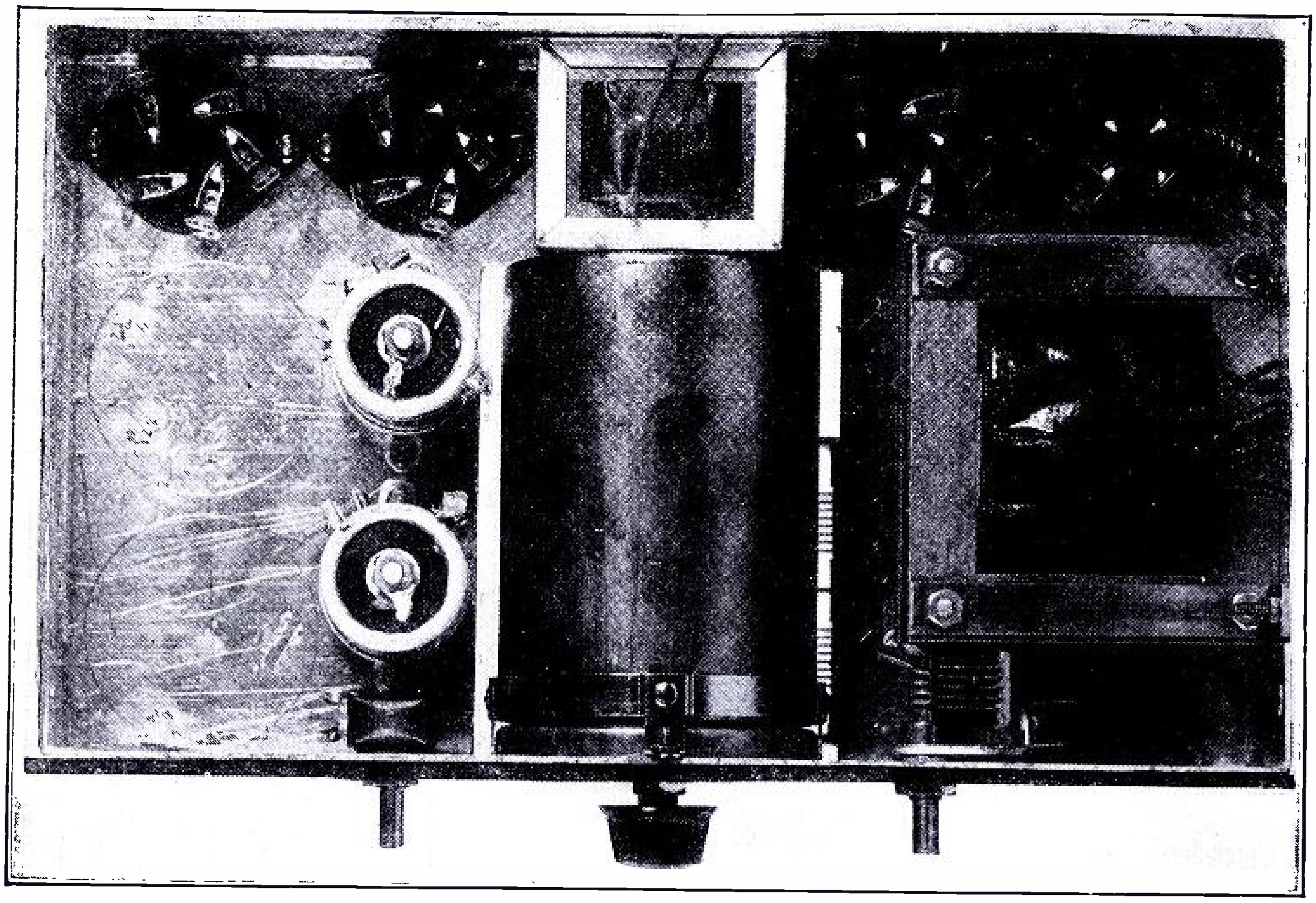


Fig. 5—View of underside of chassis for the circuit diagrammed in Fig. 3 — an "all-wave" converter with two stages of amplification, the receiving set used with it being tuned to the intermediate frequency also.

THE trend in short-wave reception is toward the use of a single switch, to control the band changing from the front panel. Since no resistance is desired or useful in the circuit, the solution resolves itself into the changing of inductance or capacity or both. Capacity changing has its mechanical difficulties; since complicated switches are needed to introduce some fixed or variable condensers in parallel and others in series with the tuning condensers. Yet inductive changing is very simply accomplished by the home constructor.

The band shift is accomplished by tying the stator of a tuning condenser to a switch which will select all of a coil or part of the coil for tuning; since the entire coil is always in the circuit, there are no dead end losses. In fact, just as soon as less than the entire coil is tuned by the condenser, there is established a set-up ratio, equal to the ratio of the number of turns in the tuned circuit to the total number of turns. That is, an auto-transformer is created. Hence (considering usual primary and secondary in their ordinary sense) you introduce a "second secondary" in the auto-transformer method, and the voltage step-up increases.

3-Tube Regenerative Receiver

Fig. 1 shows the coil-switch method adapted to the familiar pattern of a stage of screen-grid, radio-frequency amplification and a regenerative detector. The output is filtered, so that the detector plate voltage will be certain; and also so that there can be no direct-current short, when plugging into a broadcast set to give speaker volume.

Four switch points are shown; that means there are three taps, besides the extremes of the coil.

This is a circuit where the two stages are tuned to the same frequency. The coils must be independent (not coupled to each other) and may be shielded. For shields, use copper or aluminum, not less than 3-inch diameter; in which case the total secondary for .00035-mf. tuning on 1¾-inch (diameter) tubing would be 91 turns, the taps being at the 68th, 85th and 89th turns from the grid end.

For .0005-mf. capacity, with shielded coils, of the same diameter, the total secondaries would have 85 turns, the taps being proportionate. In all instances, from 15 to at least 560 meters can be covered.

Without shielding, for the same diameter, the secondary for .0005-mf. tuning would be 60 turns, and for .00035-mf. 70 turns; the taps proportionate. R1 may be 1,000 ohms; R2 any potentiometer of 3,000 ohms or more; while R3 should be about twice the value of R2. The other values are given in the circuit diagram.

It will be noticed that the new "exponential" or "variable Mu" tube, the '35, is specified as the radio frequency amplifier. The method of volume control-sensitivity adjustment renders inclusion of the '35 pertinent.

All-Wave 1-Tube Set

The same system can be applied to an all-wave one-tube set, as in Fig. 2, where there are only 9½ volts of applied plate voltage (the voltage of a 7½-volt battery

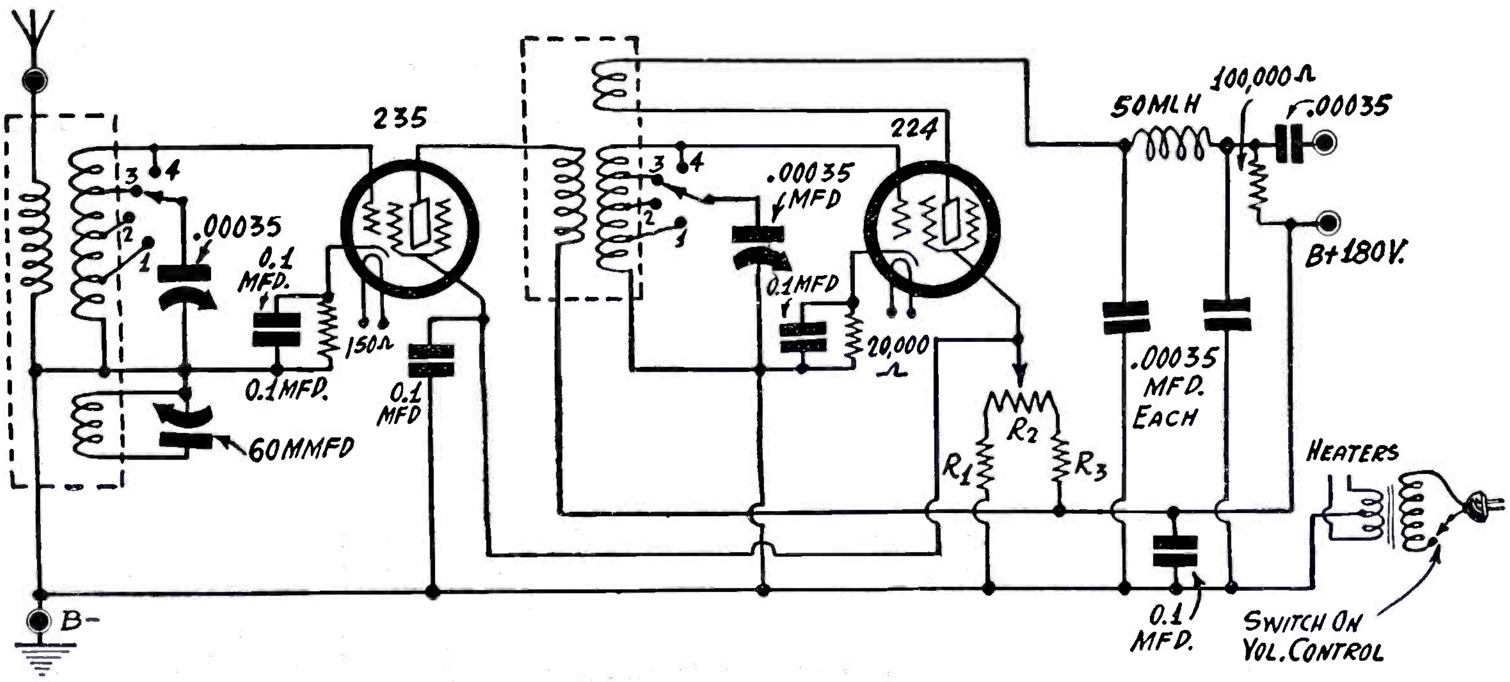


Fig. 1—How to use tapped coils and switches in a regenerative receiving circuit having one stage of R. F. amplification (with variable Mu tube) ahead of it.

of the "C" battery type plus the filament voltage drop).

Since only low voltage is required for detection, 9½ volts are sufficient, and feedback will result in great gain, if properly established. A larger number of turns is required on the feedback coil, on account of the low voltage, than would otherwise be used.

The wavelength changing from band to band is done by a band-selector switch, which should be of the insulated-shaft type. The reason for requiring insulation of the shaft from the pointer is that the moving arm or pointer of the switch is at a "hot" R.F. potential. Even shielding a non-insulated switch would not prevent body capacity; for the effect would be introduced from hand to tube through the shaft, despite the bakelite knob on the shaft.

As the diagram reveals, the moving arm of the switch is connected to the stator of the tuning condenser. At one point incidentally, (it is actually point 4 on the diagram) the stator goes direct to grid, and the tuning condenser is across the entire grid winding. However, in all other instances, the stator is connected to a point lower down on the grid coil; and, the lower down the connection is, the less inductance is in the tuned circuit, and the higher are the frequencies for which the switch is set.

While the feedback winding L3 is entirely separate from the secondary L2 (which permits the interposition of the feedback condenser in grounded-rotor fashion, to prevent body capacity) the direction of the winding must be such as to afford regeneration. This means that the secondary L2 and the tickler winding L3 must be oppositely phased; since the radio frequencies in the grid and plate circuits are 180 degrees out of phase. If no oscillation results, simply reverse the connections to the tickler winding.

The tickler may have 20 turns, the antenna winding 12 turns. Wire gauges are not very important, except that the secondary should not have finer than No. 28 wire.

All-Wave Super-Het Without Plug-in Coils

When one uses the switch system in the mixer of a superheterodyne, or of an all-wave converter which uses the superheterodyne method, the situation is a little different. In the broadcast band and in the lower-frequency region of the short waves, there is a substantial *percentage* difference in frequency between the modulator and the oscillator; the *absolute* difference equalling the intermediate frequency. To this extent the situation is just the opposite to that present in a tuned radio-frequency set, where there is only one frequency to consider for each circuit.

Fig. 3 shows an all-wave converter with two stages of amplification; the switched condenser E (a 20-100 mmf. equalizer), adjusted but once, takes care of the frequency difference. Built-in intermediate stages make "logging" practical. The set is to be tuned to the intermediate frequency also.

The oscillator winding consist of 28 turns: with 15 between (3) and (2); 10 between (2) and (1); and three between (1) and (0). The modulator has 68 turns between (3) and (2); 18 turns between (2) and (1); and 5 turns between (1) and (0).

These data are for .00035-mf. with shield, and a three-point double-throw switch is used. With that capacity, about the same wave band can be covered with three points as with four. The only difference is that four give greater "overlap"; which some prefer, because of the small capacity change in the first ten dial divisions or so, with a straight-frequency-line condenser.

The view under the chassis, for the Fig. 3 circuit, is shown in Fig. 5; while the coil construction is detailed in Fig. 4.

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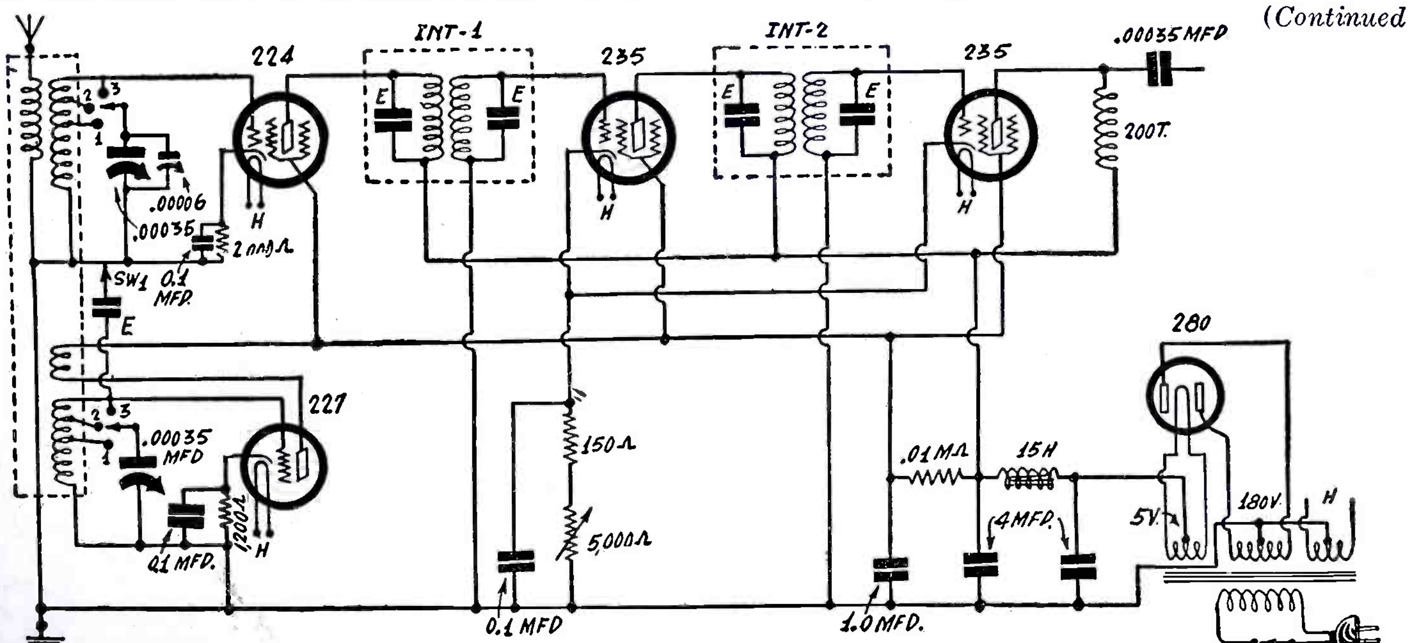

Fig. 3—Illustrating the use of tapped tuning inductances provided with switches for use with an "all-wave" converter. The oscillator employs a '27 tube.

DIRECTIVE ANTENNAE
And How They Work

By C. H. W. NASON

This article has been especially prepared for the Radio Amateur and covers receiving types as well as those for transmitting. One of the principal reasons for wishing to employ a directive antenna, is to economize in the amount of energy required, to send a signal to a given point over a long distance. It is also possible to partially defeat the "skip distance" effect.

THE matter of employing parabolic reflectors of the types shown in Fig. 1 is well known to all, and it is to be expected that all electromagnetic waves should be capable of behavior similar to that of light. When a strong signal must be put only into some particular locality, it is obviously improvident to scatter energy over the world at large; and it is possible to effect startling economies by the use of directional antenna systems, both in receiving and in transmitting. It is also possible, in a measure, to defeat the vagaries of "skip distances," etc., by the use of antennas directive in two planes. Practical data on such systems, so valuable to the average amateur, are in most cases lacking and, although the many antennas suitable for directive transmission and reception would make excellent and interesting material for an article of this type, the writer assumes that it is the practical data which are of the most interest to his er—uh—public!

The original Hertzian radiator (as employed by Heinrich Rudolph Hertz) was in the form of the parabolic reflector with the radiator at its focus, somewhat after the manner shown in Fig. 1. Hertzian radiators or oscillators may be defined according to their physical length with respect to the transmitted wave. Although they may be many times the wavelength of the transmitted signal, it is most usual that they be either half- or full-wave antennas. The form of the antenna has negligible effect upon its operation—it may be horizontal, vertical or what you will—bent back upon itself, or in the form of a "V." The transmission lines feeding the antenna may be part of the antenna proper or entirely isolated, so far as their effect upon the operation of the system is concerned. In short, there are many combinations which can be achieved without destroying the efficiency of operation.

In Fig. 2, two vertical Hertzian oscillators are shown, together with sine curves representing the standing-wave forms. Points marked M indicate the maximum-voltage; and those marked O, the zero-voltage points. The O points represent also the points of maximum *current*, as the M points are those of minimum current. Input to the antenna may be achieved in many ways but, for our description, the "current-fed" types in which the input is at some point of maximum current, is most advantageous. This is shown for both half- and full-wave antennas in Fig. 3.

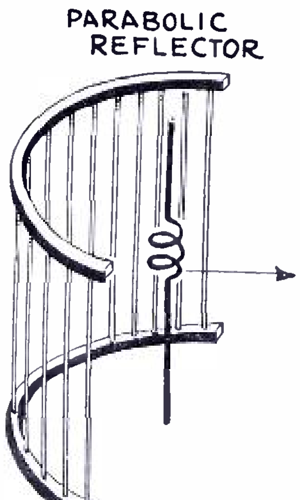

FIG. 1

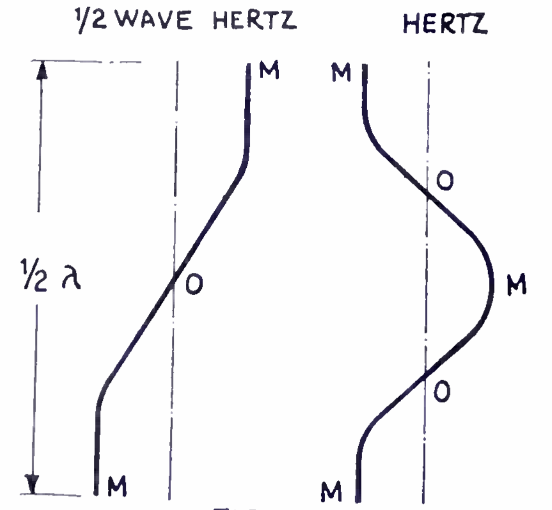

FIG. 2

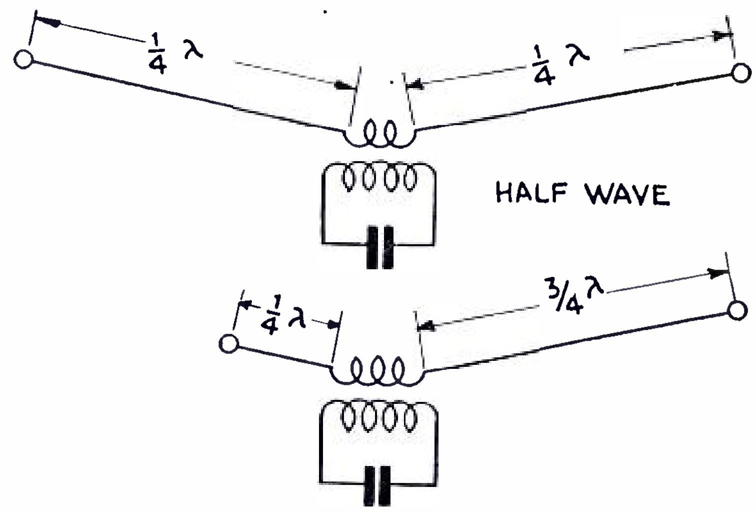

FIG. 3

Fig. 1 shows a Hertzian radiator with parabolic reflector. Fig. 2 illustrates one-half and full wave Hertzian radiators, with voltage distribution. Fig. 3 shows the feed to Hertzian radiators at maximum current point (minimum voltage); so-called "current feed" systems.

The Effect of Multiple Radiators

Now let us consider the directional properties of such antennas. A single vertical wire, excited as a full-wave antenna by means of a transmission line, as shown in Fig. 4, will have a directivity pattern as indicated. Now, if we were to split the transmission line so as to feed two antennas in the same phase relations, but have them placed just half a wavelength apart, the current waves from one antenna will always arrive half a wavelength behind those of the other at all points in the plane drawn through the two wires. The result will be that the two waves will cancel one another, and the directivity will be as shown in Fig. 5. This gives us a sharp directional effect, in the plane at right angles to the wires. If we place two antennae a quarter-wave apart, and excite them so that the current in one antenna is 90 degrees out of phase with that in the other, the current radiated will cancel out in one direction but will be radiated in the other so as to accomplish the effect shown in Fig. 6.

The ideal is now to accomplish an arrangement where directivity in two planes is accomplished; whereby the radiation is all in the direction of the receiving point and at a low angle to the earth's surface—that is to say with no vertical component.

This may readily be accomplished by the use of multiple-antenna systems or "arrays," such as are employed in transoceanic work by the large communication interests. A simplified array of this type is shown in Fig. 7.

Here we find two full wave antennas separated by half a wavelength and fed in phase. These are backed by two similar antennas which are distant a quarter-wave and are fed *parasitically*, so that they are 90 degrees out of phase with the true excitation. No trouble is to be experienced here, as the feed to the reflecting antennas is purely automatic.

Before going further it might be well to note the difference between the lengths of the wave in space and on the wire. The half and quarter wavelengths, sep-

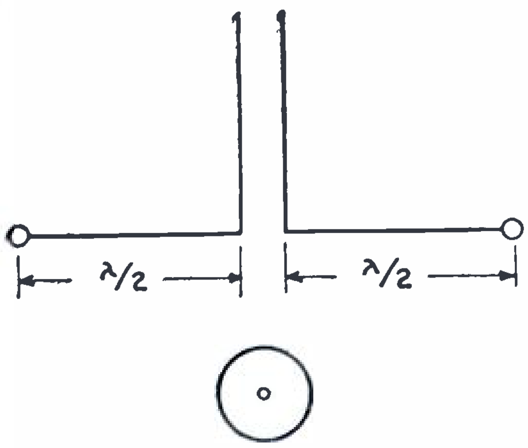

FIG. 4

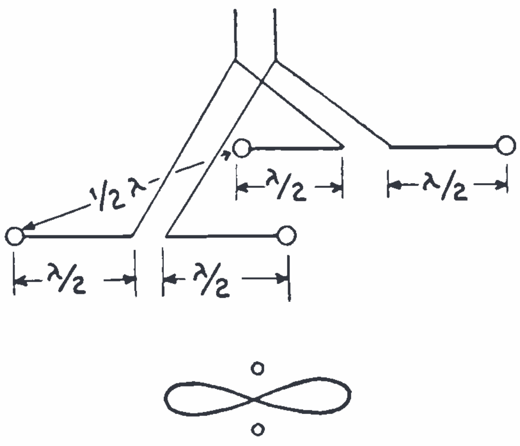

FIG. 5

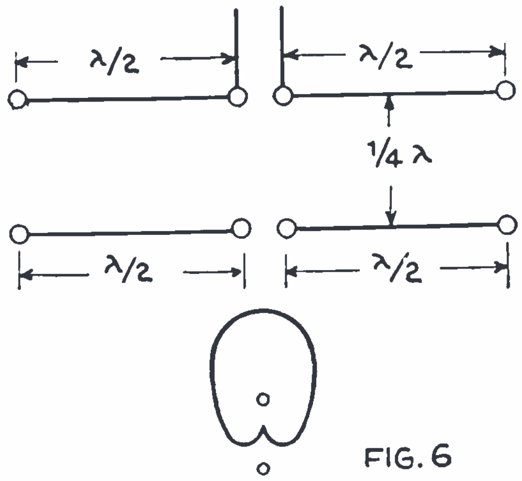

FIG. 6

Figs. 4, 5 and 6, above, show the zones of activity or "directivity patterns" for various arrangements of Hertzian radiators with double antennae and reflectors.

arating the various elements of the array, are actual physical distances gained by taking the required fraction of a wavelength, as expressed in meters. The natural wavelength of the wire is obtained by multiplying its physical length in meters by a factor which varies between 2.07 and 2.1, because the velocity of the wave on the wire is not quite the same as its velocity in space. A half-wave antenna is therefore about equal in physical length to the wavelength in meters. Practically speaking a half-wave antenna, for operating at 5 meters, is 5.25 meters in physical length or slightly shorter.

Angles of Principal Radiation

Physical dimensions given in Fig. 7 are for a 10-meter array having negligible radiation in the vertical sense but with the full directivity effective in the direction away from the reflectors and in a plane at right angles to the plane in which they lie. How this occurs may readily be seen by again referring to Figs. 4, 5 and 6. The directivity of the simple Hertzian structure is all in a plane perpendicular to the wire, there being but a slight vertical component. This factor takes care of any radiation in the direction in which the array is stretched. Directivity is now in all directions in a plane perpendicular to the wires. Addition of the second antenna fed by the transmission line localizes this radiation; in the sense that the entire radiation takes place along a line parallel with the earth's surface but in two directions while the further addition of the reflectors places the energy radiated all in one direction. It must not be thought that no energy whatever is radiated in other planes, but the greater portion of the power expended is in the predetermined direction.

It is easy to see why the directional effect in the horizontal plane (in azimuth) is desirable but it is not quite so obvious why directivity in the vertical sense is to be desired. This is because of the skip-distance effects found in the short waves (directional antennas of this type are far too unwieldy for use at the lower frequencies), which are minimized by concentrating the beam at a small angle to the earth's surface; since the components making the larger angles are virtually useless for communication at the higher frequencies. The radiation from a single vertical Hertzian antenna is at a small angle when used in the manner shown in Fig. 4; although the directional effect is in this sense only and the radiation is in all directions in azimuth.

The simple directional antenna as shown with a single reflector in Fig. 5 is ideal for general amateur work and for experimental purposes at the very high frequencies.

More complex forms are of course possible, and we may readily see that innumerable arrangements can be evolved. Consider two antennas, fed so they are in phase and a quarter wavelength apart, as shown in Fig. 8, together with their directional characteristics. By combining this with the effects designated in Figs. 4, 5 and 6, many combinations may be achieved other than those shown before.

The "Curtain" Type of Reflector

An open-ended transmission line of normal characteristics will acquire *standing waves*, the nodal points of which may be located readily. The radiation from such a line is negligible but, if the ends be bent out so as to form quarter-wave portions, as shown in Fig. 9, the radiation from the bent-out portion will be considerable. If the bent-out portion is half a wavelength on each side, a double antenna is formed having much greater radiating capabilities.

The array shown in Fig. 10 is a development of this idea; in which the vertical elements form the radiators, and the horizontal portions the transmission

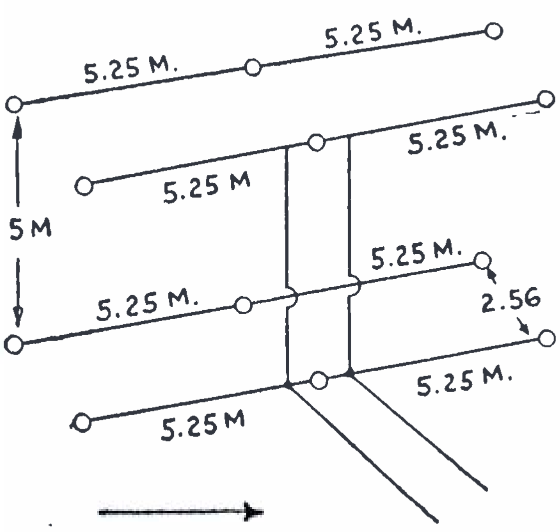

FIG. 7

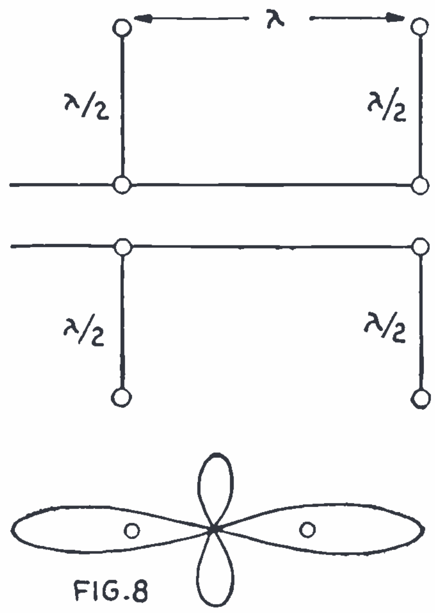

FIG. 8

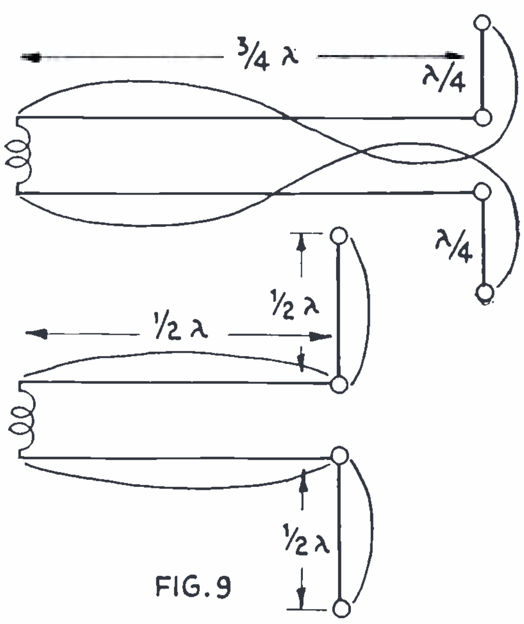

FIG. 9

Fig. 7—20 meter antenna array for directivity in two planes. This has a sharp directivity with respect to both horizontal and vertical radiation. Fig. 8 illustrates directivity of two in-phase radiators one wave apart. Fig. 9—Folded transmission lines as radiators.

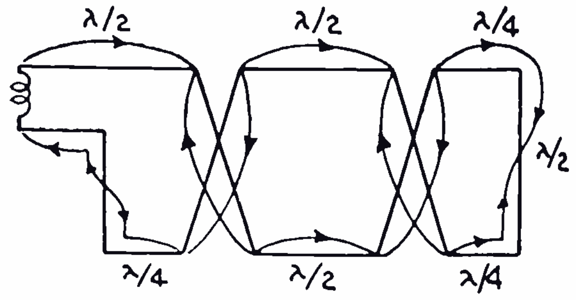

FIG.10

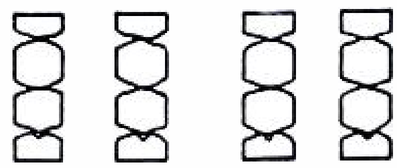

FIG. 11

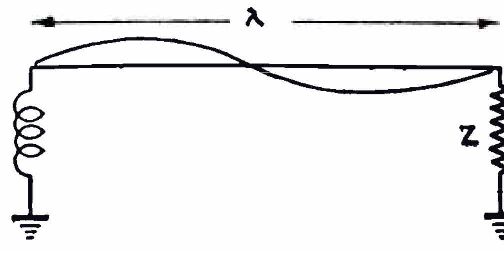

FIG.12

Fig. 10 shows the adaptation of the folded line antenna. Fig. 11—Complex array developed from the folded line. A second system may back this array for unilateral directivity. Fig. 12—The "Beverage" wire or wave antenna.

lines connecting them. The lines indicate the relative amplitudes of the current along the wires, and the arrows indicate the relative phase. It is shown graphically by this means that the currents in the horizontal members are out of phase and cancel one another; whereas the currents in the vertical sense are in phase and additive.

By placing a second and similar array in a plane parallel with the first, and exciting it parasitically; the directional effect which is normally in a direction perpendicular to the plane of the antenna can be made effective in one direction only—that perpendicular to the plane of the array and away from the second array which is a quarter-wave removed from the first.

To produce an effect in a remote receiving antenna equal to the results obtained with this type of directive array, a single Hertzian radiator would require eight times the power. This arrangement can be still further extended in the manner shown in Fig. 11, in order to obtain a more marked directional activity.

The Beverage wire or "wave antenna" was the first directional receiving antenna to attain any degree of importance as far as the amateur was concerned; this was used by Paul Godley in his transatlantic tests over a decade ago. The antenna consists of a long low wire with the receiving (or transmitting) equipment at the end opposite to the direction from which the signal is desired. The terminals must have impedances matched to the impedance of the line, which is an integral number of wavelengths long. The arrangement is substantially as shown in Fig. 12. The wave antenna is still extremely valuable in the reception of long and medium wave signals and is used in many commercial installations.

Characteristics of a Loop

The directional qualities of the loop antenna are familiar to all who have had any contact with the radio art. It is only the experienced or widely-read man, however, who realizes the principle on which the loop operates and just what gives it its directional effect. Consider two wires set up at some distance apart as in Fig. 13. If the signal wave approaches in a direction perpendicular to the plane of the two wires it will reach both at the same instant; the voltages induced in the two wires will be in phase

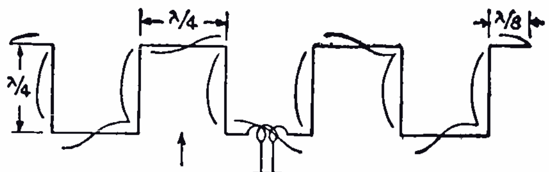

FIG.16

Fig. 16—The "Grecian Key" pattern for an antenna array. This may be continued for sharper directivity and sensitivity and may be backed by a reflector of like dimensions.

and no potential difference will exist between them. If, on the other hand, the signal approaches from a direction in the plane of the two wires, the signal wave will arrive in the two wires at different times; and the voltages induced will be out of phase by an amount dependent upon the distance between the two wires, their effective height and the wavelength of the signal. A potential difference will exist and, if the wires be connected together in such a manner as to constitute a loop antenna, the potential difference will be available as a signal at the terminals. If the signal is from some direction other than in the plane of the loop the signal will not be at its maximum available value. In as much as the "null" point (when the signal is from a direction perpendicular to the plane of the loop) is much sharper than the maximum signal point, it is the null position which is used in direction finding work. Since the maximum available potential difference is not available except where the sides of the loop are one-half wavelength apart the loop is not the most efficient collector of energy, save in special cases. For this reason, it is not employed where the intention is to obtain the maximum signal from a signal of given frequency and direction; since it is then possible to avail ourselves of the properties of the Hertzian antenna.

Various Receiving Types

The single Hertzian oscillator will operate quite effectively as a receiving collector in the manner shown in Fig. 14. The transmission line is made from simple lamp-cord and should be a quarter-wave or more in length. The antenna must be designed for some particular frequency, but will act almost as efficiently for some distance in the range on either side of the frequency chosen. It will also be operative—as will the transmitting antenna for that matter—at the harmonics of the frequency for

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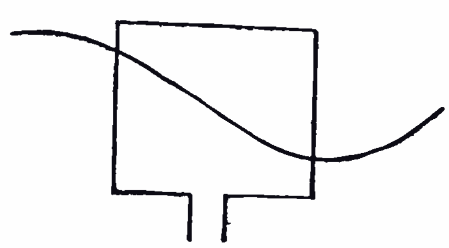


FIG.13

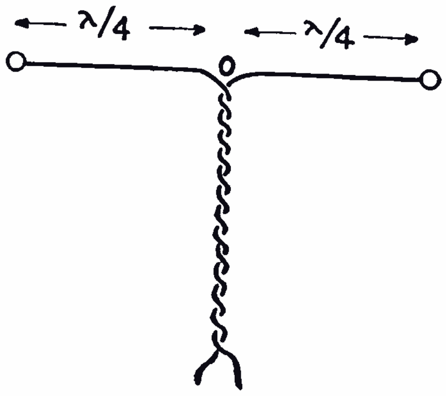


FIG.14

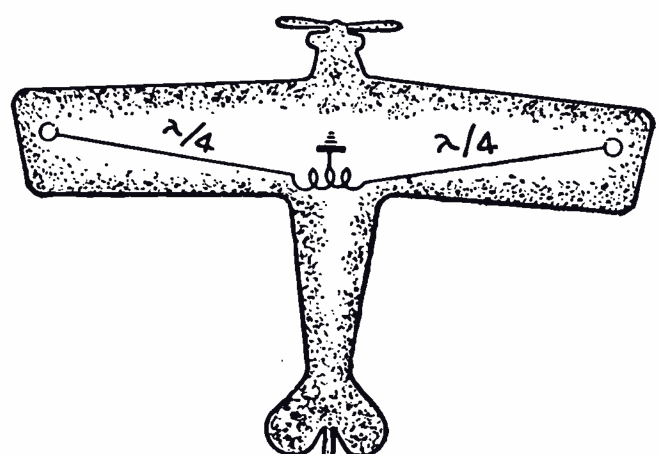
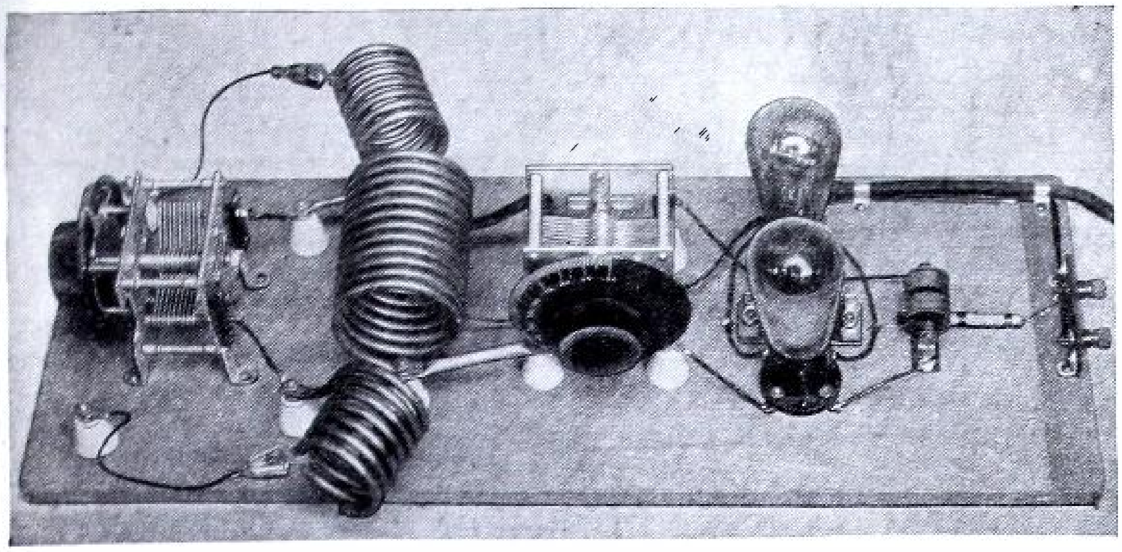


FIG.15

Fig. 13—The operation of the loop is dependent upon the phase difference between the voltages induced in the two sides. Fig. 14—Hertzian "doublet" receiving antenna with lamp cord "transmission line." Fig. 15—Used on aircraft the "doublet" obviates the necessity for shielding the ignition system.



This transmitter uses two '45 tubes in push-pull and equals any 10 type tube job. It is much cheaper to build also, as it employs ordinary receiving set parts.

Photograph above shows the push-pull C-W transmitter mounted on a neat baseboard; it is of the tuned-plate, tuned-grid type and uses two '45's as oscillators.

A Low Cost Push-Pull C-W TRANSMITTER

By L. R. SHAFFER

BECAUSE the '10 type tube was one of the first medium power oscillators available to the amateur, it has long been standardized upon for low-power transmitter use. To get the most out of a '10 type tube means the use on the plate of 550 volts, as obtained from a fairly large transformer and a pair of '81 rectifiers.

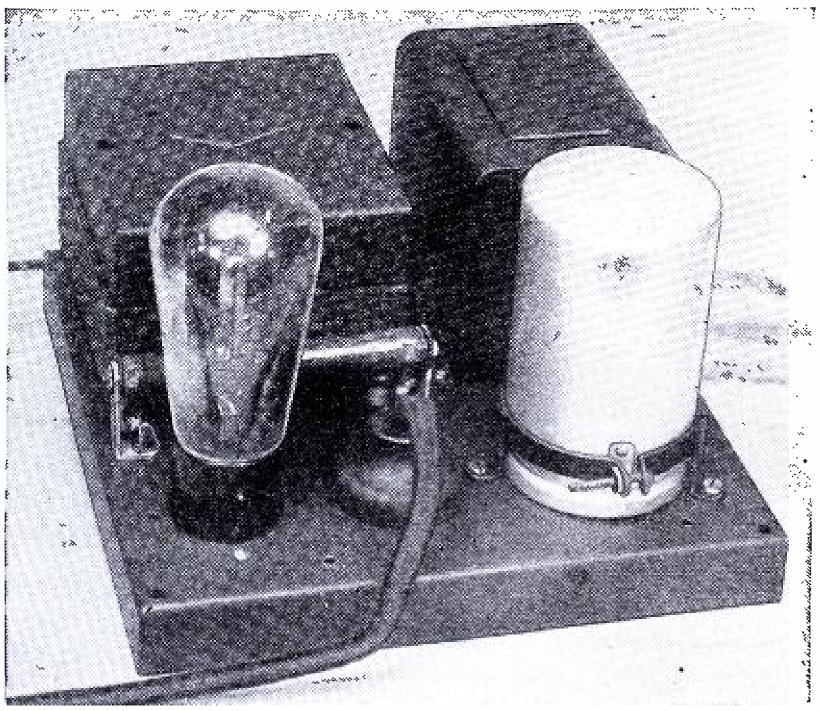
As such power-supply parts and tubes are manufactured only in limited quantity for amateur and experimental use, the cost is consequently high.

By so designing a low-power transmitter, however, to use the parts produced in large quantities by manufacturers of broadcast receiving sets, it is possible to reduce very materially the cost of a small transmitter.

The transmitter shown here, built from a kit of parts now available on the market, makes use of a push-pull type of oscillator circuit, employing a pair of '45 receiving tubes with 350 volts on the plate. This low plate voltage makes possible the use of the standard type '80 rectifier tube, a broadcast receiver's power transformer, and the inexpensive electrolytic filter condensers.

Such a transmitter will have as much power output as the more conventional '10 type; will cost less than half as much to build; and will "get out" and get plenty of DX with any kind of intelligent handling. Furthermore, tube replacements, at the present price level for broadcast receiver tubes, may be made at an insignificant cost.

As seen from the photograph, the transmitter is built almost entirely of receiving equipment; and, consequently, the initial cost of all the necessary parts comes well under $50 complete. A milliammeter to read plate current (the use of which is strongly recommended), will add seven or eight dollars more to the cost. And the set is not a toy or another "flea-power" outfit—it will do anything that the type '10 outfit will do—and perhaps do it better. Certainly it will have better frequency stability; the push-pull circuit will take care of that.



This photograph shows the appearance of power supply unit suitable for the C-W transmitter here described, the apparatus shown being of the well-known National design.

Aside from its use for amateur communication, this inexpensive l.it will be found very useful in many laboratory experiments and research problems where the use of a radio-frequency oscillator, capable of delivering several watts at almost any desired frequency and with good frequency stabilization, is desired.

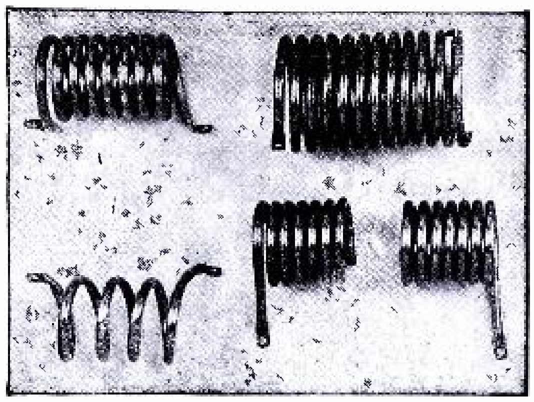
Building the Transmitter

A baseboard for the oscillator is one-half inch thick, nine inches wide and twenty-six inches long. It should be sand-papered and given several coats of clear Duco lacquer, rubbing down with fine sandpaper between each coat. Rubber-headed tacks are then fastened in each corner, for feet.

If the National kit is obtained, the baseboard will be found completely finished, with ends mortised to prevent warping, and all the necessary holes ready drilled for mounting the condensers and coils.

The circuit makes use of a fixed-tune grid coil in place of a tuned circuit, and the antenna tuning system has been arranged to require but one tuning condenser, instead of two as in the more conventional manner. In fact, all circuit elements which could be dispensed with without interfering with the efficiency of the transmitter have been eliminated.

Referring to photograph again, from left to right, the components are the an-



Here we have a picture of the C-W transmitter coils; the two coils on the left, made of copper tubing, are the 7,000 kc., and 14,000 kc. plate coils. The large coil at the center is the 3,500 kc. plate coil, while the two coils below it are the aerial coupling coils.

tenna tuning condenser; a pair of standoff insulators to which the antenna or feeder connections are made; another pair of standoff insulators which support the antenna coupling coils; and a third pair of insulators supporting the plate coils of the transmitter. Next in line is the tank tuning condenser; then come the tubes and their sockets, the grid coil and mounting, the grid leak and, finally, the binding-post strips for connecting the key. Connections to the power pack are made by means of a cable and connector plug.

Between the tubes, but not completely visible in the photograph, are located the filament center-tap resistor and the associated mica by-pass condensers (R_2 and C_3 in the circuit diagram, Fig. 1). Such an arrangement allows for symmetrical connections. It will also be noticed that the wiring is such that power leads, etc., are kept entirely out of the strong R.F. field.

Design of the Inductances

The grid coils are constructed in a novel manner; in that they are wound on the bakelite forms used for the standard National R.F. choke coils, thus permitting their being readily plugged in and out of a standard grid-leak mounting. The third, or center, connection, is obtained by a special contact fastened to the mount and making contact with a small stud on the center of the coil form. The bakelite forms are one inch in outside diameter, and no spacing is used between turns. Complete specifications for these grid coils, as well as the plate coils, are given in the accompanying table.

Fig. 1, shows series antenna tuning and the apparatus indicated is as follows:

C1—500 m.m.f.
C2—350 or 500 m.m.f.
C3—250 m.m.f.
R1—50,000 ohms.
R2—20-ohm center-tapped resistor.
RFC—Two-inch winding of No. 36 d.s.c. on half-inch form.
L1—3500 kc.—12 turns of ¼″ copper tubing 2⅜″ inside diameter.
7000 kc.—8 turns of ¼″ copper tubing 1⅝″ inside diameter.
14,000 kc.—4 turns of ¼″ copper tubing 1⅝″ inside diameter.
L2—3500 kc.—72 turns No. 32 s.s.c. on 1″ form.
7000 kc.—40 turns No. 28 d.c.c. on 1″ form.
14000 kc.—16 turns No. 28 d.c.c. on 1″ form.
L3—7 turns of ¼″ copper tubing 1⅝″ inside diameter.
I—0-150 d.c. milliammeter or 6-volt flashlight bulb.
A—0-1 thermocouple ammeters—these are not entirely necessary but are helpful in tuning.

In winding the coils, it must be remembered that a change in the wire gauge, or even a change in the type of insulation on the same gauge of wire, will make necessary a different number of turns. If the diameter of the wire, including insulation, is smaller than that given, fewer turns will be needed; and *vice versa*. To find the correct number of turns is quite easy if a plate milliammeter is available. Data on just how to adjust the grid coils for best operation will be given further on under "Operating Notes".

It is also extremely important that the same number of turns be used on each side of the center tap. When the coils are completed, they should be coated with clear Duco, to prevent loosening of the turns and to keep out moisture.

The data are for the benefit of anyone who cares to construct his own coils; since those supplied with the transmitter kit are properly adjusted at the factory as to the correct number of turns, location of mid-tap, etc.

Connections between the grid coil socket and the grid posts on the tube sockets, and also between the tuning condenser and the plate posts on the tube sockets, are made with ordinary bus wire; since these wires do not have to carry heavy currents. The connections between the tuning condenser and the insulators which support the plate coil, however, must be made of the same size of copper tubing used for the plate coil; because these connections are part of the tank circuit and heavy currents flow in them.

When placing the tuning condenser and the insulators, be sure that both of the copper-tubing connectors are the same length (from the connections on the condenser to the insulators), to make certain that the tank circuit is symmetrical.

The insulators which hold the plate coil are spaced 4½ inches between centers. The coils are wound to fit on the insulators, and the spacing between turns is about 3/16-inch. The 3,500-kc. coil is wound on a piece of pipe with an outside diameter of 2⅜ inches; while all the other coils are wound on pipe 1⅝ inches in outside diameter. Each of the plate coils must have an even number of turns, so that the clip for the center tap can be placed on the under side of the coil. A brass machine-screw is run through the baseboard, midway between the insulators holding the plate coil; and a nickel-plated battery clip is connected to the screw by a short length of flexible wire. When the coil is fastened to the insulator, the clip is placed on the center turn.

The antenna coils are wound on 1⅝-inch pipe, one end of the coil being brought out, so that the axis of the coil will line up with the axis of the plate coil when fastened in place. Be sure to wind both antenna coils in the same direction; if they are wound in opposite directions, the fields will "buck", and the antenna will not take power from the transmitter. The antenna coils shown have seven turns each, but the exact number to use will depend on the type of antenna system employed. These coils will be satisfactory with a Zeppelin antenna on all bands if the feeders are between 45 and 50 feet long.

The coils will keep a pleasing bright finish if they are carefully cleaned and lacquered. Before winding each coil, the necessary length of tubing should be thoroughly scoured with steel wool. After the coil is finished and the spacing between turns adjusted correctly, it should

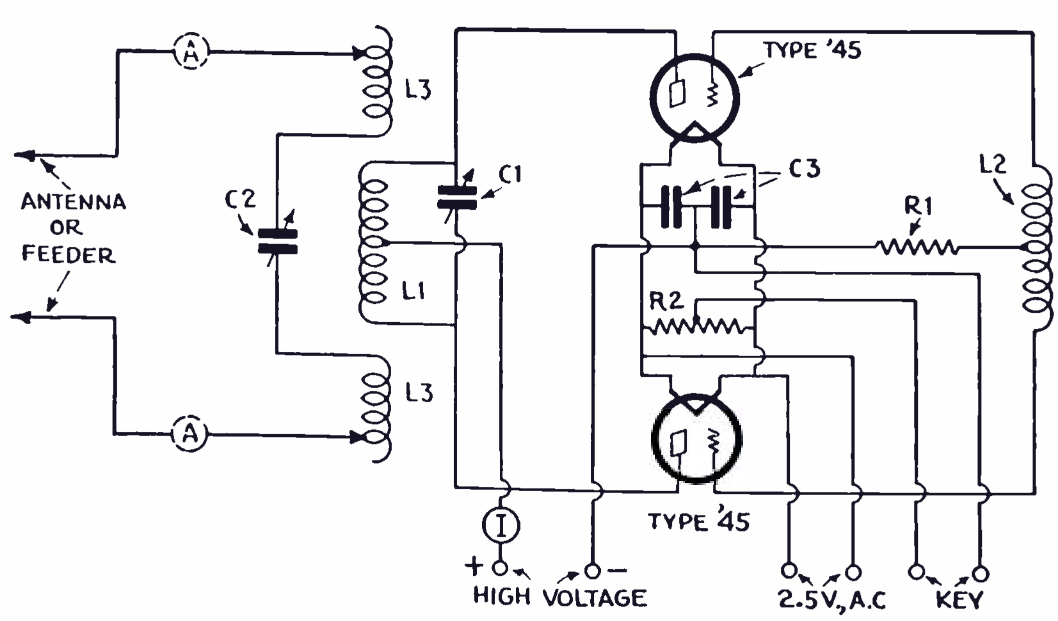


Fig. 1—Shows hook-up of simple parts used in building the push-pull transmitter here described by Mr. Shaffer. The parts corresponding to the various letters in the diagram are explained in the text.

again be touched up with steel wool, and then scrubbed with a rag soaked in alcohol to remove grease. When dry, Duco lacquer (preferably thinned out considerably with the thinner which comes for that purpose), should be painted on with a small brush. Make certain that the

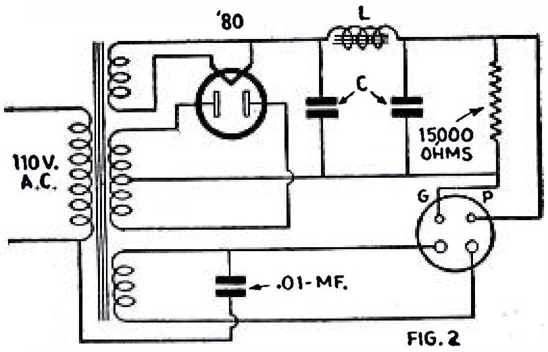


FIG. 2

Fig. 2—The rectifier tube and power-supply circuit for the transmitter.

entire surface is covered, and then allow it to dry thoroughly before the coil is put in service. If the coils are not lacquered, they will oxidize in a day or two. This is particularly true of the plate coils, which get appreciably warm in operation and, if not lacquered, will turn a muddy brown color in a very short time.

In building the transmitter, be certain to use the exact values, for the circuit elements, specified in Fig. 1; these have been found to be best after a considerable period of experimentation.

The Power Supply

There is nothing unusual about the power-supply unit, except that the output voltage is somewhat lower than that commonly employed in low-power transmitters. The high-voltage winding of the power transformer furnishes 350 volts, on each side of the center tap, which is rectified by the type '80 tube, and then fed into the filter. The latter is a brute-force arrangement, using a double-section dry electrolytic condenser and a 3-henry choke. Each unit of the condenser sections is rated at 8 mf. and will stand 500 volts peak. The peak voltage of the transformer output is safely within this rating. An actual test of the power supply showed that the no-load voltage delivered by the rectifier and filter is between 450 and 500; dropping to about 350 volts under a load current of 100 milliamperes (the normal current taken by the transmitter) when delivering power to the antenna. To prevent this high no-load voltage from causing any damage to the electrolytic condensers, a 15,000-ohm load resistor is connected permanently across the output of the filter circuit. See diagram Fig. 2.

The power transformer is the standard National unit (used in the power supply of the MB-30 receiver) and, in addition to the high-voltage winding it has a 5-volt winding for the filament of the type '80 rectifier and two 2.5-volt windings; one of which is used to light the filaments of the type '45 tubes in the transmitter, the other being left idle.

When using electrolytic filter condensers, it is important that they be connected into the circuit with the correct polarities. The outside can is usually the negative connection, the positives being the binding posts on top.

With this power supply it is easily possible to get a pure D.C. note on all bands if the transmitter is well built and properly adjusted. If the D.C. note is not forthcoming, look to the transmitter itself, and *not* to the power supply. This same trouble was encountered in working out the details of this outfit and it can be overcome with a little patience.

Getting Into Operation

There is nothing more hopeless than trying to adjust a transmitter without the means of knowing just what effects each change made has on the frequency, note and output. Two things at the very least are necessary—a monitor and some sort of indicator for telling when the antenna is taking load.

The monitor should be used in conjunction with a frequency meter, or at least should be calibrated so that it is possible to tell with certainty whether the transmitter is in the band or not.

Radio-frequency ammeters in the feeder

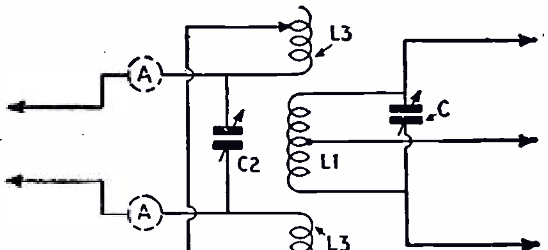


FIG. 3

Fig. 3—This diagram shows the connections of two thermocouple-ammeters for parallel antenna tuning.

leads are useful for determining when the antenna is tuned correctly, but the plate milliammeter is the handiest all-around meter to have, because with it the input power can be estimated and it can be used to indicate resonance with the antenna. By its use it is also possible to tell whether the tubes in the set are being overloaded or not. A 6-volt flashlight bulb or dial-light may be substituted for the milliammeter and will serve as a resonance indicator; although the actual plate current cannot be read in this case.

Suppose, now, that the monitor is ready for use and that a milliammeter or bulb is connected in the positive high-voltage lead to the transmitter. The transmitter is to work on the 3,500-kc. band, for illustration. The proper coils are in place and all connections are tight.

First make sure that the antenna or feeders are disconnected and that the antenna coupling coils are moved as far from the plate coil as possible. Set the plate tuning condenser at maximum, and close the key; the milliammeter reading should be somewhere between 25 and 45 milliamperes. Slowly turn the plate condenser, watching the milliammeter at the same time, and see whether the plate current decreases to a minimum at some reading and then begins to rise again. This dip should occur at very near full capacity on the condenser and, if it is very far down the scale, a few turns should be added to each side of the grid coil. This is, in fact, the way to adjust the grid coil in a circuit of this sort. The number of turns on the grid coil should be such that the minimum point

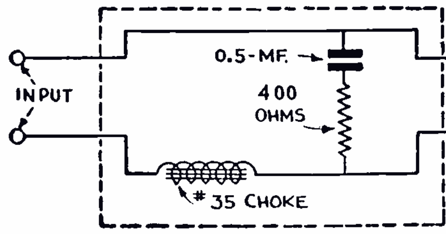


FIG. 4

Fig. 4—Hook-up of parts used for "key click" filter of National design.

on the plate-current reading (with the antenna not coupled to the oscillator) occurs at a frequency slightly lower than the low-frequency end of the band on which that coil is supposed to work. Without some means of checking frequency it is apparent that an intelligent adjustment of the coil cannot be made.

If the transmitter does not oscillate, the plate-current reading will be quite high—150 to 200 milliamperes. Reasons for non-oscillation might be: grid coil turns not adjusted correctly; center tap on grid coil or plate coil not on electrical center; bad tubes; or low filament voltage. Ordinarily, however, if the circuit specifications are followed exactly there will be no trouble in getting the transmitter to oscillate.

Now set the tuning condenser at the point which gives the lowest plate-current reading, and check the frequency and the quality of the signal. The note should be pure D.C. and very steady, and the frequency should be very near 3,500-kc. Next choose the frequency on which the transmitter is to be operated (this will naturally be the resonance frequency of the Hertzian antenna, (if such is used) and tune the transmitter to that frequency.

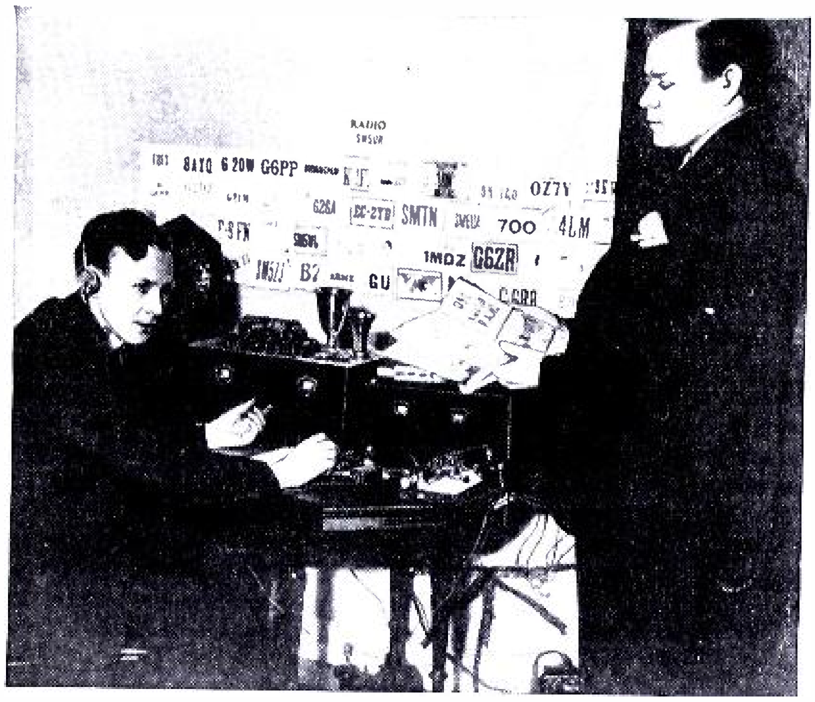
Now set the antenna coupling coils so that the distance between each of them and the plate coil is about an inch to an inch and a half. Both coils should be exactly the same distance from the plate coil. If the Zeppelin type of antenna is used, and the feeders are between 45 and 50 feet long, the parallel tuning connection shown in Fig. 3 should be used. The feeders should be clipped on the two insulators to which the antenna tuning condenser is connected; and a jumper should be connected between the two insulators to which the flexible leads which connect to the antenna coils are fastened. Now turn the antenna tuning condenser until the milliammeter or bulb shows the maximum plate current is flowing.

The frequency and character of the note should next be checked with the monitor and, if the former has changed appreciably, a readjustment of the plate condenser to bring it back to the proper place should be made. This will also necessitate retuning the antenna condenser. If the note shows signs of ripple,

(*Continued on page* 145)

AMONG THE "HAMS"

Bouquets and Brick-bats from our Readers



SWEDEN'S RADIO WIZARD

Only an amateur is Folke Berg, left, but many a professional radio expert might be envious of Berg's knowledge of the ether waves. Berg is the champion of all of Sweden's licensed amateur radio operators. On the walls are cards with call letters and numbers of amateur stations the world over with which Berg has been in contact. Osborn Duner, right, is another radio specialist. Sweden now has 122 licensed amateur sending stations.

RIGHTO!

Editor, SHORT WAVE CRAFT:

Gentlemen:

As a subscriber to your publication I have played with short-wave reception for some time and in common with thousands of others I greatly enjoy the programs from Chelmsford, England; Rome, Italy, and elsewhere.

Recently, I have noticed that there is very considerable interference with the programs from Germany as well as from Georgetown, British Guiana, Tegucigalpa, Honduras, and a number of other short wave broadcast stations.

One of the worst offenders is the short wave station of KDKA which completely swamps VE9CL of Winnipeg, and interferes with HRB as well as W2XE and VE9GW.

I have found that I can tune many stations as closely as 4 k.c., but others are very broad, which is certainly a great pity because there is a point beyond which one cannot go in the sharpening of tuning without impairing reception.

I believe your publication can do a great deal along this line by bringing pressure to bear on the authorities and the keeping clear of the channels on which short-wave "phone" broadcast is sent out.

It is true that England is comparatively free from these troubles (G5SW) but the station in Rome, Italy, is occasionally very broad and being close by, can cause interference.

Short-wave broadcast is an international proposition, in so far as a large part of the spectrum is concerned, and I am sure your efforts along this line will be appreciated by many thousands.

Respectfully submitted,
GILBERT C. SHADWELL,
LL.B., A.M., E.E.,
39 Cortlandt St.,
New York City.

(Here is another kick about stations abroad. If we can get a sufficient amount of complaints from our readers, we can then take the matter up with the proper authorities. Let's hear from you and we hope that it will be the means of remedying the existing poor condition.—Editor.)

NO TROUBLE AT ALL

Editor, SHORT WAVE CRAFT:

I have been reading "Among the Hams" in every edition of SHORT WAVE CRAFT that I have obtained so far and it got me to itching, so I thought I'd write a letter myself.

First, I want to say that I think that your magazine sure takes the cake as far as *Short Waves* are concerned. I can't go back on old "*Q. S. T.*" but I know that the five issues of SHORT WAVE CRAFT I have bought have been worth it: the only trouble is that it isn't published once a month. *I have several of the sets I have made myself from the hookups in your magazine and I have got "perfect results!"*

I have sort of a "den" in the west end of my house where I fool around with radios of every sort. This room is a meeting place for four of my *Short Wave Hound* friends every Tuesday, Thursday, and Saturday nights. We tinker, listen to Short and Long Wave reception, and discuss radio in general.

Every one of these fellows take SHORT WAVE CRAFT and like it fine. We are now building a "Super Wasp" battery model receiver and expect some good results.

I would like to hear from some other "Hams" and will answer all letters. You may publish this if you wish.

Yours, with best wishes for SHORT WAVE CRAFT.

DEAN R. BARKER,
597 Cohannet St.,
Taunton, Mass.

(Thanks Dean, yours is only one of several hundred requests and there is really no trouble at all in publishing SHORT WAVE CRAFT *once a month. You see it is up to the readers. It would not pay us at the present time, with the present circulation, as we would be worse off financially in publishing the magazine once a month at a price of 25c, than we are in publishing it every other month at a price of 50c. If the circulation does increase, however, to about fifty per cent more than it is today, it would not be a trick at all to bring it out once a month. Translated into other words, we mean that if you fellows get behind the magazine and get new readers continuously, it wouldn't be very long before* SHORT WAVE CRAFT *would be a monthly publication.—Editor.)*

YOU'LL HEAR PLENTY!

Editor, SHORT WAVE CRAFT:

Have read two issues of your magazine and I find it to be the best ever.

It has inspired me to build a short-wave set, a receiver and transmitter.

I would like to hear from those who have built the *National Thrill Box*.

If the magazine affects everyone as it did me, you surely will have a large circulation in no time.

STANLEY SANINK,
Box 301,
Danbury, Conn.

(I am sure you will hear from plenty, Stanley. As you know, there are hundreds who have built the National Thrill Box and get the most excellent results. Let's hear from you again. —Editor.)

A GOOD STOMACH

Editor, SHORT WAVE CRAFT:

I have been devouring SHORT WAVE CRAFT ever since you first issued it. I haven't missed a single copy. I wish to offer my most sincere congratulations on your fine magazine. I am a rabid C.W. (code) hound and have quite a layout here at 1AQW. It consists of a modified tuned-grid, tuned-plate transmitter using a Hertz antenna, 66 feet long with 15 feet parallel tuned feeders. Two receivers both with an antenna coupling radio frequency stage, detector and two stages of transformer-coupled audio. The outfit works fine and the receiver "dx" has been all U. S. districts and Australia and New Zealand. The transmitter hasn't been on the air lately as a recent storm took down the transmitting antenna.

I forgot to mention that I have also a one tube S.W. receiver built from plans published in your magazine and also that my first transmitter was the Hartley described in a recent issue of SHORT WAVE CRAFT.

I don't experiment much with sets for receiving short wave broadcasting stations, but have heard all the best ones in the U. S. and Canada. I would be pleased to hear from other hams (YL'S letter will be answered). I'll say 73's now.

C U L
ROBERT "BOB" ROWE, W1AQW,
374 College St.,
Lewiston, Maine.

(What is urgently needed, Bob, for this department is a photograph of yourself in the art of devouring those SHORT WAVE CRAFT *copies. We would like to know how you season them, whether with butter or Worcestershire sauce to aid digestion. It is a good idea because it sells more copies. Hope your stomach doesn't suffer.—Editor.)*

A YOUNG S.W.P. PUP

Editor, SHORT WAVE CRAFT:

I want to say that SHORT WAVE CRAFT is the best radio magazine (outside of *Radio-Craft*) that I have ever read. I like the editorials especially well. Your "call list" and "time schedule" can't be beat. I have not been a *short wave hound* very long but have had some success. I have heard the following stations in the last month and a half: HKT, HKC, HKF, VRY, HC1BR, LSG, GBS, GBU, GBK, CGA, VZA, CJRX, XDA, XC51, XFA, AGJ, 13RO, VLK, RFM, RFN, RB15, RA97, PK3AN, K1XR, HS2PJ-Saigon, Indo-China; UOR2-25 U. S. stations and many amateur phones. This part of the country is a good zone for reception from Asia and South America, but a rotten one for Europe. I would like to communicate with someone around Los Angeles, about the way Europe is or is *not* coming in.

N. G. STAHEVITCH,
R1, Box 1043,
San Gabriel, California.

(For a short wave phone "Pup", Nick, you are doing pretty well. What you will do after

you are grown into a regular short wave "hound", no one can tell, but the earth certainly seems to be pretty small already, as far as you are concerned. More power to you and may your loudspeaker keep on blasting out everything but "locals".—Editor.)

WE PITY YOU

Editor, Short Wave Craft:

It looked to me like a meteor hitting the earth, when I first ran across your Short Wave Craft magazine a few weeks ago. There was nothing to decide or debate about buying it; it was "tooked" before the newsstand man had a chance to ask me what I wanted.

I dont know much about short waves *yet*, but I have built the copper-clad special, and at present listen through a very simple set à La Junk Box, as I have little space and time for my hobby, the "Shorts". I would like to get in touch with a good S-W operator in Los Angeles, California (or any of its suburbs), who could teach me the operation of an Xmitter and the praxis of the code. As I have only Sunday to myself I cannot attend any evening schools, nor regular given courses for this purpose.

I would be more than glad to pay for this instruction and perhaps it would be a good way for a "ham" to get some side money for a bigger and better outfit. Correspondence for this purpose is cordially invited by

FRED GAMPERLE,
10907 Blix St.,
No. Hollywood, Calif.

(Now boys, do not all talk at once, particularly those who live around Hollywood. If we hear a loud noise over the short wave phone, coming from Hollywood, we will know that the reserves were called out to keep the road clear on Blix Street. It would seem that you should hear plenty from "hams" all around Los Angeles and it won't take long either.—Editor.)

SOON

Editor, Short Wave Craft:

I have been reading Short Wave Craft since the first issue, and think it's the best there is in the way of radio mags.

I would like to know if the S.W.P.H. has QSL cards, and if an ordinary steel-plated oath will do in place of the regular one. Why not publish a picture of M.U. Fips, unless you think it would disillusion too many readers.

My only suggestions are: Keep up the *ultra short wave* and *phone articles*. In my opinion Short Wave Craft is far superior to the old *Radio News*. Maybe its a punk idea, but I'd like a few tall tales like C. Sterling Gleason used to write.

I hope the readers of S.W.C. have decided to buy more and may your circulation never grow less.

Yours truly,
LUSGAN A. RODDY, Jr.,
R. F. D. No. 1, Twin Lakes Blvd.,
Tampa, Fla.

(Well Lusgan, we had the matter up again with Fips, and he is still monkeying around with that card of his. Frankly, we have an idea that he will never get it out, so the best thing to do is to go over his head and put it up to the readers to send in a few good designs for Q.S.L. Cards. If we get hold of a real good design, we will have those cards out in no time.—Editor.)

10,600 MILES ON 2 TUBES

Editor, Short Wave Craft:

Have enjoyed immensely the first year numbers of your magazine and appreciate the information and interest in them. The idea of a magazine specializing in one particular branch of radio is excellent. I have been a short wave listener for some time and well do I remember the triumph of holding PCJ (PCJJ it was then) from 1:30 A.M. to 5:20 A.M. on June 24th, 1927. I sent them eight pages of notes on that reception and received a reply stating it was the most complete report received at such a distance up till that time.

The distance is 10,600 miles and that on two tubes ("regen." detector and single stage; UX199's). I had heard KDKA on 63 meters as long ago as 3rd November, 1926, and was putting 2XAF on the speaker every other morning at breakfast time in May, 1927.

KANSAS SHINES

Here is a 17-year-old senior of the Baldwin, Kansas, high school, Karlton Marquard. After constructing his own station, young Marquard established communications with 17 foreign and 19 domestic stations, scattered in all parts of the world. Karlton has won second place in an international radio broadcasting and receiving contest for the second consecutive year. His station is placarded with cards representing stations in every corner of the globe.

So I ought to be thoroughly bitten by the "S-W bug". Many shapes and sizes of sets have been "rigged" and I'm not satisfied yet by any means. However I have a reasonably effective set under construction now as a result of my try-outs consisting of a S-grid radio stage, S grid detector and high gain pentode audio amplifier. Both radio and detector are fully tuned and extensive shielding is used. Heres hoping!

In Australia it is difficult to get satisfactory short wave parts of the size and condition required. The advertisements run in Short Wave Craft fairly make our mouths water! Alas we have to perform surgical operations on variable condensers as few are of suitable size. However, I have amassed a collection of material that gives me a fair choice.

Well, thank you for your magazine. I look forward to coming copies.

Yours sincerely,
JOHN W. CORPE,
1 Belle Vue Place,
Unley Park, So. Australia.

(We are always glad to receive letters from our foreign readers. When we see you pull 10,600 miles on a "two tuber", it makes us feel really good, and we are glad to be one of the means of bringing so many short wave fans together. Keep up the good work.—Editor.)

RANK!

Editor, Short Wave Craft:

In regard to your magazine, Short Wave Craft: If I had not received an advertisement from you telling about this magazine, I do not suppose I would ever had known about it, but I answered the add with my subscription as I knew I could put plenty of faith in the name of the publisher, and anything that he issued, and I want to say that no amount of praise can do justice to the quality of magazine that you put on the market.

I have been a member of the A.R.R.L. for a long time and have been receiving *QST* for the same length of time and although *QST* is as good as the best, *you sure rank with them all.*

I am glad to see a "mag." with your style of articles. Something that any amateur can understand without being an engineer or having degrees from about twenty colleges. Let me add my praise with the multitude of Hams and wish you and your "Mag." the best of success and keep the articles as they are. I have recommended this "Mag." to my Ham friends around here and think it will mean some more subscriptions to help the good old cause along.

Best 73's and C.U.L.
DEAN POWELL, W3VJ,
104 West London Ave.,
Salisbury, Md.

(At first we did not get you, Dean. When we saw the word "rank" we thought you applied it to us. We were glad to see that we were mistaken and thanks for the praise. Frankly speaking, however, we are getting fed up on all this praise. We would appreciate a first-class brick-bat.—Editor.)

OH! BOY! HE'S LOGGED 200 STATIONS!

Editor, Short Wave Craft:

Enjoy your articles very much. I have a Pilot Super-Wasp and have logged 200 stations. I have a wrinkle to give to the boys that are Super-Wasp owners. My '22 tube went bad, and wanting to keep up my code practice, I substituted a tube I rigged up. I used a '01A tube, wound about it 6 turns of copper wire, size No. 20 gauge, and let one end come to the top of the tube and fasten to the clip.

The tube gave the same signal strength as the '22; regeneration was harder to control, but it will work until a regular '22 tube can be purchased. I also wrapped tin-foil around the outside of a tube and fastened the clip to it (the tinfoil) with the same results.

Any of the fellows who try this and get results, I would appreciate hearing from with a card or letter. Would like to swap photos of receivers or transmitters. Would like to correspond with some one in California, Nevada, Oregon, Washington, Wyoming, New Mexico and Arizona. Also any foreign country.

Many thanks.

WENDELL SNYDER,
625 West Jefferson,
Kokomo, Indiana.

(That's a gosh darn good idea, Wendell, about tin-foil wrapped tubes. There really ought to be a patent of it and pretty soon they will be selling tin-foil wrapped tubes in the same manner as tin-foil wrapped cheese. However, joshing aside, one of the Short Wave Craft advertisers is selling a copper-plated tube, which we recommend heartily to the fraternity—maybe there is something to it. We would really like to hear from more "hams" who have tried them. Of course the whole idea boils down to an external plate, on which a great deal of experimentation was done during the radio "boom", but as far as we know, nothing much has been done as far as short waves are concerned. However the idea certainly deserves some additional try.—Editor.)

PHILLY HAMS

Editor, Short Wave Craft:

Will you please put the letter below in your magazine "Among the Hams."

Would like to hear from radio clubs in Phila. We are interested in joining one.

J. B. A. and A. M.,
915 N. Leithgow St.,
Phila., Pa.

P. S. Why not put S. W. C. out every month. I think this way would be much better.

Oblige,
JAMES B. ALEXANDER, JR.,
AARON MEZEY.

(Well, boys, you ought to hear from some Philly "Hams"—pronto! We know that there are some good clubs in Philadelphia that should be glad to take you up on their phone. Good luck to you.—Editor.)

(Continued on page 152)

Short-Wave Stations of the World

Meters	Kilocycles	
4.97-5.35	60,000-56,000	—**Amateur Telephony and Television.**
5.83	51,400	—**W2XBC**, New Brunswick, N. J.
6.89	43,500	—**W9XD**, Milwaukee, Wis. **Television.** Milwaukee Journal.
		—**W3XAD**, Camden, N. J. **Television.** (Other experimental television permits: 48,500 to 50,300 k.c., 43,000-46,000 k.c.)
		—**W1XG**, Boston, Mass.
		—**W2XBT**, New York.
7.05	42,530	—....Berlin, Germany. Tu. and Thu., 11:30-1:30 p.m. Telefunken Co.
7.32	41,000	—**W8XI**, East Pittsburgh, Penna.
7.58	39,560	—**PCJ**, Hilversum, Holland.
7.85	38,220	—....Eindhoven, Holland.
8.67	34,600	—**W2XBC**, New Brunswick, N. J.
9.68	31,000	—**W8XI**, Pittsburgh, Pa.
9.93	30,200	—**W6XD**, M. R. T. Co.
9.96	30,105	—....Golfo Aranci, Sardinia. Telephone to Rome.
10.51	29,190	—**PK313**, Sourabaya, Java, Wed. and Sat., 5:50-7:50 a.m.
10.79	27,800	—**W6XD**, Palo Alto, Calif. M. R. T. Co.
11.55	25,960	—**G5SW**, Chelmsford, England Experimental.
11.67	25,700	—**W2XBC**, New Brunswick, N. J.
		—**W3XA**, Philadelphia, Pa. Norden-Hauck El. Mfg. Co.
12.48	24,000	—**W6AQ**, San Mateo, Calif.
		(Several experimental stations are authorized to operate on non-exclusive waves of a series, both above this and down to 4 meters.)
13.04	23,000	—**W2XAW**, Schenectady, N. Y.
13.92	21,540	—**W8XK**, Pittsburgh, Pa.
13.97	21,469	—**W2XAL**, New York.
13.99	21,429	—**XFA**, Mexico City, Mex. (Authorized to broadcast at any higher frequency.)
14.00	21,420	—**W2XDJ**, Deal, N. J. And other experimental stations.
14.01	21,400	—**WLO**, Lawrence, N. J., transatlantic phone.
14.15	21,130	—**LSN**, Monte Grande, Argentina.
		—**W2XAO**, New Brunswick, N. J.
14.28	21,000	—**OKI**, Podebrady, Czechoslovakia.
14.47	20,710	—**LSY**, Monte Grande, Argentina. Telephony.
14.50	20,680	—**LSN**, Monte Grande, Argentina, after 10:30 p. m. Telephony with Europe.
		—**FMB**, Tamatave, Madagascar.
		—**FSR**, Paris-Saigon phone.
14.51	20,620	—**PMB**, Bandoeng, Java. After 4 a.m.
14.62	20,500	—**W9XF**, Chicago, Ill. (WENR).
14.89	20,140	—**DWG**, Nauen, Germany. Tests 10 a.m.—3 p.m.
15.03	19,950	—**LSG**, Monte Grande, Argentina. From 7 a.m. to 1 p.m. Telephony to Paris and Nauen (Berlin).
		—**DIH**, Nauen, Germany. Press (code) 6:15 a.m., English; 8:30 a.m. and 11 a.m., French, daily. 8:30 a.m. Sundays, French.
15.07	19,906	—**LSG**, Monte Grande, Argentina. 8-10 a.m.
15.10	19,850	—**WMI**, Deal, N. J.
15.12	19,830	—**FTD**, St. Assise, France.
15.20	19,720	—**EAQ**, Madrid, Spain.
15.40	19,460	—**FZU**, Tamatave, Madagascar.
15.45	19,400	—**FRO, FRE**, St. Assise, France.
15.50	19,350	—....Nancy, France, 4 to 5 p.m.
		—**VK2ME**, Sydney, Australia.
15.55	19,300	—**FTM**, St. Assise, France. 10 a.m. to noon.
		—**PPU**, Rio de Janeiro, Brazil.
15.58	19,240	—**DFA**, Nauen, Germany.
15.60	19,220	—**WNC**, Deal, N. J.
15.94	18,820	—**PLE**, Bandoeng, Java. 5:40-6:40 a.m. and from 2:40 a.m. Tues. and Fri.; 8:40-10:40 a.m. Tues. Also telephony.
16.10	18,620	—**GBJ**, Bodmin, England. Telephony with Montreal.
16.11	18,610	—**GBU**, Rugby, England.
16.30	18,400	—**PCK**, Kootwijk, Holland. Daily from 1 to 6:30 a.m.
16.35	18,350	—**WND**, Deal Beach, N. J. Transatlantic telephony.
16.38	18,310	—**GBS**, Rugby, England. Telephony with New York. General Postoffice, London.
		—**FZS**, Saigon, Indo-China, 1 to 3 p.m. Sundays.
16.44	18,210	—**FRO, FRE**, Ste. Assise, France.
16.50	18,170	—**CGA**, Drummondville, Quebec, Canada. Telephony to England. Canadian Marconi Co.
16.52	18,150	—**PMC**, Bandoeng, Java.
16.54	18,130	—**GBW**, Rugby, England.
16.57	18,120	—**GBK**, Bodmin, England.
		—**W9XAA**, Chicago, Ill. Testing, mornings.
16.61	18,050	—**KQJ**, Bolinas, Calif.
16.70	17,950	—**FZU**, Tamatave, Madagascar.
16.80	17,850	—**PLF**, Bandoeng, Java ("Radio Malabar").
		—**W2XAO**, New Brunswick, N. J.
16.82	17,830	—**PCV**, Kootwijk, Holland. 3 to 9 a.m.
16.87	17,780	—**W8XK**, Pittsburgh, Pa.
16.90	17,750	—**HSIPJ**, Bangkok, Siam. 7-9:30 a.m., 1-3 p.m. Sundays.
17.00	17,640	—**Ship Phones** to Shore: **WSBN**, "Leviathan"; **GFWV**, "Majestic"; **GLSQ**, "Olympic"; **GDLJ**, "Homeric"; **GMJQ**, "Belgenland"; work on this and higher channels.
17.25	17,380	—**JIAA**, Tokio, Japan.
17.34	17,300	—**W2XK**, Schenectady, N. Y. Tues., Thurs., Sat. 12 to 5 p.m. General Electric Co.
		—**W8XL**, Dayton, Ohio.
		—**W6XAJ**, Oakland, Calif.
		—**W7XA**, Portland, Ore.
		—**W7XC**, Seattle, Wash.
		—**W2XCU**, Ampere, N. J.
		—**W9XL**, Anoka, Minn., and other experimental stations.
		—**VE9AD**, Glace Bay, N. S., Canada.
17.52	17,110	—**WOO**, Deal, N. J. Transatlantic phone.
		—**W2XDO**, Ocean Gate, N. J. A. T. & T. Co.
17.55	17,080	—**GBC**, Rugby, England.
18.37	16,320	—**VLK**, Sydney, Australia. Phone to England.
18.40	16,300	—**PCL**, Kootwijk, Holland. Works with Bandoeng from 7 a.m. Netherland State Telegraphs.
		—**WLO**, Lawrence, N. J.
18.50	16,200	—**FZR**, Saigon, Indo-China.
18.56	16,150	—**GBX**, Rugby England.
18.68	16,060	—**NAA**, Arlington, Va. Time signals, 11:57 to noon.

All Schedules Eastern Standard Time: Add 5 Hours for Greenwich Mean Time.

Meters	Kilocycles	
18.80	15,950	—**PLG**, Bandoeng, Java. Afternoons.
18.90	15,860	—**FTK**, St. Assise, France. Telephony.
18.93	15,760	—**JIAA**, Tokio, Japan. Up to 10 a.m. Beam transmitter.
19.01	15,750	—....Chi-Hoa, Saigon, Indo China. Telephony.
19.50	15,375	—**F8BZ**. French phone to ships.
19.56	15,340	—**W2XAD**, Schenectady, N. Y. Broadcasts 3-6 p.m.; Sun., 1-6 p.m.; relaying WGY.
19.60	15,300	—**OXY**, Lyngby, Denmark, Experimental.
19.63	15,280	—**W2XE**, Jamaica, N. Y.
19.66	15,250	—**W2XAL**, New York, N. Y.
		—**W6XAL**, Westminster, Calif.
19.72	15,210	—**W8XK** (KDKA), Pittsburgh, Pa. Tues., Thurs., Sat., Sun., 8 a.m. to noon.
19.83	15,120	—**HVJI**, Vatican City (Rome, Italy), 4-4:30 a.m.
19.86	15,080	—**FYA**, Pontoise (Paris), France.
19.99	15,000	—**CM6XJ**, Central Tuinucu, Cuba.
		—**LSJ**, Monte Grande, Argentina.
		—**VK6AG**, Perth, West Australia.
20.50	14,620	—**WMI**, Deal, N. J.
		—**XDA**, Mexico City, 2:30-3 p.m.
20.70	14,480	—**W8XK**, East Pittsburgh, Pa.
		—**GBW**, Rugby, England.
		—**WNC**, Deal, N. J.
20.80	14,420	—**VPD**, Suva, Fiji Islands.
20.90	14,340	—**G2NM**, Sonning-on-Thames, England. Sundays, 1:30-3 p.m.
20.97-21.26	14,300-14,100	—**Amateur Telephony.**
21.17	14,150	—**KKZ**, Bolinas, Calif.
21.50	13,940	—..., Bucharest, Roumania, 2-5 p.m., Wed., Sat.
21.59	13,890	—..., Mombasa, East Africa.
22.20	13,500	—...., Vienna, Austria.
22.38	13,400	—**WND**, Deal Beach, N. J. Transatlantic telephony.
22.68	13,220	—**Ship Phones.**
23.00	13,013	—**OBE**, La Punta, Peru. Time signals 2 p.m.

(NOTE: This list is compiled from many sources, all of which are not in agreement, and which show greater or less discrepancies; in view of the fact that most schedules and many wavelengths are still in an experimental stage; that daylight time introduces confusion and that wavelengths are calculated differently in many schedules. In addition to this, one experimental station may operate on any of several wavelengths which are assigned to a group of stations in common. We shall be glad to receive later and more accurate information from broadcasters and other transmitting organizations, and from listeners who have authentic information as to calls, exact wavelengths and schedules. We cannot undertake to answer readers who inquire as to the identity of unknown stations heard, as that is a matter of guesswork: in addition to this, the harmonics of many local long-wave stations can be heard in a short-wave receiver.—EDITOR.)

Meters	Kilocycles	
23.35	12,850	—**W2XO**, Schenectady, N. Y. Antipodal program 9 p.m. Mon. to 3 a.m. Tues. Noon to 5 p.m. on Tues., Thurs. and Sat. General Electric Co.
		—**W2XCU**, Ampere, N. J.
		—**WOO**, Deal, N. J.
		—**W2XDO**, Ocean Gate, N. J.
		—**W9XL**, Anoka, Minn., and other experimental relay broadcasters.
23.38	12,820	....Rabat, Morocco. Sun., 7:30-9 a.m. Daily 5-7 a.m. Telephony.
23.46	12,780	—**GBC**, Rugby, England.
23.90	12,550	—**VBS**, Glace Bay, Nova Scotia, Canada.
23.98	12,500	—**CT3AQ**, Funchal, Madeira.
24.41	12,280	—**GBU**, Rugby, England.
24.46	12,250	—**FTN**, Ste. Assise (Paris), France. Works Buenos Aires, Indo-China and Java. On 9 a.m. to 1 p.m. and other hours.
		—**GBS**, Rugby, England.
		—**PLM**, Bandoeng, Java. 7:45 a.m.
24.63	12,280	—**Airplane.**
24.68	12,150	—**GBS**, Rugby, England. Transatlantic phone to Deal, N. J. (New York).
		—**FQO, FQE**, Ste. Assise, France.
24.80	12,090	—....Tokio, Japan, 5-8 a.m.
24.80	12,090	—....Trieste, Italy.
24.89	12,045	—**NAA**, Arlington, Va. Time signals, 11:57 to noon.
		—**NSS**, Annapolis, Md. Time signals, 9:57-10 p.m.
24.98	12,000	—**FZG**, Saigon, Indo-China. Time signals, 2-2:05 p.m.
		—....Oporto, Portugal.
25.10	11,945	—**KKQ**, Bolinas, Calif.
25.16	11,920	—**FYA**, Pontoise, France. Variable beams to French Colonies.
25.24	11,880	—**W8XK** (KDKA), Pittsburgh, Pa. Tues., Thurs., Sat., Sun., 11 a.m.-4 p.m., and Sat. night Arctic programs. Television, Mon. and Fri., 2:30 p.m., 60 lines, 1200 r.p.m.
		—**W9XF**, Chicago (WENR).
		—**W2XAL**, New York (WRNY).
25.26	11,870	—**VUC**, Calcutta, India. 9:45-10:45 p.m.; 8-9 a.m.
25.30	11,860	—**VE9CA**, Calgary, Alta.
25.34	11,840	—**W2XE**, Jamaica, New York (WABC).
		—**W9XAA**, Chicago, Ill. 7-8 a.m., 1-2, 4-5:30, 6-7:30 p.m.
25.42	11,800	—**UOR2**, Vienna, Austria. Tues., 9-11 a.m.; Wed., 5-7 p.m.; Thurs., 5-7 a.m.
		—**W2XAL**, New York.
		—**W9XF**, Chicago.

Meters	Kilocycles	
25.42	11,800	—**PK6KZ**, Macassar, Celebes.
		—**I2RO**, Rome, Italy. Also relays Naples. 1:30-5:30 p.m.
25.47	11,780	—**VE9DR**, Drummondville, Quebec, Canada.
		—....Chi-Hoa, Saigon. Telephony.
25.50	11,760	—**XDA**, Mexico City.
25.53	11,750	—**G5SW**, Chelmsford, England. 6:30-7:30 a.m. and 1-6 p.m. except Saturdays and Sundays.
25.58	11,720	—**CJRX**, Middlechurch, Man., Canada.
25.63	11,690	—**FYA**, Pontoise, France. Intercolonial broadcasting.
25.68	11,670	—**KIO**, Kahuhu, Hawaii.
26.00	11,530	—**CGA**, Drummondville, Canada.
26.10	11,490	—**GBK**, Bodmin, England.
26.22	11,435	—**DHC**, Nauen, Germany.
26.60	11,280	—**ONIBDK**, Brussels, Belgium.
26.70	11,230	—**IBDK**, S.S. "Elettra," Marconi's yacht.
27.30	10,980	—**ZLW**, Wellington, N. Z. Tests 3-8 a.m.
27.75	10,800	—**GBX**, Rugby, England.
28.00	10,710	—**CTIBO**, Lisbon, Portugal.
		—....Casablanca, Morocco.
28.20	10,630	—**PLR**, Bandoeng, Java. Works with Holland and France weekdays from 7 a.m.; sometimes after 9:30.
28.44	10,540	—**WLO**, Lawrence, N. J.
28.50	10,510	—**RDRL**, Leningrad, U.S.S.R. (Russia).
		—**VLK**, Sydney, Australia. 1-7 a.m.
28.80	10,410	—**PDK**, Kootwijk, Holland.
		—**KEZ**, Bolinas, Calif.
28.86	10,390	—**GBX**, Rugby, England.
28.97	10,350	—**LSX**, Buenos Aires, Argentina. 7-9 p.m. Transradio Internacional, San Martin 329, Buenos Aires.
29.00	10,340	—....Paris, France. 1:30-3 p.m. daily; 9 a.m. Sundays.
29.50	10,160	—**HS2PJ**, Bangkok, Siam. Monday, 8-11 p.m.
29.54	10,150	—**DIS**, Nauen, Germany. Press (code) daily: 6 p.m., Spanish; 7 p.m., English; 7:50 p.m., German; 2:30 p.m., English; 5 p.m., German. Sundays: 6 p.m., Spanish; 7:50 p.m., German; 9:30 p.m., Spanish.
29.98	10,000	—**CM2LA**, Havana, Cuba.
		—....Belgrade, Jugoslavia. Monday 3-4 p.m.
30.15	9,910	—**GBU**, Rugby, England.
30.20	9,930	—**W2XU**, Long Island City, New York.
		—....Posen, Poland.
30.30	9,890	—**LSN**, Buenos Aires, phone to Europe.
		—**EAQ**, Madrid, Spain.
30.50	9,830	—**TI4NRH**, Heredia, Costa Rica. 10-11 p.m. Amando Cespedes Maria, Apartado 40.
30.57	9,810	—**LSOR**, Buenos Aires, Argentina.
30.64	9,790	—**GBW**, Rugby, England.
30.75	9,750	—....Agen, France. Tues. and Fri., 3 to 4:15 p.m.
		—**WNC**, Deal, N. J.
30.90	9,700	—**WMI**, Deal, N. J.
31.10	9,640	—....Monte Grande, Argentina, works Nauen irregularly after 10:30 p.m.
		—**VVB**, Bombay, India. Testing.
31.23	9,600	—**LGN**, Bergen, Norway.
31.26	9,590	—**PCJ**, Hilversum (Eindhoven), Holland. Wed. 11 a.m.-3 p.m., Thurs. 9 a.m.-1 p.m., 5-9 p.m., Fri. 1-3, 8 p.m., Sat. 2 a.m. Philips Radio.
31.30	9,580	—**W3XAU**, Byberry, Pa., relays WCAU daily.
		—**VK2ME**, Sydney, Australia.
		—**VPD**, Suva, Fiji Islands.
31.33	9,570	—**W1XAZ**, Springfield, Mass. (WBZ). 6 a.m.-10 p.m. daily. Westinghouse Elec. & Mfg. Co.
		—**SR1**, Poznan, Poland. Tues. 1:45-4:45 p.m., Thurs. 1:30-8 p.m.
31.36	9,560	—....Konigswusterhausen, Germany, 10 to 11 a.m., 11:30 a.m. to 2:30 p.m., and 3 to 7:30 or 8:30 p.m. Relays Berlin.
		—**NAA**, Arlington, Va.
		—**ZL2XX**, Wellington, New Zealand.
31.48	9,530	—**W2XAF**, Schenectady, New York, 5-11 p.m.
		—**W9XA**, Denver, Colorado. Relays KOA.
		—....Helsingfors, Finland.
31.49	9,520	—**OXY**, Skamleboek, Denmark. 1 p.m. daily. Relays Copenhagen. Sunday 2-3. (Medical ship telephone service, also from Thorshavn, Faroe Islands, and Julianehaab, Greenland.
31.56	9,500	—**OZ7RL**, Copenhagen, Denmark. Around 7 p.m.
		—**VK3ME**, Melbourne, Australia. Wed. and Sat. 5-7:30 a.m. Amalgamated Wireless, 47 York St., Sydney, Australia.
31.70	9,460	—...Radio Club of Buenos Aires, Argentina.
31.75	9,450	—....Rio de Janeiro, Brazil. 5:30-7:30 p.m.
32.00	9,375	—**EH90C**, Berne, Switzerland. 3-5:30 p.m.
		—**OZ7MK**, Copenhagen, Denmark. Irregular after 7 p.m.
		—**3UZ**, Melbourne, Australia.
		—**W8XAO**, Detroit, Mich.
32.06	9,350	—**CM2MK**, Havana, Cuba.
32.13	9,330	—**CGA**, Drummondville, Canada.
32.21	9,310	—**GBC**, Rugby, England. Sundays, 2:30-5 p.m.
32.26	9,290	—....Rabat, Morocco. 3-5 p.m. Sunday, and irregularly weekdays.
32.40	9,250	—**GBK**, Bodmin, England.
32.50	9,230	—**FL**, Paris, France (Eiffel Tower). Time signals 4:56 a.m. and 4:56 p.m.
		—**VK2BL**, Sydney, Australia.
32.59	9,200	—**GBS**, Rugby, England. Transatlantic phone.
32.80	9,110	—**SUS**, Cairo, Egypt.
33.00	9,091	—**XFD**, Mexico City, Mex.
33.26	9,010	—**GBS**, Rugby, England.
33.81	8,872	—**NPO**, Cavite (Manila), Philippine Islands. Time signals 9:55-10 p.m.
		—**NAA**, Arlington, Va. Time signals 9:57-10 p.m., 2:57-3 p.m.
33.95	8,830	—**Ship Phones.**
33.98	8,810	—**WSBN**, S.S. "Leviathan."
34.00	8,820	—**VK3UZ**, Melbourne, Australia. Mon., Wed., 3-5 a.m.
34.50	8,690	—**W2XAC**, Schenectady, New York.
		—**ZPZ**, Asuncion, Paraguay.
34.68	8,650	—**W2XCU**, Ampere, N. J.
		—**W9XL**, Chicago.

(Continued on opposite page)

Short-Wave Stations — When to Listen

(Continued from opposite page)

Meters Kilo-cycles

34.68 8,650—**W3XE**, Baltimore, Md. 12:15-1:15 p.m., 10:15-11:15 p.m.
—**W2XV**, Long Island City, N. Y.
—**W8XAG**, Dayton, Ohio.
—**W6XN**, Oakland.
—**W4XG**, Miami, Fla.
—**W3XX**, Washington, D. C.
—And other experimental stations.
34.74 8,630—**WOO**, Deal, N. J.
—**W2XDO**, Ocean Gate, N. J.
35.00 8,570—**RB15**, Khabarovsk, Siberia. 5-7:30 a.m.
—**HC2JM**, Guayaquil, Ecuador.
35.50 8,450—**PRAG**, Porto Alegre, Brazil. 8:30-9:00 a.m.
35.70 8,400—**VBS**, Glace Bay, N. S., Canada.
36.00 8,330—**3KAA**, Leningrad, Russia. 2-6 a.m., Mon., Tues., Thurs., Fri.
36.74 8,160—....Mombasa, East Africa.
36.92 8,120—**PLW**, Bandoeng, Java.
37.02 8,100—**EATH**, Vienna, Austria. Mon. and Thurs., 5:30 to 7 p.m.
—**JIAA**, Tokyo, Japan. Tests 5-8 a.m.
—**HS4PJ**, Bangkok, Siam. Sunday 8-10 a.m.
37.43 8,015—**Airplanes.**
37.65 7,980—**VK2ME**, Sydney, Australia.
37.80 7,930—**DOA**, Doeberitz, Germany. 1 to 3 p.m. Reichpostzentralamt, Berlin.
38.00 7,890—**VPD**, Suva, Fiji Islands.
—**JIAA**, Tokio, Japan (Testing).
38.30 7,830—**PDV**, Kootwijk, Holland, after 9 a.m.
38.60 7,770—**FTF**, Ste. Assise, France.
—**PCK**, Kootwijk, Holland. 9 a.m. to 7 p.m.
39.15 7,660—**FTL**, Ste. Assise.
39.40 7,610—**HKF**, Bogota, Colombia. 6-10 p.m.
39.74 7,520—**CGE**, Calgary, Canada. Testing, Tues., Thu.
39.80 7,530—..."El Prado," Riobamba, Ecuador. Tues., Thurs., 9-11 p.m.
40.00 7,500—...."Radio-Touraine," France.
40.20 7,460—**YR**, Lyons, France. Daily except Sun., 10:30 to 1:30 a.m.
40.50 7,410—....Eberswalde, Germany. Mon., Thurs., 1-2 p.m.
—**ZTD**, Durban, So. Africa.
40.70 7,370—**X26A**, Nuevo Laredo, Mexico. 9-10 a.m.; 11 a.m.-noon; 1-2; 4-5; 7-8 p.m. Tests after midnight. I.S.W.C. programs 11 p.m. Wed. A.P. 31.
40.72 7,360—**FYA**, Vincennes (Paris), France. Federation Nationale de Radiofusion Coloniale.
41.00 7,310—....Paris, France ("Radio Vitus") Tests.
—....Moscow, USSR. 7-7:45 a.m.
41.46 7,230—**DOA**, Doeberitz, Germany.
41.50 7,220—**HB9D**, Zurich, Switzerland. 1st and 3rd Sundays at 7 a.m., 2 p.m.
41.58 7,210—**EAR58**, Canary Islands (Spain). 7-9 p.m.
41.67 7,195—**VSIAB**, Singapore, S. S. Mo., Wed. and Fri., 9:30-11 a.m.
42.00 7,140—**HKX**, Bogota, Colombia.
42.12 7,120—**OZ7RL**, Copenhagen, Denmark. Irregular. Around 7 p.m.
42.50 7,060—....Liakov Islands (north of Siberia).
—**XFA**, Mexico City, Mex.
42.70 7,020—**EAR125**, Madrid, Spain. 6-7 p.m.
42.90 6,990—**CTIAA**, Lisbon, Portugal. Fridays, 5-7 p.m.
43.00 6,980—**EAR110**, Madrid, Spain. Tues. and Sat., 5:30 to 7 p.m.; Fri., 7 to 8 p.m.
—....Binche, Belgium. 2-4 p.m.
43.50 6,900—**IMA**, Rome, Italy. Sun., noon to 2:30 p.m.
43.60 6,875—**F8MC**, Casablanca, Morocco. Sun., Tues., Wed., Sat.
—**D4AFF**, Coethen, Germany. Sundays, 4-6 a.m.; Tuesdays, Fridays, noon to 2 p.m.; Thursdays, 4-6 p.m.
43.70 6,860—**KEL**, Bolinas, Calif.
—**Radio Vitus**, Paris, France. 4-11 a.m., 3 p.m.
44.40 6,753—**WND**, Deal, N. J.
—**XFD**, Mexico City, Mex.
44.99 6,660—**F8KR**, Constantine, Algeria. Mo., Fri., 5 p.m.
45.00 6,600—....Berlin, Germany.
46.05 6,515—**WOO**, Deal, N. J.
—**W4XG**, Miami, Fla.
46.60 6,430—**REN**, Moscow, U.S.S.R. Tues., Thurs. and Sat., 6-7 a.m.
46.70 6,425—**W2XCU**, Ampere, N. J.
—**W9XL**, Anoka, Minn.
—**W3XAL**, Bound Brook, N. J. Testing. And others.
47.00 6,380—**CT3AG**, Funchal, Madeira Island. Thursday, Sunday.
—**HCIDR**, Quito, Ecuador. 8-11 p.m.
47.35 6,335—**W10XZ**, **Airplane Television.**
—**VE9AP**, Drummondville, Canada.
—**CN8MC**, Casablanca, Morocco. Mon. 3-4 p.m., Tues. 7-8 a.m., 3-4 p.m. Relays Rabat.
47.77 6,280—....Strasbourg, France (?)
—**WWV**, Bureau of Standards, Washington, D. C. Tuesdays, 2-4, 10-12 p.m. Standard Frequency Code.
47.81 6,270—**HKC**, Bogota, Colombia. 8:30-11:30 p.m.
48.00 6,250—**HKA**, Barranquilla, Colombia. 8-10 p.m. ex. Mo., Wed., Fri.
48.62 6,170—**HRB**, Tegucigalpa, Honduras. 5-6, 9-12 p.m., Mon., Wed., Fri., Sat. Int. S. W. Club program. Sat., 11:30-12 p.m.
—**X1F**, Mexico City, Mex.
48.74 6,155—**W9XAL**, Chicago, Ill. (WMAC), and Airplanes.
—**VE9CL**, Winnipeg, Canada. 5:30-11 p.m.
—**W2XDE**, Bell Telephone Laboratories, New York.
48.83 6,140—**W8XK**, East Pittsburgh, Pa. Tues., Thurs., Sat., Sun., 5 p.m. to midnight.
48.99 6,120—....Motala, Sweden, "Rundradio." 6:30-7 a.m., 11-4:30 p.m. Holidays, 5 a.m. to 5 p.m.
—**F3ICD**, Chi-Hoa (Saigon), Indo-China. 6:30-10 a.m.
—....Moscow, U.S.S.R., 4-5 p.m.
—**W2XE**, New York City. Relays WABC 6:30 a.m. through to 1 a.m. through to 1 a.m.; Sundays 7 a.m. to midnight. 1 a.m.; Sundays 7 a.m. to midnight.
—**FL**, Eiffel Tower, Paris. 5:30-5:45 a.m., 5:45-12:30, 4:15-4:45 p.m.
—....Toulouse, France. Sunday 2:30-4 p.m.
—**EAR25**, Barcelona, Spain. 3-4 p.m.

Meters Kilo-cycles

49.10 6,110—**VE9CG**, Calgary, Alta., Canada.
49.15 6,100—**W3XAL**, Bound Brook, N. J. 4-5 p.m., 10 p.m.-midnight, except Sundays, to 5:45 p.m. Mondays. (WJZ, New York.)
—**VE9CF**, Halifax, N. S., Canada. 6-10 p.m., Tu., Thu., Fri.
49.17 6,095—**VE9GW**, Bowmanville, Ontario, Canada. Daily, 6:45-10 a.m., 3 p.m.-midnight. Sundays, 12:30-11:15 p.m. Gooderham & Worts, Ltd.
—**WSEA**, Submarine "Nautilus," Wilkins Polar Expedition.
49.26 6,090—....Copenhagen, Denmark.
49.31 6,080—**W2XCX**, Newark, N. J. Relays WOR.
—**W9XAA**, Chicago, Ill. (WCFL). 6-7 a.m., 7-8 p.m., 9:30-10:15, 11-12 p.m. Int. S.-W. Club programs. From 10 p.m. Saturday to 6 a.m. Sunday.
—**W6XAL**, Westminster, Calif.
—**HS2PJ**, Bangkok, Siam. 6-6:30 a.m.
49.40 6,070—**UOR2**, Vienna, Austria. 5-7 a.m., 5-7 p.m., Tues. and Sat.; 9-10 a.m., Thurs.
—**VE9CS**, Vancouver, B. C., Canada. Fridays before 1:30 a.m. Sundays, 2 and 10:30 p.m.
—....Johannesburg, So. Africa, 10:30 a.m.-3:30 p.m.
49.46 6,065—**SAJ**, Motala, Sweden. 6:30-7 a.m., 11 a.m. to 4:30 p.m.
49.50 6,060—**W8XAL**, Cincinnati, Ohio. Relays WLW. 6:30-10 a.m., 1-3 p.m., 6 p.m. to 2 a.m., daily. Sunday after 1 p.m.
—**ONVA**, Brussels, Belgium.
—**7LO**, Nairobi, Kenya, Africa. Mon., Wed., Fri., 10 a.m. to 1:30 p.m. From 10:30 Tuesday, Thursday, Sunday.
—**W3XAU**, Byberry, Pa. Relays WCAU.
49.59 6,050—**VE9CF**, Halifax, N. S., Canada.
49.67 6,040—**W9XAQ**, Chicago, Ill. (WMAQ).
—**W2XAL**, New York.
—**PK3AN**, Sourabaya, Java. 6-9 a.m.
49.75 6,030—**VE9CA**, Calgary, Alta., Canada.
49.80 6,020—**W9XF**, Chicago, Ill.
—**W2XBR**, New York, N. Y. (WBNY).
49.97 6,000—**ZL3ZC**, Christchurch, New Zealand. 10 p.m. to midnight, Tuesdays, Thursdays and Fridays.
—**HRB**, Tegucigalpa, Honduras. 9:15 p.m. to midnight, Mon., Wed., Fri. From 11 p.m. to midnight, Sat. Int. S. W. Club programs.
—**EAJ25**, Barcelona, Spain. Sat., 3-4 p.m.
—**RFN**, Moscow, Russia. Tues., Thurs., Sat., 8-9 a.m.

"HAMS" PLEASE NOTE

At the suggestion of one of our readers, beginning with this issue we will publish advertisements of radio experimenters, Hams, and all others who wish to swap or exchange used radio material. Such advertisements will be published in the classified section, and the rate will be 2c. a word (including address, city, etc.). This will provide a market-place for all.

—Eiffel Tower, Paris, France. Testing, 6:30 to 6:45 a.m., 1:15 to 1:30, 5:15 to 5:45 p.m., around this wave.
—**PK2AF**, Djokjakarta, Java.
—**VE9CU**, Calgary, Canada.
—....Bucharest, Rumania.
50.23 5,970—**HVJ**, Vatican City (Rome). 1-1:30 p.m.
50.80 5,900—**HKE**, Medellin, Colombia. 8-11 p.m.
51.22 5,860—**XDA**, Mexico City. 10-11 p.m.
51.40 5,835—**HKD**, Barranquilla, Colombia. 7:45-10:30 p.m. Mon., Wed., Sat.; 2-4, 7:45-8:30 p.m. Sunday. Elias J. Pellet.
52.00 5,770—**AFL**, Bergedorf, Germany.
—**HIX**, Santo Domingo, R. D. 9 a.m. Sundays.
52.50 5,710—**VE9CL**, Winnipeg, Canada.
52.72-54.44 5,600-5,510—**Aircraft.**
54.02 5,550—**W8XJ**, Columbus, Ohio.
54.51 5,500—**W2XBH**, Brooklyn, New York City (WBBC, WCGU).
58.00 5,170—**OKIMPT**, Prague, Czechoslovakia. 1-3:30 p.m., Tues. and Fri.
—**PMY**, Bandoeng, Java.
—**PMB**, Sourabaya, Java.
59.96 5,000—....Bratislava, Czechoslovakia.
60.26 4,975—**GBC**, Rugby, England.
60.30 4,975—**W2XAV**, Long Island City, N. Y.
60.90 4,920—**LL**, Paris, France.
61.22-62.50 4,800-4,900—**Television.**
—**W8XK**, Pittsburgh, Pa.
—**WIXAY**, Lexington, Mass.
—**W2XBU**, Beacon, N. Y.
—**WENR**, Chicago, Ill.
62.50 4,800—**W2XV**, Long Island City, N. Y.
62.56 4,795—**W9XAM**, Elgin, Ill. (Time signals.)
—**W3XZ**, Washington, D. C.
—**WSXDD**, portable. Bell Telephone Laboratories, New York.
—**W9XL**, Chicago, Ill.
62.69 4,785—**Aircraft.**
—And other experimental stations.
—**VZA**, Drummondville, Canada.
62.80 4,770—**ZL2XX**, Wellington, New Zealand.
63.00 4,760—**Radio LL**, Paris, France.
63.13 4,750—**WOO**, Deal, N. J.
—**WXDO**, Ocean Gate, N. J.
63.79 4,700—**WIXAB**, Portland, Me.
65.00 4,610—**HIX**, Santo Domingo, R. D.
65.22-66.67 4,500-4,600—**Television.**
—**W6XC**, Los Angeles, Calif.
67.65 4,430—**DOA**, Doeberitz, Germany. 6-7 p.m., 2-3 p.m., Mon., Wed., Fri.
70.00 4,280—**OHK2**, Vienna, Austria. Sundays, first 15 minutes of hour from 1 to 7 p.m.
—**HC2JM**, Guayaquil, Ecuador.

Meters Kilo-cycles

70.20 4,273—**RB15**, Khabarovsk, Siberia. 4-7 a.m.
—**GDLJ**, S.S. "Homeric."
71.77-72.98 4,180-4,100—**Aircraft.**
71.82 4,175—**Ship Phones.**
72.87 4,116—**WOO**, Deal, N. J.
74.72 4,105—**NAA**, Arlington, Va. Time signals, 9:57-10 p.m., 11:57 a.m. to noon.
—**PKIAA**, Weltevraden, Java.
80.00 3,750—**F8KR**, Constantine, Tunis, Africa. Mon. and Fri.
—**I3RO** (Prato Smeraldo), Rome, Italy.
—....Turin, Italy.
82.90 3,620—**DOA**, Doeberitz, Germany. (Television.)
83.73 3,583—**G2NM**, Sonning-on-Thames, England. 5 a.m. Sunday.
84.24 3,560—**OZ7RL**, Copenhagen, Denmark. Tues. and Fri. after 6 p.m.
84.46-85.66 3,550-3,500—**Amateur Telephony.**
86.50-86.00 3,490-3,460—**Aircraft.**
92.50 3,256—**W9XL**, Chicago, Ill.
—**W2XDD**, portable.
—And other experimental stations.
92.5-94.9 3,244-3,160—**KFR**, **WJE**, City of Seattle, Wash., Light Dept.
94.20 3,184—**KQS**, **KQT**, City of Los Angeles, Calif., Water Dept.
95.00 3,156—**PK2AG**, Samarang, Java.
95.48-97.71 3,142-3,070—**Aircraft.**
96.03 3,124—**WOO**, Deal, N. J.
97.15 3,088—**W10XZ**, **Airplane Television.**
97.53 3,076—**W9XL**, Chicago, Ill.
98.95 3,030—....Motala, Sweden. 11:30 a.m.-noon, 4-10 p.m.
—**VE9AR**, Saskatoon, Sask., Canada.
101.7 to 105.3 meters—2,850 to 2,950 kc. **Television.**
—**WIXAV**, Boston, Mass. 1-2, 7:30 p.m. daily ex. Sun. 48- and 60-lines. Works with WIXAU 10-11 p.m. Shortwave & Television Corp.
—**W2XR**, Long Island City, N. Y. 48- and 60-line, alternately. 4 to 10 p.m. exc. Sundays. Silent 7-7:30 Sat. Radio Pictures, Inc.
—**W9XR**, Chicago, Ill. (24 lines).
—**VE9AR**, Saskatoon, Sask., Canada.
104.4 2,870—....Milan, Italy. After 2 p.m.
105.0 2,855—**WIXY**, Tilton, N. H.
105.9 2,833—**W6XAN**, Los Angeles, Calif.
—**W7XAB**, Spokane, Wash.
—**W2XAO**, Yacht "MU-1," New York.
—**VE9AK**, Red Deer, Alberta, Canada.
105.3 to 109.1 meters—2,750 to 2,850 kc. **Television.**
—**W2XAB**, New York City. Atlantic Broadcasting Corp. (60 lines).
—**W2XBO**, Long Island City, N. Y.
—**W9XAA**, Chicago, Ill.
—**W9XG**, West Lafayette, Ind.
—**VE9BZ**, Vancouver, B. C., Canada.
108.8 2,758—**VE9CI**, London, Ont., Canada.
110.2 2,722—**Aircraft.**
112.1 2,938—**W6XAF**, Sacramento, Calif. State Dept. of Agriculture.
121.5 2,470—**Police and Fire Departments.**
—**KGOZ**, Cedar Rapids, Ia. — **WRDQ**, Toledo, Ohio.
122.0 2,458—**WPDG**, Youngstown, Ohio
122.3 2,452—**WRBH**, Cleveland, O. — **KGPP**, Portland, Ore.
—**WPDK**, Milwaukee, Wis. — **KGPH**, Oklahoma City, Okla.
123.0 2,440—**WPDF**, Flint, Mich. — **WNDA**, Miami, Fla. — **WPDP**, Philadelphia, Pa.
—**WPDM**, St. Petersburg, Fla. — **WPDL**, Lansing, Mich.
—**W3XB**, Portable.
123.9 2,422—**WMJ**, Buffalo, N. Y. — **KGPE**, Kansas City, Mo. (Mo. State).
124.2 2,416—**WPDI**, Columbus, O. — **WPDE**, Louisville, Kentucky.
—**KGPB**, Minneapolis, Minn. — **WPDJ**, Passaic, N. J.
—**WPDS**, St. Paul, Minn. — **WPDA**, Tulare, Calif.
124.5 2,410—**WCK**, **WRDR**, **WMO**, Detroit (Belle Isle, Grosse Pointe, Highland Park, Mich.
—**WPDW**, Washington, D. C.
—**KGPD**, San Francisco, Calif.
—**KGPG**, Vallejo, Calif. Police Dept.
125.1 2,398—**W9XL**, Chicago, Ill.—**W2XCU**, Ampere, N. J.—And other experimental stations.
—**W2XAD**, **W2XAF**, Schenectady. — **WPDT**, Kokomo, Ind. Police Dept.
125.4 2,392—**W10XAL** and **W10XAO**, Portable. National Broadcasting Co.—**W2XCZ**, Portable. N.B.C.
128.0-129.0 —**Aircraft.**
129.0 2,325—**W10XZ**, **Airplane Television.**
130.0 2,306—**DDDX**, S.S. "Bremen" and "Europa" testing.
135.0 2,220—....Stockholm, Sweden.
—....Oslo, Norway.
136.4 to 142.9 meters—2,100 to 2,200 kc. **Television.**
—**W2XBS**, New York, N. Y., 1,200 R.P.M., 60 lines deep, 72 wide. 2-5 p.m., 7-10 p.m. ex. Sundays. National Broadcasting Co.
—**W2XR**, Long Island City, N. Y. 48 and 60 line. 5-7 p.m. Radio Pictures, Inc.
—**W3XAD**, Camden, N. J. (60 lines).
—**W2XCW**, Schenectady, N. Y.
—**W3XAK**, Bound Brook, N. J. (Portable, 60 lines).
—**W8XAV**, Pittsburgh, Pa., 1,200 R.P.M., 60 holes, 1:30-2:30 p.m., Mon., Wed., Fri.
—**W9XAP**, Chicago, Ill. (45 lines).
142.9 to 150 meters—2,000 to 2,100 kc. **Television.**
—**W2XAP**, Jersey City, N. J.
—**W2XCR**, Jersey City, N. J. 8:10 p.m., Mon., Wed., Fri., 3-5 p.m.
—**W3XK**, Wheaton, Maryland. 7-9 p.m. ex. Sat., Sun. and holidays. Works with W3XJ 7-8 p.m.
—**W2XBU**, No. Beacon, N. Y. (1-2 p.m.)
—**W2XCD**, Passaic, N. J. 9-10 p.m. ex. Sun. Works with W2XCD.
—**W9XAO**, Chicago, Ill. (45 lines).

(Continued on page 151)

EXPERIMENTS With Simplified Remote Control

By

CLYDE A. RANDON

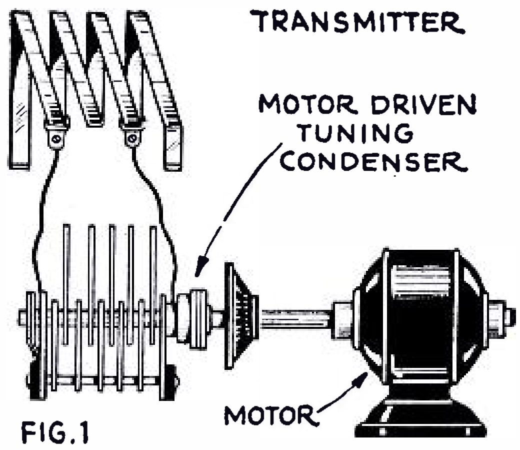


FIG.1

Fig. 1 — Diagram at left shows one method of applying a motor to tune a variable condenser for the purpose of remote control, the motor circuit being opened or closed by a control circuit running to any desired distance.

REMOTE control is of interest, not only to the transmitting amateur but also to those who like to try new stunts in connection with their short-wave receivers. In a sense, all radio experimenters are engineers; because they make practical application to their own sets of ideas which they find in SHORT WAVE CRAFT or which are suggested to them in the course of their experiments.

Not so long ago a radio amateur had a bright idea and made practical application of it. It went like this: the place where he kept his transmitter (called the "shack" in polite amateur language) became a little too cold during the winter evenings, to carry on properly (that is, without freezing one's fingers) his transmitting work. His purse was rather lean, too; so it was impracticable to install a heater in the transmitting station. This caused him to think (that's what gets results!). Of course, his first idea was one of remote control from the fireside in his home. But how? Unfortunately, one of these high-frequency brain heaters was not available at the time, since he was evidently using the apparatus for many other experiments. Difficulties seemed to overwhelm him at first, however.

Need For a Wave-Changer

In the rather narrow amateur bands there are a considerable number of stations and, during the "popular" hours, one frequently encounters interference when transmitting to foreign stations. Since the amateur bands are narrow, one can change wavelength with little difficulty and the possibility that the "sky wave" will still come in good at the other end. Thus a simple arrangement for changing wavelength is a great advantage.

Changing Wave Length at a Distance

Our bright young friend, whom we started to tell about, was well aware of the convenience and necessity of such a wave-changer. But how was he to change the wavelength of his transmitter from a distance? It hadn't been done before. There was the necessity. Into his head popped a bright idea—the invention itself?

Some inventions are of very little value because they work only on paper; this invention, however, was practical because all the equipment he needed, to build a "model", was available. The idea was to operate the key in the usual way (by means of a relay) but to drive the condenser in the oscillating circuit of his transmitter with a small motor fitted with a clever reducing gear. The reducing gear (taken from an old clock mechanism), allowed the motor to turn extremely slow, and thus accurately tune the condenser to any desired wavelength when the motor was turned on. Thus, when interference was found, the motor was started and allowed to run until the condenser tuned the transmitter to a favorable wavelength at which there was no interference. This arrangement is suggested in Fig. 1.

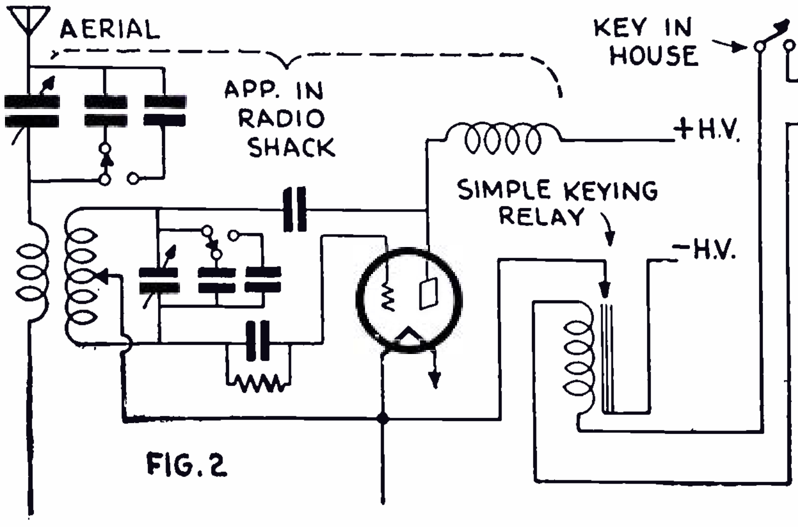


FIG.2

Fig. 2—At left, shows how magnetically controlled switches may change wavelength of a transmitter; also use of "Keying" relay.

The idea worked fine, and, naturally, like all good ideas, there was immediately a "run" on this amateur's shack by neighboring amateurs to discover how he did it. Undoubtedly, he didn't use much discretion; there is a possibility that he could have made a small fortune from the idea (if he could have patented it!). Soon the "good news" was all around the neighborhood and, via amateur radio, it was known all over the country. Even airplanes circled over his shack to see his antenna construction. However, he had not made the "hit" that he thought he had.

"Just a Fad," They Said

Notwithstanding the merits of his idea, it was used by only a few amateurs. One day he asked one of them over the air why it was that he hadn't adopted the idea, and was frankly told. The idea wasn't suitable for all-around use, because few amateurs have the necessary motor for the tuning control. However, a friend of this amateur had discovered a simpler way to accomplish the same desired result and our friend was willing to pass on the idea!

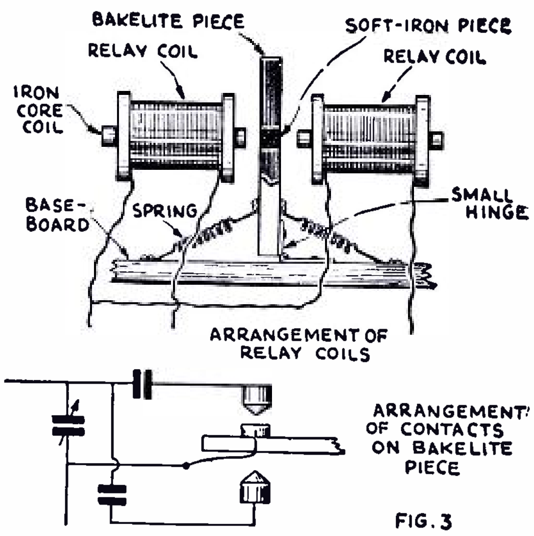


FIG.3

Fig. 3—Shows one suggested form of remote control relay, the relay being placed in the radio shack with the transmitting apparatus.

The idea is shown in Fig. 2. Small condensers are connected to both the aerial and oscillating circuit condensers; so that, by operation of a switch, the wavelength can be readily changed to predetermined values. All adjustments are made beforehand so that, when the switch is operated, both the oscillating circuit and the antenna are adjusted to

(*Continued on page* 143)

Short Wave Question Box

Edited by R. William Tanner, W8AD

Television Receiver Hook-up

Steve Rehak, Sharpsville, Pa.:

Q. (1) I would like a diagram of a television receiver using an '01A R.F. stage, '01A detector, and three-stage resistance-coupled amplifier with '71A tubes in parallel in power stage.

A. (1) The circuit you desire is given herewith. Use an '00A detector if possible; this will give greater sensitivity with a slight loss of the higher audio frequencies. The filter resistors and bypass condensers in the "B+" leads of the A.F., and detector will not be needed for batteries.

A. (1) Almost any value from 10 to 50 ohms will serve, since it is used only to prevent heating of the microphone.

Q. (2) What gauge of wire for the antenna and oscillator coils?

A. (2) No. 14 enamelled wire will do very nicely.

Q. (3) Would modulation of oscillator result in a broad wave?

A. (3) Modulation of an oscillator will ALWAYS produce an effect known to Amateurs as "wobbulation," which results in a broad wave.

Pentode for Transmitters

H. Covert, Beacon, N. Y., writes as follows:

Q. (1) Can the new power pentode be used as an output amplifier in a transmitter?

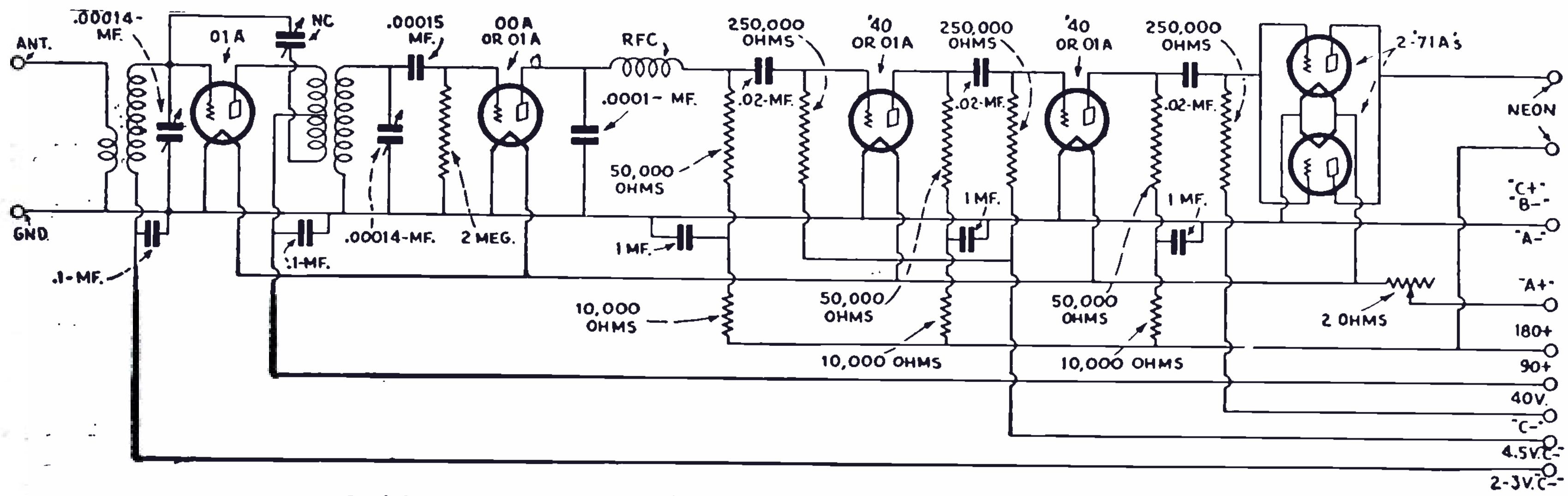
A. (1) This tube can, undoubtedly, be employed; but the power output will not be very high.

Q. (2) Can a dynatron oscillator be used as an oscillator in a transmitter?

A. (2) No. The output of a dynatron is extremely low.

Cure for "Motor-Boating"

Richard Clay, Indianapolis, Ind., asks:



Hook-up for television receiver, requested by Mr. Rehak, the audio amplifier being resistance coupled.

Neutralizing

B. Wearly, Warren, Ind., asks:

Q. (1) Would '50-type tubes require neutralizing in a transmitter?

A. (1) Yes.

Q. (2) What would be the output of three '50 tubes in parallel?

A. (2) I would not advise connecting these tubes in parallel, because of their low plate resistance.

Q. (3) Would it be permissible to connect a resistor in series with a modulator choke, to obtain the correct reactance?

A. (3) No!

Use of Counterpoise

J. B. A., Philadelphia, Pa., wants to know:

Q. (1) Is it possible to use a counterpoise with an inside antenna?

A. (1) Yes. The counterpoise will give about the same results as with a ground; it should have approximately the same length as the antenna.

Modulator Rheostat

Glenn Russell, Watertown, N. Y., desires the following information:

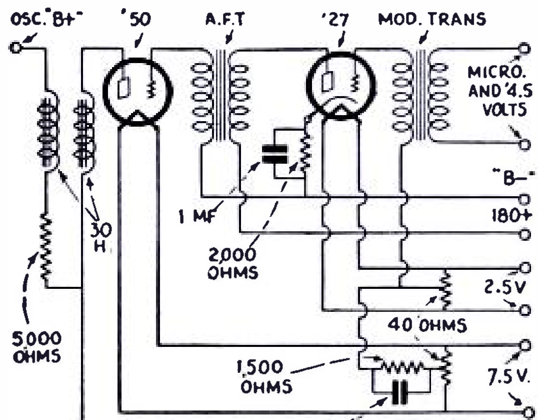
Q. (1) Size of rheostat mentioned for use in the modulator in the article "Efficient Hartley Oscillator" (April-May issue)?

Modulator and Speech Amplifier

Thaddeus Drogaski, Clairton, Pa., writes this department:

Q. (1) Will you publish a circuit for a low-power modulator and speech amplifier?

A. (1) The circuit is given herewith. You intend to employ a '10-type oscillator; therefore a '50 modulator will be required. The connection to the oscillator is clearly shown.



Mr. Drogaski asked for this circuit of a low-power modulator and speech amplifier. A potential of 4.5 volts is connected in series with the microphone.

Q. (1) What value of *bleeder resistor* should be used for a power transformer delivering 800 volts, center-tapped?

A. (1) A 10,000-ohm 25-watt "Truvolt" with sufficient sliding taps would be ideal. It would then be possible to obtain the exact voltages desired, by sliding the taps along the unit.

Q. (2) My broadcast set "motor-boats" when used with a super converter. How can this be cured?

A. (2) It will probably be necessary to add more bypass condensers across all the taps on the voltage divider.

Pilot Coils

Frank Joseph, Mineral Ridge, Ohio, inquires:

Q. (1) Can you give a circuit for a short-wave set using Pilot Super-Wasp coils?

A. (1) You are referred to the article "The Pilot A.C. Super-Wasp Receiver" (Page 42, June-July, 1930, issue of SHORT WAVE CRAFT.

Q. (2) Can a 25,000-ohm adjustable resistor be used in the power amplifier (Page 448, April-May issue).

A. (2) Yes, if the current rating is high enough; 50 milliamps being about right.

Short Wave Question Box

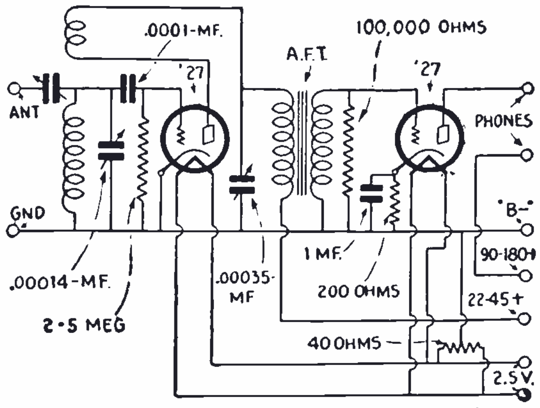
(Continued)

Two-Tube Receiver

Harold Geuber, Cincinnati, Ohio, wants to know:

Q. (1) The circuit of a good two-tube A.C. receiver?

A. (1) The circuit is shown in these columns. The first tube is a regenerative detector and the second an audio amplifier.



Circuit for a two-tube receiver devised by Mr. Geuber. This hook-up is for A.C. tubes.

Best Super-Converter

Albert Sobel, Kew Gardens, L. I., asks:

Q. (1) Which type of super-converter will give the best results, the one-coil, dynatron or conventional plate-grid-coil type?

A. (1) The best type is, without a question of a doubt, the one using a three-electrode tube with tuned grid coil and feedback or plate coil. The disadvantage of the one-coil type is that the tuned circuit must be considerably off resonance with the incoming signal, in order to obtain a beat-frequency equal to that of the I.F. amplifier; resulting in low sensitivity. The dynatron, while very stable in operation, is out of the question on waves below about 60 to 70 meters. It is sometimes possible to find a tube that will oscillate on lower waves, but not very often.

Q. (2) Will a converter and a good broadcast receiver give as good results as a superhet built especially for short waves?

A. (2) Generally, the results will be the same; providing the broadcast receiver does not cause feedback to the converter's detector.

Circuit Inquiry

L. Filderman, Richmond Hill, N. Y., would like to know:

Q. (1) The specifications of C1, C3 and L1 in the circuit of the "1930 Receiver" (P. 474, April-May issue)?

A. (1) It would be well to wind L1 exactly like L2, and tune it with a condenser C1, the same as C2. Then connect a small midget condenser of .000025-mf. in series with the antenna. The dials of C1 and C2 would then track fairly close together.

Transmitter Hook-up for '16A Tubes

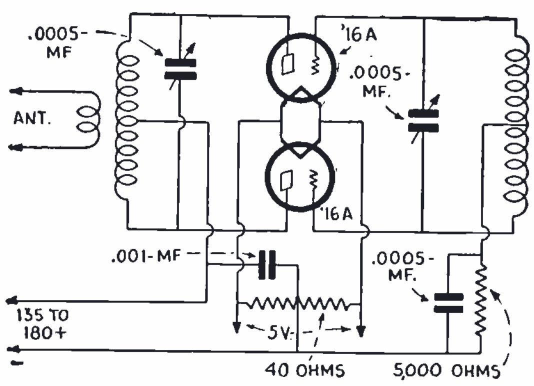
Albert Batis, Philadelphia, Pa., wants to know:

Q. (1) Data on Western Electric 216 A tubes?

A. (1) Filament 5-6 volts, 1 ampere. Plate 135 volts, 5 ma.

Q. (2) Will you give the circuit of a small transmitter using two of these tubes?

A. (2) The circuit is given in these columns. Both coils are wound alike with 12 turns of No. 14 enameled wire on a 3-inch form, center-tapped. The antenna coil will depend upon the size and type of antenna used; but 6 turns of No. 14 is suggested. The circuit is for push-pull connection, and the power output will be twice that of one tube.



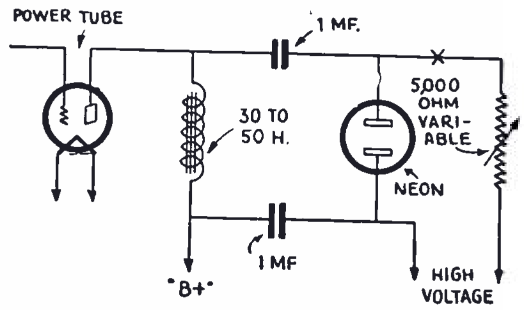
Push-pull transmitter hook-up using two Western Electric 216A tubes.

Television Amplifier

J. E. Hastings, Sacramento, Calif., desires:

Q. (1) A circuit for the power audio stage of a television amplifier, making it possible to receive either a *positive* or *negative* picture at will.

A. (1) The circuit is given in these columns. It may be necessary to connect a large iron-core choke in the positive high-voltage lead to the neon tube, as shown at X. Reverse the A.C. terminals as desired.



This neon tube hook-up permits one to change television image from positive to negative or vice versa.

Transmitter Tubes

John Troost, Spring Lake, Mich., inquires:

Q. (1) Which tube is better to use in a transmitter, a '10 or a '50?

A. (1) The '10 will be best as an oscillator, and the '50 as an output amplifier. For intermediate amplifiers, the '10 is better.

Q. (2) Are there any 25-watt tubes on the market?

A. (2) The '50 tube has a rating of approximately 25 watts.

Range of Phone Transmitter

Forrest Clark desires the following data:

Q. (1) What would be the range of the "Beginner's Radiophone" (as described in the Feb.-March issue) for 85-meter operation?

A. (1) It is impossible to give any certain range of any transmitter.

Q. (2) What size coils would be needed for 85-meter operation?

A. (2) The number of turns in the coils should be reduced about one-half.

In Our Next Issue

A "TWO-TUBE" S-W PORTABLE THAT WORKS A LOUDSPEAKER—A Self-Contained, Battery Operated Receiver, Utilizing the Latest Style Tubes; Change of Wave Bands Is Effected Without Plug-in Coils, by Clyde J. Fitch.

HERTZIAN AND INFRA-RED RAYS—How Shall We Use Them, by Dr. Fritz Schroeter.

HOW TO NEUTRALIZE TRANSMITTING AMPLIFIERS, by C. H. W. Nason.

PUSH-PULL TRANSMITTER CIRCUITS—Their Merits and Demerits.

A SIGNAL FREQUENCY AMPLIFIER FOR S-W CONVERTERS, by E. T. Somerset, G2DT.

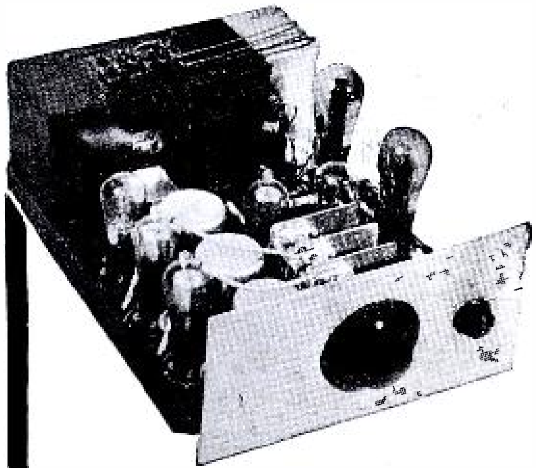
THE VACUUM TUBE VOLTMETER—How to Make and Use It.

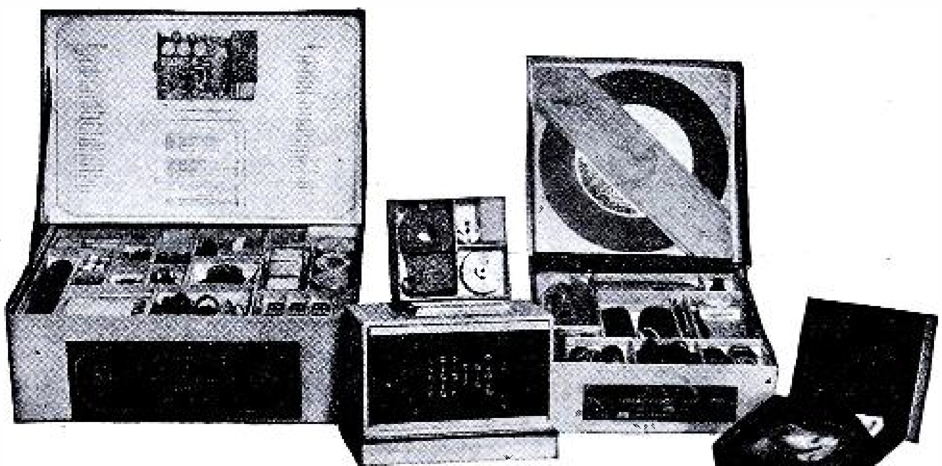
SIMPLIFIED INDUCTANCE CALCULATIONS.

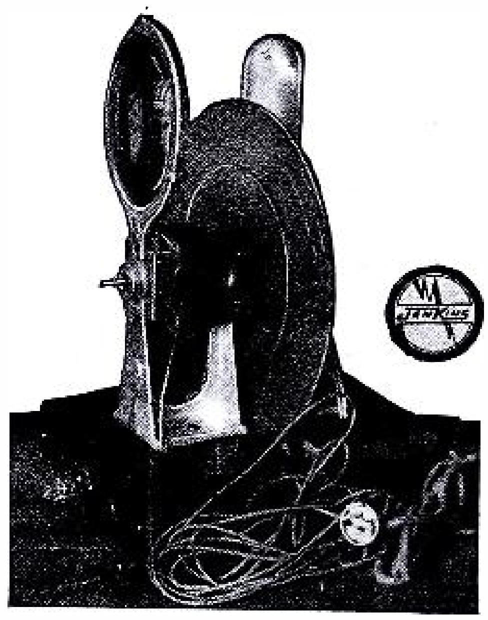
ULTRA SHORT WAVES—Experiments With Waves From 8 to 28 Inches Long, by Prof. Esau, of the Physical-Technical Institute of Jena. Prof. Esau Is Considered Germany's Outstanding Expert on Ultra-Short Waves.

RADIO-CONTROLLED PLANES AND AUTOS—With Photos of Actual Craft, by Olen W. Clements.

BESIDES THE USUAL PRACTICAL CONSTRUCTION ARTICLES ON S-W RECEIVERS, ADAPTERS AND CONVERTERS, Written by Experts.



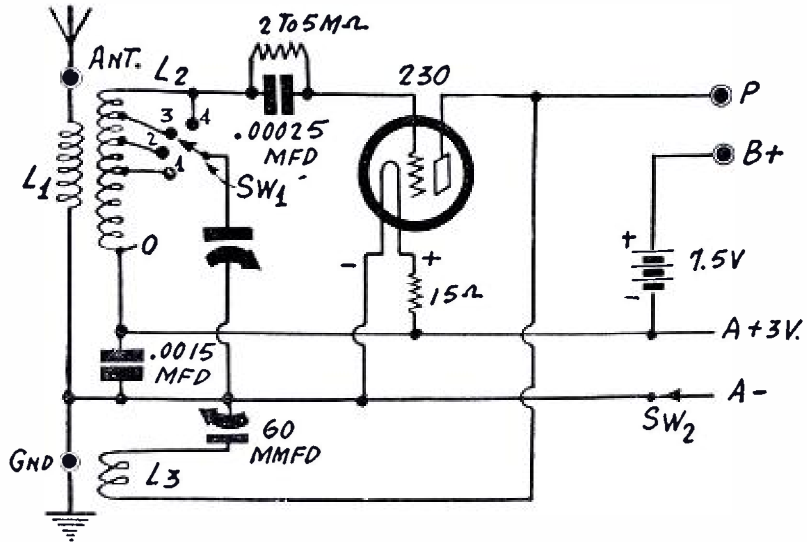




Short-Wave Tuning Less Plug-In Coils

By HERMAN BERNARD

(*Continued from page* 125)



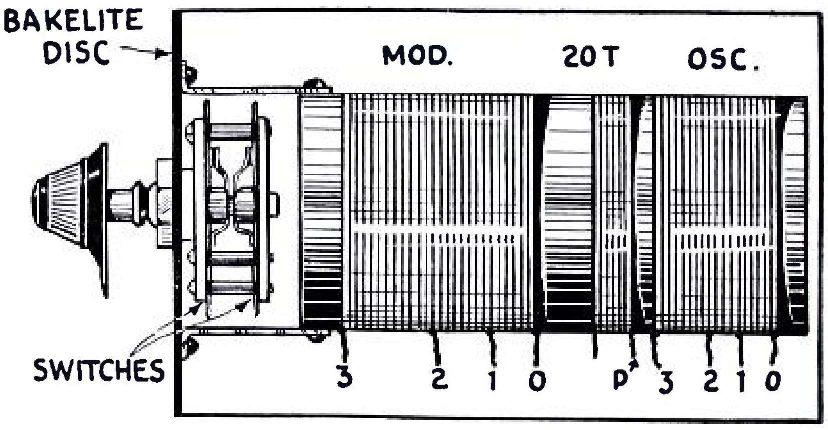


Fig. 2—Using the tapped coils and waveband change-over switch for an "all-wave" one-tube receiver.

Fig. 4—Shows how tapped inductances are wound and mounted.

There has been and still is considerable controversy among the short wave fraternity as to the efficacy of using tapped tuning inductances in short wave receivers, but the fact of the matter remains that the circuits here shown have been tried out successfully. Success with tapped coil circuits provided with switches for tuning in various wavelengths have been used by a number of experts, and if you have not already read the article by Mr. Roderick Berry, which appeared on page 23 of the June-July issue of this magazine, it would be to your advantage to do so. Also see p. 439, Apr.-May issue.

A Super-Sensitive Short-Wave Receiver

By THOMAS A. MARSHALL

(*Continued from page* 116)

brackets. Fig. 4 shows how to arrange this type of condenser for a push-pull circuit. The rotor is grounded and tunes both halves of the circuit simultaneously.

Mechanical Details

The complete layout of the parts of the receiver, as described in this article, is the result of a choice of many circuits. For this reason, it will be inadvisable for the builder to vary from the design recommended. Under no condition should a substitution of parts be made. The aluminum shields are 3/16-inch in thickness; dimensions for them are as follows:

Front panel......	33 x 10½"
Top and bottom...	33⅜ x 9½"
Ends and partitions	10½ x 9 5/16"
Back	10½ x 33⅜"

Dimensions of compartments:

First R.F. amplifier stage..11"
Second R.F. amplifier stage. 9½"
Detector circuit and audio stages ....12½"

Reasons for High Sensitivity

The input tube capacities of the circuit, as shown in Fig. 1, are in series across the input inductances L1, L2 and L8. The resultant inter-electrode capacities across each circuit are half the value of those in conventional circuits. For this reason, a greater number of turns may be used in both grid and plate circuits, resulting in a high input and output impedance.

In the detector there are more turns available for the grid and tickler circuits for a given frequency; which increases regeneration, making it an easy oscillator for the ultra-high frequencies. Due to the increased regenerative properties, the circuit has more sensitivity in the upper frequencies. Hence, greater signal strength is made possible in this way.

Another important feature of the circuit is due to the two grid-filament circuits being across half of the tuned circuit. Thus, the grid-filament conductance is decreased to half value for each circuit. Since the two input reactances are in series, the total conductance across the

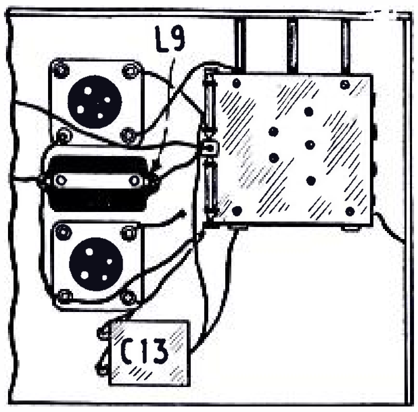


FIG. 8

Fig. 8—Top view of the apparatus in the detector circuit.

tuned input circuit is one quarter in value as compared with a conventional circuit. In view of these features, and the regenerative properties of the detector circuit, it is apparent that the symmetrical push-pull circuit described in this article will give greater performance than any other known circuit.

It is to be noted that each tuned circuit is permitted to find its own electrical center, which may be different from the apparent center; because of electrical irregularities within the tubes and to the wiring. This method helps to preserve the symmetry which is so essential to efficient and stable operation, particularly in the ultra-high-frequency bands.

Coil Data

Band in Meters	*Coil No.*	*L*	*L1*	*L2*	*L8*	*L7*	*Diameter*
80	1	6	22	21	21	6	2
40	2	6	14	14	13	6	2
30	3	6	8	8	7¾	4	2
20	4	5	6	6	5	4	2
15	5	5	3¾	3¾	3	3¾	2
11	6	4	4	4	4	4	1
9	7	4	3	3	3	4	1
7	8	4	2½	2½	2	4	¾
5	9	4	2	2	2	4	¾

Tickler and grid coils for coils No. 1 to 5 inclusive are spaced ¼-inch. Tickler coils are wound 30 turns to the inch with No. 28 enamelled wire. The grid coils are wound 18 turns to the inch with No. 22 enamelled wire.

For coils No. 6 to 9 inclusive, use No. 22 D.S.C. wire, and wind coils without spacing turns. Tickler coils are spaced until the desired range in frequency is obtained.

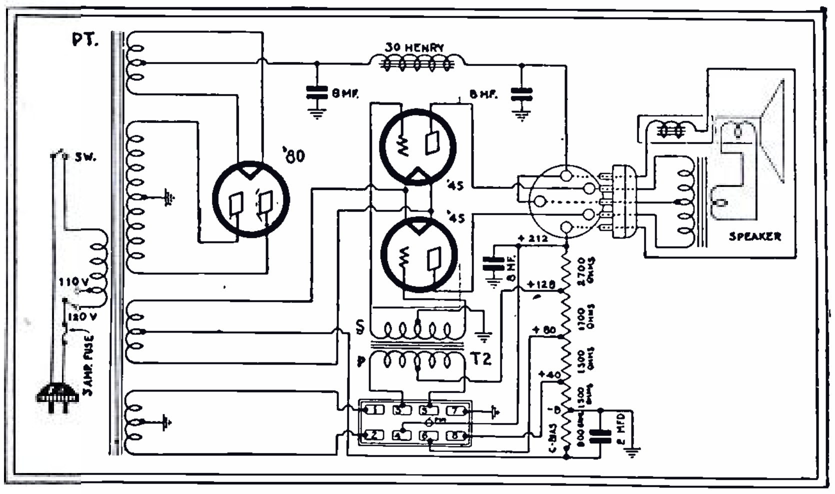
List of Parts Used

Three "Type 169-E" Cardwell variable condensers;
One 2-mf. bypass condenser;
One ½-mf. bypass condenser;
One 1-mf. condenser;
One .01-mf. bypass condenser;
Five Samson No. 125 chokes;
Four 1-megohm metallized grid leaks;
Two ½-megohm metallized grid leaks;
Two 15-ohm rheostats;
One 6-ohm, 2-ampere rheostat;
One Electrad 100,000-ohm wire wound volume control;
One Electrad 200-ohm potentiometer;
Eight tube sockets;
Six grid-leak holders;
One voltmeter, 0-6 scale;
Three dials National "VV" type;
Two small dials for regeneration control and antenna coupling;
One filament "ON-OFF" switch;
Four grid cap connectors for UX '22 tubes;
Six .0001-mf. Sangamo stopping condensers;
One 2-1 ratio audio transformer;
One 5-1 ratio audio transformer;
One telephone jack;
One 1-1 ratio output transformer (not essential);
Two 100-mmf. variable midget condensers;
Three dozen GR jacks;
One dozen GR plugs;
Three pieces ⅛-inch bakelite, 3⅝x3⅜;
One piece ⅛-inch bakelite, 2x5;
One piece ⅛-inch bakelite, 5½x6.

New Scott "All-Wave" Super-Het

By H. WINFIELD SECOR

(*Continued from page* 112)



The circuit of the Scott power pack, with its connections to set and speaker.

tubes, with the usual '80 rectifier tube. Five of the tubes in the receiver chassis are of the high gain, screen grid '24 type and the other four tubes are of the '27 type. The signal frequency amplifier tube is a '24, while the first detector is of the same type. The main tuner chassis, the power supply and power output stage are quickly and easily connected together by means of a special cable and plug arrangement.

"P. C. J." — Holland Speaking

(*Continued from page* 89)

frequency, is utilized to generate a current of very constant frequency.

In the P. C. J. transmitter the crystal-generated high frequency currents are amplified and multiplied several times, until the desired transmitting frequency is obtained. These currents are applied to a large water-cooled transmitting valve, type TA 12/20000 K, having an input of 25 to 27 kilowatts at a plate voltage of 8000 to 12000 volts. The generation of high powered short waves only became possible by the use of water-cooled transmitting valves, a Philips specialty.

One of the accompanying photographs shows the new P. C. J. experimental beam antennas for operation on a wave range of 31.28 meters. P. C. J. is heard consistently in this country by thousands of people equipped with short wave receivers or short wave adapters which convert their broadcast receivers into short wave sets. The operating time and other information concerning P. C. J. is given in the "List of Short Wave Stations" published elsewhere in this issue. One of the editor's friends heard P. C. J. some weeks ago very clearly when they broadcast a special concert to America and which lasted several hours. P. C. J. has three beam antenna systems on which they may transmit alternately as desired.

Improved Short Wave Reception

Another rather annoying feature of many home-built short-wave receivers is their often violent radiation, that may spoil all short wave reception within a radius of a couple of miles. The Philips engineers built a short wave receiver that overcomes all difficulties of this kind and possesses many other unusual features. The Philips short-wave set incorporates one stage of R.F. amplification, which not only prevents radiation and improves the sensitivity, but adds greatly to the stability and ease of tuning.

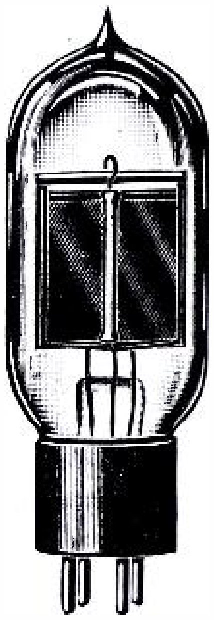
The R.F. amplifying valve is of the screen-grid type. The tuning is done with a carefully designed condenser, provided with an efficient vernier control, which enables one to do very fine tuning. A variable condenser is also employed for the regeneration control, which is smooth and easy throughout the tuning range, which covers all wavelengths between 10 and 2,600 meters. This is made possible by means of six interchangeable coil units, each containing two coils. A picture of this receiver appears herewith. Interchanging a coil unit is very easily done by opening a small flap and pushing the coil into its socket. The detector valve is of a non-microphonic type, especially designed for this set. After the detector follow two stages of A.F. amplification, each of which gives an almost ideal amplification of 45 times. The last stage is provided with a pentode tube, ensuring both perfect tone quality and great volume.

A very efficient volume and selectivity is obtained by regulating the filament current of the R.F. valve. This really universal set, which makes reception possible of the ultra-short, the short, and the long waves, posesses still another most valuable feature, in its facilities for the connection of an electrical pick-up. In this way records may be reproduced through the loud-sepaker with wonderful volume and richness of tone.

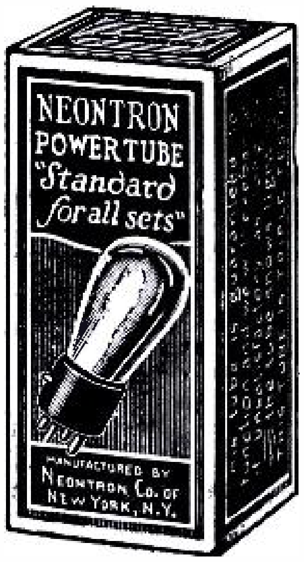
The set has been designed with an eye to the often severe climatic conditions and is electrically and mechanically "tropic-proof."

GUARANTEED RADIO TUBE SALE

All Tubes Guaranteed for 6 Months



Telion Television Tube $3.90



All tubes come in this attractive carton.

FOR THE FIRST TIME, a standard brand of radio tubes is sold at extraordinarily low prices, yet each and every one of the tubes is guaranteed in all respects for 6 months.

All tubes are perfect and any tube that fails to make good for ANY reason will be replaced free of charge within 6 months, as long as the filament lights.

Radio tube users have become wary of so-called cheap tubes. Such tubes are nearly always "seconds"; that is, tubes that have failed to pass the manufacturer's tests. These tubes do not give good service and therefore are never guaranteed for any length of time.

NEONTRON tubes are manufactured by one of the oldest, reliable Eastern tube manufacturers and we have made special arrangements for this unparalleled sale. You will find here tubes that you cannot buy elsewhere, yet the price is low when you figure the long service that these tubes will give you. There are no better tubes made than NEONTRON, regardless of price.

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If you wish a tube replaced, it is necessary to return it to us and we will send you a new one immediately.

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High Grade (Hi Mu) 201A Type—better vacuum — works and fits in any set. $.85

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Switch is used when one filament burns out, tube therefore has twice normal life. With switch on acts as 171 or 112 Power Tube — with switch off it is 201A Tube.

A.C. Adapter Tubes to convert battery sets into A.C. Electric sets—furnished for 226, 227, 171A. $.85

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UY-227 —Used as detector amplifier for A.C. operation	No. 602	.65
UX-171A—Power output amplifier for A.C. or D.C. operation, ¼ amp	No. 603	.65
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NEW UX-232—Screen grid R.F. amplifier for dry cells or storage battery	No. 637	1.10
NEW UY-235—Variable Mu, screen grid heater, 2½-volt	No. 638	1.50
NEW UY-247—Pentode Power tube, 2½-volt filament	No. 639	1.50
UX-210—For power amplifier, high voltage	No. 622	1.60
UX-250—Power amplifier used in last stage of audio frequency	No. 623	1.60
201A—All bakelite shield tube	No. 624	1.60
UX-222—Screen grid tube for D.C. operation. Radio frequency amplifier	No. 625	1.60
Telion television tube	No. 626	3.90
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125 mil. rectifying tube (B. H. type)	No. 628	2.15
2 amp. old and new type charger bulbs (list $4.00), our price	No. 629	2.95
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UX-280—Used as a fullwave rectifier tube for high emission	No. 631	.75
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Freshman rectifying tube, especially designed for use with Freshman Master "B" Eliminators, UV brass base, limited quantity	No. 633	.60

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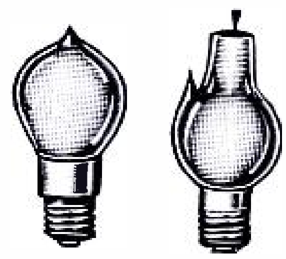

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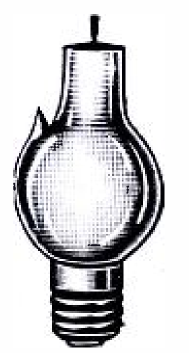

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RADIO TRADING CO., 25A West Broadway NEW YORK

Directive Antennae and How They Work

By C. H. W. NASON

(*Continued from page 128*)

which it is designed. (Operation on the harmonics of the antenna fundamental is not recommended for directional arrays.) The lamp cord acts as a simple transposition line, and the pick-up in this line is negligible.

Aircraft receivers, for operation at the extremely high frequencies, can employ Hertzian antennas to excellent advantage in the manner shown in Fig. 15. Here the noise due to ignition interference is balanced out, because it appears in opposite phase in the two portions of the antenna. If the receiver and contributing equipment are suitably shielded against such interference, shielding of the ignition equipment is no longer found necessary.

To return to our original study of the directional properties of antennas, we assume that suitable arrays may be designed for reception of a highly directional character; just as was the case with the transmitting arrays already described. Fig. 16 shows the so-called "Grecian key" pattern receiving antenna, such as used in transatlantic telephone reception at the high frequencies. This system is also highly suited to transmission, and has an extremely sharp directional characteristic, both horizontally and vertically. The effects of the standing waves are shown by the curves in the figure. The antenna is directional in the plane broadside to the array, and may be made unidirectional by the addition of another array, not connected to the receiving or transmitting equipment, and situated a quarter-wave away from the connected array. As will be seen, the verticals and horizontals are quarter-wave. The arrangement is folded back and forth in such a manner that the phase relations between the elements cancel out signals from other than the desired direction. These arrays are constructed by winding the wire in the required manner on wooden forms or arbors.

The writer does not pretend to have covered his subject in a manner suitable to the theorist; but he feels that the information contained herein is of extreme value to the experimenter who requires directional antennas. Some of the arrangements are quite simple in construction, and can be set up on the average city rooftop when extremely short waves—say 20 meters—are involved. Others are more suited to the man in the country who has plenty of back yard to play in.

Any obscurity will be gladly clarified by the writer, if he is addressed in care of this journal; this does *not* mean that he is willing to work out directional arrays for use in the broadcast band or at 180 meters, for such a request is pure nonsense.

Efficiency In Long-Distance Work

The higher frequencies demand such usage if scheduled operation is to be attained between remote stations. There is far more satisfaction in maintaining a faultless two-way schedule with one or two stations, with but slight power in the antenna, than in working a mess of distant stations on a fine night. A transmitter with a rated output of but 7.5 watts will slap a signal into a directional antenna in Australia with the same precision and sock that a 250-watter would be expected to give with an ordinary antenna structure. Set up a directional array of the type shown in one of the figures, using a fairly sturdy wood structure to support it. Have your friend the surveyor orient you to the true geographic direction of the point you want to reach down into—and watch the reports come in. Only be sure that the surveyor does your basic orientation for you; since otherwise you may slap a signal into the polar regions where there are none to reply. Above all, be *certain of your operating frequency*; so that you do not interfere with commercial services. Use a good meter stick in laying off distances on your antenna, so that your efficiency will be of the highest order. Remember that the distances in space are actual, while those on the wire must be calculated.

Experiments With Simplified Remote Control

By CLYDE A. RANDON

(*Continued from page* 136)

the same frequency. These condensers need be only small air condensers. The writer has used small copper plates (about 1½ inches square; but, of course, the actual sizes will depend upon the wavelength-shift desired. Small midget-type condensers are somewhat easier to adjust. To change the wavelength of a transmitter quickly, when interference is encountered on the air, a small condenser is switched in parallel with the main tuning control; this is accomplished by remote control as shown. The switching arrangement for remote-control is shown in Fig. 3. Pointed contacts give smaller capacity between them, and are therefore preferable. To shift the natural frequency of the transmitting aerial, and the frequency of the transmitter, at the same time, two sets of contacts are required on the bakelite piece (Fig. 3). Two springs hold this piece vertically when the relay coils are not energized. Another simple relay (such as a revamped doorbell) operates the key, as in Fig. 2.

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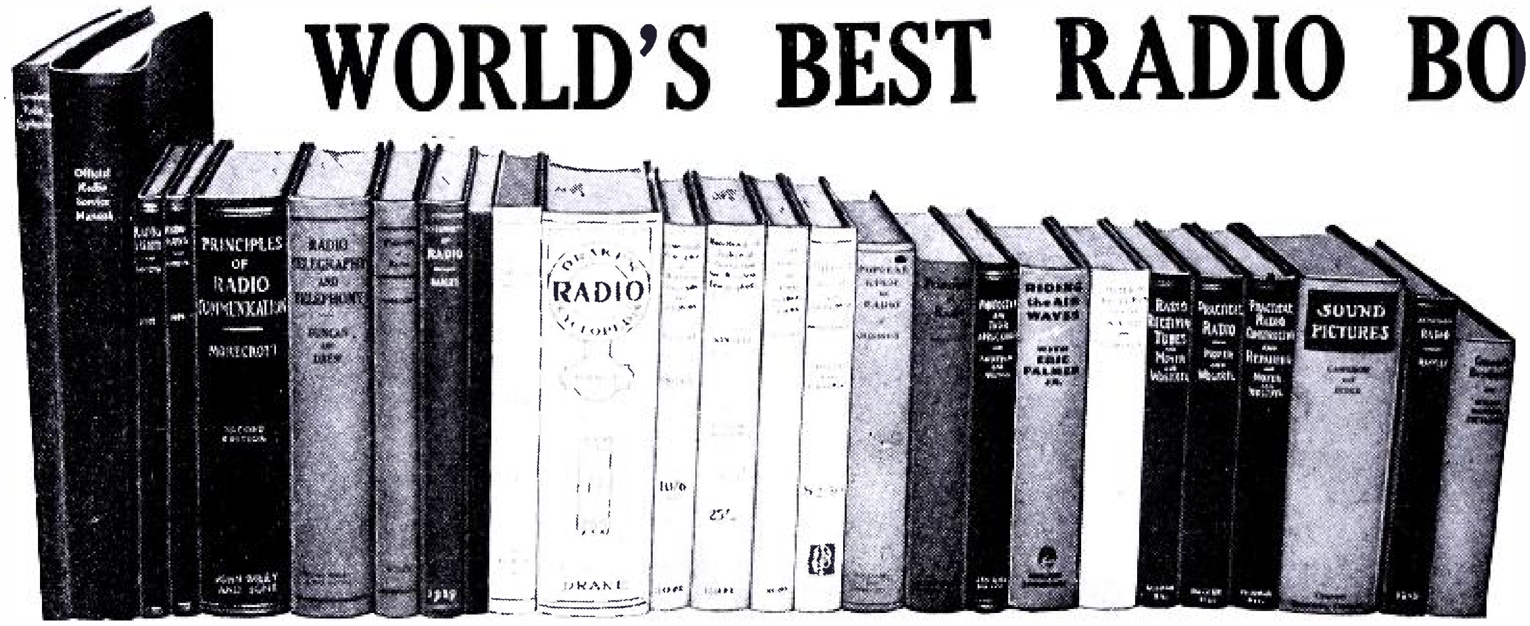

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PRINCIPLES OF RADIO COMMUNICATION, by J. H. Morecroft, Prof. of Electrical Engineering, Columbia University. Cloth covers, size 9½x6", 988 pages. Profusely illustrated. Price **$7.50**

A radio classic, indeed, is Professor Morecroft's very complete text-book which covers such important radio phenomena as: the action in condensers; self and mutual induction in a circuit; phase and phase difference; effect of condensers and coils on wave shape; resonance frequency of coupled circuits; skin effect in coils; antenna resistance; transformers; vacuum tubes; radio frequency alternators; modulation and circuits; amplifiers and filters.

RADIO TRAFFIC MANUAL AND OPERATING REGULATIONS, by R. L. Duncan and C. E. Drew. Flexible covers, size 9x6", 186 pages. Price **$2.00**

This valuable handbook starts off with instructions on how to learn the code in considerable detail, with a list of abbreviations. Then comes operating rules and regulations of the Radiomarine Corporation of America with operators' report forms; followed by the rules of the International Radiograph Convention; the United States Radio Act of 1927; the Ship Act of 1912; etc.

PHOTOCELLS AND THEIR APPLICATION, by V. K. Zworykin, E.E., Ph.D., and E. D. Wilson, Ph.D. Cloth covers, size 5½x8", 210 pages, 97 illustrations. Price **$2.50**

Photocells today occupy a very important place in radio and talking pictures, as well as other branches of applied science, and these two experts have provided the very latest information as to the action taking place in various types of photocells. The theory on which these different cells operate, including color sensitivity, together with amplifier and scanning discs used in picture as well as television transmission, etc.

PRINCIPLES OF RADIO, by Keith Henney, M.A. Cloth covers, size 8x5½", 478 pages, 306 illustrations. Price **$3.50**

The author is well known in radio and he has here provided a very complete and clearly written discussion of radio circuits and apparatus, including such important topics as: condensers; transformers; determination of inductance; vacuum tube action, including Screen Grid and Pentode; wave meters, their calibration and use; modulation; amplifiers; long wave receivers; and different types of rectifiers.

HOW TO PASS U. S. GOVERNMENT RADIO LICENSE EXAMINATIONS, by R. L. Duncan and C. E. Drew. Flexible covers, size 9½x7", 170 pages, 92 illustrations, appendix. Price **$2.00**

The authors are thoroughly conversant with their subject and all of the most important information including hook-ups; types of antennae and receivers with wiring diagrams of both small and large receivers and transmitters of commercial type, including ship sets are given.

RADIO RECEIVING TUBES, by Moyer and Wostrel. Cloth covers, size 7½x5½", 298 pages, 181 illustrations. Price **$2.50**

No radio student or operator can do without this authoritative book on the radio vacuum tube. The various chapters include construction of vacuum tubes; electrical fundamentals; elementary action taking place in the vacuum tube, with graphs; reactivation of tubes; testing of tubes including determination of amplification factor; plate resistance; grid resistance, etc.

PRACTICAL RADIO—INCLUDING THE TESTING OF RADIO RECEIVING SETS, by James A. Moyer, S.B., A.M., and John F. Wostrel. Cloth covers, size 8x5", 378 pages, 223 illustrations. Price **$2.50**

Everyone will find this volume of the utmost practical value as the authors have explained in text and diagrams, for the practically-minded student, such interesting subjects as telephone receivers and crystal sets; various types of aerials; current sources for vacuum tubes; audio and radio frequency amplification with hookups; loud speakers and how they work; various radio receiving sets with diagrams and just how they work.

PRACTICAL RADIO CONSTRUCTION AND REPAIRING, by J. A. Moyer, S.B., A.M., and J. F. Wostrel. Cloth covers, size 8x5", 354 pages, 163 illustrations. Price... **$2.50**

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RADIO TELEGRAPHY AND TELEPHONY, by R. L. Duncan and C. E. Drew. Cloth covers, size 9½x6", 950 pages, 468 illustrations. Price **$7.50**

This 950 page book forms indeed a most complete treatise on radio facts. The authors treat thoroughly the magnetic circuit; Ohm's law; transformers and induction; motor generators and starters; storage batteries; alternating currents; capacity and inductance formulae. Vacuum tubes as detectors and amplifiers; oscillographs; radio compass; wavelength measurements and short wave receivers.

RADIO SERVICE MAN'S HANDYBOOK WITH ADDENDA DATA SHEETS. Flexible covers, size 9x12", 200 pages, 200 illustrations. Price, prepaid **$1.95**

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Commercial wiring diagrams for all the regularly manufactured receiving sets are included in this manual and no radio service man or student who builds and repairs radio sets can be without this tremendously useful compilation of circuits and their descriptions. This book is worth $100.00 to anyone who has a use for it. The Manual is indexed so that any commercial receiving circuit can be found instantly. One of the most valuable radio books ever published.

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RADIO TROUBLE SHOOTING, by Ennor R. Haan, E.E. Flexible covers, size 6x9", 323 pages, 257 illustrations. Price **$3.00**

This is a well illustrated and intensely practical handbook for all radio service men and operators, as well as set builders and testers. Some of the practical problems illustrated and discussed are, interference and noise problems—how to locate and remedy them; antenna circuit troubles and their effect on radio; batteries, chargers and eliminators.

DRAKE'S RADIO CYCLOPEDIA, by H. P. Manly. Cloth covers, size 6x9", 1035 pages, profusely illustrated. Price **$6.00**

This massive cyclopedia covers radio apparatus—its operation and maintenance, the various subjects being alphabetically arranged. There are 1735 subjects in alphabetical order ranging from A-battery to zero-beat. This volume contains 1110 illustrations, diagrams, etc. There are 414 illustrations and articles on the building and designing of radio sets, alone; 110 articles with 383 illustrations on the methods of repair, service and adjustment of radio sets.

S. GERNSBACK'S RADIO ENCYCLOPEDIA, by S. Gernsback. Stiff leatherette covers, size 9x12", 168 pages, profusely illustrated. Price **$1.65**

Radio apparatus, inventors and terms are all illustrated and described in this remarkable book which required the efforts of several engineers in its compilation. The subjects are alphabetically arranged and the illustrations are especially fine and clear.

TELEVISION TO-DAY AND TOMORROW, by S. A. Moseley and H. J. B. Chapple. Cloth covers, size 8x5½", 130 pages, profusely illustrated. Price, prepaid **$2.50**

This up-to-the-minute work on television describes in detail the apparatus used by Baird. The student will learn all about scanning discs; the best type of motor; reverse defects and how to overcome them; isochronism and synchronism; various ways of synchronizing the receiving discs; photocells and neon tubes; radio receivers for television signals; noctovision.

SOUND PICTURES AND TROUBLE SHOOTER'S MANUAL, by Cameron and Rider. Cloth covers, size 8x5½", 1120 pages, profusely illustrated. Price **$7.50**

This useful volume will appeal to all radio as well as "talkie" trouble-shooters. The first chapters deal with fundamentals of electrical circuits, including Ohm's law. A.C. and D.C. circuits, rectifiers, amplifiers, mixers and faders; various types of loud speakers and how to arrange them; photocells; electric motors; various types of talkie projectors; also commercial amplifiers with diagrams are given.

RIDING THE AIR WAVES, WITH ERIC PALMER, JR., by himself. Cloth covers, size 7½x5½", 328 pages. Price **$2.00**

Short wave fans cannot miss reading this highly entertaining and informative book which tells the story of youthful Mr. Palmer and his remarkable achievements in amateur radio. "Around the World with 5 Watts" and many other interesting subjects appear between the covers of this book.

A POPULAR GUIDE TO RADIO by B. Francis Dashiell. Cloth covers, size 5½x8½", 286 pages, profusely illustrated. Price, prepaid **$3.50**

The author starts off with an excellent section on electricity and magnetism; the use of radio aerials and grounds; the fundamental principles of radio; the electron tube and crystal rectifiers—how they work; the principle of radio amplification; radio inductance coils and condensers; fundamental radio receiving circuits; electrical reproduction of sound; the atmosphere and radio phenomena, etc.

RADIO VISION, by C. Francis Jenkins. Cloth covers, size 9½x6", 144 pages, profusely illustrated. Price, prepaid **$1.25**

A beautifully printed and interesting illustrated history of transmission of images by radio; particularly covering the apparatus and successful demonstrations of the Jenkins system. Other apparatus illustrated and discussed are the Braun tube receiver; the R. C.A. Photo-radio apparatus; the A. T. & T. Company system; and the Belin machine.

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A Low Cost Push-Pull C-W Transmitter

By L. R. SHAFFER

(Continued from page 131)

the antenna condenser should be tuned a little off resonance until the note clears up again; or the antenna coils may be moved a little farther away from the plate coil. The correct adjustment will be that at which the antenna takes the most load with the note remaining steady and pure. The character of the note is more important than the current put into the antenna; because high antenna current is useless unless the signal is clean and steady.

The method of adjustment on the 7,000- and 14,000-kc. bands is similar; except that series antenna tuning, as shown, is used with the 45-foot feeders assumed. Other feeder lengths or differing antenna types will require different handling; and, since the number of combinations is rather large, it is impossible to cover all of them at this time. The proper setting of the plate tuning condenser will be at approximately 75% of full capacity on 7,000-kc., and 60% on 14,000-kc.

The output obtainable will vary somewhat with the frequency, as with all vacuum-tube oscillators; but tests with a dummy antenna have shown that it can be expected at least to equal that obtainable from a typical single type '10, with similar values and circuit conditions on corresponding frequencies. The stability seems to be better than the '10 will give, probably because of the use of the push-pull circuit.

The R.F. ammeters indicated in the diagrams will be found useful for tuning purposes, although not altogether necessary. The antenna current values are really meaningless and, if the meters are used, the transmitter and antenna tuning should be so adjusted that the current through both is the same, regardless of the actual value of that current. A scale of 0-1 amp. will be sufficient for this set.

While under most conditions little or no trouble will be had from "key clicks" or "thumps", due to the fact that keying opens both the -B return and the grid return, a special filter is made by the National Company for use with this transmitter when it is operated so close to a broadcast receiver as to otherwise cause trouble. The circuit is given in Fig. 4.

How to Build Your Own 'Phone Transmitter

By LAWRENCE B. ROBBINS

(Continued from page 109)

Any good tubes will do the trick.
(While I am using the cheapest bootleg tubes at present, they work OK but would recommend using RCA or similar tubes for maximum results.)

Table of Constants

- L1—Primary coil of 1/8" copper tubing, wound 3" in diam., turns spaced about 1/4";
- L2—Coupling coil, same dimensions and construction;
- L3—Radio-frequency choke consisting of 100 turns No. 28 d.c.c. wire on 1" form;
- L4—Heising choke (iron-core) 30 Henries, 150 mills.;
- L5—Shielded (B.C.L.) R.F. choke, 85 ma.;
- L6—Heavy duty filter choke—30 Henries, 150-200 ma.;
- C1—23 plate — (.0005 mf.) receiving variable condenser;
- C2—.002-mf. fixed condenser—1,000-volt;
- C3—.00025-mf. grid condenser;
- C4 (2)—.002-mf. fixed condensers;
- C5—.00025-mf. fixed condensers;
- C6—0.2-mf. fixed condenser;
- C7—2-mf. fixed condenser;
- C8—2-mf. fixed condenser;
- C9—1 4-mf. fixed condenser, 1,000-volt;
- C10-11—2 2-mf. fixed condensers, 1,000-volt;
- R1—5,000 ohms, 50 watts;
- R2—1,000 ohms, 100 watts;
- R3—50,000 ohms (potentiometer);
- R4—2,000 ohms, fixed resistor;
- R5— 675 ohms, fixed resistor;
- R6—1,000 ohms, fixed resistor;
- R7—1,500 ohms, variable;
- R8—20 ohm potentiometer;
- R9—R10—100,000 ohms, 100-watt resistor with sliding contact;
- T1—Single-button microphone transformer;
- T2—T3—Input and output audio push-pull transformers;
- T4—2½-volt filament transformer (at least 15 watts);
- T5-6—(2) 10-watt filament transformer, 7½-8 volts;
- T7—¼-kw. power transformer and fil. transformer for rectifiers—550 volt output;
- Two 5-amp. line fuses;
- One fuse, No. 2 (any ¼- to ½-amp. flashlight bulb);
- S1—S2—Power switch and filament transformer switch;
- MA—0-100 milliammeter, cord and plug;
- VM—0-700 D.C. voltmeter and D.P.D.T. switch.

FOR BOOKS to read during your spare time, we suggest that you turn to page 144 of this issue. On that page you will find many books to complete your hours of pleasure.

The New Telefunken Ultra-Short-Wave Receiver

By **DR. FRITZ NOACK**

(*Continued from page* 119)

treme shortness of the feed wires. The regeneration coil is within the secondary, and consists of 2½ turns of very heavy copper wire. The tuned circuit is connected by an ordinary grid condenser (.000275-mf.) with the grid of the tube; the grid leak, 2—3 megohms, connects to the "—" leg of the filament of the tube. The variable resistor P, which serves as the regeneration control, is to be about 50,000 ohms; it must have a proper wattage rating.

It is well to use an audio transformer with low D.C. resistance; for which one of 1:4 ratio has proved best.

In the plate circuit, additional by-pass condensers are provided, which are to have the usual values of .001-mf. Under certain conditions it will be necessary to insert in the two filament leads, right at the tube, two R.F. chokes, of some 20—30 turns and about ¾-inch in diameter, which are simple solenoids. Under certain conditions, a similar choke will be necessary behind the resistor P; *i. e.*, between this and the tap to the by-pass condenser.

Furthermore, it must be noted in general that any losses in the construction of such a receiving set must be avoided so far as possible; because the high-frequency radiation of the ultra-short waves can under certain circumstances be troublesome.

Use of Ultra S-W Adapter

Fig. 3 shows the adapter connected to the phonograph terminals of an all-electric receiver (right). For connecting leads, one can use ordinary lamp cord, if the transformer built into the ultra-short-wave unit has low coil capacity.

The ultra-short-wave receiver is best operated, not from a power pack, but with batteries; because disturbances in the light-line can affect reception. Yet work is being done to develop the ultra-short-wave set for light socket operation. Since, in an ultra-short-wave adapter, the detector under certain circumstances is inclined to microphonic noises, the tube must be provided with a howl arrester or, better still, an indirectly-heated tube may be used. In this case, the cathode is to be connected to the ground. Since the filament is insulated from the cathode, oscillation is better regulated as a rule in indirectly-heated tubes than in those directly heated.

Figs. 4 and 5 show the Telefunken ultra-short-wave transmitter, and the dipole antenna (vertical uppermost wire) set up on the Telefunken building. The antenna is connected by a double feeder line (right of the mast) to the transmitter, which is located in the top story of the building. This feeder (two thick vertical tubes) connected to a tuning condenser is also visible at the right of the transmitter itself.

Baird Short-Wave and Television Receiver

By JOSEPH CALCATERRA

(*Continued from page* 100)

of the parts to eliminate all possibility of instability and distortion through electromagnetic or electrostatic coupling.

Every hole necessary to mount a part or bring a connection through the chassis has been punched to simplify assembly.

Sockets *S*1 to *S*8 inclusive and the bases of tube shields *TS*1, *TS*2 and *TS*3 are riveted to and furnished as part of the chassis. So also are the bases of the coil shields *CS*1, *CS*2 and *CS*3 and condensers *C*10 and *C*13.

The first step in mounting the other parts, is to slip three $\frac{5}{32}$ round head screws into the mounting holes on the side of the gang variable condenser, with the heads of the screws on the inside of the condenser, and fasten the screws in place with $\frac{5}{32}$ nuts. The screws will then project outward from the condenser, thus providing three studs which fit into the holes provided for them in the chassis. The condenser can then be fastened onto the chassis with three nuts screwed on the studs from the under side of the chassis. A soldering lug should be fastened at the rear mounting stud as shown at *G*7 to provide a ground connection for the potentiometer *P*. Soldering lugs should be attached to the frame of the condenser at the points indicated.

Sockets *S*9, *S*10 and *S*11 used for the plug-in Octocoils should then be mounted, care being taken that the terminals are mounted in the relative positions shown (the F terminals toward the rear of the chassis and bent flat against the bases of the sockets to prevent the terminals from touching the cans of the condensers over which they are mounted. Mounting is effected by using the long screws and insulating bushings to mount them at a height sufficient to clear the condensers *C*10 and *C*13, shown in Fig. 6.

Although no condenser is used under *S*9, this socket must also be mounted at the same height to keep the relative position of its coil with respect to the shield, the same as that of the other coils.

The bakelite strip on which condensers *C*28, *C*29 and *C*30 are fastened should be mounted with a clearance of about a quarter of an inch between it and the bottom of the chassis. This is done by putting spacers on the mounting screws at the desired height to serve as supports for the strip.

Switch *SW*1 should be mounted with the terminals toward the left side of the chassis as shown in the picture wiring diagram, Fig. 7, of the sub-panel of the chassis. Switch *SW*3 should be mounted with the single terminal end (terminal 2) toward the left and with the double terminal end (terminals 1 and 3) toward the right. The number 1 terminal of switch *SW*3 (the terminal which connects with the number 3 terminal of the double choke unit *CH*1, *CH*2) is the terminal which is nearest the sub-panel and is hidden from view when looking into the chassis as in Fig. 7.

The terminal of switch *SW*1 which is connected with the *K* terminal of socket *S*3 is also hidden from view in Fig. 7. These hidden terminals are shown by dotted lines.

The connections to these terminals should be made by turning the switches around, soldering the connection to such terminals and then turning the switches back into position and fastening them firmly in place.

The front panel is mounted on the chassis by means of the potentiometer *P* and the switches *SW*1 and *SW*3 which fasten the front panel and chassis together. All spacing washers and nuts from these units should be removed to permit mounting.

The body of each resistor *R*5 to *R*14 inclusive is insulated from the metal mounting strip which holds it in place. This mounting strip is automatically grounded when it is mounted on the chassis. The ground connections of resistors *R*5, *R*7, *R*8, *R*9, *R*10, *R*11, *R*13 and *R*14 can therefore be made very easily by soldering one pigtail from each resistor mentioned to the mounting strip, as shown in Fig. 7.

It is important to note that the diameter of the resistor at one end of the resistor assembly is larger than the rest. The resistor assembly should be mounted so that this large size resistor locates at position R14. If this is not done, the values of the resistors will not be properly located and trouble will result.

Since the radio frequency choke coils *CH*3, *CH*4 and *CH*5 are polarized, it is important that they be located as shown and connected as follows: The terminals marked "Hi-Freq." on chokes *CH*3 and *CH*4 should be connected with their respective radio frequency transformers through holes *H*6 and *H*12 respectively, as shown in Fig. 7.

The terminal marked *Hi-Freq.* on choke *CH*5 should be connected with the P terminal of socket *S*3 and with resistor *R*6 as shown.

The location of the remaining parts on the chassis is shown so clearly on the photographs and layouts that detailed instructions for mounting them are not necessary.

It is important, however, that the transformer T and the choke units CH1 and CH2 should be mounted so that the terminal lugs point toward the center of the chassis in order to be sure that the relative locations of the terminals will be such as to make the proper connections as shown on the wiring diagrams.

It is also important to bend up the terminals of both the transformer T and the double choke unit *CH*1 and *CH*2 so as to be sure that they clear the edges of the holes in the chassis and that there will be no danger of the wires leading to such terminals shorting to the chassis.

All about Radio's latest wonder, TELEVISION, is thoroughly covered in TELEVISION NEWS. Full details about this important magazine appear on page 154. Be sure to read this message which tells of the important developments in this new field.

The set screws provided with condensers *C*4 and *C*7 should be removed to prevent any possibility of binding as the condensers are operated.

Condensers *C*18, *C*19, *C*20, *C*21, *C*22 and *C*23 are all contained in a single can with their common leads grounded to the can. All of the capacities in the can are equal and have the same voltage ratings. Pairs of leads from this condenser block should be twisted as shown in the diagram, Fig. 7.

Condensers *C*24, *C*25, *C*26 and *C*27 are furnished in one block, with their common leads grounded to the can. Condenser *C*24 (red lead) is a higher capacity than the other in the block and should be connected as indicated in the diagram. Condensers *C*25, *C*26 and *C*27 are of equal capacity and are provided with blue leads which should be connected as shown.

In the case of condensers *C*1, *C*2, *C*3, *C*4, *C*5, *C*6, *C*7, *C*18, *C*19, *C*20, *C*21, *C*22, *C*23, *C*24, *C*25, *C*26, *C*27, *C*31 and *C*32, the connection to ground (chassis) is automatically made when the units are mounted.

This is also the case with the *Gnd* binding post terminal, the mounting strip of resistors *R*5 to *R*14 inclusive and the frame terminals of jacks *J*1 and *J*2.

The *G* numbers, *G*1, *G*2, etc., indicate grounded connections made through the chassis.

The *H* numbers indicate holes in the chassis or shields through which wires are passed to make connections between terminals on one side of the chassis or shields and terminals on the other side. These holes are marked with corresponding numbers on both sides of the chassis to indicate that the wires which pass through them continue to their respective terminals on both sides of the chassis.

Wiring the Receiver

Much time will be saved and mistakes will be avoided, if each connection is traced over with a colored pencil on the wiring diagrams shown in Figs. 1, 6 *and* 7 *as each connection is made. It is then easy to tell at a glance which connections have been made and which remain to be made.*

The builder should make every joint carefully, to be sure that a good mechanical and electrical joint is made. Use a good grade of rosin core solder and be sure to heat the connecting elements well before actually applying the solder. A little care taken in soldering will pay big dividends in freedom from the troubles which usually result from loose and high resistance connections.

In wiring, it is a good plans to make all the connections which go to the ground (chassis) first. Then wire up the filament leads being very careful to make the connections to the transformer terminals properly as indicated in the wiring diagram, Fig. 7. The heavy wire should be used for the filament leads and the filament wires should be run in twisted pairs.

The ground connections to resistors *R*5, *R*7, *R*8, *R*10, *R*11, *R*13 and *R*14 are made easily by soldering one of the pigtail leads from each resistor mentioned to the metal mounting strip of the resistor assembly.

In wiring the radio frequency transformer units, all the wiring of the elements around the sockets should be made first and long leads should be provided for the leads which are to be brought out through the shields. These wires can then be run through the holes provided in the shields and the cylindrical portions of the shield can be fitted to the bases by means of the bayonet joint provisions made in the base and shields. The P and F2 terminals of socket *S*10 are not used.

Operation of Receiver for Short Waves

The first step, preparatory to operating the receiver is to insert the proper tubes in the various sockets. Type —24 AC screen grid tubes *VT*1, *VT*2 and *VT*3 should be inserted in sockets *S*1, *S*2 and *S*3 and the tube shields should then be placed over them and fitted to the tube shield bases. The cap terminals from the radio frequency transformers should then be fitted over the top terminals of the screen grid tubes.

Type —27 heater type AC tubes *VT*4 and *VT*5 should be inserted into sockets *S*4 and *S*5, and a Type —45 power tube, *VT*6, should be placed in socket *S*6. A Type BH rectifier *RT* should be placed in socket *S*8.

The speaker cord tips should be inserted in the *Speaker* tip jacks.

The ground wire should be connected to the *Gnd* binding post. When using the receiver for short-wave and television reception, the antenna wire should be connected with the *Short Ant.* binding post. When using the receiver on the broadcast waveband, it is usually better to connect the antenna to the *Long Ant.* binding post.

The Octocoils which should be plugged into sockets *S*9, *S*10 and *S*11 of the radio frequency transformers inside the coil shields will depend on the wavelength range which it is desired to cover and whether the receiver is to be used for short-wave voice programs or for television reception.

A set of three coils is used in the receiver for any given wavelength range—one in the first R. F. stage socket *S*9 for coupling the antenna to the first R. F. tube, a second in socket *S*10 for coupling the first R. F. tube to the second R. F. tube and a third in socket *S*11 for coupling the second R. F. tube to the detector. The Octocoils used to cover any given wavelength range are distinguished by the colors of the forms on which they are wound. The GREEN Octocoils cover the range from 16 to 30 meters. The BROWN Octocoils cover the range from 29 to 58 meters. The BLUE Octocoils cover the range from 54 to 100 meters. The RED Octocoils cover the range from 100 to 200 meters. Octocoils are also available to extend the range into the broadcast band above 200 meters.

For Television reception it is necessary to use regular RED Octocoils in sockets *S*9 and *S*10 and the Television, (single winding RED Octocoil) in socket *S*11.

When the Television (single-winding) Octocoil is used in socket *S*11, the regenerative circuit (shown in dotted lines) is opened, thus providing the non-regenerative circuit required for Television reception.

For regular short-wave reception on 100 to 200 meters, place regular RED Octocoils in sockets *S*9 and *S*11, and the Television single-winding) Octocoil in Socket *S*10. For other wavelengths use the three coils of the proper color in all three sockets, *S*9, *S*10 and *S*11.

The AC plug of the receiver should, of course, be inserted in a lighting outlet, supplying 110-volt, 60-cycle AC power and the proper coils should be in the sockets *S*9, *S*10 and *S*11.

To tune in a signal, turn the knob of potentiometer *P* as far as it will go in a clockwise direction. This will automatically snap on the AC switch and will also put a fairly high voltage on the screen grids of tubes *VT*1 and *VT*2.

Switch *S*1 should be thrown to the *On* or *Grid Rectification* position. With the switch on, or in the closed position, the grid bias resistor *R*5 in the detector grid circuit is shorted out and the detector operates as a grid rectification detector. For Television operation or for use on very strong signals, it is advisable to throw the switch to the *Off* or plate rectification position. In that case the detector operates as a power detector and is capable of handling a stronger signal without distortion. The use of plate rectification also damps the tendency toward regeneration and is therefore preferable when using the receiver for Television. Grid rectification, however, provides greater sensitivity and better regeneration so that it is desirable to use the switch in the *On* position when tuning in distant short-wave stations.

For loudspeaker reception, the switch *SW*3 should be thrown to the *Hi* or *Speaker* position, thus connecting the speaker across the output choke *CH*2.

For Television reception, switch *SW*3 should be thrown to the *Lo* or *Television* position, thus switching the output of the power tube of the receiver to the input of the Television Unit.

With the receiver connected to the lighting outlet and the regular regenerative coil in socket *S*11, the potentiometer turned fully on in a clockwise direction, switch *SW*1 thrown to the *On* or *Grid Rectification* position and switch *SW*3 thrown to the *Hi* or *Speaker* position, the receiver is ready to be tuned to a short-wave station for adjusting the tuning and trimmer condensers.

First line up the main sections of the variable gang condensers and tighten the set screws on the shaft.

Then let out the adjusting screws on the trimmer condensers *C*5 and *C*6 of the tuning condenser sections *C*2 and *C*3 respectively, and adjust trimmer condenser *C*4 to about its midposition (half-meshed).

Next tune in a weak station by adjusting the dial which controls the main variable condensers and the regeneration condenser *C*7. The regeneration condenser *C*7 should be adjusted until the characteristic regeneration whistle is heard. Then it should be adjusted just below the spill over or whistling point, and the station tuned in by adjusting the main tuning condensers, until the station comes in as strong as possible.

The final adjustment can then be made with trimmer condensers *C*4, *C*5 and *C*6.

The adjustment of trimmer condensers *C*5 and *C*6 should be tried on different stations at different points of the dial.

After these preliminary adjustments have been made, short-wave stations within the wavelength range limits of the coils being used can be tuned in with ease providing such stations are on the air and you have acquired the knack of tuning them in, a knack which is acquired after a little practice. In tuning in distant stations, especially foreign stations, it is important to check up their transmission schedules and make due allowance for the difference in time.

List of Parts Required for Baird Universal Short Wave Receiver

Stock No.	*Quan.*	*Part and Type*	*No. on Diagram*
51	1	Chassis, all mounted, with 8 sockets riveted	*S*1, *S*2, *S*3, *S*4, *S*5, *S*6, *S*7, *S*8
		3 coil shields	*CS*1, *CS*2, *CS*3
		3 tube shields	*TS*1, *TS*2, *TS*3
		2 condensers	*C*10, *C*13
		and 1 3-post binding strip	*Gnd., Short Ant., Long Ant.*
52	3	Coil Sockets	*S*9, *S*10, *S*11
53	2	Pig-tail Resistors	*R*1, *R*2
54	3	.0001 Mfd. Condensers	*C*8, *C*11, *C*17
55	3	Screen Grid Clips	
56	2	.02Mfd. Moulded Condensers	*C*9, *C*12
57	2	Jacks	*J*1, *J*2
58	1	Block Condenser	*C*18, *C*19, *C*20, *C*21, *C*22, *C*23
59	1	Block Condenser	*C*24, *C*25, *C*26, *C*27
60	3	R. F. Chokes	*CH*3, *CH*4, *CH*5
61	1	3-Gang Baird Variable Condenser	*C*1, *C*2, *C*3, *C*5, *C*6
62	3	Electrolytic Condensers	*C*14, *C*15, *C*16
63	1	Baird Power Transformer	*T*
64	1	Baird Power Choke	*CH*1, *CH*2
65	1	Baird Gang Resistor	*R*5, *R*6, *R*7, *R*8, *R*9, *R*10, *R*11, *R*12, *R*13, *R*14
66	1	3-Condenser Strip	*C*28, *C*29, *C*30
67	4	Knobs	
68	1	Toggle Switch—2 pole	*SW*1
69	1	Speaker Terminal	*Speaker*
70	1	Combination Potentiometer and Switch	*P*, *SW*2
71	1	No. 9 Baird Midget Condenser	*C*4
72	1	No. 15 Baird Midget Condenser	*C*7
73	1	Buffer Condenser	*C*31, *C*32
74	1	Voltage Divider	*VD*
75	1	Baird Dial and Escutcheon	
76	1	Baird Front Panel	
77	2	Grid Resistors	*R*3, *R*4
78		40' Wire	
79		3-Pole Switch	*SW*3
80	1	Dial Bracket and Lamp	*DL*
81		AC Cord and Plug	*P*1
500		Hardware Assembly	
	15	Octocoils 15-520 meters Wavelength	
	1	Cabinet (optional—not furnished with kit)	

Here's That 1-Tube S-W Receiver

By J. P. LIEBERMAN

(*Continued from page* 94)

Prong of Coil Form.	*Connection to Tube in Set.*
"F" minus	Stator of feedback condenser, and end of feedback coil.
"F" plus	"A" plus, rotors of feedback and tuning condensers.
Grid	Plate of tube, and one side of feedback coil.
Plate	Coil side of the grid leak, and stator of tuning condenser.

The circuit is shown for operation with the '30-type 2-volt tube. This tube draws very little current, only 60 milliamperes in the filament circuit; and, under specified operating conditions, only 2 milliamperes of plate current. The resistance in the negative leg of the filament, therefore, should be 15 ohms (commercial value) to drop the voltage of two series-connected 1.5-volt dry cells to 2 volts for the filament.

The grid return for detection by the leak-condenser method should be to positive; so the filament's own resistance of 30 ohms and the filament ballast's resistance of 15 ohms (total 45 ohms) should be bypassed; on account of the help thus afforded in the higher-frequency brackets. Any condenser of .0015-mf. or higher capacity will do.

The choke coil in the detector circuit need have only a small inductance, because of the high frequencies to which the set tunes; therefore 5 millihenries will be sufficient.

The same capacities are used for tuning and for feedback. The greater the value of the grid leak, the higher the sensitivity and the stronger the feedback possible; therefore the largest commercially obtainable value (5 meg.), is recommended. The grid condenser should have the usual value of .00025 mf.

All points now have been covered as to the electrical features, except for assurance of feedback. The secondary and tickler, again, may be regarded theoretically as a single winding, and then imagined cut to obtain separation of the winding into two coils. The grid return and the radio-frequency plate return terminals then adjoin; in other words, they represent neighboring terminals of the windings. The grid return is "A+" in this hookup; the R.F. plate return is the connection to the stator of the feedback condenser, the rotor of which goes to "A+" also.

A positive "B" voltage of 22.5 is sufficient but, if desired, twice this plate voltage may be used, with volume a little greater.

Working the 56 M.C. Band

By HARRY D. HOOTON, W8BKV

(*Continued from page* 117)

waves. It will be necessary to use a high-resistance grid leak, about 15,000 to 20,000 ohms.

The inductance is made of the usual ¼-inch copper pipe and is composed of 1½ turns each side of the blocking condenser, 2½ inches in diameter. The blocking condenser is .01-mf. The "tank" or tuning condenser is a two-gang type and should be very rigid, since a very small amount of vibration can do a great amount of tuning when the frequency is 56 megacycles! The leads and arrangement of the parts in the transmitter are not so critical as in the receiver; but it is best to get a good layout and as short a leads as possible. Any of the usual D.C. power supplies can be used at five meters, but for radiophone work it is best to use a battery filament supply; since the A.C. flowing through the filament seems to modulate the set in the same manner as "loop modulation".

Reflectors

Since the antenna is short, reflectors can be used easily. The procedure is to set a single wire, of the same length as the main antenna, at quarter-wave length distance behind the radiating wire coupled to the transmitter. This absorbs power and re-radiates it in the direction shown by the dotted arrow in Fig. 3. This is the simplest of the directive antennas and, as mentioned above, it can be used for receiving also. If a more highly directional result is desired, other wires can be supported vertically along a horizontal parabola, the main antenna being at the focus.

Of the plain type of antennas, the Zeppelin is probably the most efficient. It is desirable to use long feeders, say 5/4-wavelength, as the radiator can then be brought more into the clear. The feeders can be spaced four or five inches with the usual spreaders. A radio-frequency ammeter should not be placed in series with either feeder, as it is possible to throw a zepp out of balance by doing so. The transmitter can be tuned to resonance by reading the maximum plate current. A small five-plate midget is placed in series with each feeder for tuning purposes. A five-meter zepp is 7 feet 10 inches long.

Frequency Measurement

In regard to frequency measurement: if an absorption meter is used it will be necessary to be very careful in tuning up, or the transmitter will be outside the band. An oscillating meter, such as the dynatron, is best and, as it is usually calibrated for the lower frequencies, it can be used for measuring the transmitter frequency on any of the amateur bands by multiplying the frequency by 2, 4, 8 or 16 according to the band in which it was calibrated.

How the Transmitter Circuit Is Related to the "Blooper"

(*Continued from page* 105)

high frequencies (short waves), energy from the plate circuit feeds back through the tube into the grid circuit, by means of the inherent capacity existing between the grid and plate electrodes. This circuit is often called the "reversed feed-back" arrangement.

Notice that in all three transmitting circuits, the filament connection is common to both grid and plate coils. Thus, by evolution from the simple regenerative receiving circuit, the more complicated circuits are evolved.

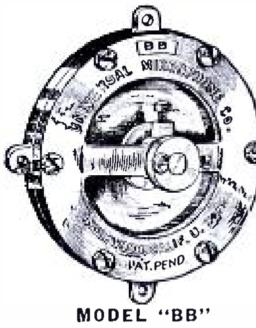
There's good news on the following page—it tells how to read Radio's greatest magazines at a reduced subscription price. Turn the page NOW to that announcement.

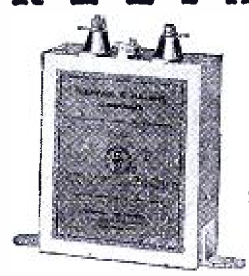
S-W Stations of the World

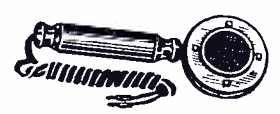
(*Continued from page* 135)

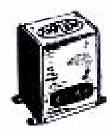
—**VE9AU**, London, Ont., Canada.
—**VE9RM**, Toronto, Ont., Canada.
150 2,000—**RA72**, Smolensk, USSR.
149.9-174.8—2,000-1,715—**Amateur Telephony and Television.**
174.0 1,723—**ZL2XS**, Wellington, New Zealand.
175 1,715—**W9XAN**, Elgin, Ill.
—**W6XK**, Los Angeles, Calif. And other experimental stations.
175.2 1,712—**Municipal, Police and Fire.**
—**KGKM**, Beaumont, Texas. — **WKDT**, Detroit, Mich. — **WEY**, Boston, Mass.
—**WPDB**, **WPDC**, **WPDD**, Chicago, Ill. — **WKDU**, Cincinnati. O.
—**KSW**, Berkeley, Calif. — **WKDU**, Cincinnati, Ohio.
—**KUP**, Dallas, Texas. — **WMDZ**, Indianapolis, Ind.
—**KGPC**, St. Louis, Mo. — **KGOY**, San Antonio. Texas.
—**KGJX**—Pasadena, Calif., (Police Dept.)
—....St. Quentin, France.
—**F8FY**, Cannes, France. 5 p.m. Wed.; 4 a.m. Sunday.
176.5 1,700—....Orly, France.
178.1 1,684—**WKDX**, New York, N. Y., Dept. Plant & Structures.
—**KOX**, Honolulu, T. H. Mutual Telephone Company.
180.0 1,662—**WMP**, Framingham, Mass. (State Police).
—**WRDS**, Lansing, Mich. (State Police).
186.6 1,608—**W9XAL**, Chicago, Ill. (WMAC) and Aircraft Television.
—**W2XY**, Newark, N. J.
187.0 1,604—**W2XCU**, Wired Radio, Ampere, N. J.
—**W2XCD**, DeForest Radio Co., Passaic, N. J. 8-10 p.m., synchronized with television broadcasts.
—**W1XAU**, Boston, Mass.
—**W3XJ**, Wheaton, Md.
—**W2XAD—W2XAF**, Schenectady.
—**W9XX**, Cartersville, Mo.
—**W5XN**, Dallas, Texas.
—**W2XDD**, Portable.
—And other experimental stations.
—....Ornskeldvik, Sweden.
187.9 1,596—**WCF**, New York, N. Y. (Fire Dept.)
—**WKDT**, Detroit, Mich. (Fire Dept.)
—**KGKM**, Beaumont, Texas.
—**KGPA**, Seattle, Wash., fire & police depts.
189.4 1,584—**W10XAL**, **W10XAO**, Portable (N. B. C.)
192.3 1,560—....Scheveningen, Holland.
194.3 1,544—**W2XDA**, New York.
196 1,530—....Karlskrona, Sweden.

The submarine "Nautilus," of the Trans-Arctic Submarine Expedition headed by Sir Hubert Wilkins, has been assigned the following wavelengths for relay broadcasting: 49.18 meters (6,100 kc.); 31.48 meters (9,530 kc.); 25.62 meters (11,710 kc.); 19.79 meters (15,160 kc.); and 16.87 meters (17,780 kc.).









Among the "Hams"

(*Continued from page* 133)

HERE'S HOPING THEY WILL

Editor, SHORT WAVE CRAFT:

I am a reader of SHORT WAVE CRAFT and receive much pleasure from reading the "Among the Hams" section. I have been a short wave fan for the past two years and think there is nothing in the world more enjoyable than listening to short wave broadcast stations, especially distant ones.

It was my good-fortune to win the prize offered by the Walthals Radio store for the most verified distant short wave stations heard between March 8th and April 8th last year. The prize was a new AC Super-Wasp set. I submitted verifications from VK2ME, I2RO, NRH, HRB, PCJ, G2IV, G2GN, FTM, GBU, GBW, GBS, PCK, VRY, and VE9CL, all heard between these two dates. In writing this I do not wish to be mistaken for a braggart, but I believe the above information will show some people what may be expected from a short wave receiver.

I am a member of the International Short Wave Club, whose headquarters are in Klondyke, Ohio. This organization and the magazine they publish monthly have proved invaluable to me, and I hope that *every short wave fan in the world* will join this organization and benefit by reading its truly wonderful magazines. We have a local chapter of this club here in New York which meets twice monthly and discusses the latest news in short waves. We also broadcast programs over station W2XV Long Island City occasionally. Anyone wishing information on this chapter or who wishes to attend the meetings may receive all the necessary information by writing to the undersigned.

Wishing you continued success, I am,

Very truly yours,
RAYMOND YARD,
1319 Bradford Ave.,
New York, N. Y.

(We are glad to publish your letter Raymond and you know that we support everything and anything that makes for more publicity for short waves.—Editor.)

HEY, H. MITCHELL!

Editor, SHORT WAVE CRAFT:

I like S. W. C. very much and read it from front to back and enjoy every line in it.

Now the S. W. C. is printed every other month, but why not print it every month and sell it for 25c instead of every other month for 50c. Thus waiting for the next issue would not seem like two years.

I received a card on April 6th from a H. Mitchell, 11702 Gay Ave.?, Ohio. Will this gentleman please write again as I couldn't make heads or tails of the name of the town or city, in Ohio. Success to S. W. C.

Truly,
PAUL J. AUBIN,
c/o Paul's Radio Service,
33 Chaple St.,
Putnam, Conn.

(We do not blame you one bit Paul, for being peeved at Harry (we presume his name is Harry). He really ought to be ashamed to send out mail without a city on it, but we hope this will be the means of finding him. In the meanwhile, we apologize for his post office as they used the mail to deface their own city. There really ought to be a law against it or something.—Editor.)

A DIRTY TRICK—WE CALLS IT, SIR!

Editor, SHORT WAVE CRAFT:

I have written a number of letters, about two months ago, to a number of "Swappers" whose names appeared in the "Swappers Column" of the SHORT WAVE CRAFT magazine, and wish to say that not even one of them have answered, even though I have requested an answer in return. Just what is the matter, I cannot tell you, but I think that these fellows want their names to be put in your worthy magazine, just for the fun of letting people see their names. Maybe they do answer when girls write to them. I have sent a postal card to the editor of the "Swapper Column," but never have I seen my name in your magazine. In closing I wish to say that I will only be too glad to answer anybody who writes me. I will not be Scotch for a two cent stamp, like most of the other people are. I am a new beginner in radio, as I recently was graduated from the R.C.A. Institutes—Correspondence School—and would like to become acquainted with some other R.C.A. Institute graduates, so please write me and I will answer anyone who wishes an answer.

STANLEY YUREK,
72 East Twenty-first St.,
Bayonne, N. J.

(If there ever was a dirty trick, Comrade Stanley, this certainly seems to be it. We are all "het up about it" and we immediately communicated with Fips, the office boy, to find out what remedy we can bring to bear upon those black-souled and thick-skinned slackers.

It is certainly a new one on us that some "swappers" would rather see their name in print, than answer mail which they promised to do when they sent in their names. Fips makes a good suggestion, that hereafter when a similar complaint comes in, the correspondent should give the names of those slackers, so that we can print their names, followed immediately by three black balls! This according to Fips, means that they are black-balled and ostracized, and should thereafter be boiled in black condenser pitch. At that, we think the punishment is too mild.—Editor.)

AUSTRALIA ON LOUD SPEAKER

Editor, SHORT WAVE CRAFT:

It's just one week since I built my *National thrill box*, battery model, as per your April-May issue, page 436, and wish to state that it's the most sensitive S.W. receiver short of a superhet that is on the market today! Here are the results of one week:

An electrical storm almost ruined the first two days for DX, but I got VE9CL and VE9GW in Canada along with a number of Americans. The third day cleared up considerably and I got HRB in Honduras and XDA Mexico (on code). The fourth day brought in LSX, the transatlantic telephone service in Bueons Aires, South America, and G5SW in Chelmsford, England. On the 5th and 6th days the atmospheric conditions were still better and I can get all of the above stations with good volume on an 18-inch cone. Today, the 7th day, I logged PK6KZ in Macassar on the Island of Celebes just a little north of Western Australia. This, as well as the other stations, I was able to tune in directly on the speaker without preliminary tuning with the phones. *I haven't found any use for the phones yet.*

VE9GW comes in just above W2XE, on 49.17 meters all day Sunday and best during the late afternoon. LSX on 28.97 is irregular but comes in best between 8 and 10 P. M. just above W8XK on 25.24 meters. XDA Mexico on 31.8 meters is heard just above W2XAF during the night hours. It is a very powerful code station. G5SW on 25.53 meters comes in almost on top of W8XK. It is best about 3 P. M. (week days) and signs off at 7 P. M. (midnight there).

PK6KZ in Macassar, Celebes, on 25.42 meters, comes in a bit above W8XK and just below G5SW on 25.53. PK6KZ comes in strong 3 to 5 P. M. They sign off at 5 P. M.

Hoping this list helps many to locate DX, I remain,

FRANK MATYAC,
(of the Royal Order of S. W. P. H.),
248 Jackson St.,
Columbus, Ohio.

P. S. I'm using a regular broadcast antenna which is connected to an A.C. set. Both can be used simultaneously without any hum in the short-wave set.

(Well Frank, either you are a gosh darn good short wave experimenter, or else you are a good story teller. But your letter sounds so sincere that at least we down here have swallowed it, hook-up, line and sinker; including those phones for which you have not found any use, as yet. Maybe, after a while the signals will come in so strong that you can dispense with the loud speaker and use tubes instead—who knows?—Editor.)

SWAPPERS

SWAPPERS are swappers of correspondence. During the past few years we have noted that Short-Wave enthusiasts love to get acquainted with each other by mail in order to swap experiences.

That's the reason we have opened a department for them under the above heading, in which we will print the names and addresses of all those who wish to correspond with others. As we know we will be deluged with requests, please be sure to follow these simple rules: Use a postcard only. Never write a letter. Address postcard as follows:

SWAPPERS
c/o SHORT WAVE CRAFT
96-98 PARK PLACE
NEW YORK, N. Y.

On the blank side of the postal PRINT clearly your name, address, city and State. Don't write anything else on card. We will then understand that this is your request to publish your name and address and that you wish to enter into correspondence with other short-wave readers. There is no charge for this service.
—EDITOR.

HARVEY BENDIX, W9EEB
Wood Lake, Minnesota
BILL BLACK
6141 Kenwood, Kansas City, Missouri
G. HAROLD BREWER
Big Pool, Md.
R. J. CONICK
35 Forest St., Wilkes-Barre, Pa.
HERB CORBETT
Box 356, Amboy, Minnesota
WILLIAM B. DALGLEISH
143 Silver Birch Ave., Toronto, Ont., Canada
T. A. DROGOSKI
324 Park Ave., Clairton, Pa.
IRVING FILDERMAN
85-28 118th St., Richmond Hill, New York
CECIL E. GOAR
General Delivery, Claremont,
Los Angeles County, Calif.
ANTONIO GOMEZ
Box 9, Banes Oriente, Cuba
AUGUST HEVEKER
3707 Woodland Ave., McKeesport, Pa.
CECIL HINKLEY, W8EOK
58 Susquehanna St., Binghamton, N. Y.
JOEL B. HOBERMAN
Centre Jr. High, Malden, Mass.
WILLIAM LEZCHUK
1508 N. Springfield Ave., Chicago, Ill.
KENNETH G. MacKENZIE
14 Green St., Guelph, Ontario, Can.
GORDON MacPHAIL
124 Ontario St., Guelph, Ontario, Can.
DOMINIC MARINO
1616A Powell St., San Francisco, California
HENRY L. MEISSNER
1662A So. 8th St., Milwaukee, Wis.
GEORGE B. MILLER
1560 Amsterdam Ave., New York City
H. MITCHELL
11702 Gay Ave., Cleveland, Ohio
LARRY MORRIS, Jr.
Box A, Darlington, Maryland
JOSEPH H. POLETES
14 Hamilton St., Pawtucket, R. I.
J. L. PRATT
Box 105, Benson, Vermont
WILLIAM J. PRICHARD
32 Llandillo Rd., Llanerch, Pa.
Upper Darby P. O.
JOHN RAU
1460 West 54th St., Cleveland, Ohio
VERYL SAFFELL
225 N. 18th Ave., Beech Grove, Indiana
SMITH BROTHERS, V. C. and L. W.,
W8ENC
413 So. Penn St., Wheeling, W. Va.
C. R. SWENSON
738 Spring St., Hot Springs, Ark.
CHARLES TOMASIK
1320 Third Ave., Arnold, Pa.
DR. BARON D. VAN RUYSDAEL
Care Radio W5HEI,
710 North Francis, Oklahoma City, Okla.
THEO. P. WIRTZ-HOVER
P. O. Box 751, Lima, Ohio
E. WOLLIN, JR., W9GWK
1313 St. Lawrence Ave., Beloit, Wis.
BERT N. YOSHIDA
2288 N. King St., Honolulu, T. H.
STANLEY J. YUREK
72 East 21st St., Bayonne, New Jersey

Europe Spans the Atlantic on Short Waves

By MARCELLUS H. GERNSBACK

(Continued from page 91)

tem a few seconds before the beginning of the program. Thus, in this case, he would connect in the London studio at 30 minutes and 25 seconds past the hour. Five seconds later, the London announcer would start his announcement, without any signal from New York. It is obvious that exact timing is necessary. Sometimes carefully-made plans come to naught, however.

On one occasion the London announcer got the impression that he was to start at 45 minutes past the hour, while the New York announcer thought the program was to start at 30 minutes past. At 30 minutes past the hour the New York announcer said: "The next program comes from London," and confidently threw the switch connecting the London studio into the network. He was checking the program through a headphone set, and waited a few seconds for London to start; nothing happened. He waited a little longer and disconnected the London studio; then made a hurried apology to the waiting audience and dashed off to get in touch with the short-wave operator in New Jersey. The operator "rang up" London and discovered that the announcer was waiting till 45 minutes past, before starting the program, as he had scheduled it. Fortunately, the guest speaker was already in the studio and started his speech in a few moments. However, the radio audience in America was forced to wait four to five minutes; and the New York announcer is said to have lost four pounds in the excitement. (The last statement is only a rumor, however.)

How Research and Industry Depend on Vibrations

By DR. WILLIS R. WHITNEY

(Continued from page 97)

blood composition, as though the product of the action of the rays on its foods were eaten. It is interesting that numbers in the thousands of the X-ray group are used to photograph and thus demonstrate the changes as they are being brought about in rachitic animals by exposure to the numbers in the millions. Both services are fairly modern technical advances. Both were rather unpredictable and quite specifically individualistic and valuable.

This series of electromagnetic food messages fits wonderfully well into other knowledge of foods, where already five or six essential vitamins are recognized. On the other hand, this work also fits the reactions of simple chemistry without reference to life reactions. For example, the production of ozone from oxygen is brought about by numbers near 20 millions, and the reverse production of oxygen from ozone by numbers about 60 millions.

(To be Concluded)

"HAM" ADS

Advertisements in this section are inserted at the cost of two cents per word for each insertion—name, initial and address each count as one word. Cash should accompany all "Ham" advertisements. No less than ten words are accepted. Advertising for the October-November issue should be received not later than August 10th.

Siemens & Halske Products

THE Siemens & Halske fixed paper condensers have been introduced into this country during the past year by Morrill and Morrill, of New York, and are meeting with a very favorable reception. They are standard with Telefunken.

These condensers are furnished in a line of voltages ranging from 250 volts DC working voltage to 3,000 volts DC working voltage and in the regular commercial capacities. They can also be furnished for AC work.

Another imported product of interest to radio fans is the new Siemens & Halske *High Constant* Cartridge Resistors.

S & H Condenser

These are made in various wattages from ½ to 140 watts, by a special process.

Morrill & Morrill are also putting on the market the Siemens & Halske Microphones which give exceptionally faithful reproductions, and yet are reasonably priced.

This firm is also offering the Morrill condenser in voltages up to 1,000 volts DC working voltage, these condensers being made especially for them by Siemens & Halske.

WHEN TO LISTEN

By ROBERT HERTZBERG

Costa Rica

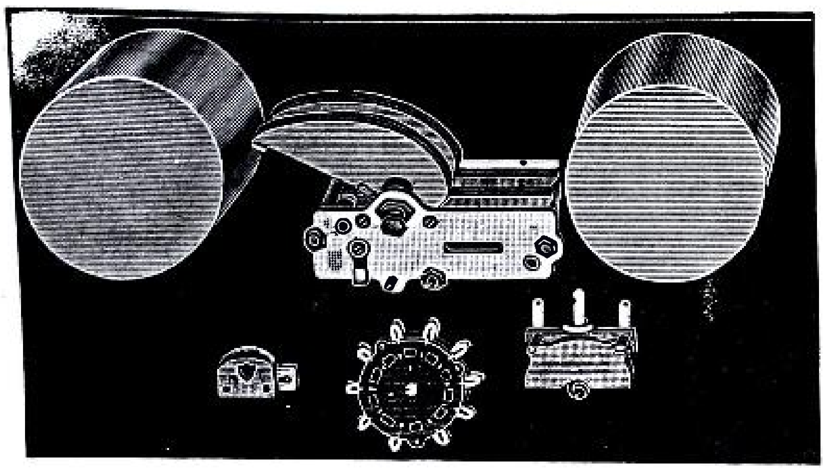
The amateur station in Heredia, Costa Rica, that achieved international renown under the call letters NRH (which rightfully belong to the United States Navy) is now using the call T14NRH. It has also changed its wavelength from 30.5 meters to 29.3 meters, and is on the air daily from 4:00 to 5:00 p.m. and 8:00 to 9:00 p.m. (Central Standard Time).

The owner of T14NRH, Senor Amando Cespedes Marin, is anxious for reports from listeners, and will gladly acknowledge them. He reads, writes and speaks English as well as Spanish.

Colombia

We are glad to be able to clear the confusion that has surrounded HKF for the past several months. A letter has been received from the owners of the station, Messrs. Manuel Jose Uribe & Cia., Apartado 317, Bogota, Colombia, in which they state that the wavelength is 39.7 meters and the hours of operation 6:00 to 10:00 p.m. (Eastern Standard Time), nightly. They, too, welcome reports of reception, which may be sent to the aforementioned address in South America.

(Continued on page 158)



Switch!

IF YOU USE plug-in coils, or contemplate using them, for wide wave coverage, switch over to switching!

A Foundation Unit gives you the convenience of front-panel knob selection of the wave band for tuning in from 15 to 550 meters. Two tuned circuits, but only a single switch. The two-gang condenser has brass plates and is straight frequency line. You know the advantage of shielding in broadcast sets. Enjoy the same advantage in short-wave and all-wave reception. Use cadmium-plated copper shields. The Foundation Unit has them.

The All-Wave Foundation Unit is made in two different models, so as to be applicable to both types of circuits, TRF or Super, whether a.c.-operated or battery-operated.

For the popular circuit comprising one stage of tuned radio frequency amplification and a sensitized detector, the double shield assembly is used (Cat. AWTRF at $15).

For a converter to be used with a broadcast set, or for any other circuit using the double detector system of reception, the unit has the same appearance as the other but the coil windings differ (Cat. AWSS at $15).

Full constructional data supplied with the units.

175 KC. BAND PASS FILTER TRANSFORMER

A DOUBLY TUNED fixed-frequency transformer, 1 to 1 ratio, tuned to 175 kilocycles, but adjustable from 100 to 190 kc., is a precision product. Two loosely coupled duolateral-wound high-inductive choke coils constitute primary and secondary, and afford a flat-top tuning characteristic, i.e., band pass filter. Suitable for all uses where high selectivity, without sideband cutting, is desired. The transformer may be mounted on the side of a chassis, in horizontal position, or upright either above or below the chassis top.

Tuning condensers are across primary and secondary, both accessible; in aluminum shield (which must be grounded) 2¼ inches diameter, 2½ inches high, with removable bottom. For screen grid tubes, Order Cat. FF-175, net price.....$3.00

450 KC. TRANSFORMER

Same as above, except that frequency is 450 kc., adjustable from 400 to 550 kc. For screen grid tubes. This intermediate frequency is particularly suitable for short-wave Superheterodynes. Order Cat. FF-450, net price.............$3.00

OTHER FREQUENCIES

We can make intermediate frequency transformers to order for any frequency, utilizing our band pass filter circuit. State frequency and write for prices.

FULL BAND SPACE-WOUND COILS

SPACE-WOUND tuning coils for shielded circuits, designed with special care to insure identity of inductance and minimum distributed capacity, with assurance of covering the whole broadcast wave band, and more, with .0005 mfd.

With each coil is supplied a drawn aluminum finished shield, 3-inch diameter, 3½ inches high. Copper shield extra.

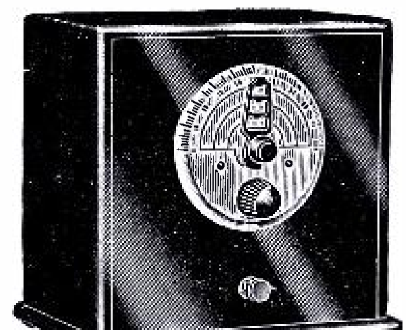
ANTENNA COIL for all circuits, also interstage coil where the primary is in the plate circuit of a general purpose tube. Order Cat. 15-85, net price........................$2.50

INTERSTAGE COIL, where primary is in the plate circuit of a screen grid tube. Order Cat. 25-85, net price...................$2.50

OSCILLATOR COIL, consisting of secondary, fixed tickler and small pickup coil winding, each winding wholly independent of the others. Order Cat. 8-30-85, net price...$2.75

COPPER SHIELD, bracket, Cat. CS-B @ $1.15 (Copper shield. 3" diam. x 4⅝" high, with bracket, substituted for aluminum shield above, extra 65c.)

DYNATRON OSCILLATOR



An oscillator for battery operation, using one 232 and one 230 tube. Wave coverage, 15 to 550 meters. The screen grid tube (232) is used as a dynatron oscillator and there is one stage of radio amplification to permit putting a load on the circuit, without stopping oscillation. Cat. DYNO at $12.50
Calibration Charts (4) at.. 1.00

Send for our Short-Wave Pamphlet, with Time Table of Short-Wave Stations. Ask for Pamphlet GB.

ROLAND RADIO CO.

137GB Hewes Street **Brooklyn, N. Y.**

Winners in $2,000.00 Amateur Station Contest

(*Continued from page* 104)

FURTHER LIST OF PRIZE-WINNERS

6—Two Flechtheim Type TH 200 Transmitting Condensers, 2,000 vt. D.C., awarded to L. Dean Powell, W3VJ, of 104 West London Avenue, Salisbury, Maryland.

7—One CeCo Type 250 Power Amplifier and 1 CeCo P-5 Pentode, awarded to L. C. Davis, W8CCI, W8DQD, of 549 Fifty-third Street, Altoona, Pa.

8—One Standard Clarostat (Universal range); one Power Clarostat (Universal range); one Power Clarostat (low range); one Super Power Clarostat (low range); one Super Power Clarostat (filament control), awarded to F. M. Whitaker, 816 Wilkerson Avenue, Durham, N. C.

9—Five Power Clarostats awarded to Geo. J. Trostle, W9FYC of 612 Fifth Avenue, Sibley, Iowa.

10—Four Electrad Transmitting Grid Leaks, awarded to Wayne Barlow, W8DOH of 89 Dalkeith Road, Rochester, N. Y.

11—Two Flechtheim T200 Transmitting Condensers, 1,500 vt. D.C., awarded to M. R. Chekomasoff, W6EZC, 1558 O'Farrell St., San Francisco, Calif.

12—One Set 25 "International" Resistors, awarded to D. Estes, W5AEM of 1611 E. Wilbarger St., Vernon, Texas.

13—One Jewell type 64, 0-1.5 Ammeter awarded to Pierre Revirieux, of 35 Rue de Bel-Air, Laval, France.

14—Two De Forest No. 566 Tubes, awarded to Lindsay Morris, VE2CO of 4700 Westmount Avenue, Westmount, Que., Canada.

15—One Universal "Baby" Microphone; 1 Input Transformer to match. awarded to P. A. McBride, W8BXM of 611 Adams Street, Ironton, Ohio.

16—Six Amperites for new 2 vt. tubes; Six Amperites for other battery tubes, awarded to Lawrence B. Robbins, W1AFQ of Harwich, Mass.

17—One (No. 180-4) set of 5 Pilot S-W Coils; 2 No. J23 Pilot Midget Condensers; 1 Pilot 412 Audio Transformer, awarded to John E. Wagenseller, W3GS of Red Hill, Pa.

18—One Trimm "Featherweight" Head-Set, awarded to E. T. Somerset, Deepdene Park, Dorking, Surrey, England.

—Two Electrad Transmitting Grid Leaks, awarded to Ad Lallemand, 4KO, of 61 Avenue des Royations, Bruxelles, Belgium.

20—Two Amperite Line Voltage Controls, three Hammarlund (MC-140-m) Midget Condensers, awarded to Wm. G. Wheat of 1017 Linwood Blvd., Kansas City, Mo.

21—One set 15 "International" Resistors, awarded to Henry H. Summers, W7AEC of Pinedale, Wyoming.

22—Two Clarostat Tone Controls, two Clarostat Automatic Line-Voltage Regulators, awarded to John Wilkinson, W9EEL of 11 S. Wright Street, Elkhorn, Wis.

23—Three sets of "X-L" Vario-Densers, awarded to Gladstone Fiddes, VE3CX of 13 Erb Street, Elmira, Ont., Can.

24—Two "National" type SE-100 Condensers, awarded to Harry E. Hurley ("HY"), W6CKS of U. S. Veterans Hospital, San Fernando, Cal.

25—Three sets "X-L" Push-Posts, awarded to H. W. Yahnel, W2SN and W2XBG (portable), Helmetta, N. J.

26—One "X-L" Sentinel Time Switch, awarded to Arthur C. Stansfield, W1COL, of Needham, Mass.

27—Four Amperite Line Voltage Controls, awarded to B. Takacs, HAF-5C of Kossuth-Lajos u. 126, Kispest, Hungary.

28—One set of 10 "International" Resistors, awarded to Clarence Bauer, W9CDD of Campbellsport, Wis.

29—One "X-L" Line Voltage Control, awarded to Andrew A. Gusack, W9IV of 1337 S. 56th Avenue, Chicago, Ill.

30—Two "Triad" '10 Type Vacuum Tubes, awarded to A. G. Gerfen, 6DIC of 231 South Bunker Hill, Los Angeles, Calif.

CROSLEY Electro Dynamic Speakers

FIRST TIME SOLD AT THIS PRICE

YOUR CHOICE **$6.50** Net

Model "A"—7" Chassis housed in beautiful metal cabinet Equipped with output transformer.
Model "B"—Same as Model "A" Chassis only.
Model "C"—9" Chassis with 900 ohm field and output transformer. Can be used with any set employing 1-171A or 1-245 power tube. Also can be used in Majestic Model 71.
Model "C"—9" Chassis with 725 ohm field and push-pull output transformer.
Model "E"—6 Volt Chassis for operation on storage battery or "A" eliminator. 85 ohm field and push-pull output transformer. Can be used with sets using the new 232 tubes. Can be converted for A.C. by use of a step-up transformer and 280 tube.

CROSLEY Type F Dynacone Speaker

This Crosley Speaker is meeting the increasing demand for an automobile radio reproducer which can be expected to give a full measure of satisfaction. Dynamic Tone!

OUR PRICE **$2.95** Net

MUSIC MASTER Model "PETITE"

110 Volt A.C. 50-60 Cycle
THE SMALLEST
17" x 13" x 7½"
THE LIGHTEST
Net 18½ lbs. Ship'g. Weight 23 lbs.
THE MIGHTIEST
in performance.

That, briefly describes this NATIONALLY and INTERNATIONALLY FAMOUS Midget Receiver. Made by a well known manufacturer. FULLY GUARANTEED to us and by us.

The chassis is a masterpiece of compact radio engineering, sturdy, clean construction. Uses three 224 screen grid, one 245 Power and one Rectifier tubes, Loftin-White amplification, Electrolytic Condensers, Magnavox or Jensen Dynanic Speaker, and all housed in a beautiful Walnut Veneer Cabinet of graceful lines.

The manufacturers' price is $49.50 less usual trade discount.

OUR NET PRICE **$25.45**

Optional: A set of good tubes supplied with each Receiver at $1.25 additional. Convince yourself of the tremendous value of this offer. Order samples at once, examine and test them, your order for as many as you can handle will follow quickly.

GENERAL ELECTRIC HIGH VOLTAGE FILTER CONDENSER

3 MFD. — 800 VOLTS
Size: 5x2¾x1 Inch.

Encased in a sturdy metal container with 8 inch flexible insulated wire leads. Equipped with handy mounting brackets.

OUR PRICE **95c** Net

$10.00 per dozen

MAXIM "Silent" Power Supplies Reduced

DRY "B" POWER

Contains no liquids. A distinct radio bargain that will be of interest to the experienced radio buyer. (Complete with tube.) For A.C. Current.

OUR PRICE **$6.50** Net

DRY "A" POWER

Regardless of price no finer "A" Power Eliminator can be procured. No need of bothering with expensive "A" batteries. Complete—for A.C. current

OUR PRICE **$9.00** Net

DRY "A-B" POWER

Ultra modern design. Compact Simple to install Only one switch Comes complete with a 280 tube ready to operate.

OUR PRICE **$16.50** Net

SONORA ELECTRIC MOTORS WITH 12" TURNTABLES

FULLY ASSEMBLED and MOUNTED

on ½ inch thick, warp proof, five ply boards, size 15 x 15, ready to install into cabinet

These motors are absolutely NOISELESS, of very rugged construction, operate on 110 volt A.C. current, and are equipped with Speed Regulator and 6 foot cord and plug. The 12" turntable will take any standard size record

By a special adjustment (at no extra cost) these motors will operate on D.C. current. Please specify when D.C. current is wanted, otherwise A.C. motors will be supplied

An exceptional Value.

OUR SPECIAL PRICE **$9.75**

RADIART STEP-DOWN TRANSFORMERS

INPUT 220-250 Volt 50-60 cycle A.C.
OUTPUT 110-120 Volt, Rated at 150-160 Watt

For use in localities where 220 volt, 60 cycle A.C. current is supplied. These Transformers adapt current of that voltage to any A.C. Radio or other Electrical Appliance which consumes up to 160 watts. Encased and easily mounted.
Size: 4x3¼x5⅜"
Ship'g w't: 6¼ lbs.

VERY SPECIAL **$3.75**

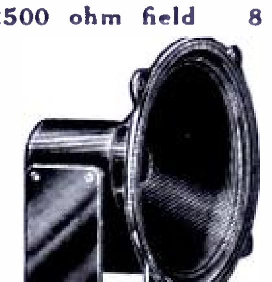
List $5.00 NATHANIEL BALDWIN RIVAL UNIT

This Nathaniel Baldwin unit is one of the finest made by that company. Can be used for Phonograph, Automobile and Portable Radio Outfits.
Order your supply today before it is too late.

OUR PRICE **65c** Net

JENSEN "CONCERT" D. C. ELECTRO DYNAMIC SPEAKERS

Model D 7 D C 10" Diameter
2500 ohm field 8 ohm voice coil



These units contain suitable push-pull transformers and are absolutely hum-free. Connect directly to the set, no outside wires.

As most standard manufactured A.C. sets are engineered for D.C. speakers of this ohmage, the possibilities for replacement with this really good speaker are practically unlimited.

The wise merchant or repair-man will take advantage of this real "buy". Never before offered at a cut price. The quantity available at this price is limited. Act quickly.

List $27.50
OUR NET PRICE **$7.90**
Original factory packing of 2 in a carton.

All offers are F.O.B. New York, and subject to prior sale. Terms: A deposit of 20% is required with every order. Balance may be paid on delivery. Or, deduct 2% if full amount is sent with order.

DO NOT WRITE FOR CATALOG!

GRENPARK CO., Dept. SW, 245 Greenwich Street, New York, N.Y.

WHEN TO LISTEN

By ROBERT HERTZBERG

(*Continued from page* 154)

France

The French colonial station at Pontoise, which has been the subject of several paragraphs in this department, is quite active now. In addition to the 40.73-meter wave last reported, it is also playing with 25.63 meters between 3:00 and 4:00 in the afternoon (E. S. T.), and with 23.20 and 19.69 meters earlier in the morning. I haven't heard this station myself; but a correspondent in Port Said, Egypt, writes me that reports of reception are desired and should be addressed as follows: Service de Radiofusion de l'administration Francaise des Postes et Telegraphes, 103 Rue de Grenelles, Paris, France.

The call letters of this station are FYA. Like most of the Europeans, it can be heard usually during the early morning and afternoon only, during bright daylight.

Colombia

The South Americans have gone into short-wave radio for all it is worth. Another station in Colombia that is attracting considerable attention is HKD, located in Barranquilla, (post office box 715). The owner is Elias J. Pellet, and announcements are made in both English and Spanish.

The wavelength is 42.92 meters (6,993 kilocycles), and the hours of operation as follows: Monday, Wednesday and Friday, 7:45 to 10:30 p.m., E. S. T.; and Sunday, 2:00 to 4:00 p.m. and 7:45 to 8:30 p.m., when they broadcast open-air concerts played by the local police band in one of the city parks.

Reports from listeners are acknowledged promptly.

Ship Stations

Most of the trans-Atlantic liners equipped with radio-telephone apparatus have dropped the experimental calls they used during the preliminary testing work last year. The S.S. *Majestic* is now GFWV; the *Olympic*, GLSQ; the *Homeric*, GDLJ; and the *Bremen* DDDX. Marconi's yacht, the *Electra*, is IBDX.

With the Summer tourist season under way, the telephone traffic will probably be heavy. Most of the transmissions will undoubtedly be "scrambled" to prevent eavesdropping on the part of short-wave listeners; but considerable testing is still done "in the clear", and the stations can be identified every now and then.

Czecho-Slovakia

There has been a short-wave broadcasting station in Prague for some time, but it used only a few watts of power. It is to be replaced soon by a new transmitter of five kilowatts rating at Hloubetin, a short distance from the city. The wavelength is 58 meters (well above the American 49-meter channel). We have no definite schedule for this station; but, if it follows the usual European habits, it will operate during the afternoon and evening, which means morning and afternoon in the Eastern United States.

Holland

PCJ, the most famous of all short-wave stations, has been establishing new records with the aid of three aerials for its well-known 31.28-meter wave. The first is a regular broadcast aerial having no particular directional characteristics. The second is an intentionally directional affair, radiating east and west, and aimed at the Dutch East Indies on one side. The third aerial, intended to hit South America, is pointed southwest.

The latest schedule of PCJ is as follows: Wednesday, 1720 G.M.T.; Thursday, 1418 and 2220 G.M.T.; and Friday, 1920 and 2600 G.M.T. Get out your conversion chart and practice on these.

The North Pole?

The submarine in which Sir Hubert Wilkins will attempt to reach the Pole will be equipped with a short-wave *telephone* transmitter. Mind you, a *telephone* transmitter. Practically every expedition in the last five years that amounted to anything had a C.W. outfit along, and managed to maintain contact with civilization through amateur or newspaper stations. However, Sir Hubert may be the first explorer to talk to the world, via short-wave relay to the chains, directly from the scene of his activities! What a stunt that would be!

Belgium

English listeners report a newcomer in the 49-meter group; a station ONVA, at Brussels, Belgium. American interference on this crowded channel may make reception here difficult, but then you can never tell. Some short-wavers have a habit of being heard in places and at times when by all the rules of the game they should be altogether absent.

Siam

HS2PJ, one of the group of official Siamese short-wave stations, is on the air only on Mondays, from 8:00 to 11:00 a.m., Eastern Standard Time. The wavelength is 29.5 meters, the power 500 watts. The opening and closing announcements are made in Siamese, English and French, with chimes of six different notes on a musical gong between the items.

This information, taken directly from a letter from the manager of the Royal Siamese broadcasting service, should settle the status of HS2PJ, which has been listed differently in every short-wave station list in print.

Mexico

X26A is a new station at Nuevo Laredo, Mexico, just across the Rio Grande from Laredo, Texas. It is on 40.7 meters, and relays the programs of XEP, which operates on 214 meters. It broadcasts every other hour on the hour, beginning at 10:00 a.m. in the morning (Central Standard Time), and ending at midnight.

The programs broadcast by X26A and XEP usually originate at the Hamilton Hotel, in Laredo, Texas. The owner is R. S. Bravo, who sends QSL cards to listeners reporting his signals.

Japan

Verification on the new Japanese station J1AA have been quite numerous. Mr. Russell Leach, of Glen Rose, Texas, has received a letter from it direct, stating that 19.04 and 38.07 meters are used, with power varying between three and five kilowatts. The transmitter is located at Kemikawa, Japan, just outside of Tokio. It works with various commercial stations on the West Coast: KEE, KEL, etc.

STOP SHOPPING!!

HERE'S a NEW plan, which saves you money. *Stop shopping—the lowest prices are right on this page.* Yes, lower than in our own catalog. Why? Because no house can get out a new catalog every month, but by advertising in this magazine we can bring you the latest and lowest prices *up to the time this ad is printed.* We watch our competitors and *do not allow anyone to undersell* us. We meet ANY price on NEW merchandise. *Order direct from this page and save money. 100% satisfaction on every transaction.*

NEW! NEW!

Official Radio Service Kit

Several months ago we sent out a questionnaire to 2,000 radio service men and asked them what their ideas were on a radio service kit. 865 answered us, and their ideas are now embodied in the Official Radio Service Kit which we herewith present to you.

This kit is a marvel in compactness, a marvel in price, a marvel in time saving. For the first time you are offered a comprehensive kit that contains **EVERYTHING** that the service man requires in making calls.

ARE YOU A 50 PER CENT SERVICE MAN?

Too often so-called service men go on a job with an analyzer and a pair of pliers. Nine times out of ten they have to run back to the shop to get tools, and thus their usefulness is cut down, as a rule, 50% and over. Why not take along, on every job, a business-looking like service kit that looks just as business-like as your analyzer?

When you call upon a prospect and you arrive with this fine-looking kit, **your prospect knows that you mean business.** It gives you a professional appearance that every service man requires more than anything else today.

AND YOU CAN COMMAND MORE MONEY ON YOUR SERVICE CALLS WITH THIS KIT

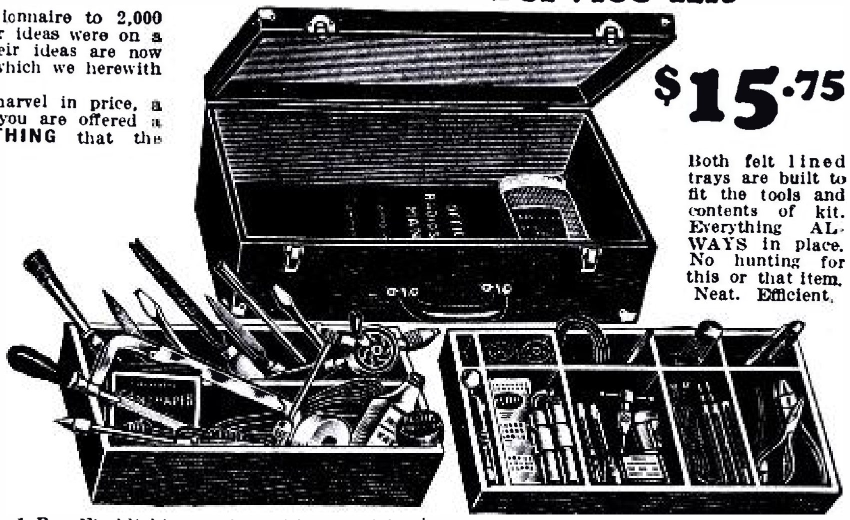
because the prospect will look upon you as a professional, and not as a tinkerer.

When you visit a medical specialist today, you are impressed by his instruments, **for which you pay.** An ordinary doctor commands no such fees. It should be clear to you that if you are a professional, you can get professional prices today too. That is why this marvelous kit will pay for itself inside of three months or less.

Herewith, are the Official Radio Service Kit specifications: Size, small and compact, not larger than a good analyzer; 17 in. long, 6¼ in. wide and 10 in. high.

Construction, wood veneer throughout, entirely covered with black leatherette, all nickel trimmings, giving outfit a beautiful professional appearance.

There are two trays which lift out. Top tray contains the following:



$15.75

Both felt lined trays are built to fit the tools and contents of kit. Everything ALWAYS in place. No hunting for this or that item. Neat. Efficient.

1 Pen Flashlight, complete with magnifying dentist's mirror (to look underneath chassis, etc.).
1 Automatic alcohol blow torch.
1 Box containing 300 assorted screws, nuts, washers, lugs, etc.
1 Nickel Bicycle wrench.
1 Tap holder with one 6/32 tap and one 8/32 tap.
1 Set of Test prods, with 6 ft. cord.
1 Telephone type pliers.
1 Diagonal pliers.
1 Insulated (5,000 volt insulated handle) heavy pliers.
1 Electrician's knife.
1 Set of 8 drill points.
10 Ft. of Phosphor bronze drum dial cable.
1 Neutralizing socket.
1 Pack extra size pipe cleaners (to clean condensers).
3 Small screw drivers.

Lower tray contains:
1 Complete Neutralizing kit with insulated screw driver and five socket wrenches.
1 Electric soldering iron, with 1 extra tip.
1 Large and
1 Medium imported screw drivers.
2 Small files with handles.
1 Large file with handle.
1 ¼ in. Star drill, 11½ in. long.
1 Hand drill, ¼ in. chuck, 10 in. long.
1 Electrician's metal hammer.
1 Hack saw and blade.
1 Package Sand papers and emery papers.
1 Roll 50 ft. solid push back wire.
1 Can genuine Kester radio solder.
¼ lb. of ¾ in. electrician's tape.
1 Bottle Furniture polish.
1 Package Furniture cheese-cloth.
1 Bottle Nujol (for lubricating purposes).
1 Tube special cement (to mend cones, etc.)
1 Socket tool to straighten socket prongs.

NEW! NEW!

IMPORTANT!

There is sufficient room in the bottom of the kit to place the **Official Radio Service Manual**, as well as other data sheets (but at the price quoted Manual is not included).

Both trays, as well as inside cover, are lined with blue felt, giving kit a beautiful appearance.

Nothing similar has ever been offered before. Only by buying the various materials in tremendous quantities are we enabled to sell this kit at such an extremely low price. **If you were to buy all of the articles separately, in the open market, you would have to pay between $30.00 and $35.00 for them.**

Due to the present depression, we are enabled to buy quantities of these materials at exceedingly low prices. For that reason, our production cost is exceedingly low, but there is no question that this price will have to be increased later.

Size, 17 in. long, 6¼ in. wide and 10 in. high; net weight, 16 lbs.; shipping weight, 18 lbs.

No. 1000—Official Radio Service Kit—Your price...... $15.75

CARRYING CASE

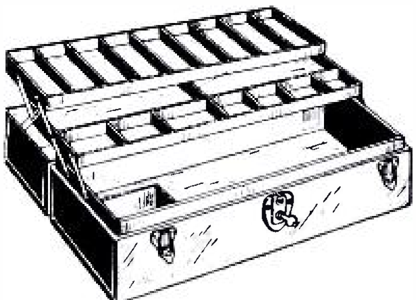
We are prepared to furnish you with the Official Radio Service Case only, without contents, as described above, just the case and the two empty trays, size 17 in. long, 6¼ in. wide and 10 in. high.

This case is made entirely of light veneered wood, nickel trimmings, covered entirely with leatherette, inside of case covered in blue felt. Net weight, 4 lbs. Shipping weight, 5 lbs.

No. 1001—Official Radio Service Carrying Case only, your price $4.85

View of kit, closed.

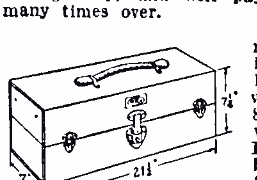
RADIO CARRYING CASES



The cases here shown are a new development. They are made in metal throughout with baked olive green enamel finish. These cases are beautifully and strongly made, and will give you a professional appearance. Lock and side locks are of burnished brass.

The smaller illustration shows dimensions and closed view of the cases. As you open the cover, **two trays automatically fold out in position**, as shown. As you tilt the cover back, the trays fold automatically into the case. The trays are provided with a number of compartments for tools and all other radio appliances that you may wish to carry. The large box accommodates about eight radio tubes in the bottom compartment. The smaller case accommodates about four tubes.

Cases are strong and rugged, **and when closed, nothing can spill.** They are marvels of ingenuity, and will pay for themselves many times over.



Large size measures 21½ in. long, 7¼ in. high and 7 in. wide. Net weight 8 lbs. Shipping weight 10 lbs. List price $8.50.

No. 1002—Carry-Case, your price $4.75

SMALL CARRYING CASE

This case is in all respects the same as the one described above, except that the dimensions are less, otherwise the same in all respects.

Size 12½ in. long, 7¼ in. high and 7 in. wide. Net weight, 5 lbs.; shipping weight, 6 lbs. List price, $6.50.

No. 1003—Carrying Case—Your Price $3.45

NEW! NEW!!

Superheterodyne S-W Converter

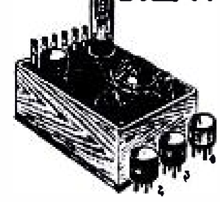
At last a short-wave converter that converts any broadcast set into a superheterodyne short-wave receiver. Employs three 227 tubes and covers from 20 to 115 meters. No plug-in coils! Coil switch is used to cover all wavelengths. Single dial control, no body capacity, no squeals. This converter has built-in filament transformer to heat the three 227's. All you need to obtain from your receiver is a positive B voltage anywhere from 45 to 180 volts. Voltage is not critical; no molestation of the receiver. So simple a child can operate it. Size 7 x 10 x 5 inches. Shipping weight, 8 lbs. **List Price $25.00.**

No. 1614—Super Converter (less tubes). YOUR PRICE......... $14.69

World-Wide Short-Wave Set

NOT A CONVERTER

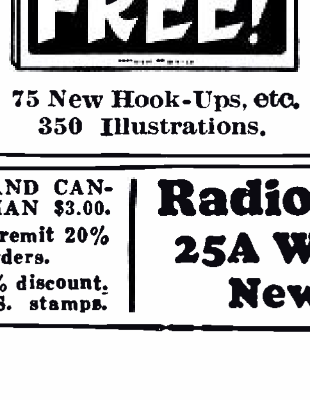
NEW



A perfect radio short-wave receiver for use between 17 and 84 meters. To put into operation, connect antenna, ground, 45-volt "B," and 6-volt "A" batteries, and headphones to the posts provided, plug in a type '01A tube, and tune in! An ingenious circuit makes possible a 4-coil single-winding plug-in design. This little instrument has the same **sensitivity** as many big, shielded short-wave receivers costing ten times as much. A power amplifier may be added for any degree of volume. Complete with 4 plug-in coils. Has fine vernier dial for precision tuning. **Never has a first class short-wave set sold for so little money.** This short-wave set measures 5½x7x4 in. high, over all. Ship. weight, 3 lbs. List price, $12.50.

No. 1666—World-Wide S.-W. Set. Your price................. $6.25

New 36 page Summer Edition No. 23



75 New Hook-Ups, etc.
350 Illustrations.

The new Summer Edition of our greatly enlarged RADIO SERVICE TREATISE has just come off the press. If you liked the Winter Issue, you will like this one a hundred-fold. It contains some 75 new hook-ups, circuit diagrams; and some 350 illustrations. **POSITIVELY THE GREATEST BOOK EVER PUT OUT BY ANYONE.** Among the new matters listed are:

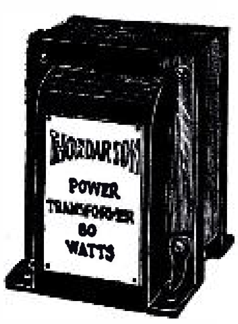
VACUUM TUBE TREATISE, with many illustrations; full page Vacuum Tube Average Characteristic Chart; How to Take Care of Your Tubes; How to Connect Phonograph Pick-ups; Improving the Tone Quality of Old Sets; Connecting Additional Loud Speakers; all fully illustrated with diagrams.

Other articles: Modernizing Old Radio Sets; How to Convert Battery to Power Sets; Selection of Tubes; Push-Pull Amplifiers; Replacing Audio Transformers; Phono Attachments; How to Choose Power Transformers; Voltage Dividers; Wattage of Power Transformers; Selecting and Installing Replacement Parts in Radio Sets; Filter Condensers; Repairing Eliminators.

WRITE TODAY. Enclose 2 cents for postage. Treatise sent by return mail.

THORDARSON "245" Power Transformer

A Miniature Power Plant — Supplies All ABC Voltages — 80 Watts



In addition to supplying a full 250 volts to the plates and 50 volts to the grids of two type '45 tubes in push-pull, this transformer may be used to light the filaments of seven or eight 2.5-volt filament tubes; and by connecting in series two of the three 2.5-volt filament secondaries it is possible to light 5-volt filaments too. Five secondaries: S1—5 V., 2 Amp.; S2—340 V. Cent. T.; S3—2½ V., 3 Amp. Cent. T.; S4—2½ V., 10½ Amp.; S5—2½ V., 3 Amp. Cent. T. **Just the power transformer for building up a high-grade public address amplifier to use a screen-grid A.F. amplifier to boost the output of a microphone or phonograph pick-up;** following this with two stages of push-pull amplification consisting of two '27's in the first stage and two '45's in the second. Bottom of transformer has bakelite panel on which are mounted all taps. **It outperforms ANY similar transformer.** Many Service Men keep this model transformer on hand for emergency replacements in hundreds of makes of radio sets. For 110-120 volts, 50-60 cycles. Size: 5 in. high x 4 x 3½ in. Shipping weight, 8 lbs. **List Price, $15.00.**

No. 1450—Thordarson Power Transformer. YOUR PRICE....... $3.84

High-Voltage Condenser Units

We guarantee these condensers unconditionally. They are ideal for general replacement purposes and can be installed in any new power-pack. All condensers are furnished with 8-inch lengths of tinned "push-back" wire.

600 VOLTS			800 VOLTS		
Cat. No.	Mfd. Capac.	Your Price	Cat. No.	Mfd. Capac.	Your Price
1702	½	$0.25	1706	1	$0.40
1703	1	.30	1707	2	.70
1704	2	.40	1708	4	1.05
1705	4	.60			

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If full cash accompanies order, deduct 2% discount. Send money order—certified check—U. S. stamps.

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Should you wish goods shipped by parcel post, be sure to include sufficient extra remittance for same. Any excess will be refunded.

Pilot Achieves Radio's Greatest Sensation!

The Entire World of Radio

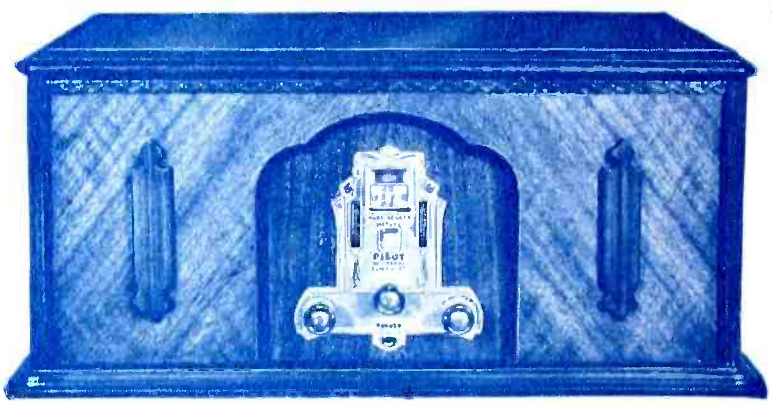
ON A SINGLE KNOB

15 TO 650 METERS

NO COILS TO CHANGE

The New

PILOT
UNIVERSAL SUPER WASP RECEIVER



Partly assembled "Universal" for the man who likes to "roll his own". With walnut cabinet, less tubes and speaker.

85⁰⁰

Pilot's wonderful wave band changing switch, incorporated in the new Universal Super-Wasp, revolutionizes the short wave art. No longer need numerous coils be changed to cover the various wave bands. No longer need dial settings change each time the same distant stations are tuned in. You can log permanently all the stations you can get throughout the world, you can tune from the short waves to the high ship waves without removing your hand from the single control knob.

Universal Features Revolutionizing the Short Wave Art

Complete coverage all wave bands from 15 to 650 meters *without coil changing*. Complete A.C. operated *chassis in cabinet*. (Also available in battery model) . . . All *Metal* Chassis . . . Highly sensitive and selective circuit . . . Screen Grid TRF amplifier *plus* Screen Grid *Detector* . . . 227 First Audio Stage . . . Two 245's in push-pull output stage . . . Stations can be logged *permanently on dial* . . . Regeneration control does not alter tuning . . . Provision for *Phonograph Pick-up* . . . Earphone Jack on *Front Panel* . . . Illuminated Dials . . . Handsome Walnut Cabinet . . . Most advanced construction yet used for short wave work . . . In kit form for easy home assembly; no drilling or cutting, all parts fully prepared.

NOTICE TO "HAMS": Pilot will continue building the original Super-Wasp in kit form for licensed amateurs and others who want to spread the tuning on their pet wave bands and add their own audio features. A.C. and battery models.

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