THE RADIO EXPERIMENTER'S MAGAZINE

HUGO GERNSBACK
Editor

SHORT WAVE CRAFT

June 1935

WORLD'S LARGEST SHORT WAVE CIRCULATION

New MAGNI-DIAL
Simplifies S.W. Tuning
See Page 76

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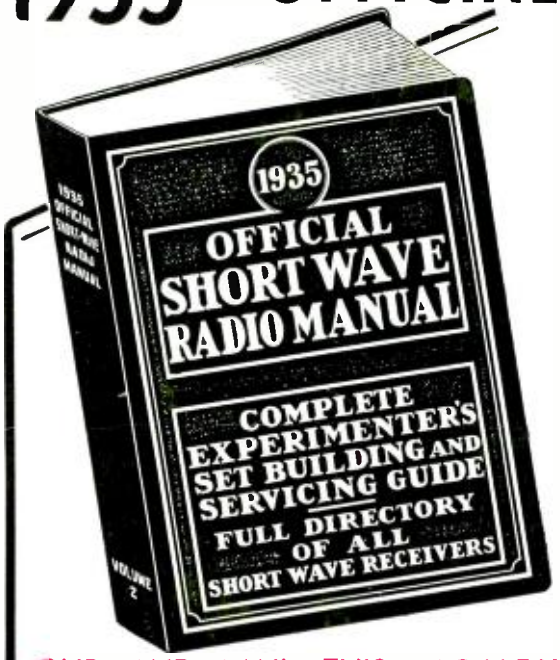
1935 OFFICIAL SHORT WAVE RADIO MANUAL



When we brought out our 1934 OFFICIAL SHORT WAVE RADIO MANUAL, of which many thousands of copies were bought by short wave enthusiasts, we promised you that a new volume would be published every year.

In keeping with this promise, we now take great pleasure in announcing the 1935 OFFICIAL SHORT WAVE RADIO MANUAL.

There has been tremendous progress and a great boom in short waves in the past year, and the art has made such rapid progress that no single book, up to now, has been able to keep up with this progress. The 1935 OFFICIAL SHORT WAVE RADIO MANUAL fills this need, and it fills it completely. All the progress made in short waves, whether it is in set building, whether it is in radio servicing, whether it is in new models, whether it is in new short wave discoveries, all are faithfully reported and chronicled in this great 1935 volume.

Like its predecessor, it is a BIG book, in which you will find literally EVERYTHING in short waves—nothing has been left out.

Not only is it a complete manual, but it is a great encyclopedia of short wave facts, information, hookups, photographs, tables, maps, etc., etc. The wealth of material is so great that it would take several pages to list all the valuable data that has been included in this volume.

Similar to last year's volume, the new book has been edited by Hugo Gernsback, Editor of SHORT WAVE CRAFT and H. W. Secor, Managing Editor, and if you are and have been a reader of SHORT WAVE CRAFT, and particularly if you have seen the 1934 Manual, you will know just what you can expect from this, the greatest short wave manual ever put out by Mr. Gernsback.

Here are the star features of the book:

29 ★ Features:

★ 1—**Short-Wave Beginners' Section**—Dozens of new simplified circuits for 1-2 and 3 tube receivers, including famous "Doerle" and "Oscillodyne," etc.

★ 2—**Short-Wave Receivers**—All types discussed with diagrams and pictures—The best types only, which have "stood the test" of actual operating service. Full details for constructing them, etc., "Band-Spreading" the Doerle, 5-tube T.R.F. Receivers, etc.

★ 3—**Battery Short-Wave Receivers**—1-2, & 3 tube sets all the way up to special 5-tube superheterodyne, designed especially for battery operation.

★ 4—**"5-Meter" Department**—All the latest "dope"—including newest transmitters, "Long Line" oscillators, improved "high sensitivity" receivers. How to arrange best aerial to get greatest distance, 5-meter transceivers, hook-ups, etc.

★ 5—**Short-Wave "Artificial Fever" Apparatus**—also newest therapeutic and other allied applications of ultra short waves.

★ 6—**Short-Wave Experimenter's Section**—filled with Short-Wave Kinks, Short-cuts, etc., of interest to every experimenter.

★ 7—**Ultra Short Waves**—Newest circuits, apparatus, and results obtained in this field.

★ 8—**Commercial "Short-Wave" and "All-Wave" Receivers**—Full Servicing Data for "Set-Owners" and "Service men."

★ 9—**How to build "Power Supply" Units for Short-Wave Receivers.**

★ 10—**Latest Short-Wave Converters**—With servicing data on Commercial Models.

★ 11—**The Short-Wave Antenna**—Including latest "Noise-Reduction" types, Transposed Lead-In systems, shielded cable, Double-Doublet, etc.

★ 12—**Short-Wave Superheterodynes**—From 3 to 11 tubes—Latest descriptions and diagrams including commercial all-wave superhets.

★ 13—**Phone Transmitters for Amateur Stations**—How to build them.

★ 14—**"Skip" Distance—Heaviside layer, etc.**—explained; physics of Short Waves.

★ 15—**Super-Regenerative Short-Wave Receivers**—latest circuits, etc.

★ 16—**Recording "Foreign" and "Domestic"** Short-Wave programs. All systems in use.

★ 17 **"High Fidelity"**—How to obtain it in Short-Wave Receivers.

★ 18—**The best Short-Wave Questions and answers of the year.**

★ 19—**The best Short-Wave "Kinks"** of the year.

★ 20—**Foreign Short-Wave Review**—Novel circuits, apparatus, etc.

★ 21—**Tubes for Short-Wave purposes**—Including tables of latest tubes for Short-Wave transmitters and Receivers.

★ 22—**Short-Wave Transmitters**—All about the new "Long Lines" Oscillators as well as other "simplified" high-efficiency transmitters, Rack and Panel jobs, Crystal Control, etc.

★ 23—**Multi-Purpose Tubes**—How to use them on Short Waves—Sets in which 2 tubes=4; 3 tubes=6; etc.

★ 24—**"Audio Amplifiers"** for Short-Wave Receivers, Circuits, etc.

★ 25—**"Band-Spread"**—How to spread the stations over the dial for easier tuning.

★ 26—**Plug-less "Mono-Coil" Receivers**—How to build efficient switch-type coils to eliminate plug-in coils; "Clip-Coil" Receivers, etc.

★ 27—**Boosters, Pre-amplifiers and Beat Oscillators**—How they work, with constructional data, diagrams, etc.

★ 28—**Portable Short-Wave Receivers and Transmitters**—Transmitter Power supply from Ford Coils, etc.

AND FOR SERVICE MEN

★ 29—Every short-wave diagram, every short-wave set, whether it is a battery set, whether it is an all-wave set, EVERYTHING, in other words, that has been manufactured in the commercial set line, will be found in this special enlarged section. Hundreds of valuable diagrams, with tube layouts, resistor values, color codes of wiring cables, etc., and the purpose of each tube in each set clearly indicated on the diagram, wherever this information can possibly be obtained.

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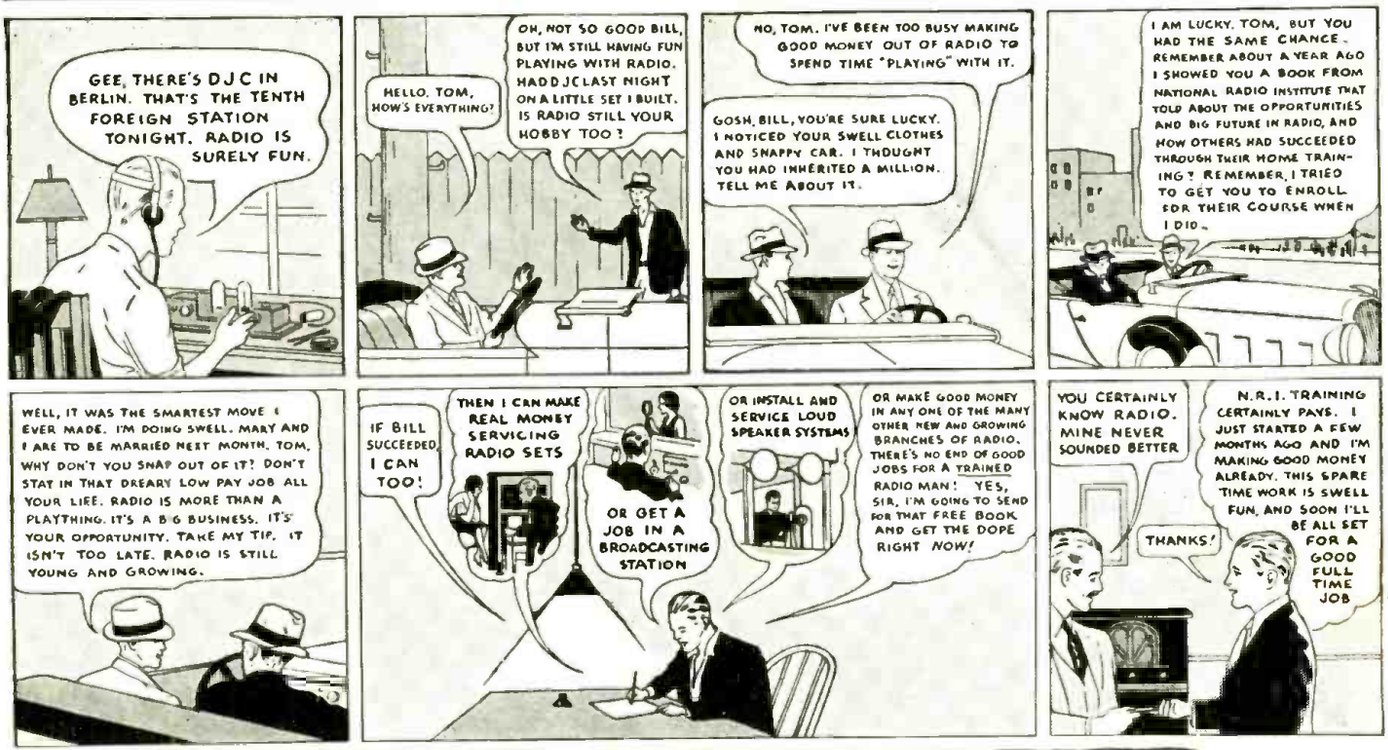

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Goodall • McCann • Olsson • McEntee • Scott • Schrage • Shuart

SHORT WAVE CRAFT

HUGO GERNSBACK
Editor

H. WINFIELD SECOR
Managing Editor

GEORGE W. SHUART, W2AMN
Associate Editor

Contents for June, 1935

Features in the July Issue

Beginners' All-Electric Short-Wave Receiver—In which 4 Tubes = 5.

New 2-Channel S-W Set Receives 2 Stations Simultaneously.

The Simplest Phone Xmitter, by Stanley Johnson, W9LBV.

Automatic Volume Control—How to Apply it to Short-Wave Receivers, by Clifford E. Denton.

The Browning 35—Constructional Data

The "Switch-Coil 2," by Ernest Kahlert.

A Mobile U.S.W. Station, by Maurice E. Kennedy, W6KQ-W6BGC.

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OUR COVER

● The cover illustration this month shows the Magni-Dial—an ingenious idea involving the use of an extra large dial, which anyone can easily adapt to their own short-wave receiver. It will help to make the tuning in of short-wave stations much easier. For full details see page 76.

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. . . SHORT WAVE ESSENTIALS

FOR MEMBERS OF THE SHORT WAVE LEAGUE . . .

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The SHORT WAVE LEAGUE was founded in 1930. Honorary Directors are as follows:

Dr. Lee de Forest, John L. Reinartz, D. E. Replogle, Hollis Baird, E. T. Somerset, Baron Manfred von Ardenne, Hugo Gernsback, Executive Secretary.

The SHORT WAVE LEAGUE is a scientific membership organization for the promotion of the short wave art. There are no dues, no fees, no initiations, in connection with the LEAGUE. No one makes any money from it; no one derives any salary. The only income which the LEAGUE has is from its short wave essentials. **A pamplet setting forth the LEAGUE'S numerous aspirations and purposes will be sent to anyone on receipt of a 3c stamp to cover postage.**

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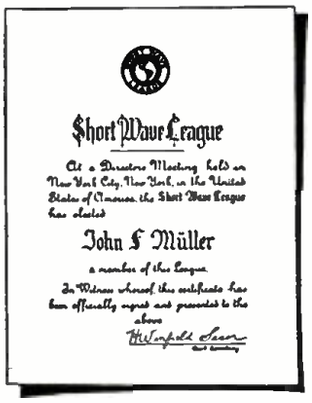

Illustration of engraved free membership certificate

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They cannot be bought by anyone unless he has already enrolled as one of the members of the SHORT WAVE LEAGUE or signs the blank on this page (which automatically enrolls him as a member, always provided that he is a short wave experimenter, a short wave fan, radio engineer, radio student, etc.).

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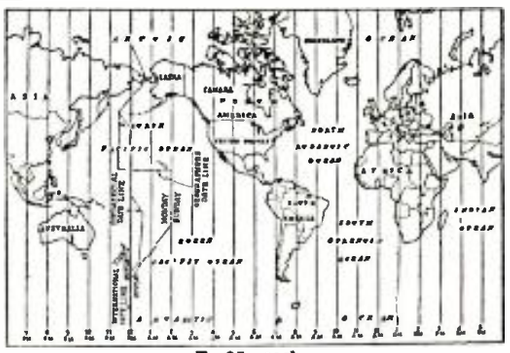

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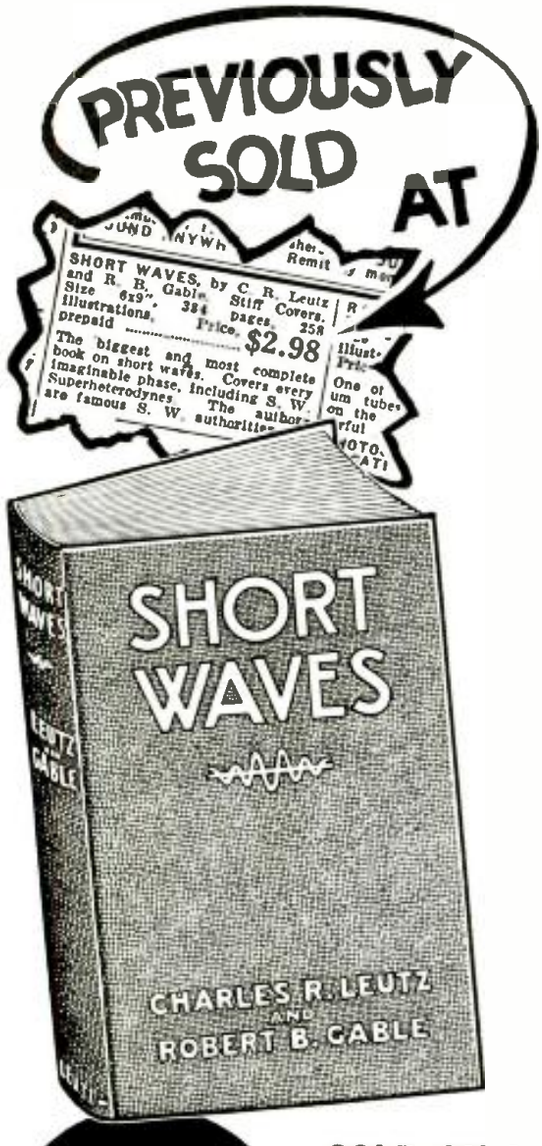

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103 Hudson Street **New York, N. Y.**

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All-Wave Sets

An Editorial By HUGO GERNSBACK

● DURING the past two years, the *all-wave* set has come to the front and has made great strides.

Previous to 1933, the public at large had practically no knowledge of an all-wave set, that is, a radio set which could receive both short waves from 15 meters up to 200 meters, and broadcast waves from 200 meters to 545 meters. This has all been changed, and very few commercial sets that come out now are made without the all-wave feature.

At one time, and not so very long ago, the all-wave set was looked upon with distinct suspicion by short-wave enthusiasts, because they felt that any set with a switching arrangement would not be as efficient as a plug-in set, and for that reason the all-wave set was in disfavor with the short-wave fraternity.

Recent engineering progress has changed all this, and there is very little, if any, difference in efficiency today between the plug-in sets and the switching type set.

Constant improvements are made by the radio industry and in a very short time the all-wave sets will no doubt not only be as efficient as the short-wave fan's plug-in set, but they will probably surpass the latter. There are still a number of improvements to be made in the all-wave sets as the larger part of the radio industry has not, as yet, caught up with the demands that the real short-wave enthusiast makes upon a short-wave set. Chiefiy, these are the following:

The tuning scale on the majority of all-wave sets, with few exceptions, are entirely too small. What is wanted is a larger scale, where tenths of divisions can be read easily without a magnifying glass.

Second, the overwhelming percentage of all-wave sets still have no band-spread arrangement, which is the one thing that is required on the congested areas such as the 31 meter and 49 meter bands, where the listener is particularly helpless due to the congestion. Band-spread is no longer a luxury but a dire necessity.

Then, there is the matter of getting the most out of the aerial system. The short-wave fan usually does this by means of a variable condenser inserted into the antenna lead in order to get the maximum resonance. This feature is missing in nearly all all-wave sets, but will no doubt be remedied very soon.

Then, there is the illumination of the dial which, in many sets, is still inadequate. If there is one thing that the short-wave listener must have it is excellent illumination on the dial, otherwise it becomes almost impossible to accurately tune in and "log" stations.

Automatic volume control is another point where the radio engineer will probably work wonders in the next few years. It is here where the greatest weakness of most all-wave sets lies. It should be understood that the average listener is not a short-wave expert and does not know much about the vagaries of short waves. He is apt to immediately condemn the set while listening to a foreign station when it fades in and out. In the broadcast band he no longer is bothered with this condition. In the first place, the power of broadcast stations has been stepped up to such an extent that the matter of fading of stations, particularly when the set has a fair automatic volume control, is no longer of great consequence. But when the average layman first listens to a foreign station when receiving conditions are not excellent, he becomes very much annoyed at the tremendous fading which, at one moment brings in the foreign station at excellent volume only to fade out almost completely within the next few moments.

Many people who do not know much about the technicalities of radio will immediately jump to the conclusion that the fault lies in the set and that listening to short waves is a nuisance. In this the listener is correct and the fault really does lie in the set. You may rest assured that the set ten years hence will not show this fading phenomenon because the sets will not only be far more sensitive but the automatic volume control feature will have been solved completely, even on weak signals. We have not, as yet, the correct automatic volume control tubes, which no doubt we shall have during the next few years. There remains quite a good deal of engineering to be done on this point alone, but I am quite certain that it will be solved very soon.

I am frequently asked the question, now that we have all-wave sets, what incentive is there for experimenters and constructors in building their own short-wave sets? Many individuals jump at the conclusion that set building is definitely over because it is now possible for the short-wave fan to buy a good all-wave set at a low price.

This conclusion is not sound. In the first place, as has been shown through the entire history of the radio art, commercial sets are always from two to three years behind the art. This is not the fault of the manufacturer because it takes time and effort, as well as capital, to develop new sets. There is also such a thing as style, and the tendency of other manufacturers.

The important point, however, is that new things are continuously being developed. Every year new tubes, more sensitive, more efficient, are being placed upon the market. Such tubes are immediately available to the builder and to the experimenter. Thus, SHORT WAVE CRAFT magazine, has for many years built special sets, far in advance of the regular manufactured product. This can easily be checked up by perusing back numbers of the magazine.

It is one of the heritages of the short-wave enthusiast that he always demands the best and latest development first. The minute a new circuit or a new development or a combination of both is published, he will wish to be the first one to build such a set. This situation will prevail for many years to come, if not forever. And this is what makes the radio art the exciting sport that it is.

The pioneering and adventuring spirit is still rampant in the breast of every young man who has the radio fever, and this is apt to continue indefinitely. When it is impossible for the young man to become an explorer in person, at least he can become, with modest means, an explorer of space, *for there is nothing quite so exciting as building a brand new set with brand new means which the radio art places at the radio enthusiast's disposal.*

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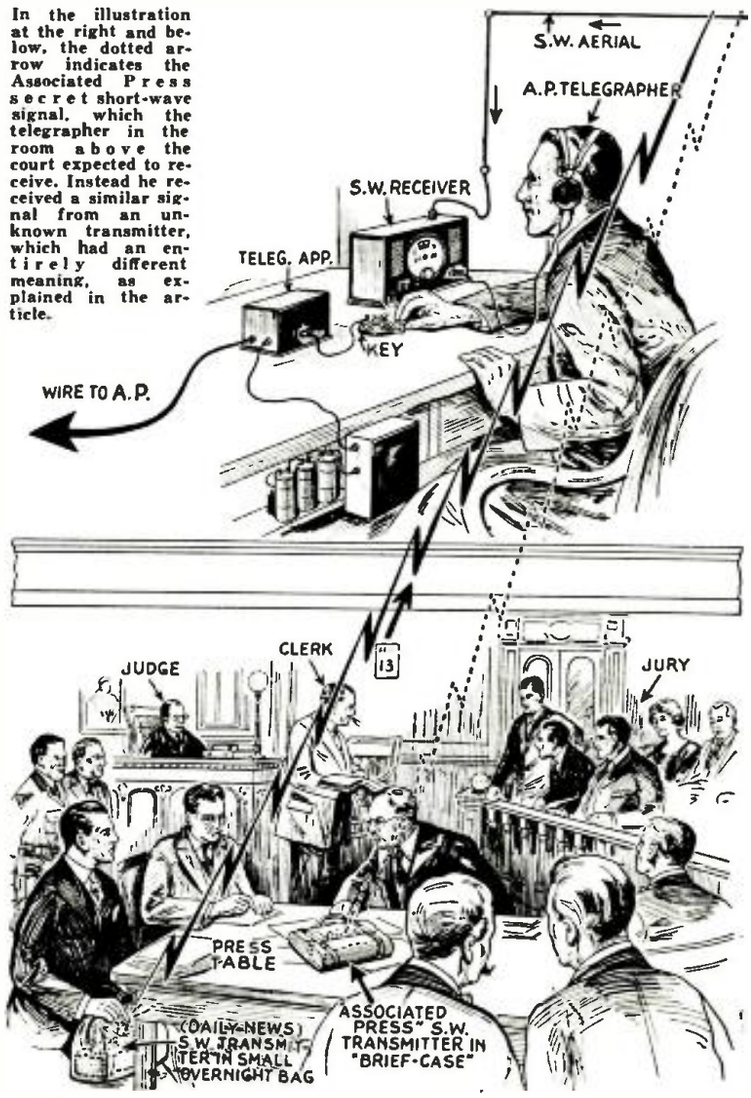
Short Waves At the Hauptmann Trial

In the illustration at the right and below, the dotted arrow indicates the Associated Press secret short-wave signal, which the telegrapher in the room above the court expected to receive. Instead he received a similar signal from an unknown transmitter, which had an entirely different meaning, as explained in the article.



Unknown to the general public and in fact to any of the court officials in the famous Hauptmann trial, was the fact that two tiny short-wave transmitters were carried into the courtroom to signal the jury's verdict to the outside newspaper world. By a peculiar mixup in the signals the wrong verdict was signaled to the press and radio bureaus as explained in the accompanying article, but this was rectified a few moments later as radio listeners will recall.

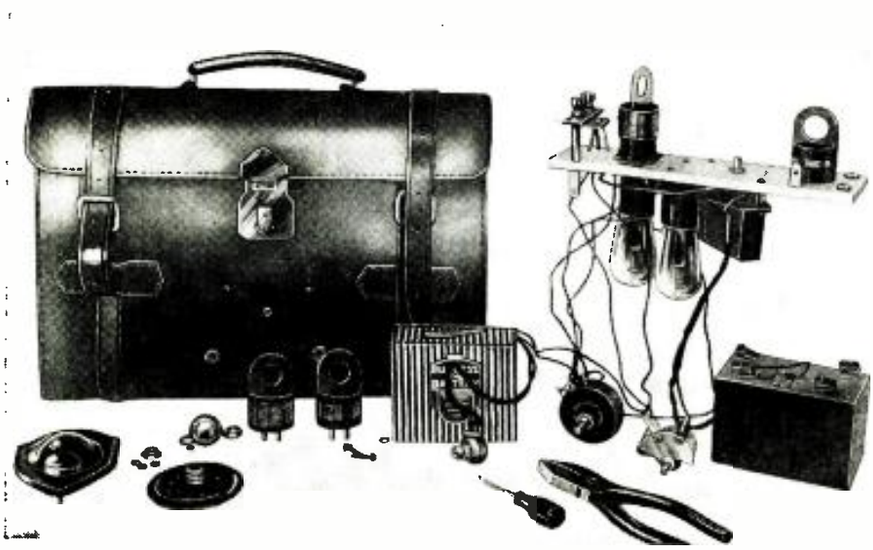
Short waves played a most important role in the famous million-dollar Hauptmann trial. Two tiny short-wave transmitters were secretly carried by reporters into the courtroom and were used to signal the jury's verdict to other reporters outside the locked courtroom. Short-waves will undoubtedly play many similar important roles in the future.

● SHORT waves played a very important rôle, in fact one of the most important of all, at the famous million-dollar Hauptmann trial, where they were called into action by the most important news-gathering organization in the country—the famous Associated Press. It is a long story, but briefly, here is what happened. If you listened to the radio reports which gave the jury's verdict on that eventful night when they walked into the courtroom, you will remember that the first verdict given over the broadcast stations was to the effect that Hauptmann had been found guilty, with a recommendation for mercy, which meant *life imprisonment*. A few minutes later a second broadcast came over the networks to the effect that he had been found guilty of murder in the first degree, which meant the *electric chair*.

The reason? Oh, just a little mixup on some short-wave code signals, and it happened in this manner. The Associated Press reporter who carried a tiny transmitter with battery and all concealed in an ordinary leather brief-case, sat at the press table and if the jury's verdict was "Guilty—Recommendation Mercy—Life Imprisonment" the A.P. code signal for this verdict was four dots. An A.P. telegrapher sat at his key in the cupola above the courtroom and suddenly was startled by hearing a signal of four dots in his headphones.

But the four signals which he heard, sad to relate, did not emanate from his buddy's transmitter in the little portfolio lying so innocently on the table in the court-room. Unknown to either of the two A.P. news-gatherers was the fact that the New York *Daily News* also had a reporter in the courtroom with a second short-wave transmitter, this one being hidden in a small overnight bag. Just to make things interesting the *Daily News* man's code signal to his coworker on the outside of the locked courtroom was four dots to indicate that the jury had *entered the courtroom!* So behold, here is what happened! The *Daily News* reporter sent the four dot signal, the A.P. telegrapher in the cupola above the courtroom heard them and presto—out to a waiting world flashed the news via his trustworthy telegraph key that *life imprisonment* was Hauptmann's fate!

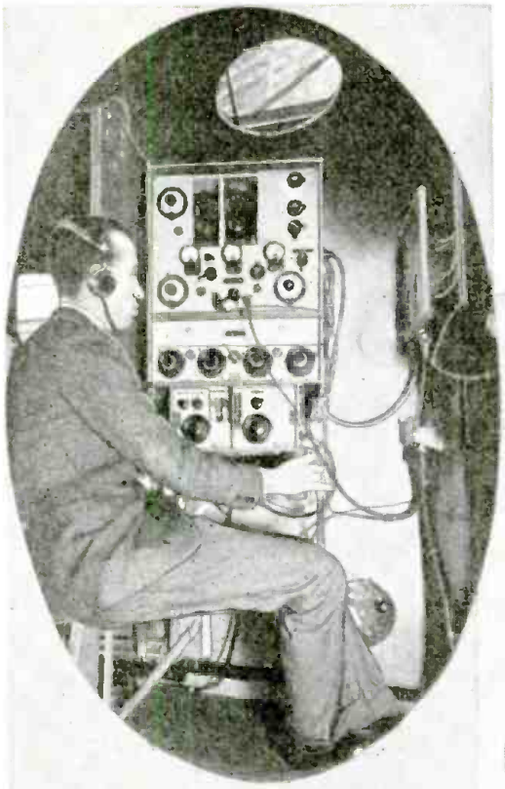
(Continued on page 103)



One of the short-wave transmitters carried by a reporter into the courtroom at Flemington was concealed in a small leather brief-case—Take a look at this photo! SHORT WAVE CRAFT described how to build a short-wave set in a brief-case in the June 1932 issue—three years ago! With a slight change in the connections, this receiver is easily converted into a transmitter for code signals, such as those used at the Hauptmann trial.

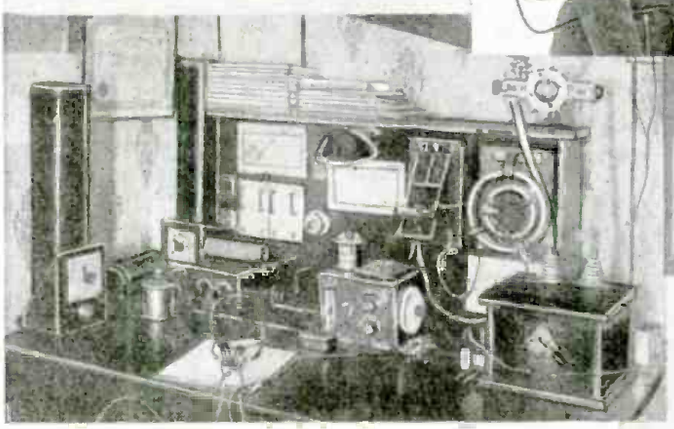
Short Wave Snapshots

Interesting Applications of Short Waves Including Sets Aboard Planes, Bobsleds and Ham Communications



Above—Short Waves recently carried a running description of the sensations experienced in the mile and one-half run of this bobsled at Lake Placid, N.Y. At times the bobsled reached a speed of 70 miles an hour. The young man shown in the "close-up" is Eugene S. Darlington, youthful General Electric Co., engineer, and he is carrying a portable 7-meter radio transmitter on his back, which is complete with batteries and all the "trimmings"; the microphone is shown suspended on his chest. The short-wave voice signals from the transmitter aboard the speeding bobsled were picked up and transferred to another transmitter in the vicinity, which relayed them on to Lake Placid Village, where the voice was picked up by an all-wave receiver and fed into a telephone line to Schenectady, where it was re-broadcast by station WGY and its short-wave "pal," W2XAD.

The top left photo shows a new plane built for the Viceroy of India, which is fitted with the latest Marconi short-wave receiver and transmitter.



Shades of Heinrich Hertz! Yep—a Ham station of 1916 vintage! Transmitter, receiver, an' everything. On the wall is a membership certificate of the "Radio League of America," established by Hugo Gernsback, editor of this magazine. This station operated on 200 meters, real short for that period, and the receiver was a "1-tuber," observable in the center of the photo. Note the rotary spark gap at the right and the oscillation transformer made of copper ribbon, just below the gap! Roswell J. Parker.

↑A Japanese Ham operating an amateur transmitter and receiving station in Japan under the license call J1DM. The picture shows 18-year-old Seichiro Handa, a student; apparently he has not heard of the depression (a very common subject of conversation in the occident) judging by the size of the meters on his control board above the table. More power to him!

← At the left—fourteen-year-old radio amateur, George Alan Bryan of Derby, England, who is reputed to be one of the youngest European Ham station operators. His call letter is G2AFV.

SHORT WAVE SCOUTS

15TH TROPHY WINNER
Robert Graham, 314 W. Eldridge Ave., Flint, Michigan
55 Stations; 43 Foreigns

● THE editors are pleased to announce the award of the fifteenth trophy cup to Robert Graham of Flint, Mich., for his excellent list of short-wave stations submitted with verifications. Mr. Graham's list contained 43 foreign stations and 12 United States stations. Our new rules only required 50 percent foreign stations in the list and Mr. Graham has therefore plenty of "foreigns" to spare. Mr. Graham rolled up this very fine list of short-wave stations on his Hammarlund Comet Pro, using an 85-foot flat-top antenna and a connection to a water pipe for a ground. Mr. Graham states in his letter accompanying the list of stations, that he has been a reader of SHORT WAVE CRAFT practically since the first issue. The list of stations submitted by Mr. Graham was accompanied by the required notarized statement that he had personally listened to all of the stations in the list during the thirty-day period between Dec. 13, 1934, and Jan. 12, 1935, and in accordance with the rules, that all verification cards entered with the list were received in reply to reports sent to the respective stations during this specified thirty-day period.

IMPORTANT: Do not fail to remember that all the entries must now be entered according to the new rules which are herewith reprinted for the benefit of those who intend submitting lists of stations. Read the new rules carefully!

Briefly they are: The Trophy will go to the person submitting the "greatest number of verifications!" No unverified stations are required! Also, at least 50 per cent of the verifications submitted must be for stations located OUTSIDE of the country in which the entrant resides. Only letters or cards specifically verifying reception of a given station will be considered.

MR. GRAHAM'S LIST: FOREIGN STATIONS

HP5B 6030 Kc. Daily. 8—10:30 p.m.; Estacion Radiodifusora Miramar, Panama City, Rep. of Panama. "Radio Miramar"
COC 6010 Kc. Daily, 9:30—11:30 a.m., 4—7 p.m.; Sat., 11:30 p.m.—12:30 a.m.; Havana, Cuba.
YV5RMO 5850 Kc. Daily. 5:15—9 p.m.; Maracaibo, Venezuela. "Ecos del Caribe"
COH 9428 Kc. Daily, 5—6, 8—9 p.m.; Havana, Cuba.
HIX 5980 Kc. Tues., Fri., Sun., 8—10 p.m.; Santo Domingo. D.R.
ORK 10330 Kc. Daily. 2:45—4:15 p.m.; Radio Ruysselede, Ruysselede, West Flanders, Belgium.
DJA 9560 Kc. Daily, 8—11:30 a.m., 5:15—9:15 p.m.; Berlin, Germany.
DJN 9540 Kc. Daily, 3:45—7:15, 8—11:30 a.m., 5:15—10:45 p.m.; Berlin, Germany.
DJC 6020 Kc. Daily. 12—4:30, 5:30—10:30 p.m.; Berlin, Germany.
Radio-Coloniale 15243 Kc. Daily, 7—11 a.m. or 1 p.m.; Paris, France. "Ici Paree Radio-Coloniale"
Radio-Coloniale 11875 Kc. Daily, 11:15 a.m.—2:15 p.m., 3—6 p.m.; Paris, France. "Ici Paree Radio-Coloniale"

Radio-Coloniale 11720 Kc. Daily. 7—10 p.m., 11 p.m.—1 a.m.; Paris, France. "Ici Paree Radio-Coloniale"
YV3RC 6150 Kc. Daily, 4:30—10 p.m.; "Radiodifusora Venezuela," Caracas, Venezuela.
PRADO 6620 Kc. Thur., 9—11:30 p.m.; Radiodifusora de "El PRADO," Riobamba, Ecuador.
PRF5 9501 Kc. Daily exc. Sun., 5:30—6:15 p.m.; Comp. Radio Internacional de Brazil, Rio de Janeiro, Brazil.
GBU 12290 Kc. Irregular; Rugby, England.
GBS 12150 Kc. Irregular; Rugby, England.
GCB 9280 Kc. Irregular; Rugby, England.
YV2RC 6112 Kc. Sun., 1:30—10:30 p.m.; Daily exc. Sun., 11 a.m.—1:30 p.m.; Mon., Thur., Sat., 4:45—10 p.m.; Tues., Wed., Fri., 4:45—9:30 p.m.; "Broadcasting Caracas" Caracas, Venezuela.
HJ1ABB 6447 Kc. 11:45—1 p.m., 5:30—10 p.m.; "La Voz de Barranquilla," Barranquilla, Col.
PRADO 15410 Kc. Sun. afternoon; Riobamba, Ecuador.
CT1AA 9600 Kc. Tues., Thur., Sat., 4:30—7 p.m.; "Radio Coloniale," Three Cuckoo Calls. Lisbon, Portugal.
HC2RL 6666 Kc. Sun., 5:45—7:45 p.m.; Tues., 9:15—11:15 p.m.; Guayaquil, Ecuador.
PCJ 15220 Kc. Irregular—Relays PHI Sun.; "Philips Radio." Eindhoven, Holland.
HJ1ABG 6042.5 12—1 p.m., 6—10 p.m. daily; Sun., 1—6 p.m.; Barranquilla, Colombia.

FIFTEENTH "TROPHY CUP" WINNER

Presented to

SHORT WAVE SCOUT

ROBERT GRAHAM,
FLINT, MICH.

For his contribution toward the advancement of the art of Radio

by

SHORT WAVE CRAFT

Magazine

● **ON this page is illustrated the handsome trophy which was designed by one of New York's leading silversmiths. It is made of metal throughout, except the base, which is made of handsome black Bakelite. The metal itself is quadruple silver-plated, in the usual manner of all trophies today.**

It is a most imposing piece of work, and stands from tip to base 22½". The diameter of the base is 7¾". The diameter of the globe is 5¼". The work throughout is first-class, and no money has been spared in its execution. It will enhance any home, and will be admired by everyone who sees it.

The trophy will be awarded every month, and the winner will be announced in the following issue of SHORT WAVE CRAFT. The winner's name will be hand engraved on the trophy.

The purpose of this contest is to advance the art of radio by "logging" as many short-wave phone stations, amateurs excluded, in a period not exceeding 30 days, as possible by any one contestant. The trophy will be awarded to that SHORT WAVE SCOUT who has logged the greatest number of short-wave stations during any 30-day period.

HONORABLE MENTION AWARDS

(None this month.)

RV59 6000 Kc. Daily, 3—6 p.m.; Moscow.
RNE 12000 Kc. Sat., 10—11 p.m., 6—7, 10—11 a.m.; Moscow, U.S.S.R.
CEC 15865 Kc. Irregular; Santiago, Chile.
CEC 19680 Kc. Irregular; Santiago, Chile.
VK3LR 9580 Kc. 3—8 a.m., daily; Lyndhurst, Victoria, Australia.
TGF 14485 Kc. Irregular; Guatemala City, Guatemala.
LSN 9890 Kc. Irregular; Hurlingham, Argentina.
LSL 7901 Kc. Irregular; Hurlingham, Argentina.
LSQ 14845 Kc. Irregular; Hurlingham, Argentina.
DJE 17760 Kc. 8—11:30 a.m., daily; Berlin, Germany.
I2RO 6085 Kc. 6—7:30 p.m., Mon., Wed., and Fri.; Rome, Italy.
CJRX 11720 Kc. 8—12 p.m., Sun. 3—10 p.m.; Winnipeg, Manitoba.
CJRO 6150 Kc. Same as CJRX; Winnipeg, Manitoba.
CGA3 13285 Kc. Irregular; Drummondville, Quebec.
CGA4 9330 Kc. Irregular; Drummondville, Quebec.
CGA8 4905 Kc. Irregular; Drummondville, Quebec.
VE9DN 6005 Kc. Sat., 11:30 p.m.—12:30 a.m.; Montreal, Quebec.
VE9GW 6090 Kc. Mon., Tues., Wed., 3-12 p.m.; Thurs., Fri., Sat., 7 a.m.—12 midnight. Sun., 1—9 p.m.; Bowmanville, Ontario.

UNITED STATES OF AMERICA

WNC 15055 Kc. Irregular; Hialeah, Fla.
KWO 15415 Kc. Irregular; Dixon, Calif.
KWU 15355 Kc. Irregular; Dixon, Calif.
W2XAF 9530 Kc. Daily, 6:30—11 p.m.; Schenectady, N.Y.
W2XAD 15330 Kc. Daily, 2:30—3:30 p.m.; Schenectady, N.Y.

(*Continued on page 120*)

The Ionosphere—Where Short Waves Are Reflected

By W. M. Goodall*

At one time it was thought that there were two general ionized regions, an upper and a lower. As a result of recent researches it is now known that the ionosphere is composed of at least five, and possibly more, reflecting regions, the heights of which are not constant and may even shift relative to each other.

● WHEN you pick up your telephone and talk with a friend in Europe, South America, or Hawaii, the radio waves commonly employed to carry your voice do not cling to the earth in their journey, but reach their destination after being reflected from some point high in the atmosphere. For *short-wave* transmission, it has been known for some time that as the receiver is moved away from the transmitter, the received signal becomes weaker and at a comparatively short distance—from 50 to 100 miles—disappears entirely into the background of noise. As the distance is further increased, however, the signal will reappear, and become strong. This phenomenon is known as the "skip" effect. Its observation led to the inference that short-wave signals are returned to the earth at great distances from the transmitter by being reflected from some of the upper layers of the atmosphere. Without such a reflecting region, long-distance radio communication by short waves would be impossible. It is obviously desirable to have as sound a knowledge as possible, both of the physical nature of this region and of the method by which radio waves are propagated through it. With this in view, experiments have been carried on for some time by J. P. Schafer and the writer at the Deal Laboratory.

*Radio Research, Bell Telephone Laboratories.

Early in 1882, Balfour Stewart had suggested the existence of a conducting layer high in the atmosphere to explain variations in the magnetic field of the earth. In 1902, Kennelly and Heaviside had independently also used the assumption of a conducting layer to provide a mechanism capable of reflecting radio waves. In spite of these early suggestions, however, it was not until the last decade that experiments had been carried out which were sufficiently direct to satisfy the few who held to the bitter end that a conducting layer is an unnecessary assumption. Today, however, no one questions its existence. The evidence admits of no other interpretation.

Present-day knowledge of conductivity in gases suggests that this conducting layer is an ionized region of the atmosphere. Ultra-violet light from the sun is, under favorable conditions, a powerful ionizing agency, and might well produce these ionized regions. From measurements made by the Laboratories during a recent solar eclipse, moreover, it appears that the sun is largely responsible for ionization in at least two of the reflecting regions of the upper atmosphere.

The atmosphere surrounding the earth may be divided into two or more layers. The lower of these, extending upward to about eleven kilometers above the earth, is known as the troposphere. In this region clouds form and temperature decreases in proportion to altitude. In the region above this level, called the stratosphere, the temperature does not vary with altitude and cloud formations of the type found in the troposphere never appear. It is in a still higher region that radio waves are reflected, and it has been suggested that this latter region be called the ionosphere, a name that was derived from its most important attribute—ionization.

A convenient method of studying the ionosphere is to measure the time required for a radio signal to travel to the reflecting layer and back to the earth. Knowing the velocity of the waves, one can easily compute the distance to the point of reflection from

(*Continued on page* 116)

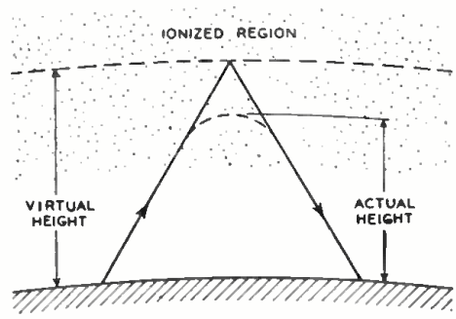


Fig. 1—Radio waves are not reflected as light from the surface of a mirror, but in effect curve around at a decreased velocity.

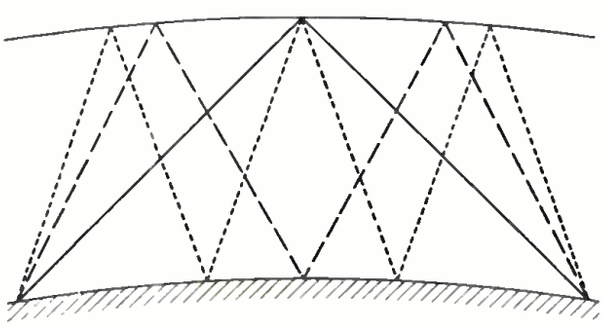


Fig. 2—Photo at left: Ionosphere measurements are made in a small building with transmitting and receiving antennas stretched above it.

◈

Fig. 3—A pattern on a cathode ray tube furnishes the necessary data for calculating virtual heights.

◈ →

Fig. 7—(Left) Possible multiple paths for radio ← transmission.

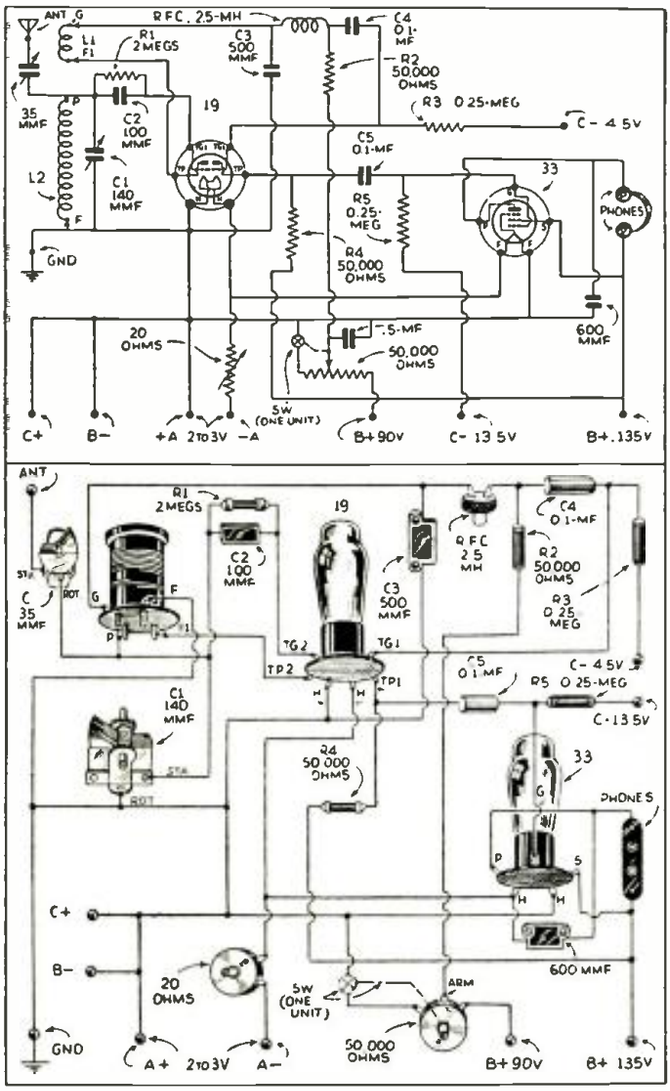
GO-GET-'em 2" for the

By George W. Shuart
W2AMN

Here is a very nifty 2-tube short-wave receiver which gives a 3-tube performance and operates in conjunction with batteries. The author also clearly explains a good many technical terms and considerations for the benefit of the beginner.

● OUR reader's correspondence has indicated that there are a great number of newcomers to the already great number of short-wave fans and it is for this group that this simple battery-operated receiver is intended.

Those just starting in the realm of short waves of course are not so familiar with the various terms used and for this reason we will endeavor to clarify a few of the most confusing along with the description of this 2-tube set. The reason we selected a battery receiver is because the majority of beginners seem to "cut their teeth" on battery-operated sets; probably because they are the most simple to construct.



Physical and schematic diagrams of this excellent 2-tube "battery-operated" receiver.

This set uses a type 19 tube, which serves as a detector and one stage of audio amplification. This tube can serve this dual purpose because it consists of two separate 3-element tubes in a single glass envelope. The second tube used is a power pentode having five elements. The entire receiver is mounted on a metal chassis and we strongly advise the builder to us the metal chassis because it allows neater and more efficient construction than could be had if a wood base board were used.

Referring to the diagrams, we have shown both physical and schematic; the most critical part of the entire set lies in the tuned circuit and its associated components. They are, the coil and tuning condenser, which are marked L1, L2 and C1, the grid condenser and grid-leak, C2 and R1. These parts of the circuit together with the detector tube are the heart of the whole receiver, because upon them depends the sensitivity of the set.

The values shown in the diagram give the best results. These values could be expressed in two different ways. For instance C1 is shown as 140 mmf. It could also have been expressed as .00014 mf. By looking at the figures we immediately see that we have made a decimal of the 140 by moving the decimal point six places to the left and then dropping the one m. Changing .00014 mf. to mmf. is just the reverse—move the decimal six places to the right and add an m. (140 mmf.). For simplicity the decimal is dropped entirely as it is of no consequence when to the extreme right of a number.

The resistor R1 is 2 megohms or two million ohms. To change ohms to megohms we perform the same operation as we did when changing from mmf. to mf. In other words R2, 50,000 ohms in the diagram, could have been expressed .05 meg. simply by moving the decimal point six places to the left. Changing from megohms to ohms the decimal point is moved six places to the right. We hope this will help the inexperienced reader in identifying condensers and resistors either when reading diagrams or when trying to select parts from catalogs which do not happen to use the same terminology he is accustomed to.

Another very important point in set construction is the proper coil connection. A great percentage of failures can be attributed to the coil. In all sets where the tickler is in the plate circuit of the tube, the windings should both be *wound in the same direction.* The plate will then connect to the lead of the tickler which is farthest away from the grid coil and the grid condenser and grid-leak will be connected to the terminal of the coil which is farthest from the tickler; in other words the two *outer* leads always go to the plate and grid of the tube. The tickler will then always be at the ground side of the grid coil, where it is supposed to be.

The antenna trimmer or coupling condenser also plays an important part and trouble caused by it is hard for the beginner to find. If the capacity of the condenser is large it will block the detector tube on the shorter waves and prevent oscillation. Many fans have obtained fine results on the 100 to 200 meter coil and nothing on the low wave coils, simply because this antenna condenser has a large minimum capacity. The usual run of 35 mmf. condensers have a very low minimum capacity and will serve nicely. If your set fails to oscillate on the low waves, disconnect the antenna from the set and if oscillation is obtained you can bet the condenser capacity is not *low* enough. That is so if the values in the circuit are as specified in the particular diagram that you are following.

If the set does not oscillate with the antenna disconnected then the trouble lies either in improper coil design or the detector tube is not supplied with the proper voltages or the tube itself may be defective and cause lack of oscillations on the lower waves, although it may work fine on the higher waves.

The Audio Amplifier

In the audo frequency portion of the set we have one triode of the 19 as the first stage and a 33 pentode as the second stage. These two stages of high-gain audio will op-

BEGINNER
GIVES 3-Tube Results

The "Go-Get-'em 2" in operation—So simple to tune anyone can roll in the "foreigns" without half trying. It is also extremely quiet as it is battery-operated.

erate a magnetic speaker on the average station, although the receiver is best suited to earphone operation. Coupling between the audio stages and the detector is accomplished by the two condensers C4 and C5, resistances and condensers being used in place of the usual transformer. A very important consideration in the audio amplifier is the grid bias (C bias) which produces better tone quality and lowers the plate current of the tubes and thus results in a considerable saving in battery power. Three 4.5 volt C batteries should be used; the full voltage should be applied to the grid of the 33 and the grid return of the first stage should be connected at the 4.5 volt tap nearest the *plus* side of the group. In order to reduce the high pitch hissing noise of the pentode we use a .006 mf. condenser and connect it from the plate to B minus. This also will eliminate any tendency of the amplifier to howl.

A Few Words About Leads

In building short-wave receivers there are two very important things to remember—these are short leads in the RF portion and securely soldered connections throughout the entire set.

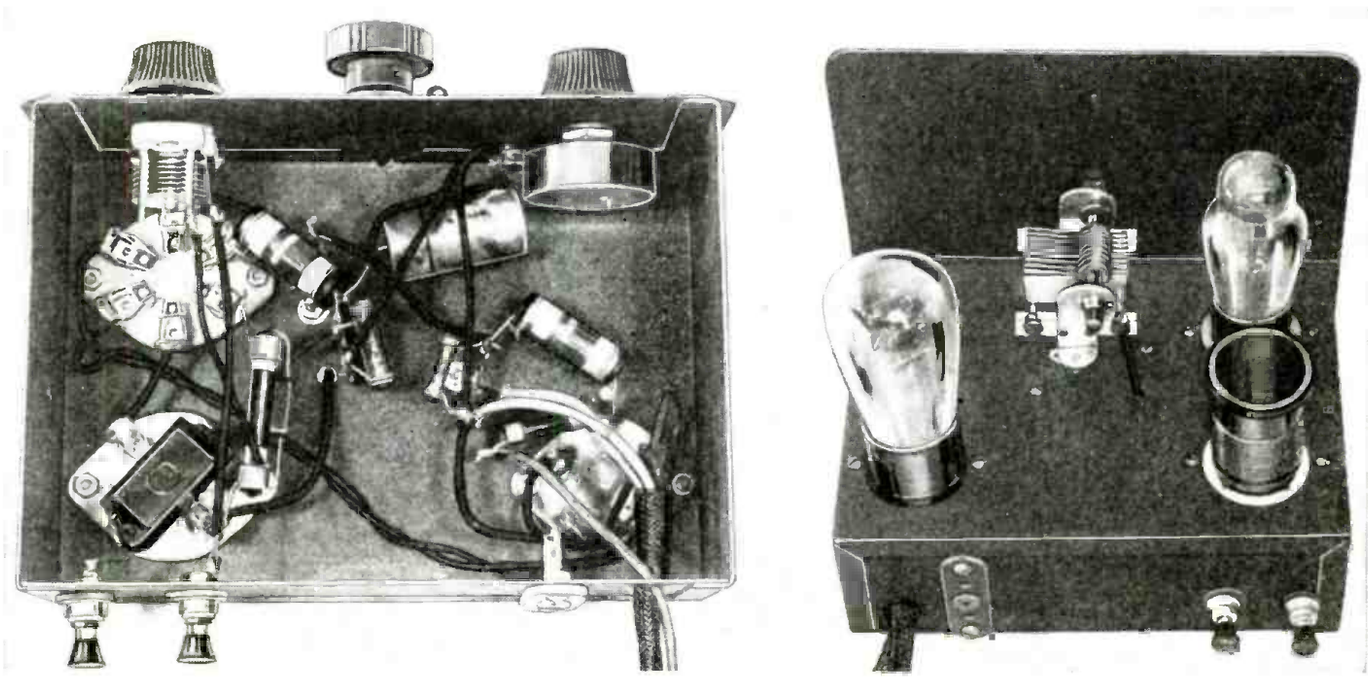
By short leads in the RF portion we mean all leads from the antenna post to the grid and plate of the detector. This takes in the plug-in coil, the tuning condenser, the grid condenser and the grid-leak. Place the different parts so that these leads will be naturally short. The length of the leads in the other part of the circuit is not so important although they should not be made any longer than necessary. Other than the length of the leads the next important consideration in set construction is the manner in which the leads are soldered. Use a hot iron and be sure that the joint is not moved until the solder is cooled, otherwise the joint will be ineffective.

The battery power needed to run this receiver consists of three 45 volt B batteries and two 1.5 volt dry cells or their equivalent. The 20-ohm rheostat is used to adjust the filament voltage to the required two volts. If one has no voltmeter for measuring the voltage, then the rheostat should be turned on no farther than the point which gives proper results.

Parts List for Beginner's Set

1—140 mmf. variable condenser, Hammarlund (Bud).
1—100 mmf. condenser, Aero-vox.
1—pr. phones. Cannon-Ball.
1—500 mmf. condenser, Aerovox.
2—.1 mf. condensers, Sprague (high frequency type).
1—.5 mf. condensers, Sprague.
1—600 mmf. mica condenser, Aerovox.
1—35 mmf. variable condenser, Hammarlund (Bud).
2—¼ meg. resistors, Lynch.
1—2 meg. resistor, Lynch.
1—20-ohm rheostat, Electrad.
1—Set of plug-in coils Na-Ald, (Hammarlund).
1—4-prong isolantite socket, National.
1—6-prong isolantite socket, National.

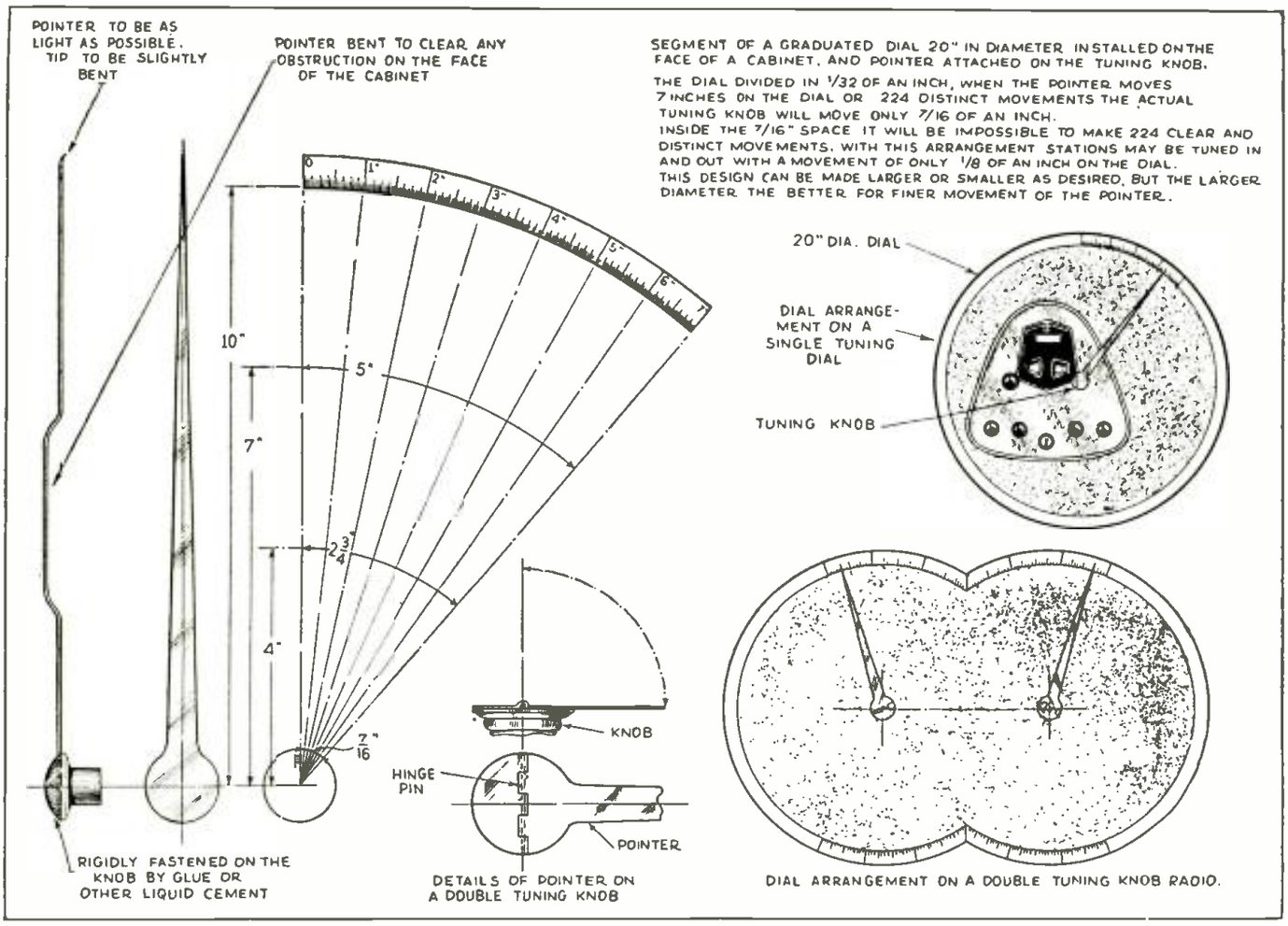
(*Continued on page* 114)



Top and bottom views of the excellent beginner's receiver, showing placement of the various parts.

MAGNI-DIAL Simplifies S-W Tuning

By H. E. McCann



The drawing above shows a very interesting and practical way in which to greatly simplify the problem of short-wave tuning. A greatly lengthened indicator is employed with a highly magnified scale, the needle serving either as an indicator or as the actual tuning device.

● THE illustration herewith shows a practical idea which the writer has worked out and employed very successfully in tuning in stations halfway round the world, with the greatest of ease. One of my principal experiences with this greatly magnified dial for short-wave tuning has been in connection with the McMurdo Silver Masterpiece 2 All-Wave receiver. With one of these large dials fitted to this set I have been able to easily tune in Berlin, Moscow, Paris, Buenos Aires, Madrid or London (on the 20-inch diameter dial; at the writer's location, Cavite, Philippine Islands.) I can tune in any one of these stations and lose them again when I move the dial indicator 1/16 of an inch, either to the right or left of the exact point where the station comes in clearly.

As shown on the drawing for example, a section of the 20-inch diameter circle about 7 inches long can ordinarily be used. Now, if you divide this 7-inch segment into 1/32's of an inch, this means that you can very easily and accurately move the tuning knob 224 times, each movement covering the space of 1/32 inch, but on the knob alone these 224 movements in a space of 7/16 of an inch would be practically impossible, without the use of this or a similar design to allow the knob to be moved 224 times an equal distance in any one direction inside the space of 7/16 of an inch.

Receivers equipped with double tuning knobs may have a long pointer like that illustrated fastened on each knob, and used with half a ring or circle of the scale for each knob. In this case it will be found best to hinge the pointer at its center so as to complete a turn; the pointer or indicator is then started again, thus going twice around the half dial as shown in the drawing.

As the drawing makes perfectly clear, this design can be used in many different ways and on practically all radio receivers regardless of the fact that it uses one or two tuning knobs or controls.

The principal advantage of this idea is that it need not cost practically anything and only requires a little ingenuity on the part of the set owner who wishes to adopt it. As the reader will at once realize upon a little reflection, there are many different ways in which this magnified dial idea can he figured out and the form of the dial and its angular spread will in many cases be dictated by the design of the particular receiver you happen to own or operate. In some cases the dial may have the graduations spread out over a half circle. Another angle of this invention is that you may simply use the new long indicating needle 10 inches in length for example, merely as an *indicator* and not as the *actual* tuning control to be set by grasping the end

(*Continued on page* 103)

Magni-Dial Easy to Build

The greatly magnified dial portrayed on our front cover should prove a godsend to short-wave fans. This idea may be applied in the manner shown on the cover or the long indicating needle may be used as the actual tuning control itself.

Short Wave SCOUT NEWS

E. M. Heiser, Brecksville, Ohio, Reports

● ALTHOUGH some evenings were very noisy, the past period (Feb. 20 to Mar. 20) was very fine on the 49-meter band. South American stations, especially, came in well. The European stations on this band were not heard very often, but were *very loud* when they did come in.

The 25- and 31-meter bands have been getting better, while the 19-meter band has been weak, although KKP comes in very loud any time of the year.

YV6RV is operating on about 46.01 meters now and comes in very loud. The call of this station is hard to get, as sometimes it sounds like YV6RV and at other times like YV5RV.

Some stations were heard. which had not been heard for some time; as follows: KEJ on 33.29 meters; LSN on 30.30 meters; DJN on 31.45 meters; OAX4D on 51.8 meters; KKQ on 25.08 meters; and KIO on 25.68 meters.

A verification has been received from HI1A on 6185 kc. or 48.89 meters. They operated from 12:20 to 2:20 p.m. and from 8:20 to 10:20 p.m. daily. Also from HVJ who operate as follows: 10:30 a.m. to 10:45 a.m. on 15,121 kc. or 19.84 meters; 2:00 p.m. to 2:15 p.m. on 5,969 kc. or 50.26 meters. On Monday they speak Italian; Tuesday, English; Wednesday, Spanish; Thursday, French; Friday, German, and Saturday, Dutch. Identification signals are, the tick-tock of the studio clock; bells of Saint Peter strike the hour and the opening and closing words are, "Laudetur Jesus Christus."—Edward M. Heiser, Rt. 2, Box 124, Brecksville, Ohio.

Turning the Dials at Angelo Centanino's S.W.C. Listening Post at Freeport, Pa.

● YV6RV in Valencia, Venezuela, has changed their wavelength to 46.01 meters.

2RO Rome, Italy, has changed the wavelength for the afternoons and South America broadcasts to 31.13 meters, and lately CT1AA has been on 31.28 meters, the same wavelength as that used by W3XAU.

W9XAA on 49.34 meters has been broadcasting a German program, mornings 9:45 to 10:45 a.m., E.S.T. Don't mistake this with one of the new German transmitters.

Some morning at 10:25 a.m. set your dial at 19.84 meters and you should hear bells ringing. This is station HVJ, Vatican, Rome, Italy, which is operating daily from 10:30 to 10:45 a.m. They give a talk in Italian on Mondays. English on Tuesdays, Spanish on Wednesdays, French on Thursday, German on Fridays, and Dutch on Saturdays.

Germany operates three transmitters nightly, and on the morning of Mar. 7, they were operating three stations; DJA, DJN, and DJB, for North America at 10:00 a.m.

DJD on 25.49 meters broadcasting for Africa is coming in good from 3:30 to 4:30 p.m., E.S.T.; the news in English is given at 4:15.

HP5J, 31.28 meters, is coming in fine; they call themselves the "Voice of Panama."

HI1A in Santiago de Caballeros, Dominican Republic, comes in fine nightly. They have been moving around a bit lately and at the present writing are on 48.50 meters.

PCJ on 19.71 meters has been testing and asking for reports. They send a very nice card showing a birdseye view of Phillip's Radio Laboratories in Huizen, Holland.

PRF5 on 31.56 meters, Rio de Janeiro, Brazil, also sends a nice card giving three views of the station; they are rated at 60 kw. power.—Angelo Centanino, Box 516, Freeport, Pa.

Listening Post Report for March from John Sorensen, Bronx, N. Y.

● STATIONS heard and logged this month are: GSA — GSB — GSC — GSD — GSE — GSF — GCW — DJA — DJC — DJD — DJE — DJN — ORK — EAQ — HBL — HBP — CT1AA — CT1GO —48.4 meters and 24.2 meters—FYA, 19-25.2-25.6 meters; HVJ 19.9 meters; Rome, on 31.13-49.3 meters; RW15, 70.6 meters; HAT, 55.5 and HAS3, 19.5 meters; PCJ, 19.9; PHI, 25.6 meters; RNE. 25; RKI, 19.8 meters. HJ3ABH, 50.1 meters.

HJ1ABB — HJ4ABE — HJ1ABD, 41.2 meters; HJ4ABA — MEDELIN, 25.7; HJ4ABB — HJ4ABD — HJ3ABE — HJ4ABL, 49.1 meters; HJ1ABC, 49.65 meters; HC2RL — HP5B — HI4D, 46 meters; HIH, 44 meters; HI1A, 48.6 meters; YV6RV — YV3RC — YV2RC — YV4RC, 47 meters; YV5RMO — HJN, 49.4 meters; COC — COH — CO9GC, Santiago, Cuba, 48.8 meters; YN10P, Managua, Nicaragua, 47 meters; PRF5, PRADO, 45 meters; OAX4B, 48.1 meters; OAX4D, 51.8 meters; TIEP — TIGPH, 51.7 meters; XEBT — HC2ET, 65.2 meters; CO5RY, 42.05 meters; CJRO — CJRX — VE9GW — VE9DN, 49.9 meters; VKI, 48 meters, U.S. Army Airport; W2XE, 19-25-49 meters; W8XK, 19-25-49 meters; W3XAL, 16-49 meters; W9XF, 49 meters; W8XAL, 49 meters; W9XAA, 49 meters; W8XAL, 49 meters; KEE, 38.8 meters; WO9, 48 meters; SG7, 45 meters; W1XAL — W1XK — W3XAU 31 and 49 meters; YDA, 49.1 meters; VK2ME — VK3ME — VK3LR.

Latest "Hot" Tips for Short-Wave Listeners from our "OFFICIAL LISTENING POSTS"

Also many unidentified stations heard mostly in South American; atmospherics have been very bad this month, also local disturbance (harmonics) has been less this month than usual.

New antenna has been erected here, 480 feet long, 30 feet high, No. 22 stranded copper wire pointed toward E.S.E. German amateur was heard on 45 meters, several Cubans on 20 and 40 meters, several Canadians on 75-20 meters, many South Americans on 40-41 meters.

Verifications received this month are: YV2RC, Caracas; CT1GO, 48.4 and 24.2 meters. DJE, 16.8 meters. DFE, 30.5 meters.

Stations WWDI — WWEC — WWHJ — WWDW 3410 kc., 50 watts, Dept. Commerce, Philadelphia, Pa. Lighthouse Service: GAS, 24.5 meters; W9XBS, 2.5 kw., 64.25 meters, Chicago, Ill.

Many reports have been sent to South American stations but not many replies received.

Frank Hogler's Report, Brooklyn, N. Y.

● RECEIVED a "veri" from RNE, Radio Centre. Moscow; they give the following schedule for their stations: Broadcasts take place on Monday, Wednesday, and Friday, at 12:00 midnight. Moscow, time: 4-6 p.m. E.S.T. on a wavelength of 1,764 and 50 meters, simultaneously.

On Sundays on 25 meters, from 6-8:45, 10-11 a.m. and 3-6 p.m. On Wednesdays 5-6 a.m. E.S.T. They also sent program for the month in advance and listeners are especially asked to mark on this program the items which they like best and those which they like least and to return programs thus marked to the Radio Centre, Moscow, U.S.S.R., at the end of the month.

VE9AS on 6,425 kc., Fredericton, N.B., Canada, is heard evenings relaying CRC.

HRP1 on 42.7 meters is heard testing around 10 p.m., E.S.T. This station is located in San Pedro Sula, Honduras.

CSL on 6,140 kc. "Emissora Nacional," Lisbon, Portugal. is heard from 3:30 p.m., E.S.T. till CJRO, in Winnipeg, Canada, goes on the air and blots him out.

A "veri" from JVT and M, Tokyo, Japan, give the following schedule for their stations: Transmitter—

JVT—6,750 kc.—20 kw. Vertical Doublet Antenna.

JVP—7,510 kc.—20 kw. Vertical Doublet Antenna.

JVN—10,660 kc.—20 kw. Vertical Doublet Antenna.

JVM—10,740 kc.—20 kw. Vertical Doublet Antenna.

Daily service hour for relaying JOAK—7 p.m.-5:40 p.m. (next day) E.S.T. Address above station as follows: Kokusai-Denwa Ksaiha, Ltd.; Osaka Bldg., Kojimackiku. Tokyo, Japan.—Frank Hogler, 222 Wyckoff Ave., Brooklyn, N.Y.

Report from H. W. Hansen, Omaha, Neb.

● THE static level was high and only the old "stand-bys" were heard here fairly good. During the last week due to several dust storms and high winds at times the large eastern U.S. stations could hardly be heard.

The 19-meter band remains fairly good in the early morning. FYA and DJB come in good at times on this band. No foreign stations heard here on 25 meters except I2RO which comes in very good. The 31-meter band has been the worst of all. EAQ coming in good as always, otherwise the only other foreigners heard here on this band were VK2ME, VK3ME, and COH. On 45 meters, HJ1ABB, TIEP, PRADO, and HC2RL were heard fairly well. On 49 meters XEBT, YV5RMO, YV2RC and YV3RC and XEBT are coming in fair as are the eastern stations.

I believe after the air has cleared up that reception in this section of the country will be much better. It seems hard to build an antenna here that will work well on all bands, I would like to hear from some of the other short-wave listeners on their ideas of a good antenna.—Harold W. Hansen, Rt. 5, Box 169, Omaha, Neb.

Official Listening Post of Geo. D. Sallade, Sinking Spring, Pa.

● WITH spring just around the corner, many changes can be expected. To the DX fan, these changes are already in evidence, since the shorter wave lengths employed by European broadcasters are now audible long after dark. Especially is this true of the Pontoise station on 11.71 megs. This station is badly heterodyned by a new Colombian station. HJ4ABA, located in Medellin. This new disseminator is heard QSA4-5, with R8-9 volume, until 7:00 p.m. From then on, heterodyne whistles prove disconcerting to either station.

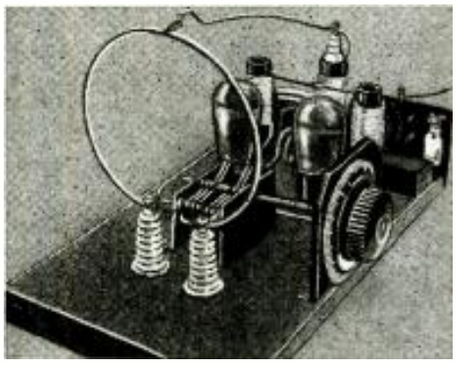
Among the new stations heard at this post are: GSL on 6,100 kc, whose schedule at present is Saturday, Sunday, Tuesday and Thursday nights from 10-11 p.m.; HJ4ABL, who transmits on the same frequency, is heard on Saturday nights from 11:00-11:45 p.m. YV6RV, located in Valencia, Venezuela, has changed its frequency to 6520 kc. HJ3ABH, 5,970 kc., is heard irregularly at 10:00 p.m. The Bo-

(*Continued on page* 109)

WORLD-WIDE SHORT-

Ultra-Shorts in Germany

● *DER QUALITATSMARKT*, a German magazine, which, by the way, is published in three languages—German, English and French—the left column on a page being printed in German, the center column in English, and the right column in French



This is a picture of the German ultra-short-wave apparatus.

—recently contained several interesting circuits for ultra-short-wave transmitters and transceivers.

The first circuit here is a push-pull transmitter, designed for operation on the 5-meter wave band. This unit has two triodes connected to opposite ends of a single turn coil which completes the plate circuit. Tuning is accomplished by two small variable condensers at the ends of the tuning inductance. The grid circuits of the two tubes are aperiodic and are isolated by the use of R. F. chokes.

The appearance of this transmitter is shown in the photo. The approximate size of the tuning inductance can be seen from the relative size of this coil against the tubes.

The circuit of a transceiver of German design is shown here, also. It consists of two tubes of the receiving variety which are connected, one as modulator and the other as oscillator. The oscillator also acts as a *one-tube receiver*, so that two-way communication by "phone" is possible, simply by throwing a switch from one side to the other. The values of the parts used in this unit are indicated in the schematic diagram.

● The Editors have endeavored to review the more important foreign magazines covering short-wave developments, for the benefit of the thousands of readers of this magazine who do not have the opportunity of seeing these magazines first-hand. The circuits shown are for the most part self-explanatory to the radio student, and wherever possible the constants or values of various condensers, coils, etc., are given. Please do not write to us asking for further data, picture-diagrams or lists of parts for these foreign circuits, as we do not have any further specific information other than that given. If the reader will remember that wherever a tuned circuit is shown, for instance, he may use any short-wave coil and the appropriate corresponding tuning condenser, data for which are given dozens of times in each issue of this magazine, he will have no difficulty in reconstructing these foreign circuits to try them out.

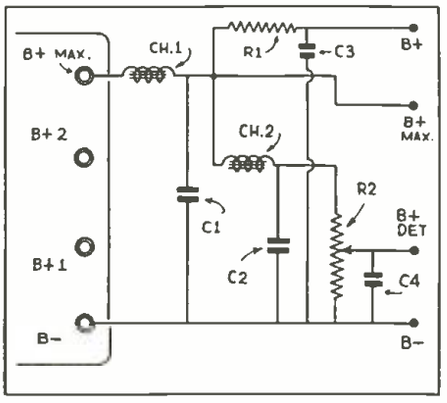
Short-Wave Power Supply

● THE use of electric light lines for supplying the "B" power to short-wave receivers requires special considerations if the background noise is to be kept low enough to permit DX reception. Short-wave sets are much more susceptible to such noises, especially in the R.F. and detector circuits, than broadcast receivers.

To permit the noise level and hum to be reduced sufficiently, *Practical and Amateur Wireless*, an English magazine, recently published the circuit of a filter to be added to a "B" power unit, or the "B" section of the power supply of an A.C. set.

The filter consists of a group of chokes, condensers and resistors connected to the maximum output terminals of the unit. A 30 henry filter choke is connected in series with the "B plus," and another in the line to the detector plate supply. Four filter condensers of about 2 mf. are connected as shown, to by-pass the output of the chokes. A resistance of 20,000 ohms is connected at R1 and a 50,000-ohm potentiometer is shunted from detector "B" to the negative terminal.

This filter unit can be added to an A.C. receiver, by opening the "B" leads to the tubes and inserting the filter. In sets which use separate "B" supply units, the task is even easier, as the filter is simply added in the leads from the "B" unit to the receiver. In addition to reducing the hum and line noises, this filter will help to keep the plate voltages steady, which is an aid to receiving weak and far distant stations.



Power supply filter for short-wave set.

A French Short-Wave Converter

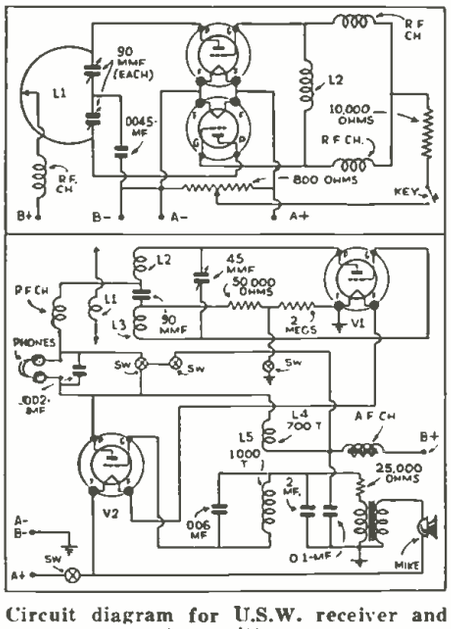
● THE circuit here is a representative arrangement used in France (from *Radio Magazine T. S. F.*) for the reception of short-wave signals. There, converters are much more popular than in this country.

This converter uses an *Octode* tube which is similar to our pentagrid converters (2A7 and 6A7) except for the addition of another element to increase the maximum frequency at which the oscillator will work.

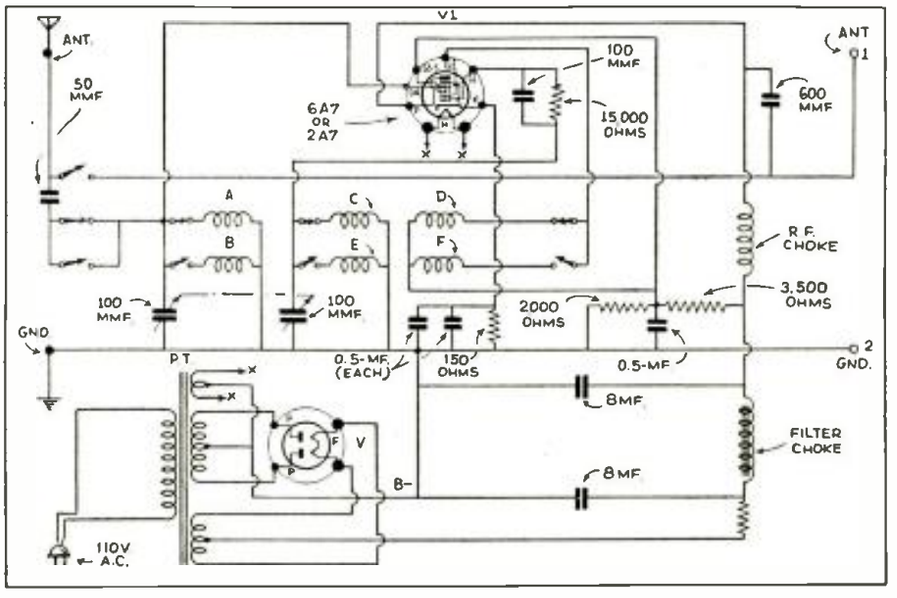
This converter has a single coil, directly connected to the aerial for station selection. The oscillator section of the *Octode* is equipped with the usual two-coil coupled with a tuned grid. A two-gang condenser accomplishes the tuning of both the aerial and the oscillator. The plate of the pentode section of the tube feeds through a condenser to the aerial of the regular broadcast set. An R.F. choke in the "B" lead prevents the output of the converter from being short-circuited through the plate voltage supply.

A series of switches on the three coils connect either one waveband or the other, or the aerial can be connected directly to the broadcast receiver and the converter cut out completely.

The coils, A to F, are designed to cover the required wavebands.



Circuit diagram for U.S.W. receiver and transmitter.



Circuit diagram of the French short-wave converter using 2 tubes.

WAVE REVIEW.. Edited by C. W. PALMER

An English Amateur Transmitter

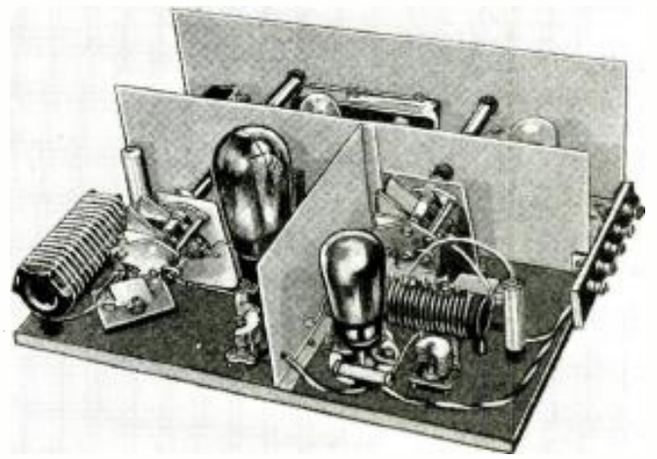
● A RECENT issue of *Wireless World* contained a description of a beginner's amateur transmitter which might be of interest to American readers.

The transmitter, which uses four tubes, is arranged for both C.W. and phone, and is tuned to the 40-meter band, as the author decided this was the most suitable waveband for a beginner to tackle.

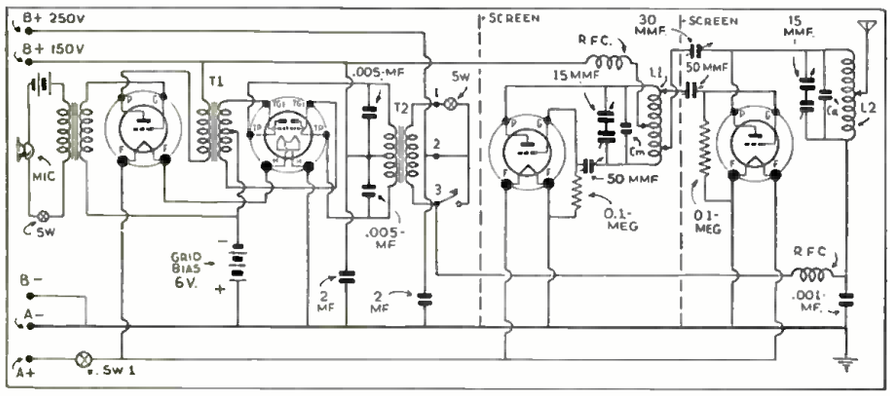
The transmitter itself consists of a master oscillator, driving a power amplifier tube. The modulating equipment consists of a "class-B" arrangement, having a driver fed from the microphone and transformer, which actuates a full-wave class B tube. This modulator is fed into the power amplifier tube.

The appearance of the complete unit is shown in the photo, here, while all essential values are given on the schematic diagram. The aerial coil consists of 16 turns of bare copper wire, 14 gauge, wound on a ribbed form 2 inches in diameter and spaced 5 turns to the inch. The master oscillator coil consists of 22 turns of bare copper wire, No. 14 gauge, wound on a form 1¼ inches in diameter and spaced 7 turns to the inch. The latter coil is provided with taps at every other turn for the three contact clips, which are situated so as to give the greatest output.

This transmitter will give the reader an idea of what is being done in amateur radio in England—and the circuit may be of assistance to "amateurs to be." You must have a license to operate it.



Compact English short-wave transmitter. Diagram below at left.



Improved S.W. Frequency-Changer

● IN employing pentagrid converter tubes or *heptodes* as they are called in Europe, for short-wave superheterodyne sets, two difficulties are encountered—first, it is impossible to apply AVC bias to the converter tube, because the potential induced on the control grid from the oscillator section above a certain critical frequency exceeds the grid bias and causes grid current to flow. This grid current flow develops a high negative potential which is applied to all the AVC controlled tubes, thus reducing considerably the sensitivity of the entire set.

The second effect is that the frequency of the oscillations generated in the triode section are controlled by the tuning of the grid circuit and if a grid-circuit trimmer is used it will give what is apparently an indication of a very sharp tuning of this circuit, though what is really happening is that the grid-circuit trimmer is in reality tuning in other stations or the original one out, because it varies the oscillator frequency.

The first defect is overcome by using a very high-intermediate frequency, But the second defect cannot be eliminated so easily. The final solution given in an article in *Wireless World* is the use of a triode oscillator with a converter tube, and an R.F. tube and additional tuned circuit. This completely frees the oscillator from the control of the grid circuit of the pentode section—down to at least 10 meters. The grid circuit trimmer only changes the oscillator frequency by a few hundred cycles, which is a negligible amount.

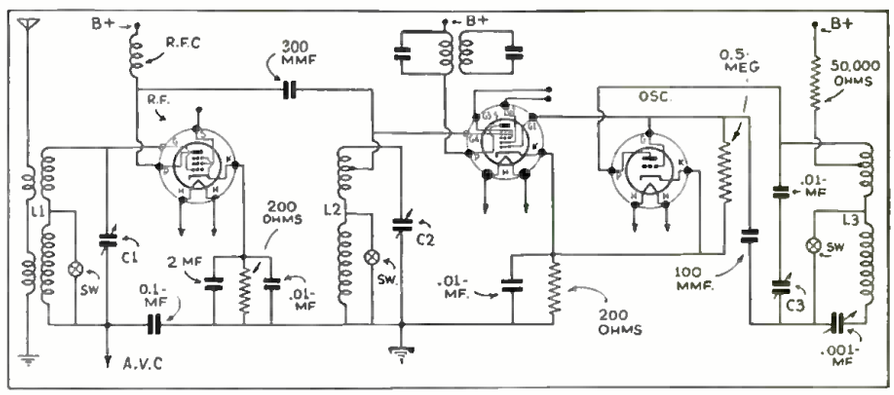


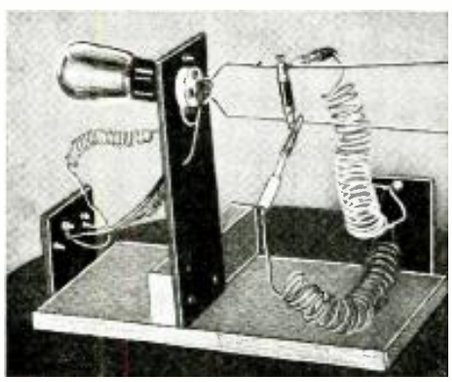
Diagram of improved frequency changer.

Some German Ultra-Short Wave Experiments

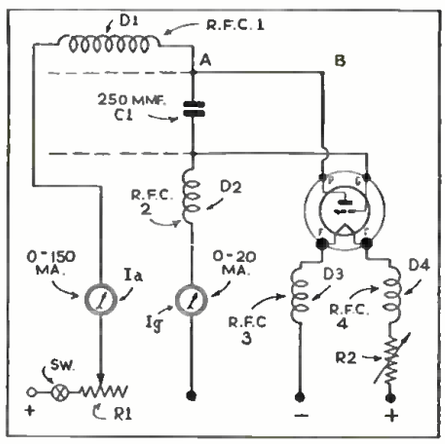
● AN account of an experimental set-up for transmitting on ultra-short waves was recently described in *Bastelbriefe der Drahtlosen*—a German radio magazine.

The device, as described, appears in the photo here. The tube is mounted on an insulating panel and the grid and plate prongs are secured directly to a double lecher wire system for radiation purposes. A condenser is shunted from grid to plate across the two lecher wires and grid and plate potentials are fed through R.F. chokes consisting of open coils of wire as shown in the photo.

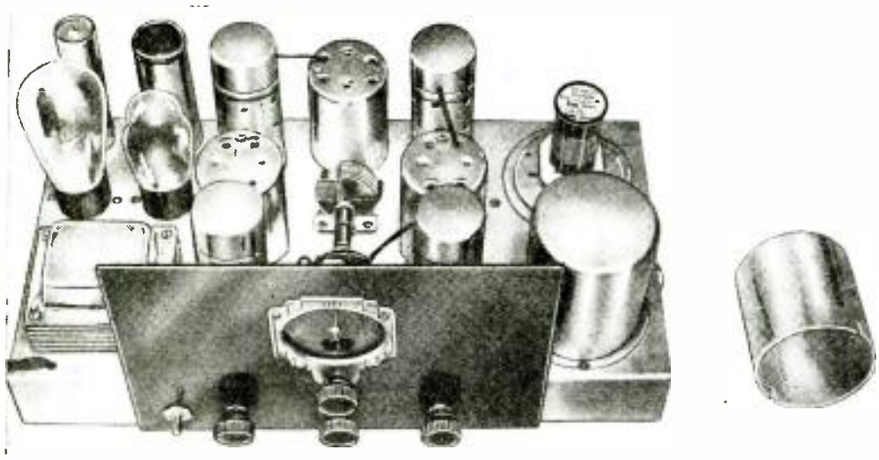
The filament leads are also conducted to the tube through twisted leads, thus forming R.F. chokes in each of the leads from the filament, grid and plate supplies.



Simple ultra-short-wave oscillator.



A Good 6-Tube Super-



Front view of Mr. Olsson's 6-tube receiver, which has power-supply built in.

● THIS receiver is the final result of approximately one year of spare-time experimenting. After having built any number of regenerative, and tuned radio-frequency receivers, the super was decided upon as the only one that could solve the problem.

Where there are more than 3 or 4 local broadcasters to contend with, as well as the police broadcasts, the regenerative with one tuned stage is practically useless. When the police come on they occupy the whole dial and the local broadcasters overpower and blanket what short wave signals are picked up. The tuned radio frequency is an improvement, but falls far short of a carefully designed superhet.

Many an experimenter has wanted to build a super but has considered it too complicated and difficult to construct. The receiver to be described is as simple as any tuned radio frequency or regenerative; in fact, it is more simple. I would rather build a half-dozen supers than one regenerative with a built-in power supply. The regenerative almost drives you crazy —trying to eliminate tunable hums.

The circuit used in this receiver is a standard superheterodyne hook-up, without any fancy tricks or gadgets that would complicate it without improving it. In describing the set let us begin with the chassis:

List of Parts

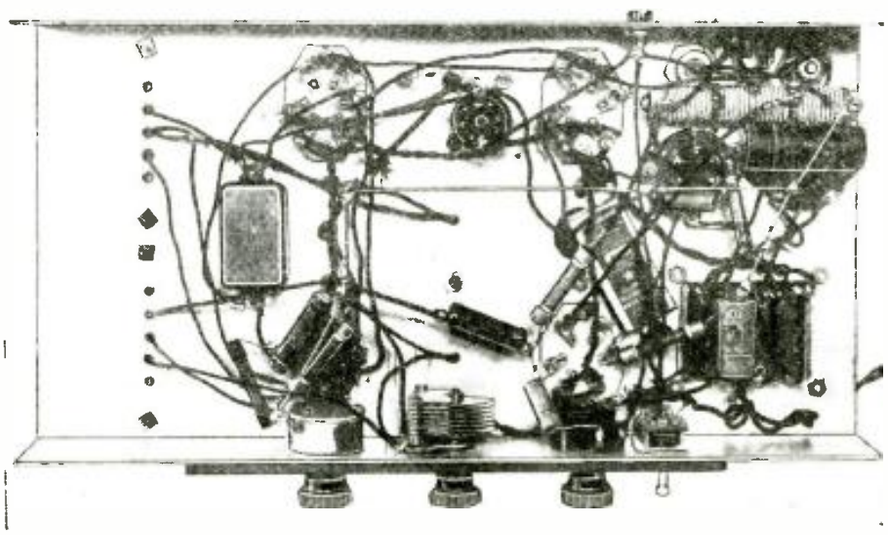
1 Chassis (Aluminum) 8"x16"x2" (Blan.).
1 Panel (Bakelite) 7"x10"x3 16" (I.C.A.)
1 Power transformer (Kenyon).
1 2-Gang Var. condenser .00014 mf. (Hammarlund).
1 Var. condenser (Star) .00014 mf.
4 6-prong wafer sockets (Na-Ald).
2 4-prong isolantite sockets (Hammarlund).
1 7-prong isolantite socket.
1 4-prong wafer socket (Na-Ald).
3 465 kc. intermediate trans. (Hammarlund).
2 Sets of coils (Bud) 4 prong.
2 Coil shields (National).
1 Voltage divider—15,000 ohms (Electrad).
2 Electrolytic cond. 8 mf. each (Sprague).
1 Dial (Crowe). 1 R.F. Choke. 85 MH.
1 10,000-ohm resistor (V.R.R.) (Electrad).
1 500,000-ohm resistor (with switch) (Electrad).
1 25 mf. Electrolytic condenser (25 volt) (Sprague) (Aerovox).
5 .1 mf. fixed condenser (400 volt) (Aerovox).
2 .01 mf. fixed condenser (400 volt) (Aerovox).
1 1 mf. fixed condenser (400 volt) (Aerovox).
2 .00025 mf. fixed condenser (Aerovox).
2 25,000-ohm resistor (Lynch).
2 300-ohm resistor (Lynch).
1 200,000-ohm resistor (Lynch).
1 500-ohm resistor (Lynch).
1 Single-Pole. double-throw switch (I.C.A.).
2 Tip jacks (phones) (I.C.A.)
1 Roll hook-up wire.
4 Knobs.
4 Tube shields (Hammarlund).
1 Dial light and bracket.
1 A.C. cord and plug.
1 Speaker; 2800-ohm (field).
1 Tube 80 (RCA Radiotron).
2 Tubes 58 (RCA Radiotron).
1 Tube 57 (RCA Radiotron).
1 Tube 2A7 (RCA Radiotron).
1 Tube 2A5 (RCA Radiotron).

Aluminum was used for the chassis because it is easy to work and the complete job can be done with the usual tools found on the experimenter's bench. The chassis measures 10"x16"x 2"—the 2" flange being on the front and back. As the aluminum used was a heavier gauge than usual, two sides gave ample strength for the unit. If the chassis is boiled in a solution of lye water for 10 minutes a very pleasing dull finish is obtained which will effectively cover scratches. The following layout of the various parts was found to be the best and most suitable. The layout and design is best described as "progressive," that is, the incoming signal starts at one end of the chassis, and the final output at the other end. This is very efficient from the electrical standpoint and produces a symmetrical and pleasing design.

A 2A7 is used as oscillator and first detector because of its efficiency and because it is easy to wire up with the least amount of parts. The antenna coil and oscillator coil are located on the extreme right of the chassis. Coil shields are used to minimize and undesired interaction that might be present due to the magnetic field created by the coils. This mixing part of the radio, as it is sometimes called, should be wired very carefully as an unnecessary noise created here will be amplified in the succeeding stages.

The two stages of intermediate frequency amplification are used to obtain the necessary selectivity and sensitivity. "58's" are used in these two stages because of their high amplification and sharp cutoff characteristics. The intermediate frequency of 465 kc. is used to insure a minimum of repeat points or image response. A sensitivity or gain control is placed in the cathodes of these two tubes and controls the incoming signal.

A 57 is used as second detector and does the job in very nice style. The



Bottom view, showing the wiring of the straight 6-tube super-het.

Het Receiver

By Stanley Olsson

57 is very sensitive and will handle a great deal of volume without overloading.

A 2A5 tube is resistance-coupled to the 57 and provides more than enough audio amplification. A volume control is placed in the grid circuit of this tube and provides a very smooth and gradual control.

An 80-type rectifier is used in a conventional power supply and should not present any difficulties. A dynamic speaker with an output transformer matched to a 2A5 tube is used. The field coil of the speaker is used as a choke in the power supply. The small bypass condenser connected across the primary of the power transformer should not be omitted as it eliminates tunable hums.

The aluminum chassis makes a poor *ground* and should never be used as such. A length of bus bar wire runs down the center of the chassis from the minus end of the power transformer, and the various resistors and condensers are grounded to this wire. This should not be omitted as it contributes a great deal to the stability of the receiver.

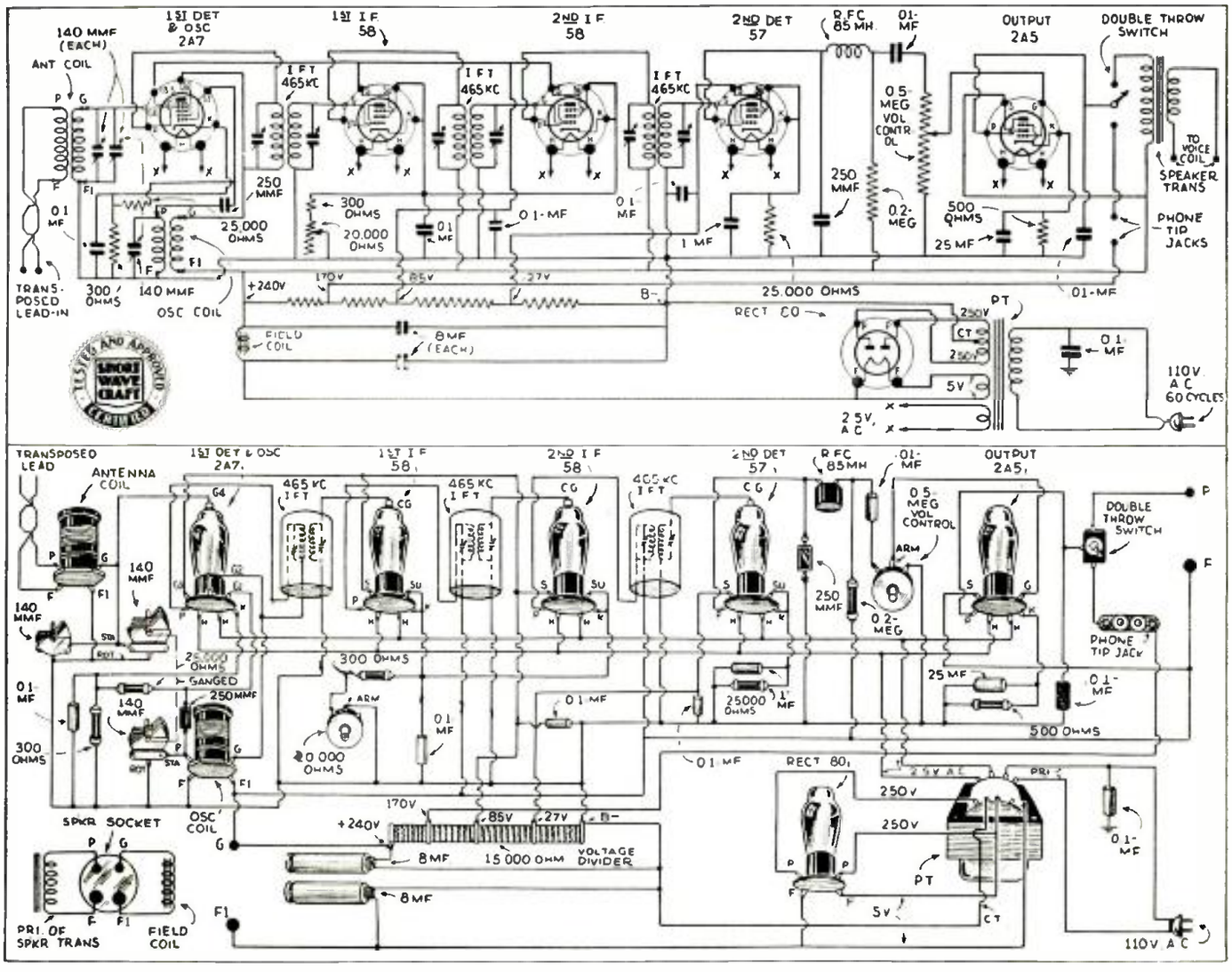
Provision for earphones is made by tip jacks at the rear of the chassis, and a switch on the panel selects either earphones or speaker.

With separate sensitivity and volume controls a degree of flexibility is attained that more than justifies the extra control. The remaining control on the panel, besides the tuning knob, is the balancing condenser. This becomes quite critical on the higher fre-

(*Continued on page* 104)

THIS MONTH'S $20.00 PRIZE WINNER

Many of our short-wave fans who are contemplating construction of a simple superheterodyne receiver will find this one just what they want. It is straightforward in design and uses the latest type tubes. Foreign stations can be pulled in with full speaker volume and it is very easy to tune. Six tubes are used in all and no separate power supply is needed to run this set; it is completely A.C. operated.



Schematic and picture diagrams which will permit even an inexperienced fan to build this excellent 6-tube super-het short-wave receiver. It uses plug-in coils.

SHORT WAVES and

Alfred King Has Dandy Listening Post

Alfred King maintains a very efficient short-wave listening station; among the S.W. receivers he possesses, are a Postal S.W. converter used in conjunction with a broadcast set.

Editor, SHORT WAVE CRAFT:

My radio activities go back to 1920 and I have never tired or lost interest in the hobby. I have also added to it writing to SWL pen-pals and now I correspond with about forty of them, here in the States and abroad. I have one very nice pen-pal in Japan and his name is Shokichi Yoshimura.

The rig is made up of two sets, one a Postal and the other a combination Sparton S-W. Converter used with a Philco B.C. set. I have had swell results with both. I use an RCA sky hook which is a double-doublet affair and have also a Lynch Cage Doublet. My other two ants. are 40-ft. single wires running east and west and north and south. I have them all connected to jacks which in turn are mounted on a panel shown between the two sets. I can use either antenna for any set.

I also have an amplifier with a 15-watt output for recording purposes which I plan to use with my moving pictures which, by the way, is another hobby of mine. I have a loudspeaker on each of the two floors above and one here in the shack which you can see on the rack to the right of the desk. I can use either or all three speakers at once with just a flip of a few switches and in that way can play recordings for my mother on the first floor or to my sister on the top landing. Hi! I can also send up the choice bits of SW DX to them in the same way with a double-button mike. The turntable is a double-speed electric one and is very good.

The walls of my shack are lined with 135 SWL and 150 QSL cards. I have also a swell collection of snapshots of my pen-pals here in the shack. I guess you know by the picture of my shack that it is in the cellar, and it is very dry and warm here in the winter and also dry and cool in the summer.

I sure would advise your many readers to go into this writing pastime and I know they will find it a very nice hobby along with listening in. I have made many friends this way and would hate to lose even one of them. My best pen-pal is a "YL" in Texas and I know when my other pen-pals see this they sure will give me the merry razz. Hi! Hi! I had some of these pen-pals at the shack last summer and we sure had one swell time chinning about the short waves and then we went to see "Radio City."

In closing I wish to say that I hope your readers get as much kick out of reading SHORT WAVE CRAFT as I do. Most of my pen-pals get it and so we have that in common to talk about. When writing to my friends I use the Ham short cuts in radio, so if I slipped here in writing this one, I hope you will overlook it, as it sure gets you. Hi! Hi! Another S.W.C. Reader.

ALFRED G. KING,
7417 Eighty-Seventh Ave.,
Woodhaven, N.Y.

(Thanks for sending in the photo of your short-wave "shack," Alfred, and we believe that many of our short-wave friends will derive a great deal of inspiration from your letter, as you have certainly been a very active short-wave enthusiast.—Editor.)

MIDWEST SET IN A NEAT SET-UP

Editor, SHORT WAVE CRAFT:

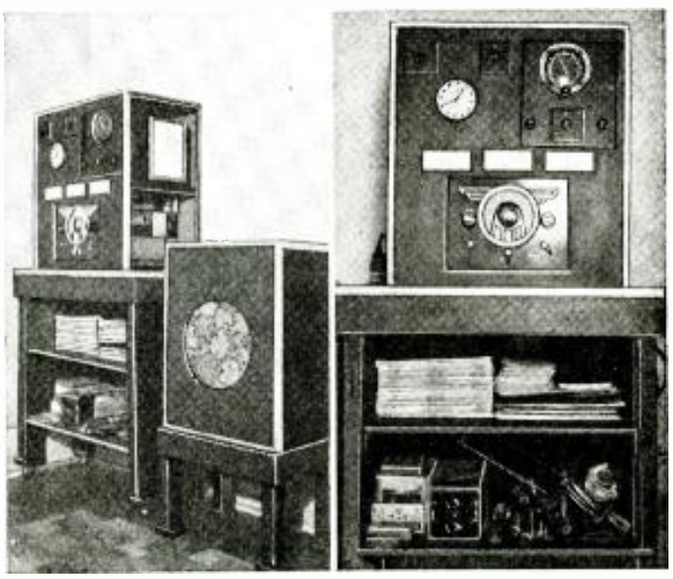
My receiver is 1935 Midwest 16-tube, all-wave, in the lower part of an angle iron rack. On the upper shelf is a Postal booster. A clock and coil rack is in the front; Masonite board was used for front and top. The top is on hinges which permits winding clock and changing antenna connections on Lynch receiver coupler. The back and sides are of screen wire. The bottom is celotex on which are two live rubber pads on which the receiver rests.

Ground wire, antenna and electric lead wires come up through the floor to the back of cabinet. The antenna lead is Lynch *Giant Killer* cable. The electric feed wire is BX cable and the ground wire is No. 12 lead-shielded cable. The table is on rollers which permit easy access to rear of cabinet, as several feet of wire is coiled in the back to permit table and cabinet to be moved out from wall several feet. The speaker is a Wright-DeCoster made especially for this set, and is enclosed in balsa wood cabinet, 10 inches by 24 inches by 14 inches deep. The Balsa is 2 inches thick as well as the front baffle which is 2-inch celotex. The legs of the speaker rest on live rubber pads, cut from kneeling pads which can be bought from any 5-and-10 store. This same pad is used for receiver in cabinet. The entire layout is painted dull black and the trimmings are silver-bright aluminum. The aluminum was thoroughly cleaned and polished and water-white shellac applied to preserve it. Under the table are radio magazine and scrapbooks in which I have pasted my acknowledgment cards from stations all over the world. The bottom shelf is used for tools.

The pictures were taken at night with a regular kodak and I used Eastman flash bulbs. The three label holders on front of cabinet show range of the coils for booster and frequencies of the important S.W. stations.

S. W. W. AMISS,
c/o Standard Fruit and Steamship Co.,
Union Bldg.,
New Orleans, La.

(Congratulations on the excellent way in which you have arranged your Midwest All-Wave receiver together with your Postal Booster, Mr. Amiss. You have the right idea in arranging your loudspeaker in a good-size cabinet with a substantial baffle as shown in your photo. The balsa wood should make an excellent baffle as it should not reflect or transmit sound waves; a very ingenious and neat-looking arrangement on the whole and one that you may well be proud of.—Editor.)



Here is a very efficient arrangement of a Midwest All-Wave receiver, and also a Postal booster or pre-amplifier; a clock is also included.

VICTOR 2-TUBE SUPER-HET SUITS HIM BEST

Editor, SHORT WAVE CRAFT:

I am a steady reader of your magazine and believe it the finest on the market today. I built several of your sets and liked them all fine, but I believe the best yet was the *Victor 2-Tube Superheterodyne.* This is my present receiver and if you think it isn't good listen to this. (This is the first super I ever built.)

I have this set hooked to a 15-ft. spring aerial about 10 feet high and a water-pipe ground. I have heard amateurs in 48 states and 11 in Canada. I have heard every district but the seventh.

Here are some of my best catches: CGA, VE9GW, VE9CL, CJRO, VE9OR, VYW, GCB, GCW, GSA, GSB, GSC, G6RX, G3A5, and G7LO.

I heard a station in Berlin, Germany, working WEM and WEN but he gave no

LONG RAVES . . . OUR READERS' FORUM

call. Also: DJC, COC, FTN, EAQ, XIF, L2RO, IRS, IRA, CT3, RQ, HI1A, NMS, NFB, LSL, TI4NRH, HJ3ABF, HJ1ABB. YV3BC, PSK, HJ4ABE, YV4RC.

I have received all the important American S.W. stations and police calls from coast to coast (some 100 police stations). Some time ago I added a 37 audio, and boy! do I roll them in now with a wallop!

Well, I guess you have heard enough from me for a while—I would like to try for one of your "trophy cups."

I am waiting now for my SHORT-WAVE LEAGUE membership certificate.

HAROLD MARTIN,
446 East Maple Ave.,
Miamisburg, Ohio.

(We are very glad indeed, Harold, to learn that you have had such excellent success with the 2-Tube Superheterodyne. It is quite surprising what very fine results can be obtained on a 2-tube super once it is properly adjusted and tuned. You have undoubtedly received your Short-Wave League membership certificate and we presume that you have had it framed and have already hung it on the wall of your shack. —Editor.)

FINE RESULTS WITH "2-TUBE CHAMP"!

Editor, SHORT WAVE CRAFT:

I am writing in regard to a 2-tube set called the "2-Tube Champ" described in the January 1934 issue. It does everything you claim it will do. It is a wonderful set and I am now listening to Germany while writing this letter. I am making a list below that I have heard; HJ4ABE, VK2ME, GSD, VK3ME, HJ4ABB, WIXAZ, W8XK, VE9GW, W9XAA, WIXAL, GSC, GSB, HJ1ABB, W2XE, HKD, W2XAF, VE9AP, W3XL, W3XAU, W9XF, EAQ, W3XALB, W3XAU, DJC, VE9CL, HKC, W3XAL.

This is a wonderful set. I have it hooked on a 7-tube set for audio amplifier.

JOHN W. POTTS,
913 Seward Ave.,
Akron, Ohio.

(Well, the 2-Tube Champ seems to have made a great many friends, John, and we were very happy to learn from your letter that it does everything that we said it would do. We have received a great number of complimentary letters concerning the 2-Tube Champ and one excellent point in its favor is that it need cost but a very small amount to construct.—Editor.)

DOERLE A.C. 5 A PIPPIN!

Editor, SHORT WAVE CRAFT:

Just a word about the Doerle A.C. 5. In two weeks I logged among others the following stations: TIEP, Costa Rica; LSY, Buenos Aires; PRADO, Ecuador; HJ4ABE, Columbia; EAQ, Spain; TIF, Buenos Aires; CJRX, Canada; YV2RC, Venezuela; COC, Cuba; W9XF, Chicago; W8XAL, Cincinnati; WCRCT, Philadelphia; W8XK, Pittsburgh. All these stations came in crystal clear with volume enough to *shake the table* on which the set stands! Also all were received on the loudspeaker! This set is worth its weight in gold, even during these depression days. All I used was a homemade cage aerial with 178 ft. of stranded copper in it. I have a very poor location on account of numerous high-tension wires running parallel with my antenna. 73 to you all

FRANCIS KMEC,
213 Linden St.,
Allentown, Pa.

(It seems, Francis, that the Doerle line of sets, particularly the A.C. 5 model will go down to posterity with a long line of honors behind them. It has really been surprising as to the very fine results which have been obtained in recent laboratory tests on the Doerle A.C. 5 and stations in practically every country have been heard on the loudspeaker with this set, paralleling the loudspeaker performance you mention in your letter. The results you have obtained are really very outstanding and exceptional in view of your very poor location, with high-tension wires running parallel with your antenna.—Editor.)

We Gave Him His Start in Short Waves

Prize-Winning Station Photo Awarded One Year's Subscription to SHORT WAVE CRAFT

A live-wire Ham station is that operated by Clifton Smith, Jr., which operates under Uncle Sam's amateur transmitting station license, W4CTM.

Editor, SHORT WAVE CRAFT:

In answer to your request for station pictures I enclose a photo of my little "rig."

The transmitter is a 45TNT and has worked all U.S. districts and several Canadian on 12 watts input.

The station usually operates on 80 meter CW and always welcomes a call from OMS and YL's alike.

I have been reading SHORT WAVE CRAFT for over two years and still think it swell. SHORT WAVE CRAFT was my first introduction to short-wave radio and I shall always feel obligated to it.

A.R.R.L. and *Short Wave League* membership certificates may be seen on the wall.

Luck to SHORT WAVE CRAFT and *Short Wave League* and VY best 73.

CLIFTON SMITH, JR., W4CTM,
409 East Lane St.,
Shelbyville, Tenn.

(It is gratifying to know that SHORT WAVE CRAFT *magazine served to introduce you to the thrills of short-wave radio. Congratulations, Clifton, on having worked all U.S. districts and we shall be pleased to hear from you again.—Editor.)*

2-TUBE DX-ER ROLLS 'EM IN!

Editor, SHORT WAVE CRAFT:

I have not seen anything in your magazine about the results of the "*2-Tube, Short-Wave DX-ER*," the diagram of which was published in the July SHORT WAVE CRAFT.

This being my first set I think I had very good results with it. Some of the stations I have heard are: W8XK, Pittsburgh, Pa.; VE9GW, Bowmanville, Canada; W2XAF. Schenectady, N.Y.; W3XAL, Bound Brook, N.J.; W1XAZ, Springfield, Mass.; W9XF, Chicago, Ill.; W8XL, Cincinnati, Ohio; DJD, Berlin, Germany.

I have heard Hams from almost every district in U.S.A. also K4SA, in Porto Rico, and VE3HC in Canada.

I hear New York talking to Buenos Aires; Buenos Aires comes in very clearly.

I think this is not so bad for 201-A's. I would like to see more *stories* in SHORT WAVE CRAFT. Also more 1- and 2-tube S.W. sets. SHORT WAVE CRAFT is a fine magazine. Keep it up!

73 to you and SHORT WAVE CRAFT,

PAUL DEITRICK,
516 Hance Ave., N.W.,
New Philadelphia, Ohio

(Fine work, Paul, and we are glad to know that you have had such excellent reception results with the 2-tube short-wave DX-er. We will endeavor to follow the suggestions given in your letter regarding plenty of articles on 1- and 2-tube sets and in regard to stories, we will keep this in mind also. We would suggest that you read a copy of the current number of our sister publication, the Official Short Wave Listener, which contains S-W fiction.—Editor.)

One Year's Subscription to
SHORT WAVE CRAFT
FREE
for the "Best" Station Photo

Closing date for each contest—60 days preceding date of issue: June 1 for August issue, etc. The editors will act as judges and their opinions will be final. In the event of a tie a subscription will be given to each contestant so tying.

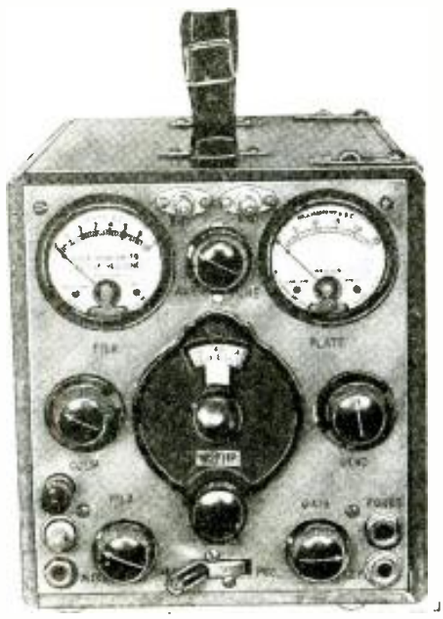
HATS OFF TO THE "MEGADYNE"!

Editor, SHORT WAVE CRAFT:

I take this opportunity to congratulate Mr. Gernsback on his *Short-Wave Megadyne* described in your book "Ten Most Popular Short-Wave Receivers." I built this exactly as described, but for the coils, which are old Silver-Marshall forms with the tickler wound in slot. I completed this set about eight days ago and have heard England, France, Mexico City, and a station in Neuavo Laredo, Mexico. I also had a station in Rio de Janiero, S.A., but it was

(Continued on page 122)

De Luxe 5-Meter Trans-



Front panel view of the De Luxe 5-meter Transmitter and Receiver which the author has designed for portable use.

● THIS portable set is not a transceiver, but is a true, separate receiver and transmitter for five meters and can also be used for duplex work. To conserve space and battery current, the audio system is common to both the detector and oscillator. No feedback trouble has been encountered, however, and duplex can be worked up to within a few divisions of the transmitter signal.

Separate antennas are best, but any length of wire will suffice for the receiver, while the transmitting antenna is usually of the single wire feed type. Since an antenna-coupling condenser is provided for both transmitting and receiving, compensation for various antenna lengths and conditions can be made directly on the front panel, which is helpful in portable work where no two antenna installations are alike.

The Cabinet—How Made

The box for the set is made entirely of ¼" tempered *pressdwood*. The pieces are fastened together with ⅜" brass screws, holes for which must be drilled in the material or it will split. The screws are used to hold the pieces together until the glue used on all the joints dries, and are left in place afterward for added strength. The glue may be Ambroid or Duco Cement and it should be smeared on liberally and allowed to dry overnight in a warm place. After the joints are firm, the corners may be rounded off and the finish applied. Two or three coats of clear lacquer, sanded after each coat and waxed after the last give a very fine finish.

The side which opens is held on the bottom with a piece of a piano hinge, while the top has a brass angle strip which engages on a strip on the under side of the cover. This transfers the weight of the set evenly to both sides and the bottom.

The panel and chassis are of aluminum, the panel being 6¼"x7"x1/6". The chassis, when bent to shape measures 6¼"x5"x1¾" high.

Mounting and Wiring the Parts

All the parts may be mounted before wiring is started, as they are not very crowded.

The 4-prong plug and jack in the original set are made of phone tips and jacks and make a very neat job, but there is plenty of room to use an ordinary small-size 4-prong socket and plug.

The wiring of the oscillating circuits of both receiver and transmitter must be as compact as possible and all parts that can be are mounted directly on the tube socket prongs.

The "mike" transformer must have also a primary for the detector tube, while the output transformer has the plate winding for the 33 and another for phones or speaker.

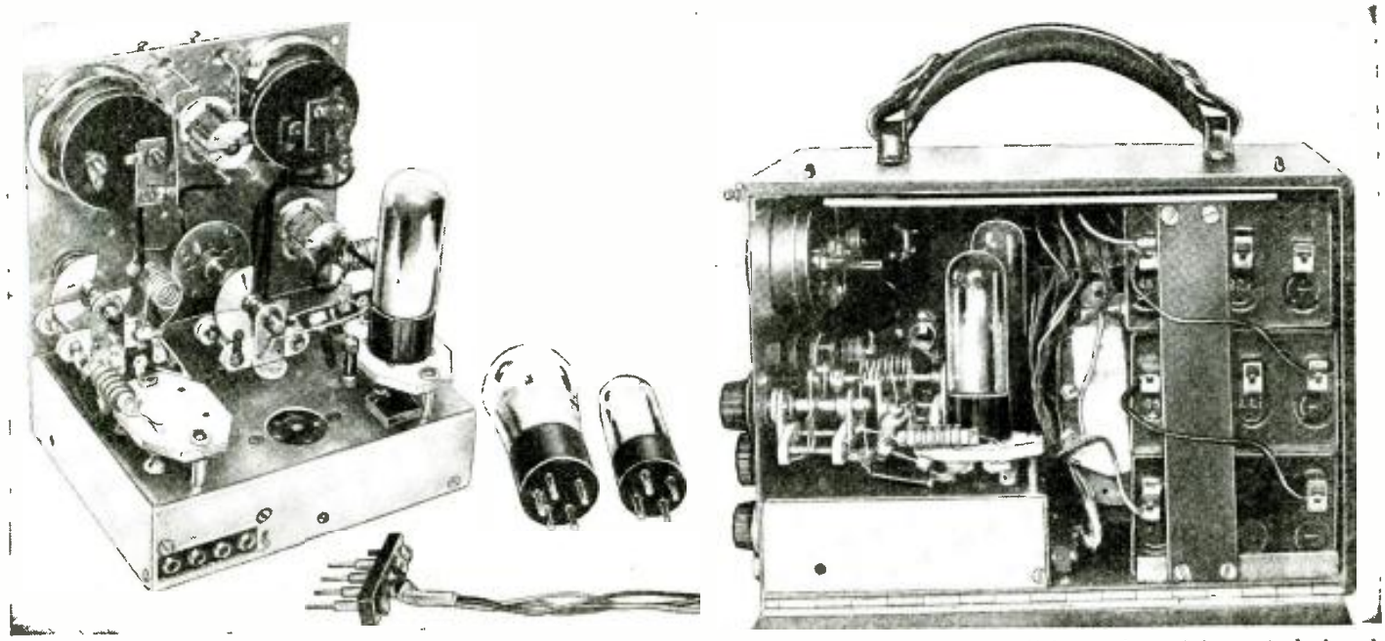
A jack is provided for a key which operates the buzzer when used for code (C.W.) operation. This is very handy for portable work and is quite frequently used. All jacks are of the midget type to conserve space. Right here it may be well to mention that a sensitive single-button mike must be used, since there is no speech amplifier.

The vernier dial on the receiver is a great help in easy tuning, but for transmitting it is not needed. It would be advisable to use some sort of dial or scale on the transmitter control so that settings could be more easily duplicated.

Quite a bit of experimentation was done on various types of antenna coupling, and a separate antenna coil was used at one time. This naturally allows a wider variety of antennas to be used, but the single wire feed is simplest and seems to be quite efficient, so the coupling coil was removed. It was attached to the insulating strip on the terminal of the plate current meter.

What "Change-Over" Switch Does

The change-over switch is really only a filament switch, as there are no circuit changes to be made such as those in a transceiver when shifting from send to receive. The switch also cuts the mike current when in the receive



Photos above show rear view as well as interior appearance of the 5-meter combination transmitting and receiving set, designed, successfully built, and tested by the author. It was also demonstrated very successfully before the editors.

mitter-Receiver

By Howard G. McEntee
W2FHP

The author of this article constructed and has thoroughly tested this extremely compact 5-meter Transmitter and Receiver. It has been used for phone over distances as great as twenty miles. The whole apparatus is battery-operated and is fitted with a "quick-change" switch for Talking and Receiving.

position, and turns off the transmitter oscillator.

In the transmit position, the detector tube is cut out, the audio tube being lighted in all positions. Several contacts on the switch are used to cut a small resistance in series with one lead of the filament battery. The resistance figures out at .4 ohms for the sending position, and .9 ohms for receiving. This is just a refinement to compensate for the varying total current when the different tubes are cut in and out of the circuit and makes it unnecessary to continually shift the rheostat. It may be set once and left that way.

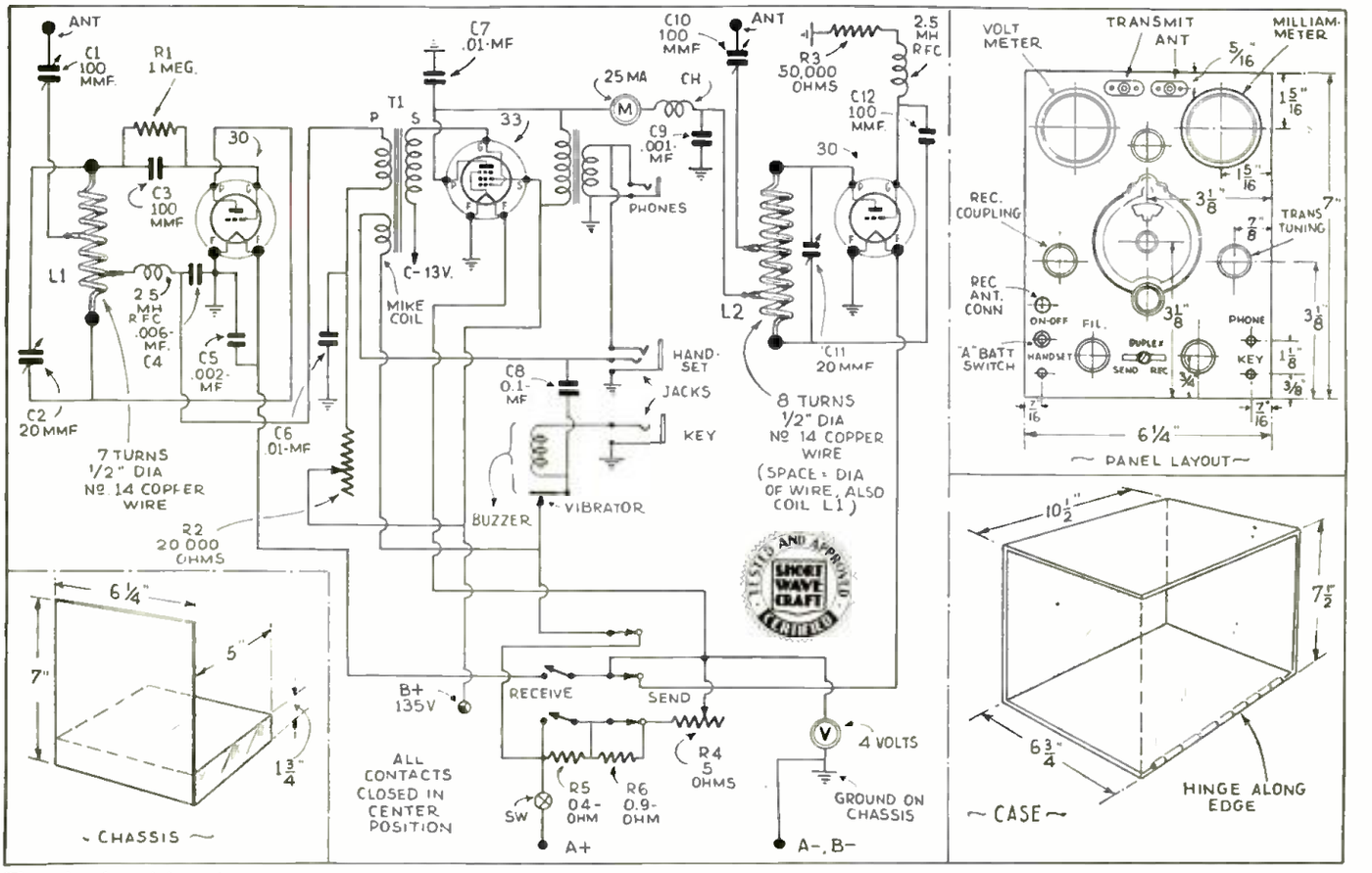
When the circuit is completely wired up and checked, the batteries may be hooked on and the set tried out. The B battery is three 45 volt units, while two No. 6 dry cells light the filaments. The C battery is made by soldering nine small-size flashlight cells in series. This will give 13.5 volts bias for the 33. The filament battery, of course, is the mike battery also.

The transmitter should work with the tap about three turns from the plate end of the coil. It should be shifted to get the best position, then soldered in place. If an R.K. 24 tube is available it should give better results than the 31 as it is really designed for high-frequency use. Also, a 30 may be used in place of the 31 with good results. With no antenna on the transmitter and 135 volts B battery, the plate current should be between 5 and 10 mils with the 31, this current increasing to about 20 mils with load, and it should not be run much over this.

The receiver should also be tried with no antenna and the ground tap set so that smooth oscillation is had all over the band. Then clip on the antenna lead and adjust the series condenser for best results. In crowded areas it is advisable to use as

(Continued on page 114)

Here is the midget transmitter and receiver for 5-meter work with the author at the "mike."



The simple wiring diagram for a 5-meter transmitter-receiver is given above and the cost of the parts is really very nominal, considering the efficiency and usefulness of this very well-designed apparatus. Dimensions for the panel and cabinet layouts are also given above.

Front view of Mr. Shuart's latest simplified transmitter using the new 802 tube.

SIMPLEST HAM Transmitter Uses 802 Tube

By George W. Shuart, W2AMN

This transmitter, while very simple and easy to build, has an output of 10 watts on C.W. or about 2 watts when used for phone. It is a complete crystal-controlled MOPA. This new 802 tube offers tremendous possibilities in simplifying amateur transmitters.

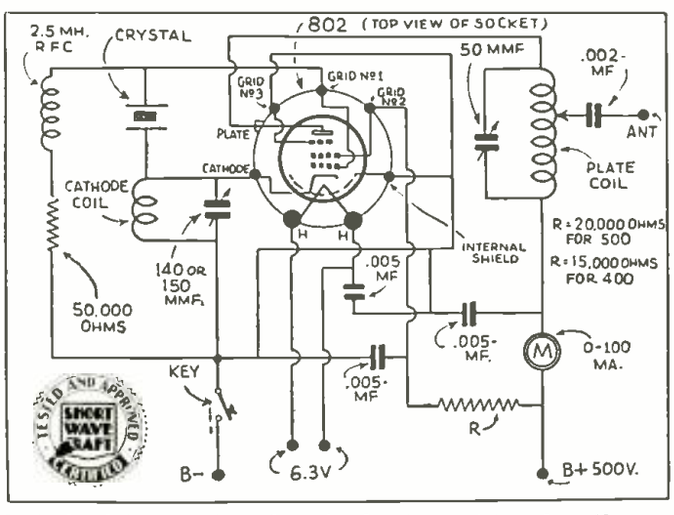
● WHENEVER there is a difficult problem to solve in radio the tube engineers are usually called upon to build a new tube which will solve that problem. Amateurs have for a long time needed a tube which would serve as a low-power *oscillator* and as a buffer or *frequency doubler*. A tube was needed that would make the average Ham transmitter simple and foolproof. Some Ham transmitters that were using *power* frequency multipliers were truly dangerous and very tricky and difficult to adjust. Not so today with the new RCA 802 screen-grid pentode, which will overcome all past ills if properly used.

There are dozens of uses for this new tube and they will immediately suggest themselves to the thoughtful amateur; space will not permit us to describe all of them, but it is safe to say that they will be used mostly as crystal-controlled oscillators, buffers and doublers.

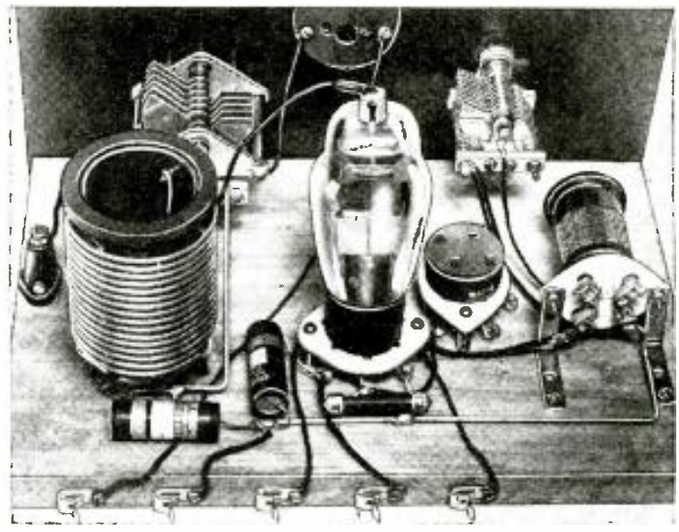
The little transmitter unit shown in the photograph is really the most simple Ham transmitter that could be built. It really is a 1-tube crystal controlled MOPA and will serve as an excellent low-power transmitter or as an exciter unit to take the place of the oscillator stage in an already existing transmitter, with a marked increase in efficiency. There are a few important things to remember when using this new tube and we will give the readers the benefit of our experiments with it.

The 802 will replace the now popular 59 crystal controlled oscillator with an increase in output and flexibility. The shielding in the 802 is so complete that the plate circuit can be tuned to the crystal frequency when using the familiar electron-coupled circuit. There are seven prongs on the base of the 802, the reason being that the shielding has its own separate pin instead of being connected internally. This allows free operation of the cathode in the so-called "electron-coupled" circuit. The plate connection is brought out at the top of the bulb to reduce coupling between it and the other elements.

When using this tube in the oscillator circuit shown in the diagram it is absolutely necessary that the suppressor



It is hard to conceive of a simpler transmitter than the one shown in diagram form above.

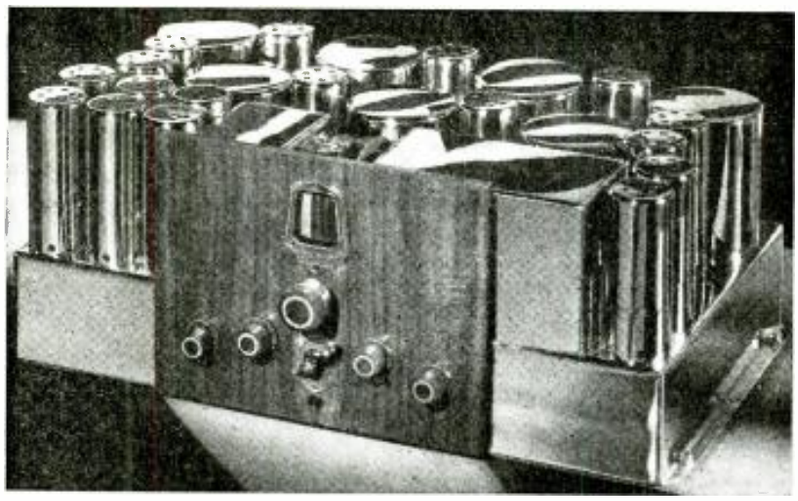


The 802 tube and its associated equipment as used in this Ham transmitter makes a very neat assembly.

grid be connected to the shield and the B minus. Do not connect the suppressor to the cathode if you are going to operate the plate circuit at the crystal frequency, because it will introduce coupling between the two circuits and the plate circuit will fall into oscillation and the whole thing will be useless. The liberal use of effective by-pass condensers is also necessary to maintain stable operation. The screen-grid should be by-passed to the B minus *as near to the tube terminal as possible* and the B minus or ground lead should be placed so that all these by-pass condenser leads are as short as possible. Probably a better method would be to use a metal (copper would be fine) base and make this the B minus or ground to which all leads should be thoroughly bolted or soldered.

The tube does not need a shield if the two coils are kept far enough apart. And with the cathode coil lying at right angles to the plate coil there is not the slightest trace of feedback from plate to grid. Plug-in coils are used in both cathode and plate circuits; the form for the plate coil is 2¼ inches in diameter and wound according to the data given in the coil table. The cathode coil is wound on a 1¼ inch dia. form with ordinary double cotton-covered magnet wire. The maximum and recommended voltages for the 802 tube are 500 for the plate and 250 for the screen-grid. The screen-grid voltage can be obtained either by a voltage dropping resistor or a voltage divider; the dropping resistor method would seem to be the best, as the two voltages, screen and plate, would then always have the same ratio. The tube is not a bit critical and a tap on a voltage divider can be used to supply the screen-grid voltage,

(Continued on page 105)



Beautiful chassis of the new Scott Imperial All-Wave 22-tube receiver.

A New 22-Tube All-Wave Receiver

By E. H. Scott*

A Custom-Built All-Wave Receiver That Will Create New Standards of Performance in World-Wide Reception and High-Fidelity Reproduction

● I WANT the reader to do a little "supposing" with me. Suppose you were a man of unlimited wealth, and were so much interested in radio that you could afford to equip a radio laboratory of your own with every modern piece of measuring apparatus used in research work. Then suppose you staffed that laboratory with the most competent engineers it was possible to secure, men who had been designing *all-wave* radio receivers for years. Then suppose you gave this staff instructions to go ahead and build for you the very finest receiver it was possible to build, and to incorporate in it every worth-while development in all-wave radio receiver design, plus any new features they discovered in their own research work. If you were to do that, then the probability is the receiver that would ultimately come into your possession would be one very similar to the new SCOTT IMPERIAL ALL-WAVE.

Some idea of the power in this new receiver will be gained from the fact that 22 tubes are used. Every one has a definite function to perform, and not one can be eliminated without decreasing the efficiency or performance of the receiver. Incorporated in its design are a large number of very advanced features, many of them recent developments of our own research laboratory.

If we are to secure the finest possible reception from distant stations on either the broadcast or short-wave bands, it is necessary that a receiver possess a very high degree of *usable* sensitivity.

Maximum antenna gain is secured by the use of separate antenna primary coupling coils for every waveband, each of which is designed to cover efficiently the range of frequencies over which it operates.

A separate tuned R.F. stage is used on each of the four wavebands, using a triple-grid, supercontrol, high-gain amplifier type 6D6 tube, giving maximum sensitivity, with a minimum of noise and image frequency interference.

Extreme Sensitivity Secured with Four I.F. Stages

Probably the most important section of any superheterodyne receiver is the I.F. amplifier. In the cheaper class of radio receiver, one I.F. stage is used; the medium-priced receiver generally uses two, and some of the higher-priced receivers use a maximum of three stages. Where only one or two stages of I.F. amplification are used, the tubes have to be pushed to the limit to secure sufficient *sensitivity*. In this receiver four stages are used in the I.F. amplifier, and extreme efficiency is secured in each stage through the use of a remarkable newly developed multiple I.F. coil tuned by special low-loss condensers, 100 per cent shielding and filtration, and the scientific apportionment of *gain per stage*.

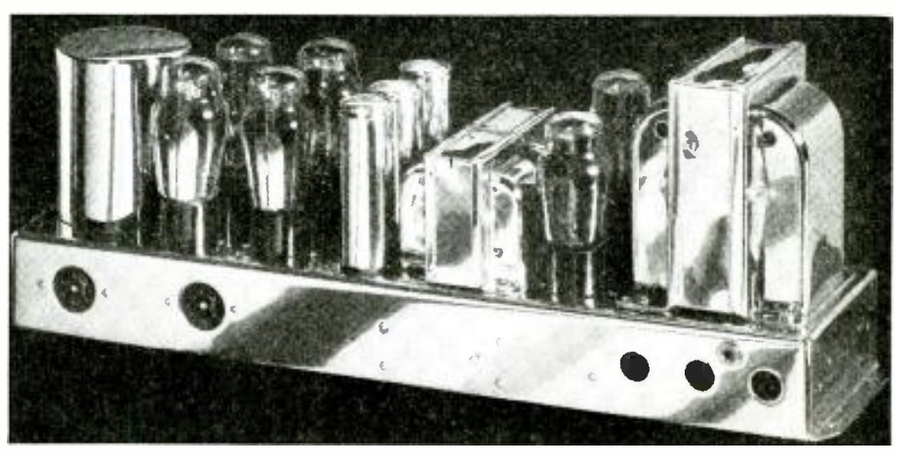
To eliminate overloading in the detector, one of the more common causes of distortion in the ordinary radio receiver, it is necessary to have more I.F. driving power than is supplied normally by the regular I.F. amplifier. In this receiver this is secured by a separate I.F. driver stage, and assures sufficient power at all times for the most efficient operation of both the detector and A.V.C. systems.

Selectivity Continuously Variable

The degree of *selectivity* possessed by a receiver determines its ability to tune through powerful local stations and bring in very weak distant signals. In this new set we have incorporated a remarkable new continuously variable *selectivity-fidelity* control, which enables the user to obtain, at all times, not only the desired degree of selectivity required, but also the maximum fidelity of reproduction possible from stations, with a minimum of noise and interference. In the most selective position, adjacent channel discrimination of approximately 5000 to 1 is obtained, while in the maximum fidelity position, audio reproduction up to the limit of the human ear, or the highest frequency being broadcast by the station is obtained. This system enables you to reach out and bring in weak distant stations, which ordinarily would be blanketed by interference from powerful near-by stations on adjacent channels.

On the other hand, when listening to local stations, a high degree of selectivity is not necessary or desirable, and under these circumstances, the receiver can be adjusted to reproduce every tone, from the lowest fundamental to the highest harmonic which the highest fidelity station on the air is capable of broadcasting.

To bring in stations from great distances, a very high degree of *usable* sensitivity is (*Continued on page* 107)



Powerful Amplifier of the new Scott Imperial All-Wave receiver.

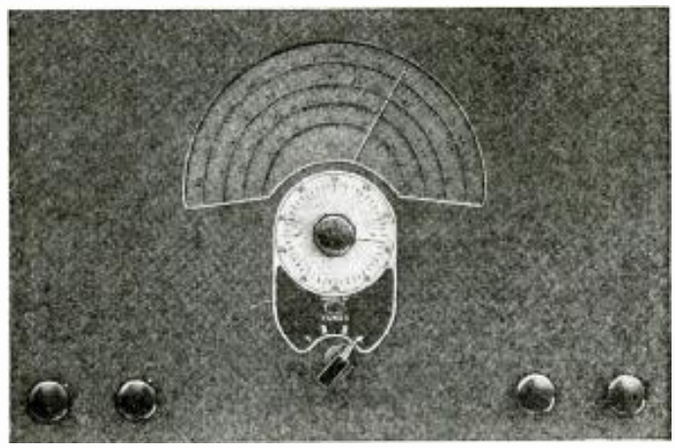
*President, E. H. Scott, Radio Laboratories, Inc.

WHAT'S NEW In Short-Wave Apparatus

The short-wave apparatus here shown has been carefully selected for description by the editors after a rigid investigation of its merits

The BROWNING 35-A 7-Tube A.C. Superhet in KIT FORM

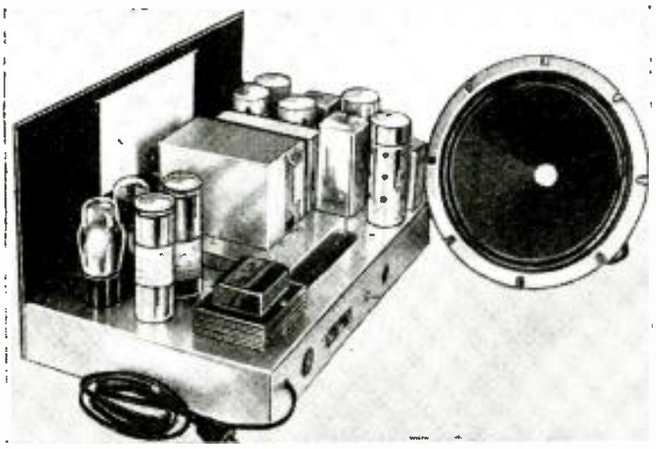
The name BROWNING once more comes to the fore. This time he presents to radio fans a modern 7-tube "all-wave" receiver which has preselection, AVC, band-spread, tone control, beat oscillator, and a cleverly designed "band-switching" arrangement.



Front view of the new "Browning 35" receiver. Note its full-vision tuning dial and its very neat appearance.

● GLENN H. BROWNING, who won fame as co-author of the famous Browning and Drake receiver which was popular a few years ago, has recently designed an excellent all-wave superheterodyne receiver.

This set is not an assembled proposition; all the parts are available in a complete kit form and can be assembled and wired in a few hours' time by even the most inexperienced fan; very simple and complete instructions, of course, make this possible.



Rear view showing the layout of Mr. Browning's latest creation. No. 280.

The "Browning 35," as it is called, is a 7-tube receiver entirely A.C. operated. The tube line-up is as follows: A 58 is used as a high-gain tuned RF. amplifier, this is inductively coupled to a 2A7 pentagrid convertor; the intermediate frequency amplifier is a 58 and a 2A6 is used as a diode detector, audio amplifier and automatic volume control tube. The output tube is a 2A5 and will operate a large dynamic speaker to full volume.

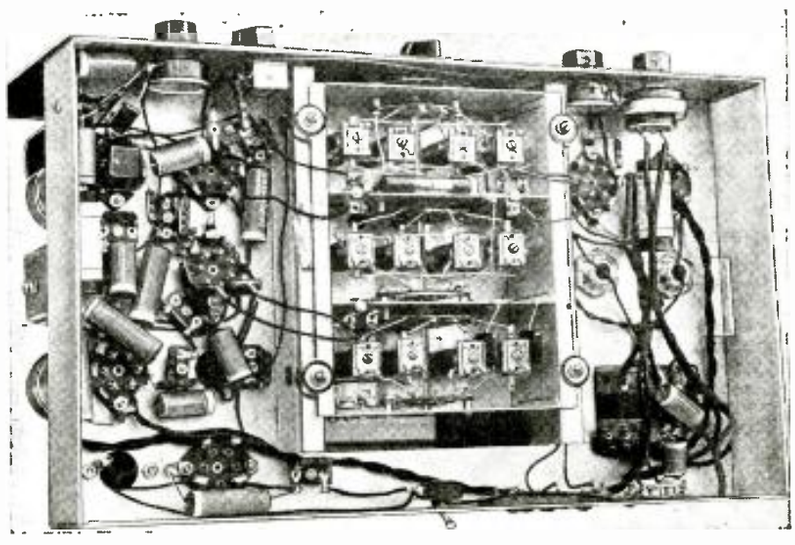
In order to receive "CW" signals and to aid in locating short-wave stations, a *beat oscillator* is used—this is a 56. A 280 is used for the rectifier in the heavy-duty power supply.

Together with its automatic volume control, tone control, beat oscillator, and provisions for a doublet antenna, this set presents something the short-wave fans have been seriously in need of. It will also give excellent service as an amateur band receiver. Band switching is accomplished by the ingenious design of a special selector unit which includes all of the coils and the necessary switches, together with over a dozen padding condensers.

The inexperienced short-wave amateur can put this set together and sure of obtaining results because the band selector is *pre-aligned*. The only necessary adjustments are in the I.F. transformers, and even these are *preset* at the factory so that results will surely be obtained, and it is only necessary to set the tuning adjustments on the transformers to maximum volume. The photographs clearly show the efficient layout and ingenious design of the Browning 35.

The receiver has a measured sensitivity of less than one microvolt over all four bands. Indeed, in the broadcast band the sensitivity is never poorer than 0.2 microvolts. This is not only exceedingly good sensitivity, but surprisingly uniform sensitivity. A large, 4-scale tuning dial marked in megacycles makes tuning accurate and easy. The pointer is driven through a microvernier knob that provides effective band-spread. The vernier is divided into 100 divisions for logging. We are told that a special model of the receiver has been developed for amateur use. This model omits the broadcast band and tunes only to the 160, 80, 40 and 20 meter amateur bands with 150 dial degrees of band-spread and with enough overshoot to include most of the foreign broadcasting.

Bottom view of the "Browning 35." The "coil-switching" arrangement, together with the necessary padding condensers, can be clearly seen in the center of the set.



Names and addresses of manufacturers of sets described on this and following pages furnished upon receipt of 3-cent stamp; mention No. of article.

New Devices of Interest to S-W Experimenters

NEW VELOCITY MIKE

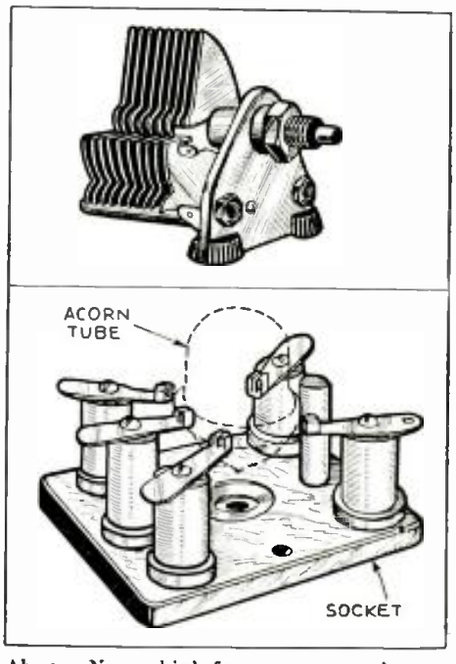
● ALTHOUGH 6 db. higher in output than formerly obtained in velocity microphones, the new 7-point microphones by Amperite are more compact. This was in part made possible by the use of the new nickel aluminum chrome magnets. The most powerful and expensive magnet available today—twice as powerful as 36 percent chrome steel—they found their first American application in the 7-point microphone. Operating without background noise and a flat response over the entire audible range, the new velocities can be used for either speech or music. Acoustic feedback and hum pickup is eliminated entirely in public address or radio station installations. The flexibility of the microphone has been increased by the addition of a swivel bracket. It is thoroughly shielded and has an unusually rugged, mechanical construction in appearance. No. 281.

NEW SOCKET AND CONDENSER

● SEVERAL very interesting new products have recently made their appearance on the market and they are being sponsored by the Alden Products Company. One is a very efficient and uniquely designed variable condenser of the midget variety, intended primarily for high frequency or short-wave use. The insulation of this condenser is Victron "AA." This condenser has a silver pressure contact on the rotor; no grease is used and no oxide skin forms in the bearing. The shaft is self-centering and self-tightening, and due to its cone-shaped bearing cannot become loose or produce noise. A single bearing is used and this aids in reducing losses to the lowest possible value.

This condenser is shown in one of the drawings. Although it cannot be seen, the shaft is hollow and will accommodate a ⅛ inch *gang-rod*. Any number of these condensers can thus be ganged together. These new variable condensers are available in three sizes, viz: 140 mmf., 50 mmf., and 15 mmf. The smallest (15 mmf.) size is ideally suited to ultra high-frequency work. Another interesting Alden product is a low-loss ultra-high frequency socket for the new Acorn 955 tube. This instrument has a Victron insulation in the plate and grid-mounting posts and is provided with a guard post located between the plate and grid terminals. This is necessary because, due to the symmetry of the terminals mountings, the tube could otherwise be inserted in the wrong direction. R.F. chokes of the 2½ millihenry size and also special 5-meter R.F. chokes are available, wound on Victron insulation. These chokes are designed so that they can be mounted with screws to the base or chassis.

Liquid Victron is available to use with a very low loss material to cement coil windings and construct self-supporting coils.



Above—New high-frequency condenser, Below—Latest Na-Ald idea—Victron socket for the Acorn 955 tube. No. 282.

New Multiple Antenna for All-Wave Sets

● FOR the past two years an attempt has been made to provide a suitable antenna system for use in radio stores and in small apartment houses, as well as homes in which more than one all-wave radio receiver is desired.

Multiple antenna systems for the broadcast band are now more or less common but they are unsuitable for use in connection with all-wave receivers.

The system very thoroughly outlined in the accompanying illustrations has been developed by Arthur H. Lynch, Inc., and has been put through the acid test of service in some of the largest radio stores in the New York area. In many cases, where five or six different antennas were employed and where such facilities would not meet the requirements of noise-free reception on the short-wave bands, it has been found possible to do all the necessary demonstrating with one or two of the new aerials.

A more rigid test of the efficacy of this system can hardly be imagined than is found in the various radio retail stores which are located in sections of the city where subway, elevated, streetcar and automobile traffic is found at its height. Here these new aerials are rendering suitable demonstration service every day.

In one week the installation of antennas of this nature resulted in the consummation of the sale of three radio installations valued at $2400.00 each, which had been unsatisfactory with all other types of aerials.

One very important feature in connection with this system is the fact that regardless of the number of receivers employed, it is but necessary to use one antenna transformer and one receiver transformer.

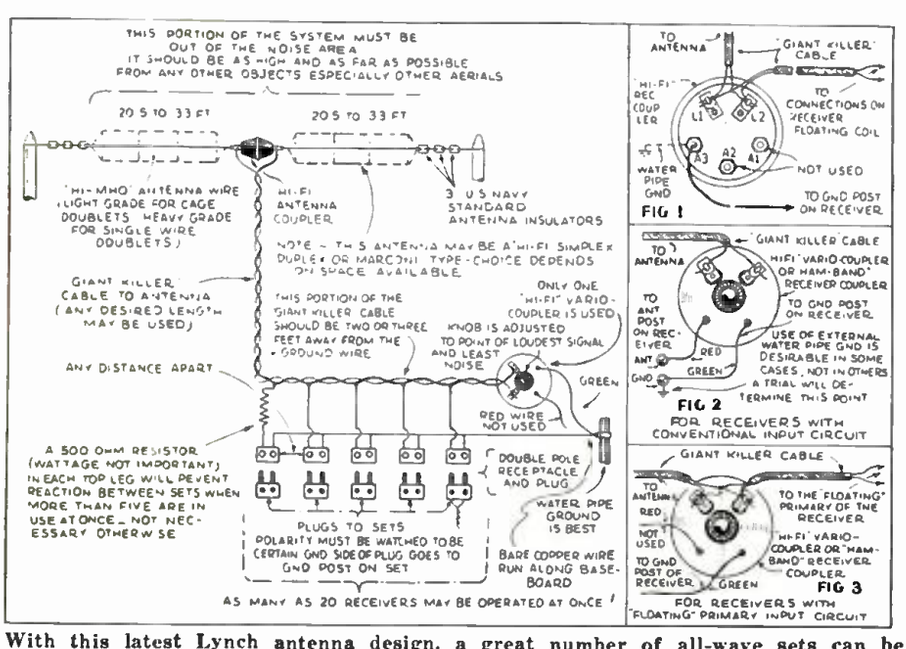
Coupling connections: With some receivers having a primary input circuit which is not grounded, the regular HI-FI receiver coupler, provided with all Lynch HI-FI kits, may sometimes be used in the manner shown in Fig. 1 with very gratifying results.

The connections for using the Lynch HI-FI Vario-coupler and their Ham-bands receiver coupler with receivers of conventional design, having antenna and ground binding posts, are shown in Fig. 2 and the method for using either of these couplers in conjunction with receivers having floating primaries, is shown in Fig. 3.

It will be noted that in every instance, the ground portion of the receiver coupler is connected to the ground posts on the receiver and that the use of a ground connection between the GND post on the receiver and a water pipe or similar ground, is determined by the performance of the receiver itself.

Receivers with "floating" primaries are distinguished by the fact that they have two "ANT" binding posts.

This instrument is particularly desirable in locations where radio fans wish to operate more than one receiver on the same antenna, principally because in a good many locations there is only sufficient space, if indeed that, to erect a high-class antenna. Rather than sacrifice efficiency with two badly crowded antennas, it would be more advisable to install a single good antenna and use such a device as this for operating more than one receiver.



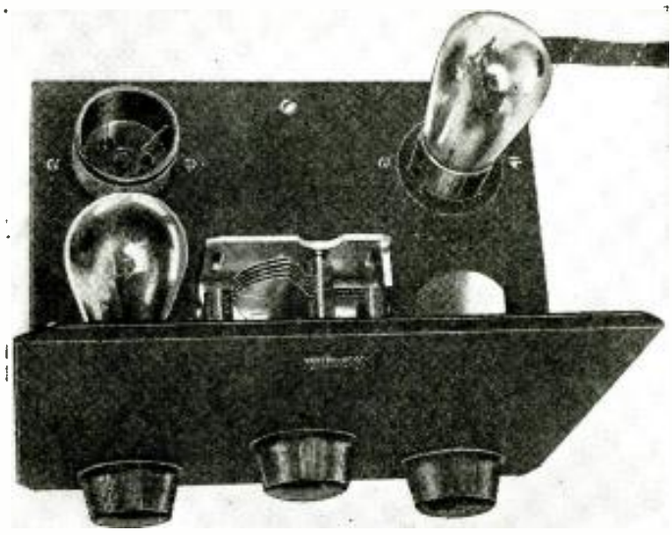
With this latest Lynch antenna design, a great number of all-wave sets can be simultaneously operated from a single aerial. No. 283.

Names and addresses of manufacturers of sets described on this and following pages furnished upon receipt of 3-cent stamp; mention No. of article.

17-In-1 "MULTI-KIT" SET

By W. Green*

Once in a blue moon some radio genius has a really new idea—here is the very latest. By adding a few small parts to a foundation kit, any one of 17 different type receivers can be built up, including battery, A.C., and A.C.-D.C. models.



Above—extremely neat and workmanlike appearance of the 2-tube battery model receiver, built up from a "multi-kit" foundation unit.

● HERE is a new idea in radio set construction—an idea which is sure to appeal to every short-wave experimenter and listener. How would you like to make a set which is so simple in construction that anyone, even though they don't know the first thing about radio, can make it, and what's more make it work well enough to bring in those elusive *forcign* shortwave broadcasters? And then when you finish with the set and want to try something better—one which will give louder signals or more distance—you find that all the parts of the original set, including the chassis, can be used for the new receiver.

17 Sets from 1 Basic Unit

In fact, you can choose from 17 different circuits, some of which are *world famous*, and ranging from the simplest 1-tube battery-operated model to an A.C.-D.C. set using two or three of the composite or "twin tubes" and supplying the results of a 3- or 4-tube receiver. Each of these 17 sets uses the same parts which you employed in the original, simple 1-tube set—with a few inexpensive additions, of course.

Think of the amount of fun you can have trying each of the 17 different sets and deciding which one is the best all-round model for your needs and location. In fact, the 17 circuits which have been devised around the original chassis and fundamental parts mentioned above, does not mean that this is the greatest number of circuits that you can use—these parts can be adapted to a great number of circuits—in fact almost any small set can be built with the parts.

What the "Multi-Kit" Consists Of

To explain in somewhat greater detail just what makes up the "multi-kit," as the chassis and fundamental parts mentioned above have been called, the pictures on this page should be examined. This multi-kit contains the drilled, crystalline-finished metal chassis and panel, a variable condenser, dial, antenna compensating condenser, regeneration control, four coils, coil socket, grid resistor, three by-pass condensers, speaker jack, two knobs and all the necessary screws, wire, etc., needed.

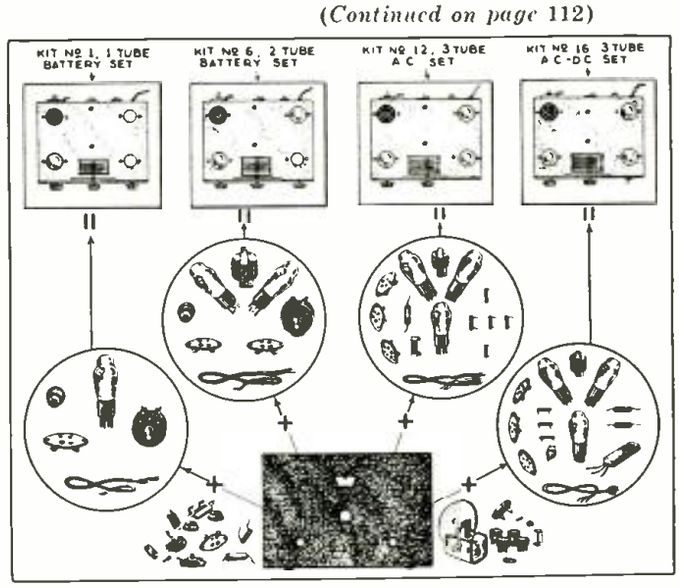
With these parts, plus a few inexpensive additions, you can construct the set shown in Fig. 1 and further illustrated in the photo of the complete model on this page.

This is a battery-operated short-wave set, consisting of a regenerative detector and a stage of audio frequency amplification, using two type 30 economical dry cell tubes.

Or if you prefer, the A.C. receiver shown in Fig. 2 can be made, using two type 56 tubes—and a somewhat different set of additional parts. The multi-kit is used in its entirety, of course. This set is also a regenerative detector and audio amplifier, but instead of using batteries it gets its current from a step-down filament transformer and a "B" eliminator. It will be noticed that the set contains a voltage divider, so that the simplest kind of a "B" unit will suffice.

(*Continued on page* 112)

Photo above shows all of the parts included in a "Multi-Kit" foundation set, plus the few extra parts required for building up the complete 2-tube receiver shown in the picture at the head of this page. No. 284.

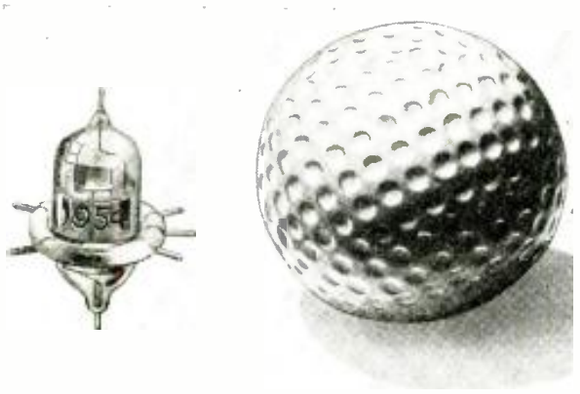


The illustration at right shows some of the possibilities of the "Multi-Kit". Extra parts available for building up to 17 different types of receivers, only 5 being indicated in this drawing.

*Chief Design Engineer, Harrison Radio Co.

Names and addresses of manufacturers of sets described on this and following pages furnished upon receipt of 3-cent stamp; mention No. of article.

New Acorn-Pentode 954 Tube Is Here!



The extremely small size of the new "Acorn"-pentode 954 tube may be judged by comparison with the golf ball at the right of the photo. No. 285.

● THE New Type 954 Acorn-Pentode Tube is a heater-cathode type of pentode designed primarily for radio amateurs and experimenters working with wavelengths as short as 0.7 meter. As an R.F. amplifier at a wavelength of one meter, the 954 is capable of gains of three or more in circuits of conventional design. Higher gains are of course attainable at longer wavelengths. The pentode 954 is a companion tube to the triode 955 and employs a similar unconventional tube structure having small size, close electrode spacing, and short terminal connections. The suppressor is brought out to a separate terminal. In addition to its primary use as a pentode, the 954 with suitable arrangement of terminal connections has application in experimental circuits as a tetrode or triode.

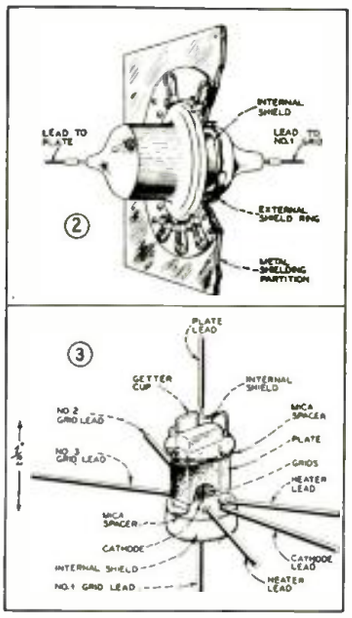
Installation

The *terminals* of the 954 require a special method of mounting by means of clips supplied with each tube. The two small clips are for the control grid and the plate terminal at the bottom and top of the bulb, respectively. The five large clips may be fastened to a supporting insulator. For minimum losses, it is desirable to clip circuit parts directly to the control-grid terminal and to the plate terminal. Since the circumferential tube terminals are located symmetrically, a stop of insulating material should be placed between the screen clip and the suppressor clip so that the cathode terminal will prevent insertion of the heater terminals in the screen and suppressor clips. This stop is identified as the Terminal Mounting Template (Fig. 1) as Alignment Plug. *Do not attempt to solder connections to the terminals.* The heat of the soldering operation is almost certain to crack the bulb seal.

The *heater* is designed to operate on either A.C. or D.C. When A.C. is used, the winding which supplies the heater circuit should operate the heater at its recommended value for full-load operating conditions at average line voltage. Then D.C. is used on the heater, the heater terminals should be connected directly across a 6-volt battery. Under any condition of operation, the heater voltage should not deviate more than plus or minus 10 percent from the normal value of 6.3 volts. Series operation of the 954 is not recommended.

The *cathode* of the 954, operated from a transformer, should prefer-

(Continued on page 115)

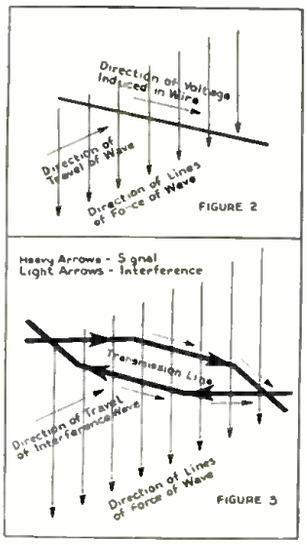


Figs. 2 and 3 above show mounting of new 954 pentode in metal shield and the internal construction of the tube's elements.

The V-Doublet—

A Practical S-W Antenna

By H. A. Crossland*

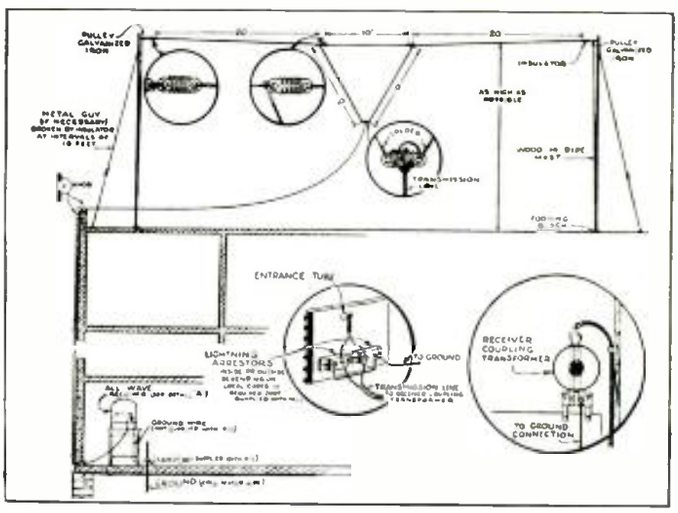


Figs. 2 and 3 above show single wire and "twisted pair" cut by a radio wave.

● CONSTRUCTION of an antenna that will attract standard domestic broadcast radio waves is comparatively simple. Except in noisy locations, a single wire 50 to 75 feet long with an insulated lead-in and a good ground connection forms a satisfactory antenna. In noisy locations, a shielded lead-in with matching transformers and a longer antenna will perform the service.

Short waves, however, are more temperamental in their behavior. Somewhere in the range between 13 and 49 meters (42 to 161 feet) the length of the antenna is likely to be one wavelength long. The antenna will invite waves of such length, while waves of some other length may pass on. Although static is less troublesome at short waves, *man-made* interference is often severe. To exclude such interference, a shielded lead-in cannot be used because the short-wave signal won't travel any great distance through a shielded lead-in without becoming greatly weakened.

Results of many experiments and calculations in developing transoceanic and transcontinental antenna systems show that the doublet antenna with transmission line fills most requirements for efficient *short-wave* reception. The ordinary doublet antenna consists of a straight wire divided at the center by an insulator, from which point a 2-conductor, transposed or twisted transmission line runs to the receiver. Properly designed, this type of doublet gives ideal efficiency at a frequency determined by its length, but not for a continuous range of frequencies covered by the short-wave bands.



Typical installation of the new "V" Doublet antenna. No. 286.

The newly designed General Electric "V-doublet" Antenna System is illustrated in Fig. 1. The "V-doublet" differs from the elementary doublet which tends to favor certain frequencies and reject others. The "V-doublet" is coupled to the transmission line by the converging "V." This makes the doublet respond uniformly to a wider range of short-wave signals, and the "V" matches the doublet more perfectly to the transmission line so that the signal transfer is smooth. The explanation is simple. At the top where the spacing is wide, the characteristic impedance is high and comparable to that of the doublet. at the bottom where the wires are close together, it is low to match the low impedance of the transmission line.

One of the most valuable features of the "V-doublet" system is its ability to exclude interference

(Continued on page 101)

* Supervisor, Radio Field Service General Electric Co., Bridgeport, Conn.

Names and addresses of manufacturers of sets described on this and following pages furnished upon receipt of a 3-cent stamp: mention No. of article

How to Eliminate . . . RADIO INTERFERENCE

By Wilhelm E. Schrage

● BEFORE starting to eliminate radio interference, amateurs and Service Men should keep in mind that not all the crackles and other noises radiated by loudspeakers are really caused through radio interference emanating from electrical apparatus in the neighborhood. Experience has often shown for example that aerials not in first-class condition contribute more crackling noises than one would expect, and an incandescent lamp not connected in the proper way with its socket may cause more disturbance than a large electric motor.

Strange as it may seem apparatus with heavy current flow are not usually responsible for interference, but rather the small electrical devices, consuming only a few watts. In this class belong all the devices used in private houses to "make kitchen work easy," and daily life more enjoyable for the housewife.

Dress Shoes or Pullman Slippers?

It may seem ridiculous, but it frequently happens that the owner of an expensive radio set does not use a well-constructed aerial, but often only a piece of old wire fixed directly upon the walls, or even the steel frame of a mattress is used as an antenna. If one were to appear at a party in full evening dress but with Pullman slippers there would be reason for considerable gossip, but using some makeshift arrangement instead of a well-constructed aerial is often considered a novel bit of technique.

The author describes in the accompanying article how to by-pass electric bells, motors, and other apparatus which frequently cause interference or noise to be heard in the loudspeaker of your radio set.

Since enjoyable radio reception can be obtained if the ratio between the interference strength and the radio signal strength is 1 to 50, only a well-designed aerial will deliver the necessary power to render strong interference no more noticeable than the scratch of a phonograph needle when playing a new record.

The Interference Cloud Around the House

However, an excellent aerial may sometimes cause quite a lot of interference if the antenna is led through a so-called "interference cloud," very often covering the house and its surroundings. The best method to avoid this evil is to use a shielded aerial lead-in as shown in Fig. 1, or a so-called "doublet" antenna, with *transposition lead-in*, as shown in Fig. 2.

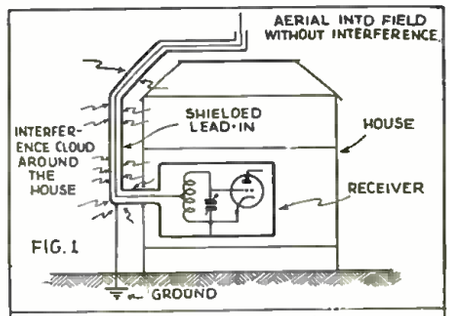


FIG. 1

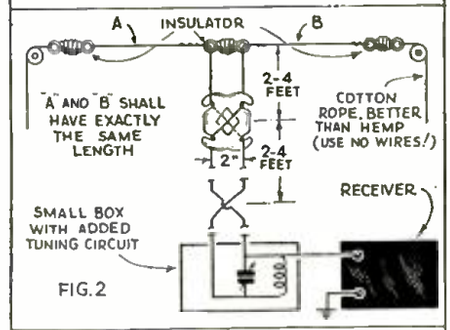


FIG. 2

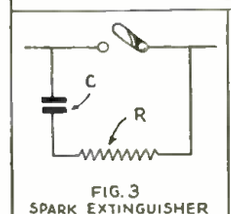


FIG. 3 SPARK EXTINGUISHER TO ADD UPON SWITCHES ETC. CONDENSER C. 0.1- TO 0.5-MF. RESISTOR R. 20-100 OHMS.

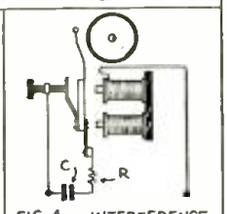


FIG. 4 INTERFERENCE ELIMINATION BY MEANS OF APPLYING A CONDENSER C (0.1-0.5-MF.) AND A RESISTOR (20-100 OHMS)

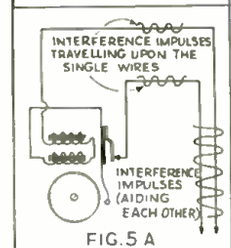


FIG. 5 A

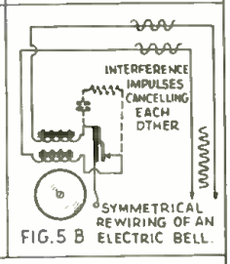


FIG. 5 B

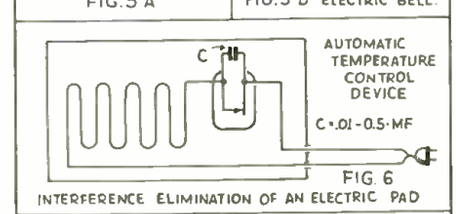


FIG. 6 INTERFERENCE ELIMINATION OF AN ELECTRIC PAD

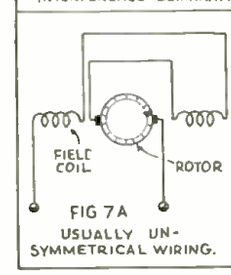


FIG. 7 A USUALLY UNSYMMETRICAL WIRING.

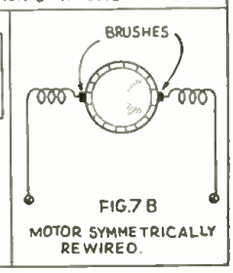


FIG. 7 B MOTOR SYMMETRICALLY REWIRED.

The diagrams Figs. 1 to 7-b above show various electrical apparatus and means of by-passing with condensers, etc., so as to eliminate interference from such sources.

Note in Fig. 5B, the connections for eliminating noise caused by the ordinary door bell, a frequent offender against short-wave receivers.

How Transposed Lead-in Helps

Telephone engineers for 30 years have used transposed lines to decrease background noise of telephone lines caused by static. This type of lead-in has been applied with great success for radio aerials in the past few years. The transposed feed line is the secret of successful interference elimination picked up in the vicinity of the house.

This feed line works in the following way: The induced interference field is out of phase with the field caused by interference in the succeeding part of the feed line, a condition which results in cancellation of the induced interference voltage in any of the following feeder sections.

Use Ground Wires of First-Class Condition

Another reason for so-called "interference" occurring is the ground line—the step-child of most broadcast receiving setups. If radio listeners knew how much trouble can be created by a "bad ground," and how much the reception can be improved through the use of a *good ground*, more attention would be paid to this simple wire which connects the receiver with the ground. This wire should be thoroughly inspected at least twice a year, because corrosion and oxidation may produce more noise than a thunderstorm. To avoid corrosion and oxidation, enameled solid copper wire at least No. 8 or No. 10 gauge should be used for the *ground* line. The wire should be connected by firmly clamping it to a "ground clamp" to the cold water pipe. It is advisable if possible to connect this ground wire on the *street side* of the water meter.

A Covered Ground Post Important

Before connecting the ground clamp to the pipe the contact point should be cleaned with emery cloth or sandpaper until a shining surface is obtained. After connecting the wire and clamp to the pipe the whole thing should be painted with several coats of lacquer to keep out moisture and air. Radio listeners will often be surprised how many of the disturbing "interference" noises will disappear if ground and antenna are put in proper condition.

Switches and Lamps

If antenna and ground are in first-class condition it is then worth while to begin with the elimination of the various sources of real radio interference. At first all incandescent lamps should be inspected insofar as proper connection with their socket is concerned. A small lamp oscillating through traffic vibrations may sometimes be the single source of interference in the entire house. Another simple device often responsible for crackling noises in your loudspeaker are switches. A so-called "spark extinguisher" consisting of a condenser "C" (0.1-0.5 mf.) and a resistor "R" (20-100 ohms) connected to the switch as shown in Fig. 3 will eliminate all of the click-clack noise at once.

(*Continued on page* 126)

Short Wave Stations of the World

Complete List of Broadcast, Police and Television Stations

We present herewith a revised list of the short-wave broadcasting, experimental and commercial radiophone stations of the world. This is arranged by frequency, but the wavelength figures are also given for the benefit of readers who are more accustomed to working with "meters."

All the stations in this list use telephone transmission of one kind or another and can therefore be identified by the average listener.

Herewith is also presented a very fine list of police as well as television stations. Note: Stations marked with a star ★ are the most active and easily heard stations and transmit at fairly regular times.

Please write to us about any new stations or other important data that you learn through announcements over the air or correspondence with the stations themselves. A post card will be sufficient. We will safely return to you any verifications that you send in to us. Communications of this kind are a big help.

Stations are classified as follows: C—Commercial phone. B—Broadcast service. X—Experimental transmissions.

Around-the-Clock Listening Guide

Although short wave reception is notorious for its irregularity and seeming inconsistency (wherein lies its greatest appeal to the sporting listener), it is a good idea to follow a general schedule as far as wavelength in relation to the time of the day is concerned. The observance of a few simple rules will save the short wave fan a lot of otherwise wasted time.

From daybreak till 6 p. m. and particularly during bright daylight, listen between 13 and 19 meters (21540 to 15800 kc.).

To the east of the listener, from about 2 p. m.-12 m., the 25-35 meter will be found very productive. To the west of the listener this same band is best from about 7 p.m. until shortly after daybreak. (After dark, results above 35 meters are usually much better than during daylight.) These general rules hold for any location.

Short-Wave Broadcasting, Experimental and Commercial Radiophone Stations

21540 kc. W8XK
-B- 13.93 meters
WESTINGHOUSE ELECTRIC
PITTSBURGH, PA.
6 a.m.-2 p.m.; relays KDKA

21530 kc. GSJ
-B- 13.93 meters
DAVENTRY, ENGLAND
B.B.C., BROADCASTING
HOUSE, LONDON, ENGLAND
See "When to Listen In" column

21470 kc. GSH
-B- 13.97 meters
DAVENTRY, ENGLAND
B.B.C., BROADCASTING
HOUSE, LONDON, ENGLAND
See "When to Listen In" column

21420 kc. WKK
-C- 14.01 meters
A. T. & T. CO.
LAWRENCEVILLE, N. J.
Calls Argentina, Brazil and
Peru, daytime

21060 kc. WKA
-C- 14.25 meters
LAWRENCEVILLE, N. J.
Calls England
noon

21020 kc. LSN6
-C- 14.27 meters
HURLINGHAM, ARG.
Calls N. Y. C.
8 a. m.-5 p. m.

20700 kc. LSY
-C- 14.49 meters
MONTE GRANDE
ARGENTINA
Tests irregularly

20380 kc. GAA
-C- 14.72 meters
RUGBY, ENGLAND
Calls Argentina, Brazil,
mornings

19900 kc. LSG
-C- 15.08 meters
MONTE GRANDE,
ARGENTINA
Tests irregularly, daytime

19820 kc. WKN
-C- 15.14 meters
LAWRENCEVILLE, N. J.
Calls England, daytime

19650 kc. LSN5
-C- 15.27 meters
HURLINGHAM, ARGENTINA
Calls Europe, daytime

19600 kc. LSF
-C- 15.31 meters
MONTE GRANDE,
ARGENTINA
Tests irregularly, daytime

19380 kc. WOP
-C- 15.48 meters
OCEAN GATE, N. J.
Calls Peru, daytime

19355 kc. FTM
-C- 15.50 meters
ST. ASSISE, FRANCE
Calls Argentina, mornings

19220 kc. WKF
-C- 15.60 meters
LAWRENCEVILLE, N. J.
Calls England, daytime

19160 kc. GAP
-C- 15.66 meters
RUGBY, ENGLAND
Calls Australia, early a. m.

18970 kc. GAQ
-C- 15.81 meters
RUGBY, ENGLAND
Calls S. Africa, mornings

18830 kc. PLE
-C- 15.93 meters
BANDOENG, JAVA
Calls Holland, early a. m.

18620 kc. GAU
-C- 16.11 meters
RUGBY, ENGLAND
Calls N. Y., daytime

18345 kc. FZS
-C- 16.35 meters
SAIGON, INDO-CHINA
Phones Paris, early morning

18340 kc. WLA
-C- 16.36 meters
LAWRENCEVILLE, N. J.
Calls England, daytime

18310 kc. GAS
-C- 16.38 meters
RUGBY, ENGLAND
Calls N. Y., daytime

18250 kc. FTO
-C- 16.43 meters
ST. ASSISE, FRANCE
Calls S. America, daytime

18200 kc. GAW
-C- 16.46 meters
RUGBY, ENGLAND
Calls N. Y., daytime

18135 kc. PMC
-C- 16.54 meters
BANDDENG, JAVA
Phones Holland, early a. m.

18115 kc. LSY3
-C- 16.56 meters
MONTE GRANDE,
ARGENTINA
Tests irregularly

18040 kc. GAB
-C- 16.63 meters
RUGBY, ENGLAND
Calls Canada,
morn. and early aftn.

17810 kc. PCV
-C- 16.84 meters
KOOTWIJK, HOLLAND
Calls Java, 6-9 a. m.

17790 kc. ★GSG
-B- 16.86 meters
BRITISH BROAD. CORP.
DAVENTRY, ENGLAND
See
"When to Listen In" Column

17780 kc ★W3XAL
-B- 16.87 meters
NATIONAL BROAD. CO.
BOUND BROOK, N. J.
Relays WJZ. Daily exc. Sun.
8-9 a.m. Tues., Thurs., Sat.
2-3 p.m.

17775 kc. ★PHI
-B- 16.88 meters
N. V. PHILIPS' RADIO
HUIZEN, HOLLAND
Daily exc. Tues. and Wed. 8:30-
10:30 or 10:45 a.m., Sat. till
11:30, Sun. till 11:15 a.m.

17760 kc. DJE
-B- 16.89 meters
BROADCASTING HOUSE
BERLIN, GERMANY
Irregular 8-11:30 a.m.

17760 kc. IAC
-C- 16.89 meters
PIZA, ITALY
Calls ships, 6:30-7:30 a. m.

17310 kc. W3XL
-X- 17.33 meters
NATIONAL BROAD. CO.
BOUND BROOK, N. J.
Tests irregularly

17120 kc. WOO
-C- 17.52 meters
A. T. & T. CO.,
OCEAN GATE, N. J.
Calls ships

17080 kc. GBC
-C- 17.56 meters
RUGBY, ENGLAND
Calls Ships

16270 kc. WLK
-C- 18.44 meters
LAWRENCEVILLE, N. J.
Phones
Arg., Braz., Peru, daytime

16270 kc. WOG
-C- 18.44 meters
OCEAN GATE, N. J.
Calls England,
morning and early afternoon

16233 kc. FZR3
-C- 18.48 meters
SAIGON, INDO-CHINA
Calls Paris and Pacific Isles

15880 kc. FTK
-C- 18.90 meters
ST. ASSISE, FRANCE
Phones Saigon, morning

15810 kc. LSL
-C- 18.98 meters
HURLINGHAM, ARGENTINA
Calls
Brazil and Europe, daytime

15760 kc. JYT
-X- 19.04 meters
KEMIKWA-CHO, CHIBA-
KEN, JAPAN
Irregular in late afternoon
and early morning

15660 kc. JVE
-C- 19.18 meters
NAZAKI, JAPAN
Phones Java 3-5 a.m.

15620 kc. JVF
-C- 19.2 meters
NAZAKI, JAPAN
Phones U.S., 5 a.m. & 8 p.m.

15415 kc. KWO
-C- 19.46 meters
DIXON, CAL.
Phones Hawaii 2-7 p.m.

15370 kc. ★HAS3
-B- 19.52 meters
BUDAPEST, HUNGARY
Broadcasts Sundays, 9-10 a.m.

15355 kc. KWU
-C- 19.53 meters
DIXON, CAL.
Phones Pacific Isles and Japan

15340 kc. DJR
-X- 19.56 meters
BROADCASTING HOUSE
BERLIN, GERMANY
Testing irregularly

15330kc.★W2XAD
-B- 19.56 meters
GENERAL ELECTRIC CO.
SCHENECTADY, N. Y.
Relays
WGY daily, 2-3 p.m.

15280 kc. DJQ
-B- 19.63 meters
BROADCASTING HOUSE
BERLIN, GERMANY
12:30-2 a. m.

15270 kc. ★W2XE
-B- 19.65 meters
ATLANTIC BROADCASTING
CORP.
485 Madison Av., N.Y.C.
Relays
WABC daily, 10 a.m.-12 n.

15260 kc. GSI
-B- 19.66 meters
DAVENTRY, ENGLAND
B.B.C., BROADCASTING
HOUSE, LONDON, ENGLAND
See "When to Listen In" column

15250 kc. W1XAL
-B- 19.67 meters
BOSTON, MASS.
Irregular, in morning

15243 kc. FYA
-B- 19.68 meters
"RADIO COLONIAL"
PARIS, FRANCE
Service de la Radiodiffusion
103 Rue de Grenelle, Paris
6-10 a.m.

15220 kc. ★PCJ
-X- 19.71 meters
N.V. PHILIPS' RADIO
EINDHOVEN, HOLLAND
Broadcasts relaying PHI

15210 kc. ★W8XK
-B- 19.72 meters
WESTINGHOUSE ELECTRIC
& MFG. CO.
PITTSBURGH, PA.
6 a.m.-4:15 p.m.
Relays KDKA

15200 kc. DJB
-B- 19.73 meters
BROADCASTING HOUSE
BERLIN, GERMANY
12:30-2, 3:45-7:15 a.m.

15140 kc. ★GSF
-B- 19.82 meters
BRITISH BROAD. CORP.
DAVENTRY, ENGLAND
See
"When to Listen In" Column

15120 kc. ★HVJ
-B- 19.83 meters
VATICAN CITY
ROME, ITALY
10:30 to 10:45 a.m., except
Sunday

(All Schedules Eastern Standard Time)

15090 kc. RKI
-C- 19.88 meters
MOSCOW, U.S.S.R.
Phones Tashkent near 7 a.m. and relays RNE on Sundays irregularly

15055 kc. WNC
-C- 19.92 meters
HIALEAH, FLORIDA
Calls Central America, daytime

14980 kc. KAY
-C- 20.03 meters
MANILA, P. I.
Phones Pacific Isles

14950 kc. HJB
-C- 20.07 meters
BOGOTA, COL.
Calls WNC, daytime

14590 kc. WMN
-C- 20.56 meters
LAWRENCEVILLE, N. J.
Phones England
morning and afternoon

14535 kc. HBJ
-B- 20.64 meters
RADIO NATIONS,
GENEVA, SWITZERLAND
Broadcasts irregularly

14500 kc. LSM2
-C- 20.69 meters
HURLINGHAM, ARGENTINA
Calls U. S., evening

14485 kc. TIR
-C- 20.71 meters
CARTAGO, COSTA RICA
Phones Cen. Amer. & U.S.A.
Daytime

14485 kc. HPF
-C- 20.71 meters
PANAMA CITY, PAN.
Phones WNC daytime

14485 kc. TGF
-C- 20.71 meters
GUATEMALA CITY, GUAT.
Phones WNC daytime

14485 kc. YNA
-C- 20.71 meters
MANAGUA, NICARAGUA
Phones WNC daytime

14470 kc. WMF
-C- 20.73 meters
LAWRENCEVILLE, N. J.
Phones England
morning and afternoon

14440 kc. GBW
-C- 20.78 meters
RUGBY, ENGLAND
Calls U.S.A., afternoon

13990 kc. GBA
-C- 21.44 meters
RUGBY, ENGLAND
Calls
Buenos Aires, late afternoon

13610 kc. JYK
-C- 22.04 meters
KEMIKAWA-CHO, CHIBA-KEN, JAPAN
Phones California till 11 p. m.

13585 kc. GBB
-C- 22.08 meters
RUGBY, ENGLAND
Calls
Egypt & Canada, afternoons

13415 kc. GCJ
-C- 22.36 meters
RUGBY, ENGLAND
Calls Japan & China early morning

13390 kc. WMA
-C- 22.40 meters
LAWRENCEVILLE, N. J.
Phones England
morning and afternoon

13075 kc. VP1A
-X- 22.94 meters
SUVA, FIJI ISLANDS
Daily exc. Sat. and Sun.
12:30-1:30 a.m.

12840 kc. WOO
-C- 23.36 meters
OCEAN GATE, N. J.
Calls ships

12825 kc. CNR
-B, C- 23.39 meters
DIRECTOR GENERAL
Telegraph and Telephone
Stations, Rabat, Morocco
Broadcasts, Sunday, 7:30-9 a. m.

12800 kc. IAC
-C- 23.45 meters
PIZA, ITALY
Calls Italian ships, mornings

12780 kc. GBC
-C- 23.47 meters
RUGBY, ENGLAND
Calls ships

12396 kc. CT1GO
-B- 24.2 meters
PAREDE, PORTUGAL
Sun. 10-11:30 a.m., Tues., Thur., Fri. 1:00-2:15 p.m.

12290 kc. GBU
-C- 24.41 meters
RUGBY, ENGLAND
Calls N.Y.C., afternoon

12150 kc. GBS
-C- 24.69 meters
RUGBY, ENGLAND
Calls N.Y.C., afternoon

12000 kc. RNE
-B- 25 meters
MOSCOW, U. S. S. R.
Sun. 6-9, 10-11 a.m., 3-6 p.m.
Wed. 5-6 a.m.

11991 kc. FZS2
-C- 25.02 meters
SAIGON, INDO-CHINA
Phones Paris, morning

11950 kc. KKQ
-X- 25.10 meters
BOLINAS, CALIF.
Tests, irregularly, evenings

11940 kc. FTA
-C- 25.13 meters
STE. ASSISE, FRANCE
Phones CNR morning,
Hurlingham, Arge., nights

11875 kc. ★FYA
-B- 25.25 meters
"RADIO COLONIAL"
PARIS, FRANCE
10:15 a.m.-1:15 p.m., 2-5 p.m.

11870 kc. ★W8XK
-B- 25.26 meters
WESTINGHOUSE ELECTRIC & MFG. CO.
PITTSBURGH, PA.
4:20-10 p.m.
Fri. till 12 m
Relays KDKA

11860 kc. GSE
-B- 25.29 meters
BRITISH BROAD. CORP.
DAVENTRY, ENGLAND
See
"When to Listen In" Column

11855 kc. DJP
-X- 25.31 meters
BROADCASTING HOUSE
BERLIN, GERMANY
Tests irregularly

11830 kc. ★W2XE
-B- 25.36 meters
ATLANTIC BROADCASTING CORP.
485 MADISON AVE., N. Y. C.
2-4 p.m. Relays WABC

11811 kc. I2RO
-B- 25.4 meters
E.I.A.R.
Via Montelle 5
ROME, ITALY

11795 kc. DJO
-X- 25.43 meters
BROADCASTING HOUSE
BERLIN, GERMANY
Tests irregularly

11790 kc. W1XAL
-B- 25.45 meters
BOSTON, MASS.
Irregularly in the afternoon

11770 kc. ★DJD
-B- 25.49 meters
BROADCASTING HOUSE,
BERLIN, GERMANY
12-4:30, 5:05-10:30 p.m.

11750 kc. ★GSD
-B- 25.53 meters
BRITISH BROAD. CORP.
DAVENTRY, ENGLAND
See
"When to Listen In" Column

11720 kc. ★CJRX
-B- 25.6 meters
WINNIPEG, CANADA
Daily, 8 p. m.-12 m.

11705 kc. ★FYA
-B- 25.63 meters
"RADIO COLONIAL"
PARIS, FRANCE
6-9 p.m.
10 p.m.-12 m.

11680 kc. KIO
-X- 25.68 meters
KAHUKU, HAWAII
Tests in the evening

10770 kc. GBP
-C- 27.85 meters
RUGBY, ENGLAND
Calls
Sydney, Austral. early a. m.

10740 kc. ★JVM
-C- 27.93 meters
NAZAKI, JAPAN
Phones California evenings

10675 kc. WNB
-C- 28.1 meters
LAWRENCEVILLE, N. J.
Calls Bermuda, daytime

10660 kc. ★JVN
-C- 28.14 meters
NAZAKI, JAPAN
Broadcasts
irregularly 2-7:45 a.m.

10550 kc. WOK
-C- 28.44 meters
LAWRENCEVILLE, N. J.
Phones
Arge., Braz., Peru, nights

10520 kc. VLK
-C- 28.51 meters
SYDNEY, AUSTRALIA
Calls Rugby, early a.m.

10430 kc. YBG
-C- 28.76 meters
MEDAN, SUMATRA
5:30-6:30 a. m., 7:30-8:30 p. m.

10420 kc. XGW
-C- 28.79 meters
SHANGHAI, CHINA
Calls Manila and England, 6-9 a. m. and California late evening

10410 kc. PDK
-C- 28.80 meters
KOOTWIJK, HOLLAND
Calls Java 7:30-9:40 a. m.

10410 kc. KES
-X- 28.80 meters
BOLINAS, CALIF.
Tests evenings

10350 kc. ★LSX
-C- 28.98 meters
MONTE GRANDE, ARGENTINA
Tests irregularly 8 p.m.-12 midnight.

10330 kc. ORK
-C- 29.04 meters
RUYSSELEDE, BELGIUM
Broadcasts 1:30-3 p.m.

10300 kc. LSL2
-C- 29.13 meters
HURLINGHAM, ARGENTINA
Calls Europe, evenings

10290 kc. DIQ
-X- 29.16 meters
KONIGSWUSTERHAUSEN, GERMANY
Broadcasts irregularly

10260 kc. PMN
-C- 29.24 meters
BANDOENG, JAVA
Calls Australia 5 a.m.

10250 kv. LSK3
-C- 29.27 meters
HURLINGHAM, ARGENTINA
Calls Europe and U. S., afternoon and evening

10220 kc. PSH
-C- 29.35 meters
RIO DE JANEIRO, BRAZIL

10055 kc. ZFB
-C- 29.84 meters
HAMILTON, BERMUDA
Phones N. Y. C. daytime

9950 kc. GCU
-C- 30.15 meters
RUGBY, ENGLAND
Calls N.Y.C. evening

9890 kc. LSN
-C- 30.33 meters
HURLINGHAM, ARGENTINA
Calls New York, evenings

9870 kc. WON
-C- 30.4 meters
LAWRENCEVILLE, N. J.
Phones England, evening

9860 kc. ★EAQ
-B- 30.43 meters
P. O. Box 951
MADRID, SPAIN
Daily except Saturday, 5:15-7:30 p.m.; Saturday, 12 n.-2 p.m.,

9840 kc. JYS
-X- 30.49 meters
KEMIKAWA-CHO, CHIBA-KEN, JAPAN
Irregular, 4-7 a. m.

9800 kc. LSE
-C- 30.61 meters
MONTE GRANDE, ARGENTINA
Tests irregularly

9790 kc. GCW
-C- 30.64 meters
RUGBY, ENGLAND
Calls N.Y.C., evening

9760 kc. VLJ-VLZ2
-C- 30.74 meters
AMALGAMATED WIRELESS OF AUSTRALIA
SYDNEY, AUSTRALIA
Phones Java and N. Zealand early a.m.

9750 kc. WOF
-C- 30.77 meters
LAWRENCEVILLE, N. J.
Phones England, evening

9710 kc. GCA
-C- 30.89 meters
RUGBY, ENGLAND
Calls Arge. & Brazil, evenings

9635 kc. ★I2RO
-B- 31.13 meters
E.I.A.R.,
ROME, ITALY
Daily 2:30-5 or 6 p.m.
M., W., F. 6-7:30, 7:45-9:15 p.m.

9600 kc. ★CT1AA
-B- 31.25 meters
LISBON, PORTUGAL
Tues., Thurs., Sat. 3:30-6 p.m.

9595 kc. ★HBL
-B- 31.27 meters
LEAGUE OF NATIONS
GENEVA, SWITZERLAND
Saturdays, 5:30-6:15 p. m.

9590 kc. ★VK2ME
-B- 31.28 meters
AMALGAMATED WIRELESS, LTD., 47 YORK ST.
SYDNEY, AUSTRALIA
Sundays 1-3, 5-9 a.m., 10:30 a.m.-12:30 p.m.

9590 kc. HP5J
-B- 31.28 meters
J Street,
PANAMA CITY, PANAMA
7:30-11 p.m.

9590 kc. W3XAU
-B- 31.28 meters
NEWTOWN SQUARE, PA.
Relays WCAU
11 a.m.-6:50 p.m.

9580 kc. ★ GSC
-B- 31.32 meters
BRITISH BROAD. CORP.
DAVENTRY, ENGLAND
See
"When to Listen In" Column

9580 kc. ★VK3LR
-B- 31.32 meters
Research Section,
Postmaster Gen'ls. Dept.,
61 Little Collins St.,
MELBOURNE, AUSTRALIA
3:15-7:30 a.m. except Sun.

9570 kc. ★W1XK
-B- 31.35 meters
WESTINGHOUSE ELECTRIC & MFG. CO.
SPRINGFIELD, MASS.
Relays WBZ, 6 a.m.-12 m.

9565 kc. VUB
-B- 31.36 meters
BOMBAY, INDIA
11 a. m.-12:30 p. m., Wed., Sat. Sun. 7:30-8:30 a.m.

9560 kc. DJA
-B- 31.38 meters
BROADCASTING HOUSE,
BERLIN
8-11:30 a.m., 5:05-9:15 p.m.

9540 kc. ★DJN
-B- 31.45 meters
BROADCASTING HOUSE
BERLIN, GERMANY
3:45-7:15 a.m., 8-11:30 a.m., 5:05-10:30 p.m.

9540 kc. LKJ1
-B- 31.45 meters
JELOY, NORWAY
Relays Oslo 5-8 a. m.

9530 kc. ★W2XAF
-B- 31.48 meters
GENERAL ELECTRIC CO.
SCHENECTADY, N. Y.
Relays WGY 5:25-11 p.m.

9510 kc. GSB
-B- 31.55 meters
BRITISH BROAD. CORP.
DAVENTRY, ENGLAND
See
"When to Listen In" Column

9510 kc. ★VK3ME
-B- 31.55 meters
AMALGAMATED WIRELESS, Ltd.
G. P. O. Box 1272L.
MELBOURNE, AUSTRALIA
Wed., Thurs., Fri., Sat.
5:00-7:00 a. m.

9500 kc. ★PRF5
-B- 31.58 meters
RIO DE JANEIRO, BRAZIL
Daily
except Sun. 5:30-6:15 p. m.

9428 kc. ★COH
-B- 31.8 meters
2 B ST., VEDADO,
HAVANA, CUBA
10 a.m.-12 n., 4-6:30, 8-10 p.m.
also 11 a.m.-12 N. Thurs.

9415 kc. PLV
-C- 31.87 meters
BANDOENG, JAVA
Phones Holland, 7:40-9:40 a. m.

9330 kc. CJA2
-C- 32.15 meters
DRUMMONDVILLE, CANADA
Phones England irregularly

9280 kc. GCB
-C- 32.33 meters
RUGBY, ENGLAND
Calls Can. & Egypt, evenings

9170 kc. WNA
-C- 32.72 meters
LAWRENCEVILLE, N. J.
Phones England, evening

9125 kc. ★HAT4
-B- 32.88 meters
"RADIOLABOR,"
GYALI-UT, 22
BUDAPEST, HUNGARY
Sunday 6-7 p.m.

9020 kc. GCS
-C- 33.26 meters
RUGBY, ENGLAND
Calls N.Y.C., evenings

9010 kc. KEJ
-C- 33.3 meters
BOLINAS, CAL.
Relays NBC & CBS
Programs in evening irregularly

8775 kc. PNI
-C- 34.19 meters
MAKASSER, CELEBES,
D. E. I.
Phones Java around 4 a. m.

(All Schedules Eastern Standard Time)

8760 kc. GCQ
-C- 34.25 meters
RUGBY, ENGLAND
Calls S. Africa, afternoon

8730 kc. GCI
-C- 34.36 meters
RUGBY, ENGLAND
Calls India, 8 a. m.

8680 kc. GBC
-C- 34.56 meters
RUGBY, ENGLAND
Calls ships

8560 kc. WOO
-C- 35.05 meters
OCEAN GATE, N. J.
Calls ships irregular

8380 kc. IAC
-C- 35.8 meters
PIZA, ITALY

8036 kc. CNR
-B- 37.33 meters
RABAT, MOROCCO
Sunday, 2:30-5 p. m.

7880 kc. JYR
-B- 38.07 meters
KEMIKAWA-CHO, CHIBA-KEN, JAPAN
4-7:40 a. m.

7860 kc. HC2JSB
-B- 38.17 meters
GUAYAQUIL, ECUADOR
8:15-11:15 p.m.

7799 kc. ★HBP
-B- 38.47 meters
LEAGUE OF NATIONS,
GENEVA, SWITZERLAND
5:30-6:15 p. m., Saturday

7715 kc. KEE
-C- 38.89 meters
BOLINAS, CAL.
Relays NBC & CBS
Programs in evening irregularly

7510 kc. JVP
-C- 39.95 meters
NAZAKI, JAPAN
Heard irregularly

7400 kc. HJ3ABD
-B- 40.54 meters
P. O. Box 509
BOGOTA, COLOMBIA
Daily 12-2 p. m.; 7-11 p. m.
Sunday, 5-9 p. m.

7380 kc. ★XECR
-B- 40.65 meters
FOREIGN OFFICE,
MEXICO CITY, MEX.
Sun. 6-7 p.m.

7310 kc. HJ1ABD
-B- 41.04 meters
CARTAGENA, COLO.
Irregularly, evenings

7140 kc. HJ4ABB
-B- 42.02 meters
MANIZALES, COL., S. A.
P. O. Box 175
Mon. to Fri. 12:15-1 p. m.;
Tues. & Fri. 7:30-10 p. m.;
Sun. 2:30-5 p. m.

7092 kc. HKE
-B- 42.3 meters
BOGOTA, CDL., S. A.
Tue. and Sat. 8-9 p. m.; Mon. & Thurs. 6:30-7 p. m.

7030 kc. HRP1
-B- 42.67 meters
SAN PEDRO SULA, HONDURAS
Reported on this and other waves irregularly in evening

7000 kc. HJ5ABE
-B- 42.86 meters
CALI, COLUMBIA
Irregular in evening

6905 kc. GDS
-C- 43.45 meters
RUGBY, ENGLAND
Calls N.Y.C. evening

6860 kc. KEL
-X- 43.70 meters
BOLINAS, CALIF.
Tests irregularly
11 a. m.-12 n.; 6-9 p. m.

6800 kc. HIH
-B- 44.12 meters
SAN PEDRO de MACORIS
DOMINICAN REP.
12:10-1:40 p.m., 6:40-7:40 p.m.,
Sun. 3-4 a.m. 12:10-1:40 p.m.,
2:20-4:40 p.m.

6755 kc. WOA
-C- 44.41 meters
LAWRENCEVILLE, N. J.
Phones England, evening

6750 kc. ★JVT
-X- 44.44 meters
NAZAKI, JAPAN
KOKUSAI-DENWA KAISHA, LTD., TOKIO
Broadcasts 2-7:45 a.m.

6666 kc. ★HC2RL
-B- 45.00 meters
P. O. BOX 759, GUAYAQUIL, ECUADOR, S. A.
Sunday, 5:45-7:45 p. m.
Tues., 9:15-11:15 p. m.

6660 kc. ★TIEP
-B- 45.05 meters
LA-VOZ DEL TROPICO
SAN JOSE, COSTA RICA
APARTADO 257, Daily 7-10 p.m.

6650 kc. IAC
-C- 45.1 meters
PIZA, ITALY
Calls ships, evenings

6620 kc. ★PRADO
-B- 45.30 meters
RIOBAMBA, ECUADOR
Thurs. 9-11:45 p.m.

6611 kc. RW72
-B- 45.38 meters
MOSCOW, U. S. S. R.
1-6 p. m.

6610 kc. HI4D
-B- 45.39 meters
SANTO DOMINGO, DOMINICAN REPUBLIC
Except Sun. 11:55 a.m.-1:40 p.m.; 4:40-7:40 p.m.

6528 kc. HIL
-B- 45.95 meters
SANTO DOMINGO, D.R.
Sat., 8-10 p.m.

6520 kc. ★YV6RV
-B- 46.01 meters
VALENCIA, VENEZUELA
5-7, 9-11 p.m., irregular

6490 kc. HJ5ABD
-B- 46.22 meters
MANIZALES, COL.
12-1:30 p. m., 7-10 p. m.

6447 kc. HJ1ABB
-B- 46.53 meters
BARRANQUILLA, COL., S. A.
P. O. BOX 715,
11:30 a. m.-1 p. m.; 5-10 p. m.

6425 kc. W3XL
-X- 46.70 meters
NATIONAL BROADCASTING CO.
BOUND BROOK, N. J.
Tests irregularly

6425 kc. VE9AS
-X- 46.7 meters
FREDERICTON, N.B., CANADA
Operates irregularly

6375 kc. YV4RC
-B- 47.06 meters
CARACAS VENEZUELA
4:30-10:30 p.m.

6316 kc. HIZ
-B- 47.5 meters
SANTO DOMINGO
DOMINICAN REPUBLIC
Daily except Sat. and Sun. 4:40-5:40 p. m.; Sat., 9:40-11:40 p. m.; Sun., 11:40 a. m.-1:40 p. m.

6250 kc. HJ4ABC
-B- 48 meters
PERIERA, COL.
9:30-11:30 a.m., 7-8 or 9 p.m.

6250 kc. OAX4B
-B- 48 meters
Apartado 1242
LIMA, PERU
Wed. & Sun. 7-10 p.m.

6198 kc. CT1GO
-B- 48.4 meters
Portuguese Radio Club.
PAREDE, PORTUGAL
Sun. 11:30 a.m.-1 p.m.
Daily exc. Tues. 7:20-8:30 p.m.

6185 kc. HI1A
-B- 48.5 meters
P. O. BOX 423, SANTIAGO, DOMINICAN REP.
11:40 a. m.-1:40 p. m.
7:40-9:40 p. m.

6175 kc. HJ2ABA
-B- 48.58 meters
TUNJA, COLOMBIA
1-2; 7:30-9:30 p.m.

6170 kc. HJ3ABF
-B- 48.62 meters
BOGOTA, COLOMBIA
6-11 p.m.

6160 kc. ★YV3RC
-B- 48.7 meters
CARACAS, VENEZUELA
Generally 4:00-10:00 p. m.

6155 kc. CO9GC
-B- 48.74 meters
GRAU & CAMENEROS LABS., BOX 137, SANTIAGO, CUBA
9-10 a.m., 11:30 a.m.-1:30 p.m., 3-4:30 p.m. and irregularly 7-11 p.m.

6150 kc. CSL
-B- 48.78 meters
LISBON, PORTUGAL
7-8:30 a.m., 2-7 p.m.

6150 kc. ★CJRO
-B- 48.78 meters
WINNIPEG, MAN., CANADA
6 p. m.-12 m.
Sun. 3-10:30 p. m.

6140 kc. ★W8XK
-B- 48.86 meters
WESTINGHOUSE ELECTRIC & MFG. CO.
PITTSBURGH, PA.
Relays KDKA
4:30 p.m.-12 m.

6130 kc. ZGE
-B- 48.92 meters
KUALA LUMPUR,
FED. MALAY STATES
Sun., Tue., and Fri.,
6:40-8:40 a. m.

6128 kc. LKJ1
-B- 48.94 meters
JELOY, NORWAY
Relays Oslo. 10 a.m.-6 p.m.

6122 kc. JB
-B- 49 meters
JOHANNESBURG, SOUTH AFRICA
Daily except Sat. and Sun., 11:45 p. m.-12:30 a. m., 4-7 a. m., 9 a. m.-3:30 p. m.
Sat., only, 4-7 a. m., 9 a. m.-4:45 p. m.
Sun., only, 11:45 p. m.-12:30 a. m., 8-10:30 a. m., and 12:30-3 p. m.

6120 kc. ★YDA
-B- 49.02 meters
N.I.R.O.M.
BANDDENG, JAVA
10:40 p.m.-1:40 a.m.,
5-9:40 a.m.

6120 kc. ★W2XE
-B- 49.02 meters
ATLANTIC BROADCASTING CORP.
485 MADISON AVE., N. Y. C.
Relays WABC, 5-10 p.m.

6115 kc. HJ1ABE
-B- 49.05 meters
CARTAGENA, COL.
P. O. Box 31
Daily 11:15 a. m.-1 p. m.; Sun. 9-11 a.m.; Mon. 10 p.m.-12 m. Wed. 8-11 p.m.

6112 kc. YV2RC
-B- 49.08 meters
CARACAS, VENEZUELA
Sun. 9:30 a.m.-10:30 p.m., Daily except Sun. 10:30 a.m.-1:30 p.m.; 4-10 p.m.

6110 kc. GSL
-B- 49.10 meters
British Broadcasting Corp.
Daventry, England
See "When To Listen In"

6110 kc. VUC
-B- 49.1 meters
CALCUTTA, INDIA
Daily except Sat., 3-5:30 a. m., 9:30 a. m.-noon;
Sat., 11:45 a. m.-3 p. m.

6105 kc. HJ4ABL
-B- 49.14 meters
MANISALES, COL.
Daily 6-7:30 p.m., Sat. 11 p.m.-12 m.

6100 kc. ★W3XAL
-B- 49.18 meters
NATIONAL BROADCASTING CO.
BOUND BROOK, N. J.
Relays WJZ
Monday, Wednesday, Saturday, 4-5 p.m. Sat. also 11 p.m.-12 m.

6100 kc. ★W9XF
-B- 49.18 meters
DOWNERS GROVE, ILL.
Relays WENR, Chicago
Daily except Mon, Wed. & Sat., 2:30 p. m.-2 a. m.
Mon., Wed. 2:30-4, 6 p.m.-2 a.m. Sat. 2:30-4, 6 p.m.-12 m.

6090 kc. ★VE9GW
-B- 49.26 meters
BOWMANVILLE, ONTARIO, CANADA

6090 kc. VE9BJ
-B- 49.26 meters
SAINT JOHN, N. B., CAN.
7-8:30 p. m.

6080 kc. CP5
-B- 49.34 meters
LAPAZ, BOLIVIA
7-10:30 p. m.

6080 kc. W9XAA
-B- 49.34 meters
CHICAGO FEDERATION OF LABOR
CHICAGO, ILL.
Relays WCFL
Sunday 11:30 a. m.-9 p. m. and Tues., Thurs., Sat., 4 p. m.-12 m.

6079 kc. DJM
-X- 49.35 meters
BROADCASTING HOUSE
BERLIN, GERMANY
Tests irregularly

6072 kc. ZHJ
-B- 49.41 meters
PENANG, MALAYA
Mon., Wed., Sat. 8-10
Also heard Fri. till 3:30 a.m.

6072 kc. OER2
-B- 49.41 meters
VIENNA, AUSTRIA
9 a. m.-5 p. m. daily

6070 kc. VE9CS
-B- 49.42 meters
VANCOUVER, B. C., CANADA
Sun. 1:45-9 p. m., 10:30 p. m.-1 a. m.; Tues. 6-7:30 p. m., 11:30 p. m.-1:30 a. m. Daily 6-7:30 p. m.

6060 kc. OXY
-B- 49.50 meters
SKAMLEBOAEK, DENMARK
1-6:30 p. m.; also 11 a. m.-12 n. Sunday

6060 kc. ★W8XAL
-B- 49.50 meters
CROSLEY RADIO CORP.
CINCINNATI, OHIO
6:30 a.m.-7 p.m.; 10 p.m.-1 a.m.
Relays WLW

6060 kc. VQ7LO
-B- 49.50 meters
NAIROBI, KENYA, AFRICA
Mon., Wed., Fri., 5:45-6:15 a. m., 11 a. m.-2 p. m.
Tues., 3-4 a. m., 11 a. m.-2 p. m., Thurs., 8-9 a. m., 11 a. m.-2 p. m., Sat., 11 a. m.-3 p. m., Sun., 10:50 a. m.-2 p. m.

6060 kc. W3XAU
-B- 49.50 meters
NEWTOWN SQUARE, PA.
Relays WCAU, Philadelphia
7 p.m.-10 p.m.

6045 kc. HJ3ABI
-B- 49.63 meters
BDGOTA, COLO.
Irregular in evening

6042 kc. HJ1ABG
-B- 49.65 meters
BARRANQUILLA, COLO.
12 n.-1 p.m., 6-10 p.m.
Sun. 1-6 p.m.

6040 kc. ★W1XAL
-B- 49.67 meters
BOSTON, MASS.
Tues., Thurs. 7:30-9 p.m.
Sun. 5-7 p.m.

6030 kc. ★HP5B
-B- 49.75 meters
P. O. BOX 910
PANAMA CITY, PAN.
12 N.-1 p.m., 8-10:30 p.m.

6030 kc. VE9CA
-B- 49.75 meters
CALGARY, ALBERTA, CAN.
9 a.m.-3 p.m., 7 p.m.-12 m.

6020 kc. CQN
-B- 49.83 meters
MACAO, CHINA
Mon. and Fri. 3-5 a.m.

6020 kc. ★DJC
-B- 49.83 meters
BROADCASTING HOUSE, BERLIN
12 n.-4:30 p.m., 9:30-10:30 p. m.

6012 kc. ZHI
-B- 49.9 meters
RADIO SERVICE CO.,
20 ORCHARD RD.,
SINGAPORE, MALAYA
Mon., Wed., Thurs., 5:40-8:10 a. m.; Sat., 12:10-1:10 a. m., 10:40 p. m.-1:10 a. m. (Sunday)

6010 kc. ★COC
-B- 49.92 meters
P.O. BOX 98
HAVANA, CUBA
Daily 9:30-11 a.m., 4-7 p.m.
Sat. also at 11:30 p.m.

6000 kc. RW59
-B- 50 meters
MOSCOW, U. S. S. R.
Daily 3-6 p.m.

5990 kc. ★XEBT
-B- 50.08 meters
MEXICO CITY, MEX.
P. O. Box 79-44
7 p. m.-1 a. m.

5980 kc. XECW
-B- 50.17 meters
CALLE del BAJIO 120
MEXICO CITY, MEX.
4-4:30 p.m., 10:30 p.m., 12 m.

5980 kc. HIX
-B- 50.17 meters
SANTO DOMINGO, DOMINICAN REP.
Tues. and Fri. at 8:10 p.m.
Sun. at 7:40 a.m., irreg. Tues. and Thurs.

5970 kc. HJ3ABH
-B- 50.25 meters
BOGOTA, COLO.
APARTADO 565
7-11 p.m.

5968 kc. HVJ
-B- 50.27 meters
VATICAN CITY (ROME)
2-2:15 p. m., daily. Sun., 5-5:30 a. m.

5950 kc. HJ1ABJ
-B- 50.42 meters
SANTA MARTA, CDLO.
11 a.m.-1 p.m., 7-9 p.m.

5950 kc. HJ4ABE
-B- 50.42 meters
MEDELLIN, COLO.
Mon. 7-11 p.m., Tues., Thurs., Sat. 6:30-8 p.m., Wed. and Fri. 7:30-11 p.m.

5940 kc. TGX
-B- 50.5 meters
SR. M. NOVALES.
GUATEMALA CITY, GUAT.
Daily except Sun., 8-10 a.m., 1-2:30 p.m., 8 p.m.-12m.

5890 kc. HJ2ABC
-B- 50.97 meters
CUCUTA, COL.

(All Schedules Eastern Standard Time)

(Continued on page 117)

Television Stations

2000-2100 kc.

W2XDR—Long Island City, N.Y.
W8XAN—Jackson, Mich.
W9XK—Iowa City, Ia.
W9XAK—Manhattan, Kans.
W9XAO—Chicago, Ill.
W6XAH—Bakersfield, Calif.

2750-2850 kc.

W3XAK—Portable
W9XAP—Chicago, Ill.
W2XBS—Bellmore, N.Y.
W9XAL—Kansas City, Mo.
W9XG—W. Lafayette, Ind.
W2XAB—New York, N.Y.

42000-56000, 60000-86000 kc.

W2XAX—New York, N.Y.
W6XAO—Los Angeles. Calif.
W9XD—Milwauke, Wis.
W2XBT—Portable
W2XF—New York, N.Y.
W3XE—Philadelphia, Pa.
W3XAD—Camden, N.J.
W10XX—Portable & Mobile (Vicinity of Camden)
W2XDR—Long Island City, N.Y.
W8XAN—Jackson, Mich.
W9XAT—Portable
W2XD—New York, N.Y.
W2XAG—Portable
W1XG—Boston, Mass.
W9XK—Iowa City, Ia.

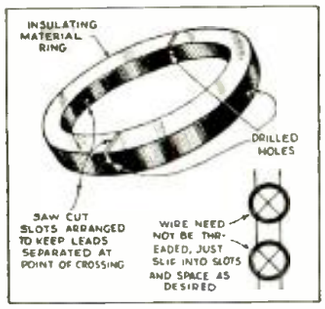
Police Radio Alarm Stations

CGZ	Vancouver, B.C.	2452 kc.
CJW	St. Johns, N.B.	2416 kc.
CJZ	Verdeen, Que.	2452 kc.
KGHA	Portable-Mobile	2490 kc.
KGHB, KGHC, KGHD, KGHE	In State of Wash.	2490 kc.
KGHG	Las Vegas, Nev.	2474 kc.
KGHK	Palo Alto, Cal.	1674 kc.
KGHM	Reno, Nev.	2474 kc.
KGHN	Hutchinson, Kans.	2450 kc.
KGHO	Des Moines, Iowa	1682 kc.
KGHP	Lakton, Okla.	2466 kc.
KGHQ	Chinook Pass, W.	2490 kc.
KGHR	(Mobile) in Wash.	2490 kc.
KGHS	Spokane, Wash.	2414 kc.
KGHT	Brownsville, Tex.	2382 kc.
KGHU	Austin, Tex.	2482 kc.
KGHV	Corpus Christi. Tex.	2382 kc.
KGHW	Centralia, Wash.	2414 kc.
KGHX	Santa Ana, Cal.	2490 kc.
KGHY	Whittier, Cal.	1712 kc.
KGHZ	Little Rock, Ark.	2406 kc.
KGJX	Pasadena, Cal.	1712 kc.
KGLX	Albuquerque, N.M.	2414 kc.
KGOZ	Cedar Rapids, Iowa	2466 kc.
KGPA	Seattle, Wash.	2414 kc.
KGPB	Minneapolis, Minn.	2430 kc.
KGPC	St. Louis, Mo.	1706 kc.
KGPD	San Francisco, Cal.	2474 kc.
KGPE	Kansas City, Mo.	2422 kc.
KGPF	Santa Fe, N. Mex.	2414 kc.
KGPG	Vallejo, Cal.	2422 kc.
KGPH	Oklahoma City, Okla.	2450 kc.
KGPI	Omaha, Neb.	2466 kc.
KGPJ	Beaumont, Tex.	1712 kc.
KGPK	Sioux City, Iowa	2466 kc.
KGPL	Los Angeles Cal.	1712 kc.
KGPM	San Jose, Cal.	2466 kc.
KGPN	Davenport, Iowa	2466 kc.
KGPO	Tulsa, Okla.	2450 kc.
KGPP	Portland, Ore.	2442 kc.
KGPQ	Honolulu, T.H.	1712 kc
KGPR	Minneapolis, Minn.	2430 kc.
KGPS	Bakersfield, Cal.	2414 kc.
KGPW	Salt Lake City, Utah	2406 kc.
KGPX	Denver, Colo.	2442 kc.
KGPY	Baton Rouge, La.	1574 kc.
KGPZ	Wichita, Kans.	2450 kc.
KGZA	Fresno, Calif.	2414 kc.
KGZB	Houston, Tex.	1712 kc.
KGZC	Topeka, Kans.	2422 kc.
KGZD	San Diego, Cal.	2490 kc.
KGZE	San Antonio, Tex.	2482 kc.
KGZF	Chanute. Kans.	2450 kc.
KGZG	Des Moines, Iowa	2466 kc.
KGZH	Klamath Falls, Ore.	2382 kc.
KGZI	Wichita Falls, Tex.	2458 kc.
KGZJ	Phoenix, Ariz.	2430 kc.
KGZL	Shreveport, La.	1712 kc.
KGZM	El Paso, Tex.	2414 kc.
KGZN	Tacoma, Wash.	2414 kc.
KGZO	Santa Barbara, Cal.	2414 kc.
KGZP	Coffeyville, Kans.	2450 kc.
KGZQ	Waco, Tex.	1712 kc.
KGZR	Salem, Ore.	2442 kc.
KGZS	McAlester, Okla.	2458 kc.
KGZT	Santa Cruz, Cal.	1674 kc.
KGZU	Lincoln, Neb.	2490 kc.
KGZV	Aberdeen, Wash.	2414 kc.
KGZW	Lubbock, Tex.	2458 kc.
KGZX	Albuquerque. N.Mex.	2414 kc.
KGZY	San Bernardino, Cal.	1712 kc.
KIUK	Jefferson City, Mo.	1674 kc.
KNFA	Clovis, N. Mex.	2414 kc.
KNFB	Idaho Falls, Idaho	2414 kc.
KNFC	SS Gov. Stevens, (Wash.)	2490 kc.
KNFD	SS Gov. J. Rogers, (Wash.)	2490 kc.
KNFE	Duluth, Minn.	2382 kc.
KNFF	Leavenworth, Kans.	2422 kc.
KNFG	Olympia, Wash.	2490 kc.
KNFH	Garden City, Kans.	2474 kc.
KNFI	Mt. Vernon, Wash.	2414 kc.
KNFJ	Pomona, Cal.	1712 kc.
KNFK	Bellingham, Wash.	2490 kc.
KNFL	Shuksan, Wash.	2490 kc.
KNFM	Compton, Cal.	2490 kc.
KNFN	Waterloo, Ia.	1682 kc.
KNFO	Storm Lake, Ia.	1682 kc.
KNFP	Everett, Wash.	2414 kc.
KNFQ	Skykomish, Wash.	2490 kc.
KNGE	Cleburne, Tex.	1712 kc.
KNGF	Sacramento, Cal.	2422 kc.
KNGG	Phoenix, Ariz.	1698 kc.
KNGH	Dodge City, Kans.	2474 kc.
KNGJ	El Centro, Cal.	2490 kc.
KNGK	Duncan, Okla.	2450 kc.
KNGL	Galveston, Tex.	1712 kc.
KSNE	Duluth, Minn.	2382 kc.
KSW	Berkeley, Cal.	1658 kc.
KVP	Dallas, Tex.	1712 kc.
VYR	Montreal, Can.	1712 kc.
VYW	Winnipeg, Man.	2452 kc.
WCK	Belle Island, Mich.	2414 kc.
WEY	Boston, Mass.	1630 kc.
WKDT	Detroit, Mich.	1630 kc.
WKDU	Cincinnati, Ohio	1706 kc.
WMDZ	Indianapolis, Ind.	2442 kc.
WMFP	Niagara Falls, N. Y.	2422 kc.
WMJ	Buffalo, N.Y.	2422 kc.
WMO	Highland Park, Mich.	2414 kc.
WMP	Framingham, Mass.	1666 kc.
WPDA	Tulare, Cal.	2414 kc.
WPDB	Chicago, Ill.	1712 kc.
WPDC	Chicago, Ill.	1712 kc.
WPDD	Chicago, Ill.	1712 kc.
WPDE	Louisville, Ky.	2442 kc.
WPDF	Flint, Mich.	2466 kc.
WPDG	Youngstown, Ohio	2458 kc.
WPDH	Richmond, Ind.	2442 kc.
WPDI	Columbus. Ohio	2430 kc.
WPDK	Milwaukee, Wis.	2450 kc.
WPDL	Lansing, Mich.	2442 kc.
WPDM	Dayton, Ohio	2430 kc.
WPDN	Auburn, N.Y.	2382 kc.
WPDO	Akron, Ohio	2458 kc.
WPDP	Philadelphia, Pa.	2474 kc.
WPDR	Rochester, N.Y.	2422 kc.
WPDS	St. Paul, Minn.	2430 kc.
WPDT	Kokomo, Ind.	2490 kc.
WPDU	Pittsburgh, Pa.	1712 kc.
WPDV	Charlotte, N.C.	2458 kc.
WPDW	Washington, D.C.	2422 kc.
WPDX	Detroit, Mich.	2414 kc.
WPDY	Atlanta, Ga.	2414 kc.
WPDZ	Fort Wayne Ind.	2490 kc.
WPEA	Syracuse, N.Y.	2382 kc.
WPEB	Grand Rapids. Mich.	2442 kc.
WPEC	Memphis, Tenn.	2466 kc.
WPED	Arlington, Mass.	1712 kc.
WPEE	New York, N.Y.	2450 kc.
WPEF	New York, N.Y.	2450 kc.
WPEG	New York, N.Y.	2450 kc.
WPEH	Somerville, Mass.	1712 kc.
WPEI	E. Providence, R.I.	1712 kc.
WPEK	New Orleans, La.	2430 kc.
WPEL	W. Bridgewater. Mass.	1666 kc.
WPEM	Woonsocket. R.I.	2466 kc.
WPEP	Kenosha, Wis.	2450 kc.
WPES	Saginaw, Mich.	2442 kc.
WPET	Lexington, Ky.	1706 kc.
WPEV	Portable (in Mass.)	1666 kc.
WPEW	Northampton, Mass.	1666 kc.
WPFA	Newton, Mass.	1712 kc.
WPFC	Muskegon, Mich.	2442 kc.
WPFE	Reading, Pa.	2442 kc.
WPFG	Jacksonville, Fla.	2442 kc.
WPFH	Baltimore, Md.	2414 kc.
WPFI	Columbus, Ga.	2414 kc.
WPFJ	Hammond, Ind.	1712 kc.
WPFK	Hackensack, N.J.	2430 kc.
WPFL	Gary, Ind.	2470 kc.
WPFM	Birmingham, Ala.	2382 kc.
WPFN	Fairhaven, Mass.	1712 kc.
WPFO	Knoxville, Ten.	2474 kc.
WPFP	Clarksburg, W. Va.	2490 kc.
WPFQ	Swathmore, Pa.	2474 kc.
WPFR	Johnson City, Tenn.	2470 kc.
WPFS	Asheville, N.C.	2474 kc.
WPFT	Lakeland, Fla.	2442 kc.
WPFU	Portland, Me.	2422 kc.
WPFV	Pawtucket, R.I.	2466 kc.
WPFW	Bridgeport, Conn.	2466 kc
WPFX	Palm Beach. Fla.	2442 kc.
WPFY	Yonkers, N. Y.	2442 kc.
WPFZ	Miami, Fla.	2442 kc.
WPGA	Bay City, Mich.	2466 kc.
WPGB	Port Huron, Mich.	2466 kc.
WPGC	S. Schenectady, N.Y.	1658 kc.
WPGD	Rockford, Ill.	2458 kc.
WPGF	Providence, R.I.	1712 kc.
WPGG	Findlay, Ohio	1596 kc.
WPGH	Albany, N.Y.	2414 kc.
WPGI	Portsmouth, Ohio	2430 kc.
WPGJ	Utica. N.Y.	2414 kc.
WPGK	Cranston. R.I.	2466 kc.
WPGL	Binghamton, N.Y.	2442 kc.
WPGN	South Bend, Ind.	2490 kc.
WPGO	Huntington. N.Y.	2490 kc.
WPGP	Muncie, Ind.	2442 kc.
WPGQ	Columbus, Ohio	1596 kc.
WPGS	Mineola, N.Y.	2490 kc.
WPGT	New Castle, Pa.	2482 kc
WPGU	Cohasset, Mass.	1712 kc.
WPGV	Boston, Mass.	1712 kc.
WPGW	Mobile. Ala.	2382 kc.
WPGX	Worcester, Mass,	2466 kc.
WPGZ	Johnson City, Tenn.	2474 kc.
WPHA	Fitchburg, Mass.	2466 kc.
WPHB	Nashua, N. H.	2422 kc.
WPHC	Massillon, O.	1682 kc.
WPHD	Steubenville, O.	2458 kc.
WPHE	Marion Co., Ind.	1634 kc
WPHF	Richmond, Va.	2450 kc.
WPHG	Medford, Mass.	1712 kc.
WPHI	Charleston, W. Va.	2490 kc.
WPHJ	Fairmont, W. Va.	2490 kc
WPHK	Wilmington, O.	1596 kc.
WPHL	Portable in Ohio	1682 kc.
WPHM	Orlando, Fla.	2442 kc.
WPHN	Tampa, Fla.	2466 kc.
WPHO	Zanesville, Ohio	2430 kc.
WPHP	Jackson, Mich.	2466 kc.
WPHQ	Parkersburg, W. Va.	2490 kc.
WPHS	Culver, Ind.	1634 kc.
WPHT	Cambridge, Ohio	1682 kc.
WPHV	Bristol, Va.	2450 kc.
WPHY	Elizabethton, Tenn.	2474 kc.
WPSP	Harrishurg, Pa.	1674 kc.
WRBH	Cleveland, Ohio	2458 kc.
WRDQ	Toledo, Ohio	2474 kc.
WRDR	GrossePt.Village, Mich.	2414 kc.
WRDS	E. Lansing, Mich.	1666 kc.

$5.00 Prize

New Transposition Ring

This is what I use for transposition



blocks. They are rings cut from any kind of insulating material that will stand the weather. A whole set can be made in a short time with a handsaw and mitre box.

Just saw them off a tube, then cut them square across on each side. If preferable, you can bore a hole in the bottom of the cut to be sure the wire won't slip out.

They have:

1. The very minimum of material so they should be low loss.
2. All sides push to the center when there is a strain on them so they won't buckle.
3. Costs practically nothing.
4. The wire doesn't have to be threaded through holes—can be put on anywhere.—Alex D. Snider.

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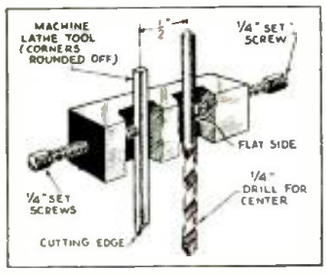

Fly-Cutter

Here is a fly-cutter constructed from easily obtained parts. It consists of a piece of ½" stock 1½" long and drilled as shown in diagram. One ¼" machine lathe tool, two ¼" set screws and a ¼" drill make up the rest of the parts necessary. The drill is ground flat on one side to receive the set screw to prevent slipping. As you see it has no adjustment and is used to cut 1¼" holes for tube sockets. It is very efficient and rids us of the annoying slippage of adjustment in factory-made cutters. —Arnold Forsman.

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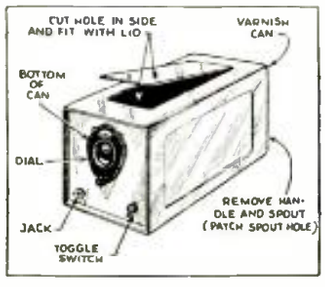
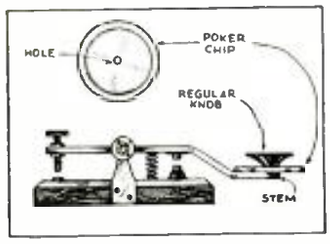
Varnish Can as Shield

Here is how to save money in building a monitor or other short-wave apparatus requiring a shield pot. An old varnish can is just the thing for the job, being of the right size and shape. One may encounter difficulties in cleaning it; however, this can be done with turpentine or other paint-removing solutions. The first step is to cut off the handle and the spout; then proceed to cut a hole in the narrow side large enough to admit the batteries. Be sure to provide for a smooth edge around this hole so that you will not cut yourself on the rough or sharp edges. The opening should be fitted with a lead as shown in the drawing. After the can has been made over as desired, it can be given a coat of black enamel, or some other artistic decoration can be applied.—Calvin Sloan.



$5.00 FOR BEST SHORT-WAVE KINK

The Editor will award a five dollar prize each month for the best short-wave kink submitted by our readers. All other kinks accepted and published will be awarded eight months' subscription to SHORT WAVE CRAFT. Look over these "kinks" and they will give you some idea of what the editors are looking for. Send a typewritten or ink description, with sketch, of your favorite short-wave kink to the "Kink" Editor, SHORT WAVE CRAFT.



Improving Key Handle

By simply drilling a hole in the center of a poker chip, and placing it between the button and stem of your key, you have a semi-Navy type knob which is very easy to handle. The added poker chip flange gives more pressure and leverage during both the upward and downward stroke. (This system has been used in conjunction with the 500-watt transmitter at WCXBY since '33). —S. R. Radom, Opr.

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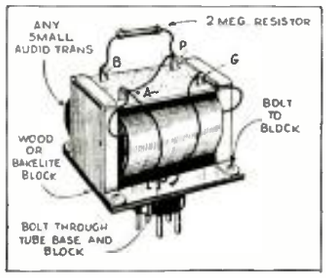
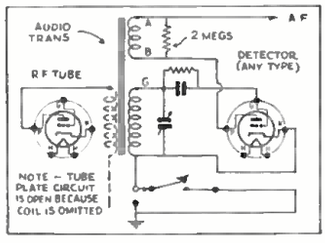
Code Practice Kink

Many of the readers of SHORT WAVE CRAFT who desire to practice code without the cost of building an entirely separate audio oscillator can accomplish this very easily by building the unit described in the drawings. It consists of an audio transformer on which has been mounted a tube



base. The number of prongs conforms with the number of prongs on your plug-in coils, and the entire instrument plugs into the coil socket, the same as your short-wave coils. A diagram is also shown and indicates where the key may be inserted.—John W. Dietrich.



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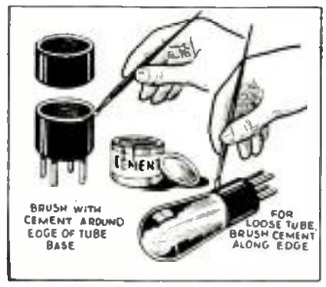
Cement Mixture

In making coil forms by cementing tube base together, I could not find a suitable cement and the coil forms soon fell apart. After much experiment I found a mixture which answered the purpose very well.

It is made by mixing together two parts of ether and one part of alcohol, both of which can be obtained at any near-by drug store. To the mixture of alcohol and ether, celluloid chips are added and allowed to stand in a corked bottle overnight.

In the morning if the solution is still watery, add more chips and let stand again. When a thick liquid is formed it will be ready for us. Making coil forms is not its only use for it can be used for holding the wire in place on spaced coils, fastening tubes that have become loosened from their bases and thousands of other uses.—Theodore Zukauskas.



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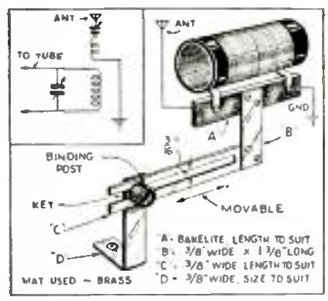

Variable Antenna Coupler

Many fans would like to use an antenna coupling coil instead of the usual capacitive coupling used in most receivers. The diagram clearly shows how a mounting bracket can be constructed which will allow varying the coupling for different short-wave bands. It is also advisable to use the condenser in series with the coil and the antenna in order to make use of what tuning may be possible.—Daniel Borneman.

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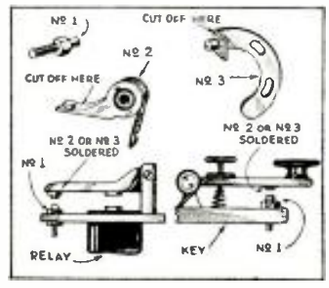
Substitute for Key Contacts

The contacts for keys or relays can be replaced when worn by substituting the used contacts from almost any type of automobile distributor.

The discarded points can usually be obtained from your local garage. After cleaning and a little filing, when soldered to the key or relay, they become a serviceable contact about 3/16 inch in diameter.

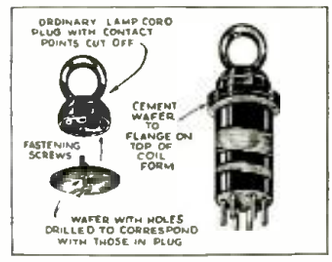
The contact No. 1 is found only on Ford Model A and AA and serves well as the adjustable contact for a telegraph relay.

Many of the readers of SHORT WAVE CRAFT who have burned off the contacts of their keys or relays will find this kink very useful and the new contacts will stand up for a very long time, because of the hardness of them and if sufficient filter is used to suppress the spark.—H. W. Crouter.



Handle for Plug-In Coils

Here is a simple way to use attachment plugs as handles for plug-in coils. Saw off the projecting prongs and then cut a small disc from a piece of ⅛ inch hard rubber or bakelite as shown in the diagram. After



this has been fastened to the attachment plug, cement the whole thing to the top of the plug-in coil with household cement or some other such material.—George Mostacello.

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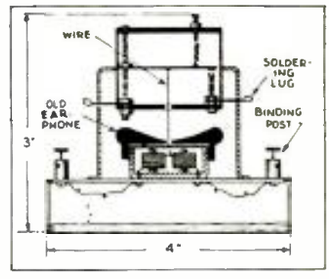
Low Current Relay

Here is my radio kink. It is a simple relay that can be made in about one hour. Most of the parts can be found in your junk box. It can be used for many things; it will make a motor go by means of a beam of light. Of course, you have to have other parts, amplifier, etc. It will do what any other sensitive relay can do.—Paul R. Schmidt.



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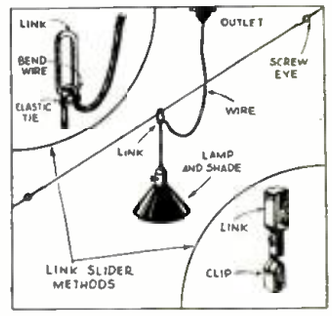
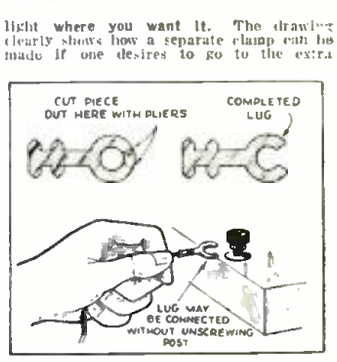
Handy Bench Light

Many experimenters have difficulty in obtaining sufficient light for their workbench without using a very powerful bulb. This can be overcome by stretching a piece of No. 14 wire across the length of the workbench and attaching an old fixture ring as shown in the drawing; the entire lamp can then be slid from one end of the bench to the other and will enable you to have a

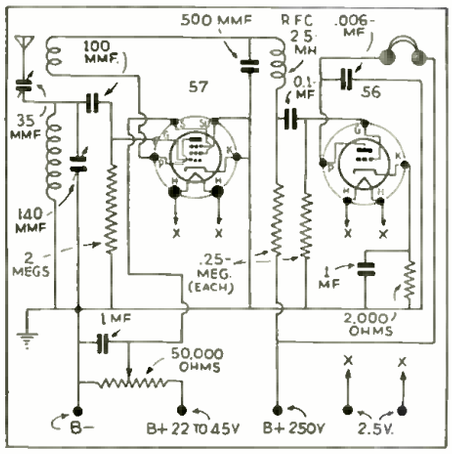


light where you want it. The drawing clearly shows how a separate clamp can be made if one desires to go to the extra



trouble. Another useful kink that I have used quite often is also shown among the drawings. When you have a closed connecting lug and you wish to overcome the necessity of removing the binding post nut each time, it is only necessary to cut out a section of the lug with a pair of dia onal pliers or tin snips.—Russell Bulger.

• • • Short Wave



Circuit diagram of the 2-tube Electrified Doerle receiver.

2 TUBE DOERLE

Jack Guttman, Passaic, N.J.

(Q) Will you please be good enough to print a diagram of the 2 tube electrified receiver? This is the one using a 57 screen-grid detector, resistance coupled to a 56 audio amplifier.

(A) We take pleasure in printing the 2 tube Doerle diagram, inasmuch as this has been one of our most popular receivers. Regeneration is controlled by use of a 50,000 ohm potentiometer and if one desires to employ *throttle* control of regeneration, condenser "C" instead of being a .0005 mf. condenser should be a .00014 mf. variable.

PHONES OR SPEAKER?

Albert Kline, Apollo, Pa.

(Q) I have noticed in the various letters published in your magazine that the short-wave listeners are hearing a good many more stations than I have been able to hear. And I would like to know whether they are using earphones or a speaker in order to obtain such excellent results.

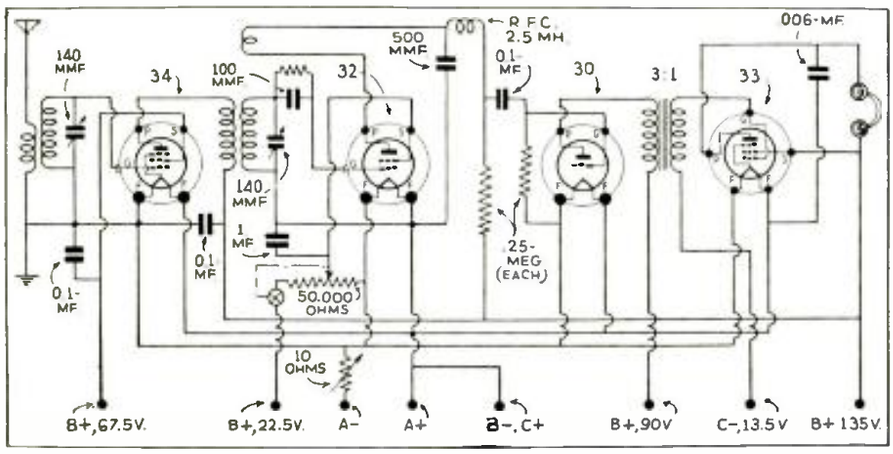
(A) Well, if a short-wave receiver is designed for speaker operation, stations will be heard just as well with a loudspeaker as they will with earphones. However, if you are using a 2- or 3-tube receiver by all means it will be necessary to use earphones to pick up those weaker stations. We cannot say whether our readers are using earphones or speakers but we believe the above will be sufficient to answer your question.

4 TUBE BATTERY SET

L. E. Clarkson, San Juan, Calif.

(Q) Will you please publish a diagram of a 4 tube, 2 volt battery set using a 34 tuned RF. stage, a 32 regenerative detector, a 30 first audio, a 33 pentode, output tube. This set is to be used with standard plug-in coils and 140 mmf. tuning condensers in both stages, either ganged or operated separately, whichever is best.

(A) We are printing the 4 tube diagram you requested. This should make a very fine battery operated receiver and it should be capable of pulling in all the short-wave stations. Regeneration is controlled by varying the screen grid voltage. Make sure that the 50,000 ohm regeneration control potentiometer has a switch on the back of it, which should be connected in series with the 22½ volt lead in order that the potentiometer will not be a constant drain on the first section of the "B" batteries while the set is not in use. This switch should be turned off together with the filaments when the set is not in use. If you wish to gang the two tuning condensers it will be necessary to connect a 35 mmf. condenser across the RF. tuning condenser in order that compensation can be made for varying lengths of antennas, etc., and to keep the two stages in alignment.



4-tube battery operated receiver having a stage of tuned R.F. ahead of the regenerative detector. This should give excellent results on all short-wave stations.

100 WATT PHONE TRANSMITTER

G. K. Burtner, Jr., Goldthwaite, Tex.

(Q) I would like to build a 160-meter amateur transmitter having 100 watts input using inexpensive parts. Can this transmitter be built for around $30?

(A) We doubt very much that it is possible to build a good 160-meter phone transmitter such as you outlined for the small sum of $30.00. We do suggest, however, that you read the series of articles that are being published on a low-power Rack and Panel transmitter for the Ham. The first of this series was published in the March issue, the second in the April issue, and the final one in the May issue.

DOUBLET ANTENNA

Dr. L. L. Hill, Jr., Montgomery, Ala.

(Q) Regarding the question of J. Rand about doublet antennas in the February Question Box, if most of the disturbance comes from passing automobiles, how far must the doublet be from the highway to be reasonably efficient?

(A) Offhand, we would say that the antenna would have to be 300 or 400 feet away from the highway in order to notice any improvement. However we have noticed that it is possible to hear some automobiles from 800 to 1000 feet away from the receiver so you can see that it is a very difficult proposition, this overcoming ignition interference.

(Q) I have two 1 mf. condensers connected in series across the A.C. power line with the center connection grounded. This cuts out only a small amount of noise originated in the low power line. Would the addition of two large radio frequency chokes in series with each side of the power line materially assist in reducing the noise?

(A) It is quite possible that the R.F. choke you mentioned will work satisfactorily. We suggest, when you connect the two in series, you use one large choke and one small one in each leg of the power line.

EDITED BY GEORGE

● **Because the amount of work involved in the drawing of diagrams and the compilation of data, we are forced to charge 25c each for letters that are answered directly through the mail. This fee includes only hand-drawn schematic drawings. We cannot furnish "picture-layouts" or "full-sized" working drawings. Letters not accompanied by 25c will be answered in turn on this page. The 25c remit-**

DOUBLET ANTENNA

C. Jones, Richmond, Va.

(Q) I expect to erect a doublet antenna and am unable to have the two sections of the doublet antenna in opposite directions and will be forced to erect it with a less than a 180 degree angle. Will this do any harm and can I expect just as good results?

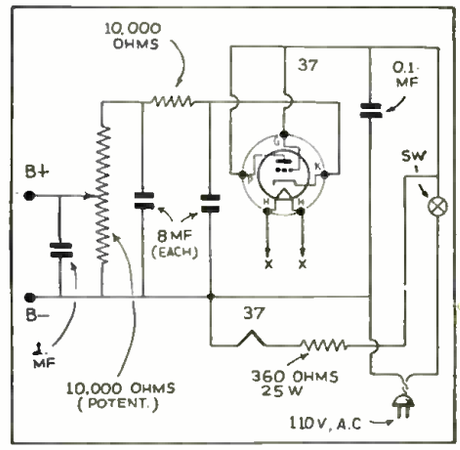
(A) Generally speaking, if the one side of the doublet does not fold back too far you will not notice any difference in reception. However, if it were to approach a V shape, it would become quite directional and you may have trouble from these effects.

SIMPLE "B" SUPPLY

N. Resnick, Philadelphia, Penna.

I built your "Pocket Receiver" described in the December issue of SHORT WAVE CRAFT and obtained very good results with it. I would like to have you print a suitable inexpensive "B" supply, one that does not use a power transformer. It should deliver from 45 to 90 volts in order to run the pocket set.

(A) We are printing diagram for a power supply which will deliver anything up to 110 volts. In using a power supply of this type, make sure that you do not attach the ground to the "B" negative side, otherwise the house fuses will be blown.



Simplest power supply which can be used to take the place of a B battery on short-wave receivers.

QUESTION BOX

W. SHUART, W2AMN

tance may be made in the form of stamps or coin.

Special problems involving considerable research will be quoted upon request. We cannot offer opinions as to the relative merits of commercial instruments.

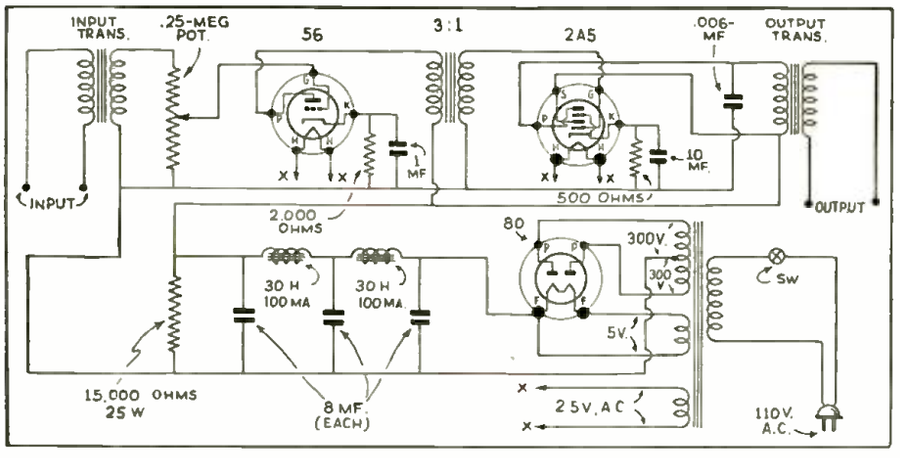
Correspondents are requested to write or print their names and addresses clearly. Hundreds of letters remain unanswered because of incomplete or illegible addresses.

AUDIO AMPLIFIER

Raymond Bourgett, Central Falls, R.I.

(Q) Will you please print a diagram of an all-electric audio amplifier which can be used in conjunction with any short-wave receiver in order to produce full loud-speaker volume. I would like to have this amplifier completely self-contained with just the input connections to be attached to the short-wave set.

(A) We are pleased to print the audio amplifier diagram you requested and complete details are given in the drawing. A volume control is incorporated in the grid circuit of the 56 first audio stage in order that you will have complete control of audio volume, independent of the short-wave set. A 2A5 is used as the output stage and will give full speaker volume. If you wish to use a dynamic speaker, the field should be connected in place of one of the 30 henry filter chokes.



Complete AC operated high gain audio amplifier which can he used in conjunction with any short-wave receiver.

2-TUBE BAND-SPREAD SET

Rolland Johnson, Minneapolis, Minn.

(Q) I built the 2-tube band-spread set described in the February, 1933, issue on page 592. I have rebuilt it twice and checked all parts to make sure that they are all right and have also experimented with the various types of coils. I am using a good power supply with this receiver and still have not been able to get it to work. Could you offer any suggestions?

(A) The 2-tube band-spread you mention was built by a good many of our readers and none of them have had difficulty in getting it to work. If you have used a metal sub-base and panel or a box, similar to the one described in the article, it is possible that you may have a resistor or condenser shorted by coming in contact with the metal. Also it is quite possible that you may have your coil connections wrong. We have found that most of the trouble, with receivers not working properly, has been in incorrectly wired coils. We suggest that you check over the above-mentioned items and we are sure that you will get it to work.

2 TUBER

Harry Foss, Waterbury, Conn.

(Q) Please print a diagram in your *Question Box* of a 2 tube receiver which can be used as a portable. I would like to have this set use a type 34 screen grid detector and a 30 in the audio stage:

(A) This simple 2 tube battery set will make a very nice portable rig, especially for earphone operation and it will be very economical so far as battery consumption is concerned.

(Q) Would a 45 volt together with a 22½ volt battery be sufficient for the plate voltage?

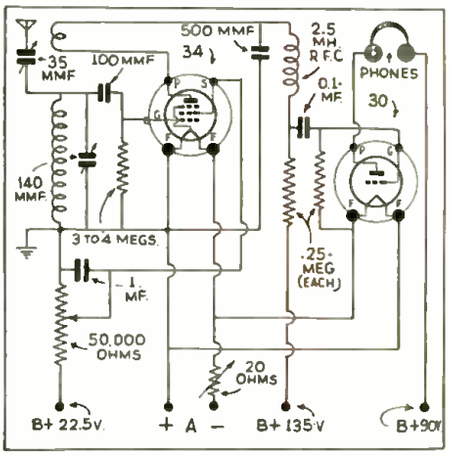
(A) 67½ volts is not sufficient when using the screen-grid detector tube. They will work however with 90 volts of "B" battery supply, but best all-around results are obtained with the full 135 volts applied to the plate. This should cause no concern as extremely small 45 volt batteries are now being manufactured by the major battery companies.

One very important point to remember in a receiver of this type is the antenna condenser. We have shown a 35 mmf. condenser here and we trust that you will use one that has a very low minimum capacity because otherwise the condenser capacity cannot be adjusted low enough and the antenna will cause the receiver to stop oscillating.

POWER SUPPLY FOR "3=6 SUPER"

R. Cleaver, Lawrence, N.Y.

(Q) I would like to have you print a diagram of a power supply which can be used



2-tube battery set intended for earphone operation.

with the *"3 tubes = 6 super-het"* described in the February issue of SHORT WAVE CRAFT. A resistance coupled 42 amplifier will be used in conjunction with this set.

(A) The power supply diagram presented herewith will run any short-wave receiver. When ordering the transformer for this power supply, make sure that you specify that you wish a 6.3 volt filament winding, otherwise you won't be able to run the 3 tube super-het from it.

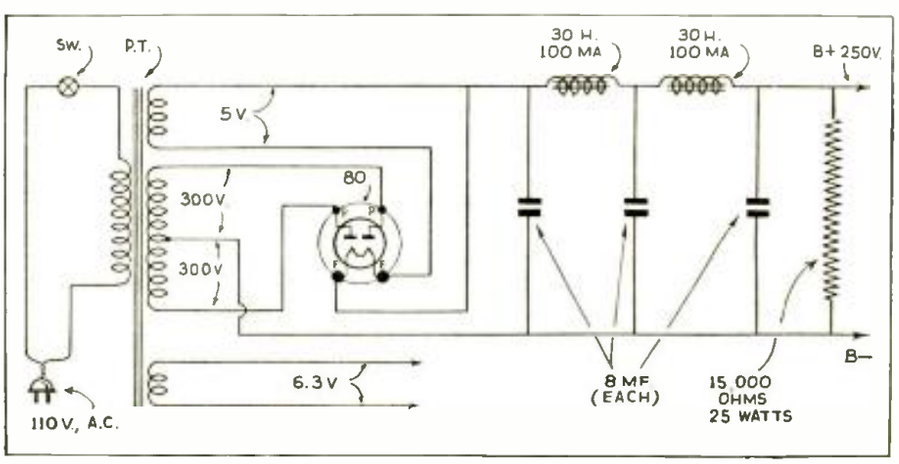
While on the subject of this set, it might be well to mention that there were several mistakes in the Parts List for this receiver as published in the February issue.

The original Parts List called for twelve .1 mf. fixed condensers; actually only eleven are required; two lines further down on the Parts List, the original specifications called for one .5 mf. fixed condenser; the corrected version should be two of these condensers. There was also a mistake in the number of .001 mf. fixed condensers; the original specification called for one; there should be two. The original specification for the .0001 mf. fixed condensers called for three of them; corrected version should be only two of these.

In addition, on the circuit diagram for the receiver, the condenser which is shunted across the cathode biasing resistor for the 6B7 tube is listed as a .5 mf. condenser; actually it should be a 5 mf. electrolytic condenser.

The midget trimmer variable condenser is listed on the diagram as having a capacity of 35 mmf.

This is correct, although the 50 mmf. condenser specified in parts list will serve also. Either should give excellent service.



Power supply for the "3 tubes-6" super-het described in the Fehruary issue of Short Wave Craft.

Transmitting Antennas

By Lawrence Reilly

● THOSE who are planning to build amateur transmitters described in SHORT WAVE CRAFT are going to find that the *antenna* is the most important factor in determining the success of your station. Luckily, the "Ham" is not limited to a single type of antenna, but he may use one of several different types, usually hitting the one best adapted to his own particular location. It is my purpose to deal with as many different types of amateur transmitting antennas as possible.

First, let us consider a little of the theory of antennas. Early experiments with antennas for transmitting work, proved that radiating wires had definite characteristics and exhibited certain tendencies when different lengths were used. When a length of wire was connected to a high frequency generator or transmitter, the measurement of current and voltage distribution in its length were found to appear as in Fig. 1, when the length approached one-fourth the wavelength of the signal.

As the length of the wire was increased to one-fourth wavelength long, it was found that the voltage now assumed a sine wave shape and decreased at the generator end, while it increased at the outer end. The current and voltage were now two sine wave forms and were 90° out of phase, as in Fig. 2 above.

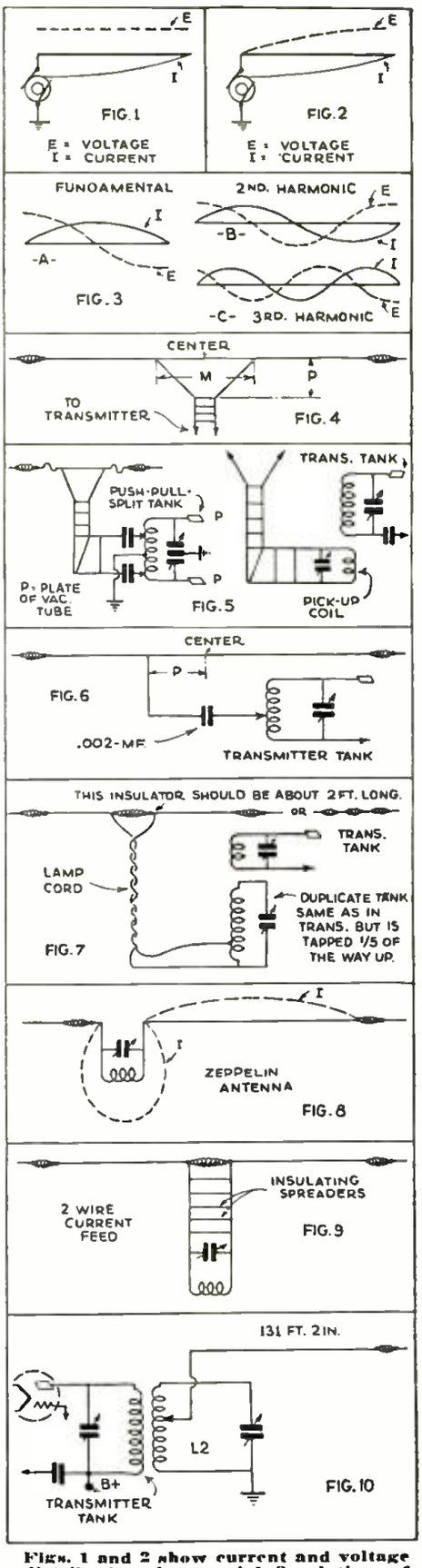
Resonance in the Antenna

At this point where the current and voltage measured a full quarter-wave each, the antenna radiated much more efficiently; at this point that antenna was said to be *resonant*. It was found, by further trial that this type of grounded antenna would *resonate* and, of course, *radiate*, at 3/4 of a wavelength long and again at 5/4 wavelength long, and at any odd number of quarter wavelengths. These were the original Marconi, or *grounded* antennas. It was found that at resonance, an antenna appears to look like pure resistance, to the generator. If it was too short to resonate, it appeared as a condenser does, so by adding an inductance or coil in series, it could be made to come up to resonance by an effect known as *loading*. If it was too long to resonate, it appeared as an inductance, and by adding capacity or condensers in series, it could be made to tune to resonance. This ability to tune the antenna to any wavelength desired by adding coils and condensers, is very useful at long wavelengths, and is useful to the amateur who wants to work on 160 meters, but cannot put up a wire long enough to resonate without *loading*. An important fact to bring out here is that an antenna which is not tuned to resonance is useless, so the closer to resonance you cut all your antennas, the better luck you'll have. This is even more important in Hertzian antennas which cannot usually be tuned except by cutting them to the proper length.

The Hertz Antenna

This brings us to the other type of antenna just mentioned, the Hertz. There are two general types of antenna, the Marconi and the Hertz. Others named the Doublet, the Zepp, the

(*Continued on page* 124)



Figs. 1 and 2 show current and voltage distribution along aerial; 3, relations of harmonics; 4, matched - impedance transmission line; 5, coupling methods; 6, single-wire feeder; 7, "lamp cord" feeder; 8, current distribution; 9, 2-wire current feed; 10, "End-fed" Hertz.

The V-Doublet, a Practical S-W Antenna

(*Continued from page 91*)

from outside sources when the doublet is erected out of the field of interference. Figure 2 illustrates how the signal voltage in induced when the radio wave sweeps across a conductor. In the same way, interference radiation induces interference voltage in any conductor within its influence. The balanced transmission line of the "V-doublet" prevents such interference from reaching the receiver, as shown in Fig. 3.

This shows how voltage is induced in the transmission line. Since the direction in each conductor is the same, these voltages are said to be "in-phase." The signal currents conducted from the doublet, having opposite directions in each wire, are said to be "out-of-phase."

Figure 4 shows the "V-doublet" antenna with the transmission line terminated in a coil. This illustrates how a transposed lead-in can conduct a signal from the doublet to the receiver through interference.

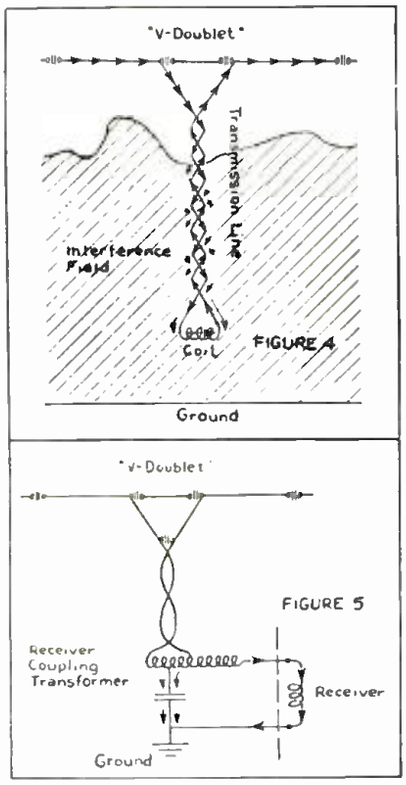


Fig. 4 above shows how currents induced by interference field cancel out, and Fig. 5 shows how interference currents may pass to ground through a condenser.

Arrows drawn on the line represent the signal, while arrows drawn alongside represent induced interference. The interference current does not flow through the coil and the receiver is not affected. *The signal current, however, flows through the coil.* If it is properly coupled to the receiver it will reproduce the signal in the loudspeaker.

The receiver-coupling transformer is illustrated in Fig. 1, and the circuit in Fig. 5. The transformer is a special balanced-primary auto-transformer which matches the transmission line to the antenna coil of the receiver and permits "in-phase" interference to flow to ground through a condenser without affecting the receiver. The size of this condenser makes it ineffective at broadcast frequencies. This permits the system to operate as a conventional "T" antenna system on broadcast signals and as a "V-doublet" on short waves. Below 55 meters the antenna is a "V-doublet"; above 55 meters it is a conventional "T-type" or standard broadcast antenna.

The design of the "V-doublet" antenna

See pages 125, 126 and 128 for our other "Ads"

lends itself readily to various methods of suspension and is simple to install. Only two points of support are required. All necessary parts are supplied with the kit, including antenna wire, insulators, transmission line and receiver-coupling transformer with connecting links and adapter. Ordinarily the antenna will be erected on the roof of a building or suspended between the roof and a near-by tree or pole. If inconvenient to erect masts, the doublet can be suspended between two chimneys, or from the eaves of a building. Where sufficient ground space is not available to provide the normal span of 51 feet, the doublet may be shortened, with a slight sacrifice of efficiency in the region of the 49-meter band only. The directional effect of the doublet is advantageous where a source of interference is unavoidably near. Least interference is intercepted by the doublet when the horizontal wires point toward the source of interference.

If desired, the transmission line can be extended as far as 500 feet from the receiver. This permits wide latitude in choosing a noise-free location for the doublet. At least 100 feet of line should be used to maintain correct electrical matching. Excess line can be coiled at the end nearest the receiver. Transmission line is supplied in rolls of 100 feet, and after the initial 100 feet, the line may be spliced or cut as desired. As the line has a definite known impedance, only the genuine transmission line should be used. Each conductor of this line is covered with a special high-grade white-rubber insulation, and a covering of waterproof braid is woven over the twisted pair.

The receiver-coupling transformer is housed in an attractive embossed aluminum case. Terminals are spaced to fit the antenna terminal board of General Electric receivers and some other makes, and the connecting links make rigid mounting easy. A good ground connection to the receiver chassis should be provided. For receivers having no antenna terminal board, an adapter is supplied to fasten the transformer conveniently to the receiver cabinet, as shown in Fig. 6.

The G-E "V-doublet" antenna, No. KV-100, will enhance the performance of practically any all-wave receiver, as well as G-E All-wave receivers. By using an antenna changeover switch with a receiver-coupling transformer at each receiver, convincing all-wave demonstrations are now possible in a dealer's store. Additional transformers and lengths of transmission line are available as spare parts. The antenna is completely assembled at the factory, guaranteeing perfect installation. All connections to lead-in and insulators are made and soldered at the factory. The antenna is ready to suspend between masts when the kit is unpacked.

Flexible and convenient to install, this new "V-doublet" antenna offers a wide appeal to set owners, radio dealers and Service Men.

$5.00 FOR BEST "YL" PHOTO

● THERE are many fine amateur short-wave transmitting stations operated by "YL" (young lady) operators; married women add one more initial and are known to the short-wave fraternity as "XYL's."

The editors are offering a $5.00 prize for the best photo of the licensed lady amateur operator and her station and the opinion of the judges will be final. The deadline for photo entries for the next issue will be May 20.

In the event of a tie, equal prizes will be given to both. Send entries to "YL" Photo Editor, W2AMN, % Short Wave Craft, 99-101 Hudson St., N. Y. City.

Short Waves at the Hauptmann Trial

(*Continued from page 70*)

As explained in an article appearing in *Time* magazine, the Associated Press explained how a garbled radio message had been responsible for the wrong news flash, which undoubtedly got into many newspaper headlines all over the country, aside from the Press Radio Bureau, but few people believed it: some editors charged that the A.P. reporter had guessed at the verdict and made a bad job of it or else that he had been tricked by the word of a bribed court attaché.

The editor of this magazine endeavored to find out more details concerning the matter of the short-wave transmitters carried by the *Daily News* and also the Associated Press reporters at the Hauptmann trial, but aside from the fact that they did not deny that such ultramodern means of conveying intelligence were used, practically no information could be obtained. The *Daily News* admitted however, that undoubtedly miniature short-wave transmitters of this type would play many important rôles in gathering news at future court trials and other important hearings.

All of the foregoing is distinctly *not* news by any means to our forty odd thousand licensed Hams, and the editors do not need to point out that it is strange indeed that such use of small S.W. portable transmitters has not been made before—and, as a matter of fact, they undoubtedly have been used by many but no one happened to find out about it.

One of the accompanying pictures shows a brief-case short-wave receiving set which was designed and built by Clifford E. Denton and the editors three years ago! It was fully described and illustrated with diagrams in the June 1932 number of SHORT WAVE CRAFT. By making a slight change in the connections, this receiving set can be instantly converted into a transmitter for code signals and undoubtedly that is just about what the small battery-operated transmitters used at the Hauptmann trial consisted of. For the short distance over which the signals had to be transmitted, possibly no more than 100 feet, no aerial would be needed for the transmitter and this would also be true for the receiver.

The range of such a transmitter would probably be a half mile or more with only a small aerial; so far as the reception range is concerned, signals were picked up over a distance of 2,500 miles with this *brief-case* receiving set and a pair of fairly sensitive headphones.

Magni-Dial Simplifies S-W Tuning

(*Continued from page 76*)

of it, and then perform the usual tuning operation by means of the vernier knob on the set.

Still another angle is that on sets having considerable band-spread, or those in which the stations are spread out on the dial pretty well, especially in some of the newer sets having switches to tune in the different bands, then you can easily arrange several dials made out of heavy cardboard or else drawing paper or bristol board, cemented or shellacked to a thin metal or cardboard backing, so that it will take but an instant to change dials for the different bands. By cutting a hole in the dial so that it will come just over the opening in the old escutcheon plate then when the set is turned on, the light may be seen through the hole which may be covered with a piece of red or green celluloid cemented to the back of the dial. In this way you have a pilot light, also very desirable.

(H. E. McCann, the author of this article, is manager of the El Varadero de Manila, Cañacao, Cavite, P.I., and the editors are pleased indeed to present this

idea as it will undoubtedly prove a boon indeed to the thousands of short-wave listeners. Of course one may use a magnifying glass to aid in reading the fine divisions on some of the dials fitted on many short-wave receivers, but what we can see with the unaided eye and without the medium of a lens is after all the most pleasant and comfortable tuning. Mr. McCann suggests a 10-inch radius or 20-inch diameter dial, but we imagine in some cases that a dial even larger than this may be used. Possibly some genius will even carry out the idea on a much larger scale and instead of using a long mechanical indicator may work out a simple light-beam arrangement, whereby a sharply focused pencil of light will sweep over a large dial. And this gives us another idea which may appeal to some of our set-builders—they may elect to arrange a small light on the end of the indicator needle so that it moves along behind a transparent dial, a sharp line being focused on the scale of the dial by means of a diaphragm of suitable shape)—Editor.

A Good 6-Tube Super-Het Receiver

(*Continued from page* 81)

quencies and should always be adjusted carefully.

The coils used were bought on the open market and were not altered in any way except for one single coil. The oscillator coil of the 100-200 meter set requires approximately from 10 to 12 turns to be removed from the grid winding. This is necessary because this particular set of coils tuned into the broadcast band as high as 1200 kc. This is caused by the difference in the incoming signal and that which the local oscillator produces. In the higher frequencies this difference is not noticeable and the trimming condenser on the panel takes care of it. Bud coils were used in this particular case although any standard make of coil will do just as well. Only one thing is necessary and that is that the coils match the tuning condensers that are used. Coils are very reasonable and very easily obtained and it is not worth while winding them by hand.

After the receiver is completed and ready for trial the intermediate transformers must be lined up. If a test oscillator is available by all means use it as a more accurate adjustment can be made. However, this is a luxury with most experimenters, and the following method produces very good results.

A weak signal is tuned in (the weaker the better) and the plate condenser of the first intermediate of transformer is adjusted for maximum response. Next the grid condenser of the same transformer, and then proceed to the next two transformers in a similar manner. During, this adjustment it is necessary that the trimming condenser on the panel be adjusted for maximum response. The receiver is now lined up and does not require any further adjustment. A bakelite or insulated screwdriver can be used to advantage in lining up as it tends to eliminate any *hand-capacity* effects that might be present. For the first adjustment it is best to choose a signal around 75 to 100 meters and then gradually work down to the lower wavelengths as the lower we go the more critical the tuning becomes.

Plug-in Coil Data

Meters Wavelength	Grid coil turns	Tickler turns	Distance between 2 coils
200-80	52 T. No. 28 En. Wound 32 T. per inch.	19 T. No. 20 En Close wound (CW)	¼"
80-40	23 T. No. 28 En. Wound 16 T. per inch.	11 T. No. 30 En. C. W.	¼"
40-20	11 T. No. 28 En. 3-32" between turns	9 T. No. 30 En. C. W.	⅛"
20-10	5 T. No. 28 En. 3-16" between turns	7 T. No. 30 En. C. W.	⅛"

Coilform—2¾" long by 1¼" dia. 4-pin base.

Simplest Ham Transmitter Uses 802 Tube

(*Continued from page 86*)

in any case the same power supply should be used in order to prevent possible damage should the plate voltage fail. The plate voltage should not be removed unless the screen voltage is also disconnected, another good reason for the series resistor method of obtaining the screen voltage. For normal operation on either the fundamental or a harmonic of the crystal, the grid-leak found to give the best results was 20,000 ohms.

By glancing at the coil table we see that the cathode coil for an 80-meter crystal does not tune to 80 meters, but somewhere between 40 and 80, the adjustment of this cathode circuit is quite fussy; that is, it is neither adjusted for maximum plate current or minimum plate current, but for a maximum change in plate current as the plate circuit passes through resonance with either the fundamental or a harmonic. In other words adjust the cathode condenser until you get the greatest dip in plate current as the plate condenser is turned through resonance.

During tests it was possible to hit the fourth harmonic in the plate circuit with a noticeable dip. But for amateur use, the second is the only one which can be used, unless we have need for frequency tripling—and here the 802 is very good, as the third harmonic is nearly as strong as the second. The plate current will go as high as 40 mills (M.A.) and dip to 10 on the crystal frequency, 15 on the second harmonic and 25 on the third harmonic of the crystal frequency; these are with 500 volts on the plate, different voltages will, of course, give different readings. A word about the output—we worked stations on the 80-meter band over a distance of 600 miles and received fine reports with this 1-tube transmitter.

Coil Data

Plate Coil

Band	Turns	Length of Winding
80 meter	30	3 inches
40 meter	16	3 inches
20 meter	10	3 inches

Wound on 2¼-inch dia. 4-prong form with No. 14 tinned, soft-drawn copper wire.

Cathode Coil

80-meterXtal—20 turns No. 22 D.C.C. wire
40-meterXtal—10 turns No. 22 D.C.C. wire
Wound on 1¼-inch dia. 4-prong form.

Parts List for Transmitter

1—50 mmf. double-spaced variable condenser. National.
3—.005 mf. high-frequency by-pass condensers. Sprague.
1—50,000 ohm, 5-watt resistor. Electrad.
1—voltage-dropping resistor 20,000 ohms, 25 watt, Aerovox.
2—4-prong isolantite sockets. National.
1—7-prong large isolantite socket. National.
3—large plug-in coil forms (Bud).
2—small plug-in coil forms (Bud).
1—80-meter crystal and holder.
1—5-prong socket for crystal.
1—2.5 mh. R.F.C. (Radio frequency choke). Hammarlund.
1—.002 mf. high-frequency condenser. Sprague.
1—small 0-100 ma. Milliammeter. Triplett.
1—Bakelite panel 7x12 inches, I.C.A.
1—baseboard 7x12 inches.
2—dials. Na-Ald.
1—802 tube. R.C.A. Radiotron.

Awards in $500.00 Prize Contest for "Best Titles" sent in by our readers for the March Cover Illustration will be published in July issue.

SHORT WAVE LEAGUE

HONORARY MEMBERS

Dr. Lee de Forest
John L. Reinartz
D. E. Replogle
Hollis Baird
E. T. Somerset
Baron Manfred von Ardenne
Hugo Gernsback

Executive Secretary

5-Meter "No-Code Test" Argument Still Hot

Benefits of No-Code 5-meter Exam.

Editor, SHORT WAVE CRAFT:

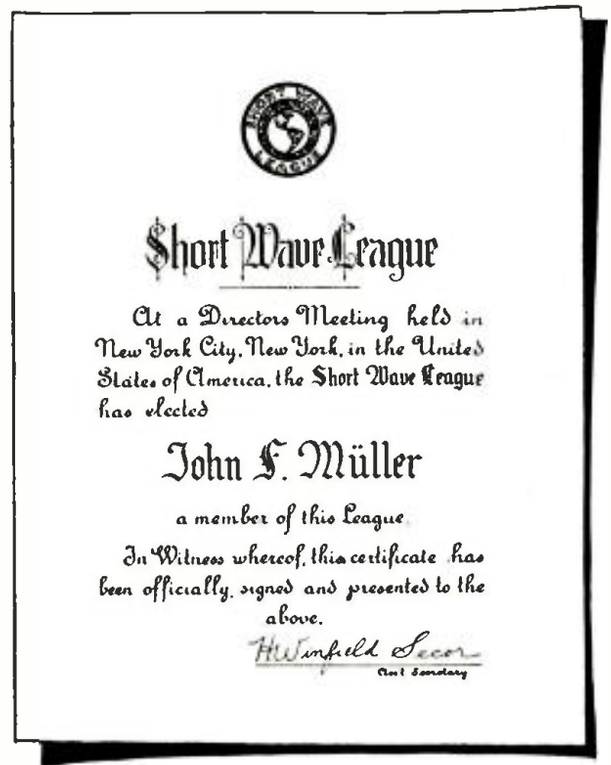
● I HAVE just finished reading Mr. Lomaster's arguments in favor of a no-code 5-meter license in your August issue; I agree absolutely with every statement he makes! I think that amateur work is the hardest part of radio to get started in, and that the issuance of licenses is entirely too restricted. In receiving, for example, it has been possible for me to start out by building a 50-cent crystal set and gradually work up over a period of two and a half years to the complex single-signal superhet. Every advance I made was based on practical experience, and I have learned much more than I would have had I got all my knowledge from a book, without ever having built or operated a receiver. In addition, my work has been much more interesting and enjoyable. But now, when I wish to get an amateur license, I find that an entirely different state of affairs obtains, that I must spend several tiresome hours a day practicing code and "boning" for a license, two tasks that are more a test of *perseverance* than of *ability!* Moreover, to really learn the code correctly, I must rent a machine, at $16 for 3 months, or else go to a school, which is also expensive.

Now I am only 16, and have not had a great deal of experience, but I can see no earthly reason why the Government should not grant a restricted beginners' license, with a code requirement of about three words a minute, greater emphasis being placed on quality of sending than speed; with a simpler technical exam, dealing with less advanced transmitting apparatus; and with a maximum power output of one watt, or less, depending upon location and the wishes of nearby amateurs. Only the 5-meter band would be open to such licensees, except in such cases where the beginner could get a signed statement from all amateurs within a two-mile radius permitting "censored" operation in regular bands. If, after a year, the licensee were not able to pass the regular exam., the license could be revoked. I believe that amateurs operating full-fledged stations for the first time would be infinitely more capable after a year's practical experience with *flea-power* sets, than they are now, when their only experience comes out of the "Handbook." Of course, there would be objections on the grounds of *interference*, but surely the interference could be no worse than that now caused by regenerative receivers, which must number in the hundred thousands. Moreover, any amateur who is troubled by such interference would have the power to immediately stop it, except on the 5-meter band, where as Mr. Lomaster so truly points out, there is room enough for 40,000,000 stations.

The advantages of the plan are these: The code requirements are so simple that absolutely anyone could master them easily in two or three weeks; the knowledge and experience necessary for the regular license could be obtained under much more interesting and instructive conditions; the size, and hence influence of the amateur fraternity would be greatly magnified; and amateur interest would tend toward efficiency rather than high power. As for SHORT WAVE CRAFT, I think it is a great magazine, even though I sometimes do get disgusted with the picture wiring diagrams and the endless repetition of beginners' circuits; but of course I realize that a magazine must try to satisfy *everyone* and that is no easy job (I know)!!

Wishing you success,

WALTER N. BROWN, JR.
15 Pembroke Street.
Garrett Park, Md.



This is the handsome certificate that is presented FREE to all members of the SHORT WAVE LEAGUE. The full size is 7¼" x 9½".

See page 67 how to obtain certificate.

Get Your Button

The illustration herewith shows the beautiful design of the "Official" Short Wave League button, which is available to everyone who becomes a member of the Short Wave League.

The requirements for joining the League are explained in a booklet, copies of which will be mailed upon request. The button measures ¾ inch in diameter and is inlaid in enamel—3 colors—red, white, and blue.

Please note that you can order your button AT ONCE—SHORT WAVE LEAGUE supplies it at cost, the price, including the mailing, being 35 cents. A solid gold button is furnished for $2.00 prepaid. Address all communications to SHORT WAVE LEAGUE, 99-101 Hudson St., New York.

Another Slap at the Code Test for the 5-meter Boys!

Editor, SHORT WAVE CRAFT:

● I HAVE been reading your magazine for the past three years and think it is the *best short-wave* magazine there is in print.

While reading your magazine one cannot escape reading the many letters for and against the no-code exam. below 5 meters. I for one vote for the no-code exam. below 5 meters.

Some of these so-called amateurs have been writing to your magazine and telling us that we are too "lazy" to learn the code; this is not so! Some people cannot learn the code as easy as some of these narrow-minded, so-called "amateurs" think they can. And when I mean "narrow-minded" I mean it. Why some of these so-called "amateurs" even send their "rigs" for repairing to some other REAL AMATEUR who does not "HOWL" at every move somebody makes to advance the art of Radio. If you ask me what the trouble is. I think it is just plain JEALOUSY. They are afraid some of us are going to get a "ticket" with a little bit less work than they did! What else would it be besides JEALOUSY? Just how many of these so-called "amateurs" who take time to write and tell us how lazy we are, are right now working the 56 Meg. (5-meter) band? I would say very few. Just to prove it, build up a good 5-meter band receiver and see how

(*Continued on page* 121)

A New 22-Tube All-Wave Receiver

(*Continued from page 87*)

required. This has been obtained in this new receiver by taking special precautions in the form of very careful shielding; thorough filtration of the I.F., oscillator, and audio stages, to prevent feedback between one element of the system and another. If any feedback or regeneration is present, it invariably results in noisy reception, especially on weak distant signals. These effects have been so minimized in this new set that you are able to use, to the greatest degree, the full sensitivity of the receiver.

The very advanced design and the high degree of efficiency in the antenna coupler, the antenna tuner, the R.F. stage and four I.F. stages, combined with an especially efficient A.V.C. system, makes it the ideal receiver for those who are particularly interested in reception from very weak, distant, *foreign* stations.

Full Range "High Fidelity"

Although this receiver is undoubtedly the most powerful superheterodyne that has ever been offered to the general public, tone has not been sacrificed, for it has *twice* the frequency range of even the finest of the so-called "high fidelity" receivers available today, with a practically flat response covering the whole audible frequency range from 25 to 16,000 cycles. But it requires an actual listening test to realize the tremendous difference in reproduction that is secured by including the frequencies above 6000 cycles. It is only when a direct comparison can be made with an ordinary receiver and this new instrument, that one realizes that there are many instruments in the orchestra whose higher tones are never heard on the ordinary radio receiver.

Visualize yourself in a dimly lighted room in which you can barely distinguish the various objects, then imagine turning a control which gradually brings up the illumination in the room until everything is clear and distinct. Your reaction will be very much the same when you listen to an ordinary radio receiver, then to the new all-wave receiver. First, you hear music which you would consider perfectly pleasing and satisfactory, *until you switch over to this new set*, and then, and then only, do you realize what you have been missing, and it is certain you will never again be satisfied with an ordinary receiver which reproduces only about one half the musical tones of the various instruments being broadcast.

Power Output Undistorted up to 50 Watts

To secure perfectly natural reception from all classes of programs, it is necessary that the amplifier be capable of handling the highest "peak" or loudest notes in the transmission without overloading or distortion. One of the many remarkable features of the power amplifier of this new set is the 35 watts of absolutely undistorted output with strict class "A" operation, and from 35 to 50 watts, class "A" prime.

The first automobiles produced had comparatively small engines, but as cars came into more general use, it was found that to secure smooth and comfortable performance at all speeds and under all conditions, it was necessary to have more reserve power. Automobile manufacturers today provide cars which have eight to ten times the power of those of a few years ago, so that an automobile owner may have satisfactory performance at all times. The day of a radio receiver with a limited undistorted output is past, and the new receiver is the first of a new era, for it meets all receiving conditions smoothly and efficiently, and is as far ahead of ordinary radio receivers, as the modern automobile of today is ahead of the first model "T" Ford.

Another remarkable feature of this new

amplifier is that although it has such a very large undistorted output, it is under perfect control at all times, and any degree of volume can be secured, from the faintest whisper to full volume. There is no detectable hum even under the quietest listening conditions, and this in spite of the fact that its frequency range is considerably greater than even the most gifted human ear.

Improved Beat-Frequency Oscillator Locates Short-Wave Stations Quickly

Tuning, especially on the short waves, has been made particularly easy by a very accurate calibration of the dial. However, to make it easier still, we have also incorporated an improved beat-frequency oscillator, which uses a special compensating circuit which gives a clear, audible signal on all stations, both strong and weak, making it just as simple and easy to tune in short-wave stations, as it is to tune in stations on the regular broadcast band.

Double A.V.C. System Holds Stations Steady

There is nothing more annoying than to tune in a distant station and have your reception spoiled by the constant fading in and out of the signal. This has been largely eliminated by means of a highly developed double A.V.C. system, which keeps the signal practically constant at any desired volume level, irrespective of variations in signal strength.

The reception of very weak or distant stations, particularly on the short-wave bands, is also often marred by a peculiar twisting or distorting effect due to the plate voltage on the oscillator varying. This defect has been overcome in this receiver by incorporating a self-stabilized oscillator with a voltage regulator which makes the plate voltage on the oscillator independent of either line voltage or signal strength. No matter what variation there may be in the line voltage, even though it drop as low as 90 volts or rise to as high as 130, and no matter what variation there is in the signal strength, this special voltage regulator keeps the plate voltage on the oscillator constant at all times to within three fourths of a volt, so eliminating another of the factors which up to this time has caused distortion and poor results on weak, distant stations.

New "Noise Suppression" System Used

Reception in many locations is spoiled by various forms of electrical interference which brings in a considerable amount of noise, especially when tuning from one station to another. The new noise suppression system incorporated in this new set is especially valuable in locations where local electrical interference is bad. It is continuously variable and enables the operator to adjust the maximum sensitivity of the receiver to whatever noise level is prevalent at the time. This control, however, differs from all other sensitivity controls *in that it does not impair the action of the A.V.C. in any way, nor does it affect the tone quality or cause distortion on any station, either local or distant.*

The operation of this system will be readily understood when it is likened to the action of a speed governor on an automobile truck. The governor may be set so that it allows the truck to travel at a certain maximum speed, however, *the governor does not affect in any way*, the operation of the machine at any speed *under* the maximum for which the governor is set. In like manner, the new between-station noise suppressor enables you to adjust the receiver to the point where all noise caused by local electrical interference, etc., is eliminated, and all stations which are tuned in will be heard without interference or noise. This development means that the receiver can always be operated at the maximum sensitive position in your particular location, to give the most satisfactory reception.

S.W. Scout News

(*Continued from page 77*)

gota transmitter, HKE, 7,092 kc., was heard sending out an excellent program on Mar. 23. HJ1ABD, 7,310 kc., located in Cartagena, Colombia, was also heard. They asked for reports.

SUV, 10,014 kc., located in Cairo, Egypt, was heard transmitting a program for CBS, on Sunday, Mar. 10. The signal was very weak, almost inaudible at times. but we cannot be too particular when waves travel from that particular clime.

FZR, located in Saigon, Indo-China, was heard testing with FTK, Paris. The frequency of FZR was 16,200 kc.

Each week many letters are received from fans asking how they might identify certain Spanish-speaking stations. From experience, I find that the only way to properly recognize these stations it not by the station slogan or wavelength, but by the call letters. For the convenience of these listeners I print the Spanish alphabet:

A is pronounced as ah; B, bay; C, say; D, day; E, ay; F, effray; G, hay; H, ahcheh; I, ee; J, hota; K, kah; L, el-lay; M, em-may; N, en-nay; O, oh; P, pay; Q, koo; R, air-ray; S, es-say; T, tay; U, oo; V, vay; W, doh-bleh-vay; X, eckis; Y, eegriega; Z, theta; Numerals: One, oono; Two, dos; Three, trehs; Four, quatro; Five, thing-ko; Six, sase; Seven, see-ate; Eight, ocho; Nine, noo-ay-ve; Ten, diez.

Report from Edward G. Schmeichel, Illinois

● RECEPTION as a whole has been very, very good during the past month. All bands have played a fine part in aiding the "logging" of many new stations. It is very interesting to note the improvement on the 19- and 25-meter bands. Stations are picking up right along; for instance on 19 meters, PCJ — HAS3 — FYA — HVJ — DJB (occasionally heard) are reaching this post regularly QSA4-5 and R8-9. This also goes for 25 meters.

The 31-meter band is the one that is about the best and most consistent of all the bands. On this band VK3ME — VK2ME — VK3LR — VUB are received consistently. I also mention VUB, because this station has been heard four times in the past month with a bang.

A tip for the fan who wants to try for them—get up some Sunday morning about 7 a.m., E.S.T. Tune for VK2ME; if they are well received then tune slightly above them, and you will hear a loud signal. Many fans will be deceived into believing that this is W1XK, but note the carrier. The carrier of W1XK has a slight hum, while VUB has a clean-cut note. Their signal is on sometimes 30 to 40 minutes before they start broadcasting. On Mar. 15, I had them coming in with a bang, but as soon as W1XK came on the air it blocked the program from VUB. With the aid of my trusty *Postal Booster*, I was able to listen to the program till "sign-off." Many programs would have utterly been ruined for me had it not been for the booster. With the aid of the R.F. gain control on the booster I am able to cut through a station with razor-edge sharpness. Many programs have been logged that otherwise would never have come through, had it not been for this. This will answer many requests sent to me concerning the selectivity of this booster. So I hope many fans will try for this "rare" station. A veri from them is worth sticking your chest out for.

HJ4ABE—Medellin, Colombia, 50.42 meters or 5.95 megacycles, is reaching this post day after day. They are very loud and announce in English occasionally. Try for them.

PRF5 and HP5B both send veries showing three views of their stations. XECW —50.25 meters or 5.98 mc. Mexico City is coming through quite well. They send one

of the finest oil-painted veries you ever saw. So if you log them send for a veri.

JVP, Nazaki, Japan, has been heard several times this month calling Manila. They are on wavelength of 39.95 meters. They speak English while calling Manila.

FZS, Saigon, Indo-China, has been heard at least ten times this month. They are on 25.02 meters and are directly above RNE. They call Paris in the mornings. They start out by saying, "Hello Paree! Hello Paree! This is FZS Saigon calling you."

VLK and VK2ME on 28.85 meters are heard every morning about 6 a.m., E.S.T. They call stations in England and America. Try for them.

Bernard Kinzel, New York City, Reports

● ALTHOUGH quite busy with moving, I managed to get a few results, as a real fan and dyed-in-the-wool DX-er, when I reached the new home. The first thing, of course, was to get up the antennas and put the receiver to work. Outside of the flock of the European *locals* a number of *newcomers* could be logged, following the list of what has been heard and when; all time is given in E.S.T.

On the 49-meter band I found the most activity, with W1XAL getting active again and quite effectively spoiling reception from at least half a dozen *foreigners*, among them DJC, GSA, HJ1ABG, HJ3ABI, PRA8 and a few smaller South Americans, that bunch around the 6,010 to 6,050 kc., making a mess out of the band. Some very strong harmonics from amateurs around the 6,030 to 6,040 kc., in conjunction with the constant carriers of several commercial code stations, with HRB of Tegucigalpa, Guatemala, C.A., calling CQ "till the cows come home," make the band go up in a bunch of peanut whistles. Now I will start on the lower frequencies and report my way up.

HC2ET, 65.22 meters 4.600 kc., Guyaquil, Ecuador, every Wednesday and Saturday from 9:00 to 11:00 p.m., using 10 chimes as a signal.

HAT, 55.5 meters, 5,400 kc., Budapest, Hungary, every Sunday, from 8:00 to 9:00 p.m., beginning with a kind of church-bell ring.

CT1AA, 51.07 meters 5,870 kc., Lisbon, Portugal, testing irregularly from 4:30 to 7:00 p.m., using the same CooCoo call as on 31 m.

YNLF, 50.3 meters 5,960 kc., Managua, Nicaragua, irregular, 6 p.m. to 1 a.m.

XECW, 50.17 meters 5,980 kc., Mexico City, Mexico, 10:30 to 12 p.m.

PRA8, 49.6 meters 6,040 kc., Pernambuco, Brazil, 2:30 to 8:30 p.m., heard best at about 7 p.m., address: Radio Club of Pernambuco, Brazil, S.A.

HJ4ABL, 49.14 meters 6,105 kc., Manizales, Colombia, daily 6 to 7:30 p.m.

CSL, 48.78 meters 6,150 kc., Lisbon, Portugal, irregular from 1:30 to 7 p.m. A rather new station, announcing in several languages as: *Radio Emissora Nacional de Lisbon*, but cannot be heard after W8XK comes on the air as they are nearly on the same wave. I am waiting for a veri. Best time to hear them is between 3 and 4:30 p.m. on Sundays.

CO9GC, 48.7 meters, 6,150 kc., Santiago de Cuba, 3 to 5:30 p.m., but can be heard until 3 a.m. calling amateurs and testing. Address: Grau and Cameneros Laboratories, Box 137, Santiago de Cuba.

CT1GO, 48.4 meters, 6,198 kc., Parede, Portugal, Radio Club Portuguese. Two verifications of this station recently received state the station's history as follows: Transmitter 350 watt crystal-controlled on 48.40 meters and 24.20 meters (12,396 kc.) DX all continents, located 16 miles west of Lisbon, facing the Atlantic Ocean, Europe's most westerly transmitter. Schedule: 24.2 meters, every Tuesday, Thursday, and Friday 1 to 2:15 p.m., Sundays, 10 to 11:30 a.m. On 48.4 meters: Daily except Saturday and Monday 7:20 to 8:30 p.m.

YV6RV, 46.01 meters, 6,520 kc., (new wave) Valencia, Venezuela, daily except Sunday from 5 to 7 and 9 to 11 p.m.

HJ4ABA, Medellin, Colombia, testing on 42 m., 25.65 meters and 21.5 m., irregular on either of these waves in late afternoon.

I2RO, Rome, Italy, changed to 31.13 meters. A very strong first harmonic is encountered on 25.64 meters from YV5RMO and mistaken for this station's regular signal, also many, too many, amateur's harmonics; will they ever take the hint and check their output before they radiate harmonics fairly strong enough to wipe out GSE's and FYA's signals completely? We have to thank the amateurs for quite a lot, they did their part to make it possible for us to listen to short waves, but should a few of them become a public nuisance just by piling up their uncontrolled harmonics in a couple of the most popular short-wave broadcast bands? I have quite a list of them and when the A.R.R.L. warns that these complaints are justified, they are rightly so and I will turn my list over to the A.R.R.L., so they may give their fellow members a friendly warning, for it is always the same fellows that I pick up and also several of my friends.

CNR, 23.39 meters 12,825 kc., was heard one Sunday morning for about 40 minutes, but fading badly, they should be on from 7:30 to 9 a.m., but can be heard as early as 5 a.m. phoning St. Assise.

VP1A, 22.94 meters 13,075 kc., Radio Suva, Fiji Islands, was heard again two days in succession, making it four times in all, they are on every morning from 12:30 to 1:30 a.m. and going on code at about 1:40 a.m.

PCJ, 19.71 meters 15,220 kc., Eindhoven, Holland, can be heard regularly every Sunday from 8:30 to 11:30 a.m. and on several mornings during the week irregularly. They have a brand new transmitter on this wave and are pounding in with tremendous volume.

HJV, 19.83 meters 15,120 kc., Radio Vaticano, Vatican City, Italy, are heard on a new schedule, daily from 10.30 to 10:45 a.m.

HAS3, 19.52 meters 15,370 kc., Budapest, Hungary, every Sunday from 8-9 a.m. The call letters of this station are HAS3 as so often stated, having received my verifications for reception of both stations HAS3 and HAT at their first day on the air; they are also, according to their own statement, only on Sundays on schedule. But their program on 5,400 kc. is usually ruined by a harmonic from WFAB, New York, who broadcasts on 1,300 kc. Maybe it is this harmonic that has been mistaken for HAT's signal on days when they were not on the air at all. (HAT on 5400 kc. has been replaced by HAT4, 9125 kc., 6-7 p.m. Sundays, editor.)

Now may I thank all those fans who so kindly wrote to me, sending congratulations, and I certainly appreciated every card or letter that I received. As the last reply to all those queries is in the mail now, those of you that did not get my card as yet, by the time this is printed, you will all have it. Those of you that came to see me personally, also many thanks and remember, that at this post everybody is welcome, at any time. *but do not forget the new address:* Bernard Kinzel, 362 East 156th Street, New York City (Bronx).

Reports from Oliver Amlie, Philadelphia, Pa.

● ONCE again the Amlie DX-er scores, from October, 1934, to March, 1935, the famous black magic receiver scores 85 morning reception reports on VK2ME, 3ME and 3LR, holding all three stations each month. I hope to double this record from April to September, 1935, which completes this post's one year test for Mr. W. T. Conder, General Manager, Broadcasting Commission of Sydney, Australia. Due to the poor reports they have received from both American and European listeners, Mr. Conder wrote this post in September, 1934, asking for my service for March alone. This post held all three Australian stations for 26 receptions, or 31 hours, hold-

ing 3ME-3LR same morning, shifting from one station to the other for one full hour. Each morning this is repeated. All reports are sent to Mr. Conder for checking-up.

"Arabia. Hello, America—this is Arabia calling, hope our signals are getting through"—then a lot of Arabian talking and singing. No station call as yet; their signals were very poor; tried two Tuesday evenings from 7-9 p.m. but failed to receive their call. Will keep on till I do. On 31.28 meters each Tuesday evening.

Unless listeners come to the aid of VUB, Bombay, India, this station will close down, as they claim no reports are being received on their station. I have volunteered my service to both VUB and VUC for six months, starting April and ending September. VUC will also close down if no reports are received. Will you help? If so write me, and I will send schedule when received from them.

VK3ME now on the air Wednesday, Thursday. Friday and Saturday from 5-7 a.m., announcement was made over 3ME Mar. 8; have heard four days a week already. 3LR Mondays till Saturdays; 2ME Sundays, Mondays and Tuesdays, testing with W2XAF, New York, 7-8 a.m. often.

GSL, 4,901 meters, testing Mar. 12-14-17 from 10-11 p.m.; no schedule as yet.

New station on 25 meters Tuesday evenings, 7-9 p.m. from Australia, have not as yet got a call on it; also two others, new to me. Two on 32.30 meters and 26 meters.

VPD (VP1A) is not a new station, have seen verification dated Aug. 5, 1929, so they must be pretty old. VPD operates VK2ME, beam stations, ship-to-shore stations. Population Fiji 1929, 170,000. Address Amalgamated Wireless (Asia) Ltd., The Wireless Service of Fiji, Suva Fiji Islands. Owner of VPD veri refuse publicity, but can secure for SHORT WAVE CRAFT magazine publicity of card if readers so wish? Address your Editor.

Any reader of SHORT WAVE CRAFT writing to *Super-Wasp*, The R. S. Sampson Printing Co., 971-973 Hay Street, Perth, Western Australia, will receive a FREE copy of *West Australia Wireless News;* it has 67 pages—free for the asking.

Oliver Amlie,
56th City Line Ave.,
Overbrook, Philadelphia, Pa.

17-In-1 "Multi-Kit" Set

(Continued from page 90)

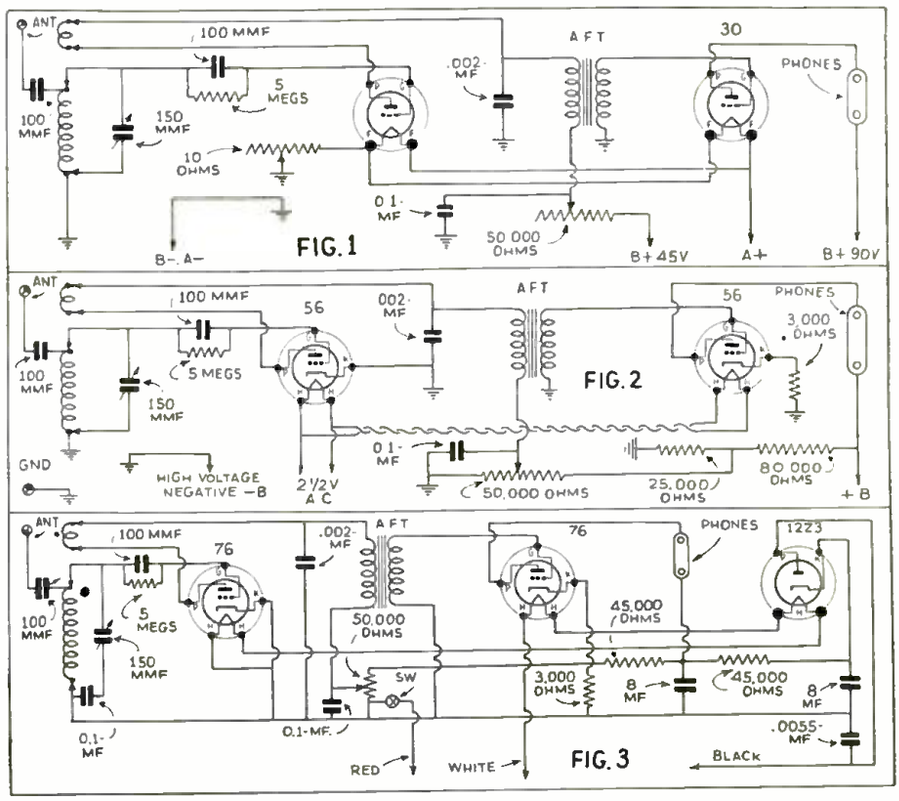
And to give a third example of the interesting sets that can be made up from the multi-kit, the one shown in Fig. 3 is presented. This is an A.C.-D.C. model—entirely self-powered and operating directly from any electric light socket. This set uses two type 76 tubes and a 12Z3 rectifier.

An examination of the values on the circuits of these three sets shows that the fundamental ones, in the multi-kit, are all the same and that the sets differ only because of the additional parts. This illustrates how it is possible to change from one circuit to another so easily.

Assembly is Extremely Simple

A study of the "multi-kit" diagram discloses that numerals have been added to the circuit wherever a wire terminates. These numbers are an invaluable aid in wiring any one of the 17 sets, as simple instructions can be obtained telling just how and where to connect the various wires. Each of the 17 circuits has the same numeral at each essential point, so that the changes from one circuit to another can be explained simply. The instructions merely tell that wire from figure 23 to figure 46 is removed and that a wire is added from 27 to 3, etc. Picture diagrams are included in these instructions and the numbers are given here also, so that a person with absolutely no knowledge of radio has no difficulty in making any of the sets or changing from one to another.

Complete instructions, including not only the easy wiring details described



3 Circuits for S-W Receivers which can be built up with the "multi-kit."

briefly above but also such fundamental facts as soldering hints, instructions for mounting parts, type of phones or speaker to employ, coil frequency ranges, instructions for adding band-spreading (for crowded amateur and broadcast short-wave bands) and hints on how to erect a good aerial and get the best all-round results can be obtained for any of the 17 sets.

The 17 Sets—What They Are

To give an idea just how versatile the 17-in-1 multi-kit set is, a brief description of each circuit, and the type of tubes employed, is listed below, in three classifications—battery—A.C.—and universal A.C.-D.C. operation.

Battery Models

1—One type 30 or 01A tube—recommended for the beginner is short waves.

2—One type 19—this new 2-in-1 tube equals a detector and stage of audio.

6—Two type 30 or 01A tubes—this is the set shown in Fig. 1.

7—One 30 and one 33—this is similar to No. 6, but uses a power pentode for more volume.

8—Two 30s and one 33—a detector and two audio stages—full loudspeaker volume.

9—One 19 and one 33—similar to set No. 2, but with a power pentode to give full loudspeaker volume.

A.C. Models

3—One 56, 27, 37 or 76 tube—a simple 1-tube short-wave set which requires only 45 volts of "B" potential.

10—Two 56 or 27 tubes—supplies a detector and one audio stage with transformer coupling.

11—One 56 and one 2A5 tube—similar to No. 10 but using a power pentode for greater volume and better quality.

12—Two 56s and one 2A5—a very powerful set having a detector and two audio stages one of which is a power pentode.

Universal A.C.-D.C. Sets

4—One 12A7 tube—this set supplies its own power due to the rectifier section of the 12A7 tube. It has one pentode detector and rectifier.

5—One 76 and one 12Z3—a triode detector for stability and a rectifier for plate supply.

13—One 6F7 and one 12A7—a new 4-in-2 circuit. Each tube acts as two separate tubes which makes a very powerful set.

14—One 78 and one 12A7—supplying a power pentode and a pentode detector—this set is very sensitive.

15—One 76 and one 12A7—which supplies *8-tube* performance—a regenerative detector transformer coupled to a power pentode and a rectifier.

16—Two 76s and one 12Z3—this set supplies a triode detector, a triode amplifier and a separate rectifier.

17—One 6F7, one 76 and one 12Z3. This is a new 4-in-3 circuit supplying a detector, a triode A.F. stage, a pentode output tube and a rectifier for "B" supply. This set is both powerful and stable in operation.

This brief description and outline of the 17 circuits which have been devised up to this time for the multi-kit and accessories will serve to show you just what possibilities there are for the short-wave radio fan and constructor. If you are interested in making or listening to short-wave receivers, whether you know anything about radio set construction or not, you can have innumerable hours of fun making and trying these sets. And the cost of the multi-kit and the additional parts needed for changing from one circuit to another is so small that it will certainly not stand in the way of any ardent radio fan.

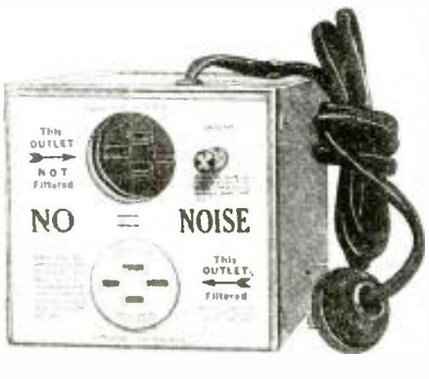
And just in case you prefer to obtain any of the 17 sets already assembled, ready to operate, they can be bought for a slightly higher price, though by obtaining them in this way you lose all the fun of making them and also the pride of doing something yourself which is really worthwhile.

A neat cabinet, in black crackle finish which fits any of the sets, is available. This cabinet is made in such a way that the aerial compensator, and the aerial, ground and speaker terminals are left exposed at the back. The top of this neat cabinet is also hinged so that tubes and coils can be easily changed.

There is plenty of room inside of the cabinet for the coils not in use. These sets, either in battery- or power-operated models make ideal portable units because of their small size and light weight.

NEW "NOISE FILTER"

● A NEW YORK radio house announces a new type of noise filter which really is versatile. This instrument is designed to reduce noise coming from a power line into the radio set and successfully accomplishes this. One thing about it which is quite novel; it can be reversed. In other words, if you are using your vacuum cleaner on some Sunday morning and do not wish to interfere with your neighbors' radios, you plug your vacuum into the noise filter and the noise filter in turn is connected to the 110 volt power line. This prevents any noise being transmitted from your vacuum cleaner into the power line and we dare say it would make any neighborhood more peaceful to live in.



New Blan "line filter" for use with short or all-wave receivers. No. 278.

$20.00 PRIZE MONTHLY FOR BEST SET USING 1 OR MORE TUBES

● **THE Editors are looking for some "brand-new" Receiving Circuits USING BUT ONE TUBE. The tube must be a standard one and any type tube can be used. The new multi-element tubes provide Short-Wave "Fans" with almost limitless opportunities. Send along your set—or a circuit diagram and 200 word description for opinion as to acceptability.**

The Editors offer a $20.00 monthly prize for the best short-wave receiver submitted. If your set does not receive the monthly prize the Editors will pay space rates for any articles accepted and published.

You had better write the "S-W Contest Editor," giving him a short description of the set and diagram, BEFORE SHIPPING THE ACTUAL SET, as it will save time and expense all around. A $20.00 prize will be paid each month for an article describing the best short-wave receiver, converter, or adapter. Set should not have more than five tubes and 1-tube sets featuring one of the new "twin-element" tubes are in great demand. Let's see "YOUR" idea of an Ultra-Modern 1-Tube Set!

Sets must be sent PREPAID and should be CAREFULLY PACKED in a WOODEN box!

The closing date for each contest is sixty days preceding date of issue (June 1 for the August issue, etc.). In the event of a "tie" an equal prize will be paid to each contestant so tying.

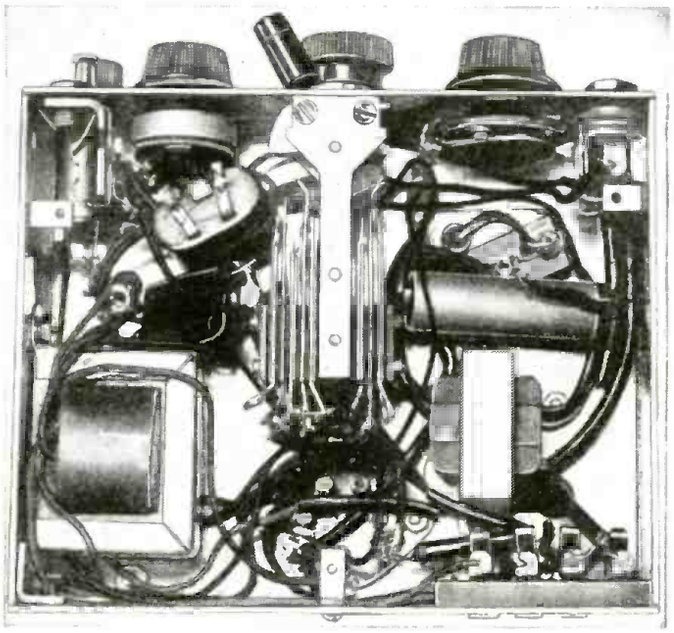
The judges will be the Editors of SHORT WAVE CRAFT, and George Shuart and Clifford E. Denton, who will also serve on the examining board. Their findings will be final.

Address your entries to:

Editor,
SHORT WAVE CRAFT,
98 Park Place,
New York City.

DeLuxe 5-Meter Transmitter-Receiver

(*Continued from page* 85)



Right—bottom view of the 5 meter Transmitter-Receiver built by Mr. McEntee. Note the very compact arrangement of the apparatus; while it is not necessary to use a cam switch of the type shown, this will be found very useful, as it controls several circuits with one simple throw of the switch handle.

loose coupling as possible so that lower plate voltage may be used and in this way the radiation from the detector minimized. Of course, on a weak signal the coupling may be increased by using more capacity on the antenna condenser. By operating the set this way you can give the local hams a break by causing a lot less Q. R. M.

Antenna

As previously mentioned, almost any piece of wire will do for receiving. The best seems to be an 8-foot length with the lead-in taken from the top, the antenna wire being vertical. For transmitting, an 8-foot wire or rod with the tap about 12 to 14 inches either side of center, the vertical position also being best for this.

If desirable, the transmitting antenna can be used for receiving by using a short wire with a clip on one end to snap on the transmitter antenna post, and removing it when transmitting.

Care should be used to pick *good* tubes, the detector especially being rather fussy. The 30 and 31 in the set shown are of the old type with straight-side bulb, but the internal characteristics are the same as those of the new dome-top bulbs.

The hand-set (French type) is very convenient to use with a set of this type and they can be obtained at reasonable prices now. The mikes are usually all high sensitivity types of the standard 200 ohms resistance. Be sure to get an output transformer to match the type of receiver or headphones to be used, as any mismatch here, if serious, will result in decreased volume and poor quality.

The mike and key jacks are arranged in a sort of parallel circuit, so it is best to remove either one when the other is in use in order to get the maximum audio signal to the 33 grid.

This set has been *worked duplex for twenty miles* but no great DX has been attempted or attained, since it is used more as a "stand-by" set and for odd "tricks" rather than consistent work.

It may be used with voltages up to 180 or so with increased output, but the C battery should then be increased to keep the 33 plate current at a reasonable value.

List of Parts

C1, C10—100 mmf. variable air condenser, Hammarlund.
C2, C11—20 mmf. variable air condenser, Hammarlund.
C3, C12—.0001 mf. mica midget condenser, Aerovox.
C4—.006 mf. mica midget condenser, Aerovox.
C5—.002 mf. mica midget condenser, Aerovox.
C6, C7—.01 mf. paper tubular, Aerovox.
C8—.1 mf. paper tubular, Aerovox.
C9—.001 mf. mica midget, Aerovox.
R1—1 meg. ¼ watt resistor I.R.C.
R2—20,000 variable resistor, Electrad (choose nearest value).
R3—50,000 ¼ watt resistor I.R.C.
R4—5-ohm wire-wound variable rheostat.
R5, R6—Made of wire from 4 to 6 ohm wire-wound resistor.
T1—Transceiver type input transformer (Thordarson).
T2—Output transformers, 33 to 5,000 ohms (Thordarson).
CH—2.5 millihenry chokes Hammarlund (National).
2—Isolantite 4-prong sockets, Hammarlund (National).
1—5-prong wafer socket.2 Na-Ald.
1—5-volt meter (Triplett).
1—25 M.A. meter (Triplett).
1—Flexible coupling Hammarlund.
1—Buzzer, high-pitched.
1—Anti-capacity switch.
1—Small vernier dial, National.
1—On-off switch, ICA.

"Go-Get-'em 2" for the Beginner

(*Continued from page* 75)

We Want GOOD ARTICLES on 1-, 2- and 3-tube sets. Send us sketch or diagram of your set for approval. If it seems new, the Editors will at once advise you so you can send set in and write article. Let's hear from you!!

1—5-prong wafer socket, Na-Ald.
1—Ant. Gnd. binding post strip, Na-Ald.
1—Large National dial.
1—19 RCA Radiotron.
1—33 RCA Radiotron.
1—50,000-ohm potentiometer, Electrad.
1—Chassis and panel, Blan (Korrol).

Na-Ald Plug-In Coil Data

Meters Wave-length	Grid coil turns	Tickler turns	Distance between 2 coils
200-80	52 T. No. 28 En. Wound 32 T. per inch	19 T. No. 30 En. Close wound (CW)	⅛"
80-40	23 T. No. 28 En. Wound 16 T. per inch.	11 T. No. 30 En. C. W.	⅛"
40-20	11 T. No. 28 En. 3-32" between turns	9 T. No. 30 En. C. W.	⅛"
20-10	5 T. No. 28 En. 3-16" between turns	7 T. No. 30 En. C. W.	⅛"

Coilform—2½" long by 1¼" dia. 4-pin base.

New Acorn-Pentode 954 Tube Is Here!

(*Continued from page* 91)

ably be connected directly to the electrical mid-point of the heater circuit. In the case of D.C. operation from a 6-volt storage battery, the cathode circuit is tied in either directly or through bias resistors to the negative battery terminals. In circuits where the cathode is not directly connected to the heater, the potential difference between heater and cathode should be kept as low as possible. If the use of a large resistor is necessary between heater and cathode in some circuit designs, it is essential that this resistor be by-passed by a suitable filter network or objectional hum may develop.

The *screen* voltage may be obtained from a fixed tap on the B-battery, or from a potentiometer across the B-supply, or from the B-supply through a series resistor when the tube is self-biased by means of a cathode resistor. This last method, however, is not recommended if the B-supply exceeds 250 volts.

Shielding of each R.F. amplifier stage employing the 954 is required in order to prevent interstage coupling. A convenient method of shield construction is illustrated in Fig. 2. The control-grid end of the tube is inserted through a hole in a metal plate so that the metal edge of the hole is in close proximity to the internal shield in the control-grid end of the tube. It may be desirable, depending upon circuit requirements, to provide a small collar on the baffle hole in order to increase the shielding effect.

R.F. grounding by means of condensers placed close to the tube terminals is required if the full capabilities of the 954 for ultra-high-frequency uses are to be obtained. Conventional by-passing methods and grounding are not adequate. One convenient method is to use ribbon lead-ins to the clips and to insulate the ribbon lead-ins and the terminal clips from the grounding plate by mica spacers to form by-pass condensers right at the tube terminals. It is important in the cases of the plate and control-grid circuits that separate R.F. grounding returns be made to a common point in order to avoid R.F. interaction through common return circuits. It may also be advisable in some applications to supplement the action of the by-pass condensers by R.F. chokes placed close to the condensers in the return or supply lead for the control-grid, the screen, the suppressor, the plate, and the heater.

Application

As an *amplifier*, the 954 is applicable to the audio or the radio-frequency stages of short-wave receivers, especially those operating at wavelengths as short as 0.7 meter.

For A.F. amplifier circuits, typical operating conditions are as follows: Plate-supply voltage, 250 volts; screen voltage, 50 volts; control-grid voltage, —2.1 volts; suppressor, connected to cathode at socket; plate-load resistor, 250,000 ohms; and plate current, 0.5 milliampere. The control-grid resistor may be made as high as 1.0 megohm. Under these conditions, an undistorted voltage output of 40 to 50 volts RMS may be obtained. The voltage amplification is approximately 100.

As a *grid-bias detector*, the 954 may be operated under the conditions given in *detector* data. The control-grid bias may be supplied from the voltage drop in a resistor between cathode and ground. The value of this self-biasing resistor is not critical, 20,000 to 50,000 ohms being suitable.

For *miscellaneous applications* around the laboratory, the 954 offers important features. For instance, its small size permits the design of vacuum-tube voltmeters such that the tube itself can be placed at the point of measurement.

RCA-954
Tentative Characteristics
Pentode Connection

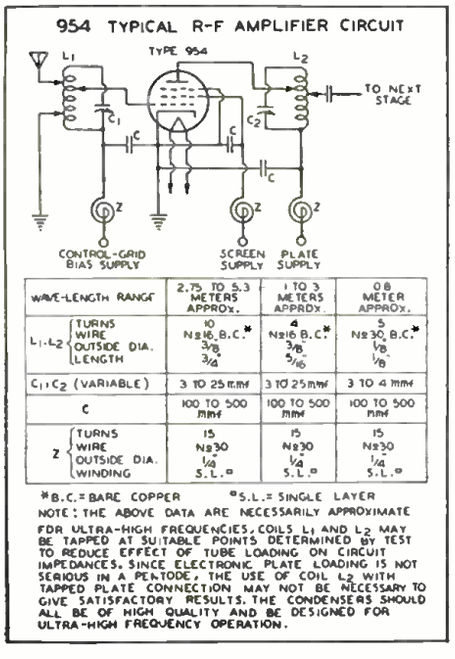
HEATER VOLTAGE (A.C. or D.C.)	6.3	Volts
HEATER CURRENT	0.15	Ampere
DIRECT INTERELECTRODE CAPACITANCES:		
Control-Grid to Plate (with shield baffle)	0.007 max.	mmf.
Input	3	mmf.
Output	3	mmf.
OVERALL LENGTH	1-11/16"±3/16"	
OVERALL DIAMETER	1-3/32"±1/16"	
BULB	J-4	
TERMINAL MOUNTING	Special	
AMPLIFIER—CLASS A		
D.C. PLATE VOLTAGE	250 max.	Volts
D.C. SUPPRESSOR (Grid No. 3) VOLTAGE	100 max.	Volts
D.C. SCREEN (Grid No. 2) VOLTAGE	100 max.	Volts
TYPICAL OPERATION AND CHARACTERISTICS:		
Heater Voltage	6.3	Volts
D.C. Plate Voltage	90	250 Volts
D.C. Screen Voltage	90	100 Volts
D.C. Control-Grid Voltage	—3	—3 Volts
Suppressor	Connected to cathode at socket	
Amplification Factor	1100	Greater than 2000
Plate Resistance	1.0	Greater than 1.5 Megohms
Mutual Conductance	1100	1400 Micromhos
Plate Current	1.2	2.0 Milliamperes
Screen Current	0.5	0.7 Milliamperes
DETECTOR		
D.C. PLATE VOLTAGE	250 max.	Volts
D.C. SUPPRESSOR (Grid No. 3) VOLTAGE	100 max.	Volts
D.C. SCREEN (Grid No. 2) VOLTAGE	100 max.	Volts
TYPICAL OPERATION AS BIASED DETECTOR:		
Heater Voltage	6.3	Volts
Plate-Supply Voltage	250	Volts
D.C. Screen Voltage	100	Volts
D.C. Control-Grid Voltage	—6 approx.	Volts

Suppressor—Connected to cathode at socket

Plate Load—250,000 ohms or equivalent impedance

For resistance load, voltage at the plate will be less than the plate-supply voltage by an amount equal to the voltage drop in the load resistor caused by the plate current.

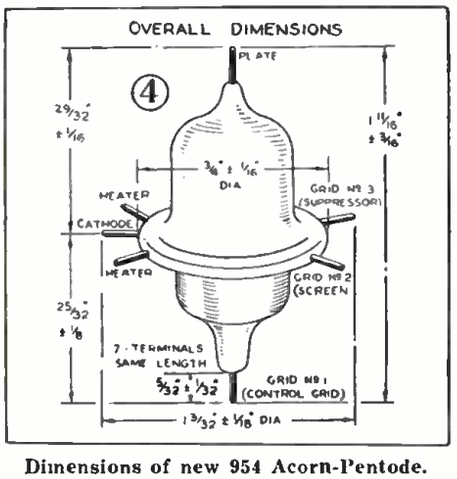
Plate Current—Adjusted to 0.1 ma. with no input signal.



WAVE-LENGTH RANGE	2.75 TO 5.3 METERS APPROX.	1 TO 3 METERS APPROX	0.8 METER APPROX.
L_1-L_2 TURNS	10	4	3
L_1-L_2 WIRE	No16 B.C.*	No16 B.C.*	No30 B.C.*
L_1-L_2 OUTSIDE DIA.	3/8"	3/8"	1/8"
L_1-L_2 LENGTH	3/4"	5/16"	1/8"
C_1-C_2 (VARIABLE)	3 TO 25 mmf	3 TO 25 mmf	3 TO 4 mmf
C	100 TO 500 mmf	100 TO 500 mmf	100 TO 500 mmf
Z TURNS	15	15	15
Z WIRE	No30	No30	No30
Z OUTSIDE DIA.	1/8"	1/4"	1/4"
Z WINDING	S.L.°	S.L.°	S.L.°

*B.C.=BARE COPPER °S.L.=SINGLE LAYER

NOTE: THE ABOVE DATA ARE NECESSARILY APPROXIMATE FOR ULTRA-HIGH FREQUENCIES, COILS L_1 AND L_2 MAY BE TAPPED AT SUITABLE POINTS DETERMINED BY TEST TO REDUCE EFFECT OF TUBE LOADING ON CIRCUIT IMPEDANCES. SINCE ELECTRONIC PLATE LOADING IS NOT SERIOUS IN A PENTODE, THE USE OF COIL L_2 WITH TAPPED PLATE CONNECTION MAY NOT BE NECESSARY TO GIVE SATISFACTORY RESULTS. THE CONDENSERS SHOULD ALL BE OF HIGH QUALITY AND BE DESIGNED FOR ULTRA-HIGH FREQUENCY OPERATION.



Dimensions of new 954 Acorn-Pentode.

The Ionosphere—Where Short Waves Are Reflected

(*Continued from page 73*)

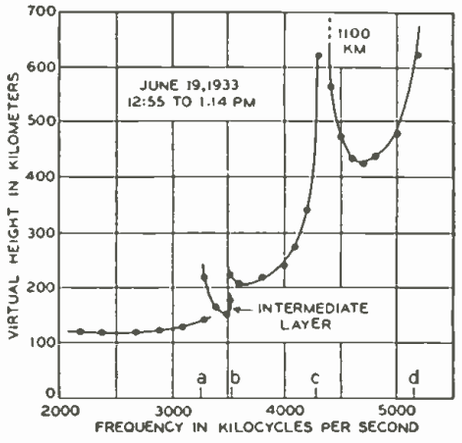
the total elapsed time, much as the distance to a mountain could be calculated by timing the return of a sound echo. With radio waves, however, an uncertainty enters because the reflection does not occur sharply at a plane. The wave penetrates the ionized region for some distance and in this region its velocity is reduced.

Because of this, two heights are referred to—the virtual height and the actual height. Virtual height is that calculated on the assumption that the radio wave travels with the velocity of light to the reflecting plane where it is sharply reflected and returns at the same velocity. Actual height is that of the highest point the wave reaches. The situation is suggested diagrammatically in Figure 1. When the virtual height is independent of frequency for a considerable range of frequencies, the virtual height is probably not greatly different from the actual height. When virtual height changes with frequency, it may be several times the actual height. Only the virtual height can be measured directly, but from plots of virtual height against frequency together with certain reasonable assumptions, it is possible to estimate ionic density of the different reflecting regions and to make approximate estimates of the actual heights.

For measuring virtual heights a radio transmitter and receiver are mounted side by side so as to be controlled by a single operator. The arrangement is shown in the photograph at the head of this article. Transmitting and receiving antennas are located above the small building housing the testing apparatus, as shown in Figure 2. Short pulses are sent out from the transmitter at the rate of sixty per second, which travel up to the reflecting layer and back to the ground. The receiver picks up both the direct and the reflected signal, and the time displacement of the two is a measure of the virtual height of the reflecting layer.

The output of the receiver is connected to one pair of deflecting plates of a cathode ray tube, while the other pair of deflecting plates is connected to the sixty-cycle source that controls the rate of emission of the transmitted pulses. When no signals are being sent out, the pattern on the cathode ray tube is a horizontal straight line caused by the electron stream sweeping back and forth across the tube sixty times a second. When pulses are being transmitted, the motion of the electron stream across the tube will be deflected vertically twice or more each trip—once for the direct pulse picked up and once or more for the reflected pulses. The appearance of such a pattern is shown in Figure 3. The time of sending the pulse relative to the sixty-cycle current can be adjusted, and is usually chosen to bring the first or direct received pulse near the left edge of the tube and at the zero of the small scale fastened on the front of the tube. The position of the second or reflected pulse can then be read directly from this scale. Since the receiving antenna is immediately adjacent to the transmitter, the direct signals are much stronger than the reflected ones. If the gain of the receiver is increased until the reflected signal produces a satisfactory deflection, however, the overloading effect limits the amplitude of the direct pulse to a satisfactory value.

An extremely useful method of studying the structure of the ionosphere is to measure the virtual height as a function of frequency. To secure such data, the frequency is changed so rapidly that the condition of ionization remains essentially constant during the experiment. A plot of one such set of measurements is shown in Fig. 4 above. The significant feature of the relationship shown is that the virtual height remains essentially constant for a range of frequencies and then suddenly increases. Beyond these critical frequencies the virtual height rapidly decreases, but always to a value higher than that found below the critical frequency. The critical frequency is that at which the



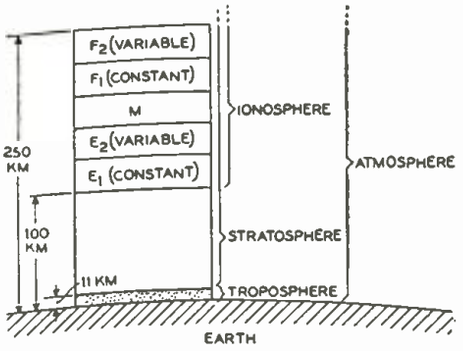


Fig. 4—A plot of virtual height against frequency showing at least three critical frequencies.

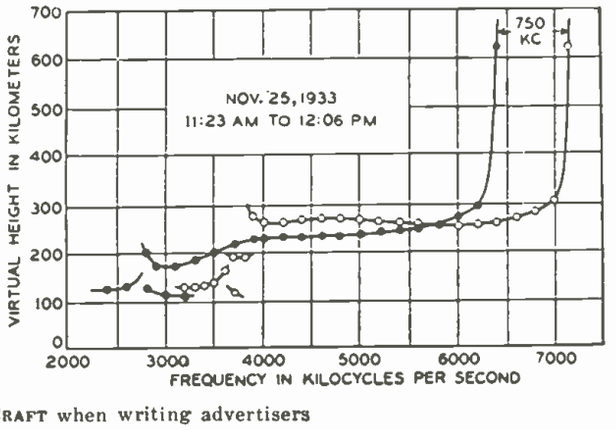
●

Fig. 5—Positions of various ionized regions in the upper atmosphere.

●

Fig. 6—Virtual height and frequency plot for two components of reflected wave.

●



lower reflecting layer is completely penetrated, and the virtual height beyond the critical frequency is that of the next higher layer. The large virtual height obtained at the critical frequency is not due to a greater penetration but to a decrease in velocity of travel through the penetrated layer at the critical frequency. From such sets of measurements it becomes evident that there is more than one reflecting layer in the ionosphere.

At one time it was thought that there were two general ionized regions, an upper and a lower, designated the F and the E respectively. As a result of studies made by the Laboratories, however, *it is now known that the ionosphere is composed of at least five, and possibly more, reflecting regions.* Their heights are not constant and may even shift relative to each other, but a typical indication of their arrangement is shown in Figure 5. The various regions differ not only in their heights but in the manner in which their ionization varies.

In regions E_1 and F_1, the ionization throughout the day varies uniformly with time in a manner that would be expected if the ionizing agent were the sun. The same cycle of ionic density repeats itself day after day, attaining a maximum shortly after noon. Tests made during the solar eclipse a few years ago indicate strongly that ultra-violet light from the sun is the ionizing agency. In the other regions, the ionization varies in an erratic manner from day to day and even from hour to hour. During winter the ionic density in the F_2 region may change as much as fifty per cent in from 15 to 30 minutes. The maximum for this region usually occurs about noon in winter and about sunset in summer. The ionization of the M region sometimes varies in a constant manner, as does that of the E_1 and F_1 regions, and sometimes varies erratically from hour to hour.

Because of this variation in ionic density, it is not always possible to find all the regions at the same time. If, for example, the ionic density of the E_2 region should be greater than that of any higher regions, signals that completely penetrated the E_2 layer would not be returned to the earth, giving no indication of the existence of higher levels. In general a signal that completely penetrates one layer will be reflected only by a layer of higher density.

Besides this complexity of reflecting regions, there is an additional complication caused by the effect of the earth's magnetic field. In such a field the signal is split into two components, each of which in general is reflected at a different virtual height and has a different critical frequency. This is indicated in Figure 6, where one component is indicated by black dots and the other by circles.

The effects described so far are detected when the transmitter and receiver are side by side, and the signal is transmitted up and back vertically. When the receiver is at a considerable distance from the transmitter, however, the reflection phenomena are further complicated by there being a number of paths which use different parts of the ionosphere for reflection as shown in Figure 7. When it is remembered that the reflection along all of these paths encounters the diversity of reflecting regions and the splitting effect of the magnetic field already described, it becomes apparent that the transmission of short waves must be a very complicated process. Fundamental studies of the elements of this type of propagation should contribute materially to the improvements in long-distance radio transmission which the next few years should bring forth.—*Bell Laboratories Record.*

Short Wave Stations of the World

(*Continued from page* 95)

5853 kc. WOB
-C- 51.26 meters
LAWRENCEVILLE, N. J.
Calls Bermuda, nights

5850 kc. ★YV5RMO
-B- 51.28 meters
MARACAIBO, VENEZUELA
5:15-9 p. m.

5825 kc. TIGPH
-B- 51.5 meters
SAN JOSE, COSTA RICA
6:15-11 p.m.

5790 kc. JVU
-C- 51.81 meters
NAZAKI, JAPAN
Broadcasts 2-7:45 a.m.

5780 kc. HI1J
-B- 51.9 meters
SAN PEDRO de MACORIS, DOM. REP.
7-9:30 p.m.

5780 kc. OAX4D
-B- 51.9 meters
P.O. Box 853
LIMA, PERU
Mon., Wed. & Sat. 9-11:30 p.m.

5714 kc. HCK
-B- 52.5 meters
QUITO, ECUADOR, S. A.

5660 kc. HJ5ABC
-B- 53 meters
CALI, COLOMBIA
11 a. m.-12 N.
Tues. and Thurs. 8-10 p. m.
Sun. 12 N.-1 p. m.

5077 kc. WCN
-C- 59.08 meters
LAWRENCEVILLE, N. J.
Phones England irregularly

5025 kc. ZFA
-C- 59.7 meters
HAMILTON, BERMUDA
Calls U.S.A., nights

4975 kc. GBC
-C- 60.30 meters
RUGBY, ENGLAND
Calls Ships, late at night

4820 kc. GDW
-C- 62.24 meters
RUGBY, ENGLAND
Calls N.Y.C., late at night

4752 kc. WOO
-C- 63.1 meters
OCEAN GATE, N. J.
Calls ships irregularly

4600 kc. HC2ET
-B- 65.22 meters
Apartado 249
GUAYAQUIL, ECUADOR
Reported Wed., Sat. 9-11:30 p.m.

4320 kc. GDB
-C- 69.44 meters
RUGBY, ENGLAND
Tests, 8-11 p. m.

4273 kc. RW15
-B- 70.20 meters
KHABAROVSK, SIBERIA, U. S. S. R.
Daily, 3-9 a. m.

4272 kc. WOO
-C- 70.22 meters
OCEAN GATE, N. J.
Calls ships irregularly

4107 kc. HCJB
-B- 73 meters
QUITO, ECUADOR
7:14-10:15 p. m., except Monday

4098 kc. WND
-C- 73.21 meters
HIALEAH, FLORIDA
Calls Bahama Isles

4002 kc. CT2AJ
-B- 74.95 meters
PONTA DELGADA, SAO MIGUEL, AZORES
Wed. and Sat. 5-7 p. m.

3543 kc. CR7AA
-B- 84.67 meters
P. O. BOX 594
LOURENCO MARQUES, MOZAMBIQUE, E. AFRICA
1:30-3:30 p.m., Mon., Thurs., and Sat.

3490 kc. PK1WK
-B- 85.96 meters
BANDOENG, JAVA
Daily except Fri., 4:30-5:30 a. m.

All Schedules Eastern Standard Time

Articles on good 1 to 5 tube sets wanted! The Editors are looking for good set construction articles on:
A—One and Two Tube Receivers.
B—Sets using new "dual-purpose" tubes.
C—S-W Converters of efficient type and proven worth.
D—Transmitters, low-power, efficient types, and allied "Ham" station apparatus including Monitors, etc.
Send diagrams of set first and photo for editor's opinion, before shipping set.

When To Listen In

By M. Harvey Gernsback

Australia

● VK3ME at Melbourne, 9510 kc. now operates from 5:30-7 a.m. on Wed., Thurs., Fri. and Sat. VK2ME at Sydney on 9590 kc. operates Sundays from 1-3, 5-9 a.m. and 10:30 a.m.-12:30 p.m.

Berlin

The German stations have made some changes in their schedule. The program on DJC which formerly began at 5:30 p.m. now starts at 5:05 p.m. The program which began at 5:15 p.m. on DJA and DJN now starts at 5:05 p.m. also. DJE, 16.89 meters is used almost daily from 8-11:30 a.m. with a directional aerial for South America sending the same program as DJA and DJN do at that time. After May 1st, the evening program will be broadcast on DJD, 11770 kc. from 5:05-10:30 p.m. and on DJC, 6020 kc. from 9:30-10:30 p.m.

Daventry

On April 14 daylight saving time went into effect in England. The following changes in schedule were made: Trans. 1, 12:15-2:15 a.m. (11:30 p.m.-1:30 a.m. after May 11) on GSD and GSB. Trans. 2, 6-8:45 a.m. (6:30-8:45 on Sun.) on GSG and GSF GSH or GSJ may replace GSF late in May. Trans. 3, 9 a.m.-12 n. on GSF and either GSG or GSE. Trans. 4, 12:15-3:45 p.m. on GSD and GSB GSF or GSI, may replace one of these. 4-5:45 p.m. (Sun. 4-4:55 p.m.) on GSB and either GSC or GSD. Trans. 5, 6-8 p.m. on GSD and GSC. Trans. 6, (experimental) 10-11 p.m. on Sun., Tues., Thurs. and Sat. on GSC and either GSL or GSD.

France

Radio Coloniale (FYA) at Paris operated from 6-10 a.m. on 19.68 met., 10:15 a.m.-1:15 p.m. and 2-5 p.m. on 25.25 meters and from 6-9 and 10 p.m.-12 m. on 25.63 meters during April. They announced that a further change would be made the first of May and that they would shortly increase their transmitters' power, leading us to the conclusion that their new plant at Villejust, mentioned in this column several months ago, will be placed in service around May 1st. Several new waves have been assigned to this station. (6145 kc., 9585 kc., 11845 kc., 15295 kc., 17765 kc., and 21490 kc.) These are in addition to the old waves. As to what schedules and wave-lengths will be used when and if Villejust gets going we have no information.

Madrid

EAQ at Madrid on 9860 kc., now seems to operate till 7:30 p.m. every night. The full schedule is daily 5:15-7:30 p.m. On Sat. from 1-3 p.m. in addition to the regular schedule.

Budapest

The Budapest stations have changed frequencies and schedules, according to a letter just received direct from the station. HAS3 (it is HAS3 and not HAS as some people claim) on 15370 kc., operates on Sundays from 9-10 a.m. HAT4 on 9125 kc. (32.88 met.) operates on Sun. from 6-7 p.m. Announcements are made in English. HAT on 5400 kc. is no longer used for broadcasting. The station requests reports and will answer letters. Address: Chief Engineer, Radiolabor, Gyali-ut, 22, Budapest, Hungary.

Mexico

There are 2 new Mexican broadcasters. One is XECW, a 10 watter operating on about 5975 kc. (50.25 meters). It is reported from 4-4:30 p.m. and from 10:30 p.m.-12 m. Also irregularly from 4:30-10:30 p.m. The address is Carlos Codero, Calle del Bajio, No. 120, Mexico City, Mex. The big news from Mexico is the inaugural of the new 20 kw. government broadcasting station which operates on 7390 kc. (40.6 meters). This station broadcasts each Sunday from 6-7 p.m. The station is under the direction of the Mexican Foreign Office. The transmitter is at Chapaultepec. The station uses the studios of XEBT in Mexico City. Thanks to Manuel Ortiz Gomez of Mexico City for this information.

Holland

PHI at Huizen, Holland is now back on its summer wavelength of 16.88 meters. During April PCJ on 19.71 meters relayed all of PHI's programs. PCJ is now reported to be testing on Tuesdays from 3 to 6 a.m. and on Wednesdays from 7 a.m. until 5 p.m. on 19.71 meters.

Italy

The 30 meter transmitter of I2RO made two changes in wavelength in March to escape interference. First it moved from 9780 kc. to about 9600 kc. (Same as CT1AA.) After remaining there a week it decided that it was worse off than before so it made one more jump to 9635 kc. (31.13 meters) and settled down there. Incidentally, it seems to have cleared itself of all interference by this last move. The American Hour from Rome is still radiated on Mon., Wed., and Fri., from 6-7:30 p.m. By the time that this is printed it is probable that the American Hour will be broadcast on either 9635 kc. or on 2RO's old frequency of 11811 kc. (25.4 meters). The daily broadcasts from 2:30-5 p.m. (approximately) will probably be shifted to 11811 kc., too. A program for South America is broadcast on Mon., Wed. and Fri. from 7:45-9:15 p.m. on 9635 kc.

Schenectady

From April 28th on the schedule of the Schenectady transmitters follow. W2XAD, 15330 kc. daily, 2-3 p.m. This station is also frequently heard on Sat. from about 11:30 a.m. till 12:30 p.m., sending NBC programs to London. W2XAF operates daily from 5:30-11 p.m. on 9530 kc.

Springfield

W1XAZ at Springfield, Mass., is now known as W1XK. This station operates on 9570 kc. After April 28th, it will operate daily from 6 a.m. until 12 midnight.

Costa Rica

A TIPG on 6550 kc. is reported on at 10:15 p.m., giving its address as P. O. box 225, (City unknown) in Costa Rica. Any information on this one?

YV5RMO

The second harmonie of YV5RMO (5850 kc.) which is equal to 11700 kc., is heard very strongly in the evenings and is mistaken for a new station. It heterodynes FYA (11705 kc.).

This month about 25 stations have been added to the Short Wave Station list and about 60 added to the Police Radio Alarm List

YOU Can Easily WIN A S-W SCOUT TROPHY!

Have You Read the Simple Rules on page 120?

In Next Issue More "Ham" Articles—Don't Miss 'Em!!

Book Review

APPLIED ACOUSTICS, by Harry F. Olson, and Frank Massa. Published by P. Blakiston's Son & Co., Inc. Has stiff cover, measures 8½" by 6" by 1" thick. There are 430 pages. Price $4.50.

This is one of the most complete books in its field that we have had the pleasure of reviewing. It has 15 chapters covering every conceivable phase of acoustics, from fundamental equations and definitions right through to miscellaneous acoustical applications. It gives definite information on measurements of noise, architectural acoustics, microphones, loud speakers, the calibration of microphones, and dynamic systems, electrical, mechanical and acoustic elements and systems of elements. Hundreds of interesting diagrams and graphs are given, together with various types of circuits and constructional data on microphones and speakers.

* * *

PRACTICAL MATHEMATICS FOR HOME STUDY by Palmer. Published by McGraw Hill Book Company. Bound in flexible leather cover. Measures 5" by 8" by 1¼" thick. Contains 606 pages. Price $4.00.

This book gives about the most comprehensive practical explanation imaginable of the art of mathematics, starting with elementary arithmetic. It is intended for the *practical* man and will undoubtedly aid him in his work considerably if he is not already thoroughly acquainted with mathematics. There are 11 chapters and it goes through logarithms and trigonometry. The author has written the book in such simple language that the most inexperienced reader will have no difficulty in thoroughly understanding it and gaining a really practical knowledge of mathematics. Various tables and illustrations accompany the text in order to make clear and fix in the reader's mind the thought that the author tries to convey.

* * *

RADIO ENGINEERING HANDBOOK, by Keith Henney. Published by McGraw Hill Book Company, New York City, N.Y. Measures 5" by 7" by 1½". Price $5.00.

This book is intended for the more serious-minded radio man who wishes to have a handbook which thoroughly explains the various functions of radio circuits and components. It is a technical book, profusely illustrated with formulas, diagrams, charts, graphs, etc., and covers the entire field of radio. It has 23 sections covering mathematical and electrical tables, electric and magnetic circuits, resistance and inductance, capacities, measuring instruments, vacuum tubes, oscillating circuits, R.F. amplifiers, various types of receiving and transmitting systems, antennas, aircraft radio, facsimile transmission, photo-cells, and sound motion pictures.

* * *

New Treatise on Super-Hets

● FOR those who are seriously interested in the superheterodyne and who wish to gain a thorough knowledge of the workings in this most efficient type of radio receiver, the Radio Research Laboratories are publishing a book entitled, "The Superheterodyne Receiver." This book is written by Dr. R. H. von Liedtke, M.S., E.E., D.Sc. University of Heidelberg.

It covers the design, construction, and aligning of superheterodyne and component circuits. It is profusely illustrated with drawings of oscillators and detectors, and design of an I.F. transformer and their selectivity curves.

It treats automatic volume control very thoroughly, giving circuits for several different methods of obtaining this very desirable feature. The difficult parts of superheterodyne design and construction are clearly explained in simple terms and also in elaborate mathematical expressions. One of the many charts provides for the rapid determination of the wavelength, frequency, and "L.C." values for radio frequency circuits. This book is ideally suited for classroom and laboratory use.

List price of this book is $3.75.

Short Wave Scouts

(*Continued from page 72*)

W3XAL 17780 Kc. Daily, 10 a.m.—4 p.m.; Bound Brook, N.J.
W3XAL 6100 Kc. Mon., Wed., Sat., 5:30 p.m.—1 a.m.; Bound Brook, N.J.
W9XAA 6080 Kc. Tues., Thurs., Sat., 4—12 p.m.; Sun., 11:30 a.m.—9 p.m.; Chicago, Ill.
W9XF 6100 Kc. Tues., Thurs., Fri., Sun., 2:30 p.m.—2 a.m.; Chicago, Ill.
W3XAU 9590 Kc. 12—8 p.m., daily; Newtown Square, Pa.
W3XAU 6060 Kc. 8—11 p.m., daily; Newtown Square, Pa.
W8XAL 6060 Kc. Daily, 6:30 a.m.—8 p.m., 11 p.m.—2 a.m.; Cincinnati, Ohio.

Trophy Contest Entry Rules

● NOTE that we have amended our rules and you will find that the rules now read:

In order to protect everyone, the rules have been amended that a sworn statement before a Notary Public which only costs a few cents to get, must be sent in at the same time.

For the complete article of the Purpose of the SHORT WAVE SCOUTS, we refer to page 393 of the November, 1933, issue.

Here are the rules amended:

You wish to know how you can win this valuable trophy, and here are the simple rules. *Be sure to read them carefully. Do not jump at conclusions.*

1.—A monthly trophy will be awarded to one SHORT WAVE SCOUT only.

2.—The purpose of this contest is to advance the art of radio by "logging" as many short-wave commercial phone stations, in a period not exceeding 30 days, as possible by any one contestant.

3.—The trophy will be awarded to that SHORT WAVE SCOUT who has logged the greatest number of short-wave stations during one month.

4.—In the event of a tie between two or more contestants each logging the same number of stations, the judges will award a similar trophy to each contestant so tying.

5.—Verifications are necessary; these must be sent in with each entry. All cards or verification letters must be sent in at the same time with a statement by the SHORT WAVE SCOUTS, giving the list of stations in typed or written form, with the station calls, wave-lengths, and other able information. (See below.) The verification letters and cards will be returned to the SHORT WAVE SCOUT at the end of each monthly contest. (See Jan., 1933, editorial how to obtain verifications.)

Note! All Stations Sent In Must Now Be Verified!

6.—The winner each month will be the person sending in the greatest number of *verifications*. *Unverified* stations should *not* be sent in, as they will not count in the selection of the winner. At least 50 percent of the verifications sent in by each listener must be for stations located *outside* of the country in which he resides! In other words, if the contestant lives in the United States at least 50 per cent of his "veris" must be from stations *outside* of the United States. Letters or cards which do not specifically verify reception, such, as those sent by the Daventry stations and, also by commercial telephone stations, will not be accepted as verifications. *Only letters or cards which "specifically" verify reception of a "given station," on a given wave length and on a given day,* will be accepted! In other words it is *useless* to send in cards from commercial telephone stations or the Daventry stations, which state that *specific* verifications will *not* be given. Therefore do not put such stations on your list for entry in the trophy contest!

7.—This is an *international* contest in which any reader, no matter where located, can join. It is allowable for SHORT WAVE SCOUTS to list stations in their own countries, if they desire to do so.

8.—SHORT WAVE SCOUTS are allowed the use of any receiving set, from a one-tuber up to one of sixteen tubes, or upwards, if they so desire.

9.—When sending in entries, note the following few simple instructions: Type your list, or write in ink, *pencilled matter is not allowed.* Send verification cards, letters and the list all in one package, either by mail or by express prepaid; *do not split up the package.* Verification cards and letters will be returned, at the end of the contest, to their owners; the expense to be borne by SHORT WAVE CRAFT magazine.

10.—In order to have uniformity of the entries, when writing or typing your list, observe the following routine: USE A SINGLE LINE FOR EACH STATION; type or write the entries IN THE FOLLOWING ORDER: Station call letters; frequency station transmits at; schedule of transmission, if known (all time should be reduced to Eastern Standard which is five hours behind Greenwich Meridian Time); name of station, city, country; identification signal if any. Sign your name at the bottom of the list and *furthermore state the type of set used by you to receive these stations.*

11—Don't list amateur transmitters or code stations in this contest.

12.—This contest will close every month for the next twelve months on the first day of the month, by which time all entries must have been received in New York. Entries received after this date will be held over for the next month's contest.

13.—The next contest will close in New York, June 1.

14.—The judges of the contest will be the editors of SHORT WAVE CRAFT, and their findings will be final.

15.—Trophy awards will be made every month at which time the trophy will be sent to the winner. Names of the contesting SCOUTS not winning a trophy will be listed in Honorable Mention each month.

16.—From this contest are excluded all employes and their families of SHORT WAVE CRAFT magazine.

17.—Address all entries to SHORT WAVE SCOUT AWARD, 99-101 Hudson St., New York City.

FREE BATTERIES TO TROPHY WINNER!

● The manufacturers of the well-known Burgess batteries have offered to furnish FREE one year's supply of batteries—all the batteries that the "trophy" winning set will need for a year—and providing it happens to be a Burgess Battery-powered set. A very fine offer indeed, and the editors are glad to pass on the good word to all of their embryo trophy contestants.

A New Discovery in Crystallography

By William Threm

● I HAVE been cutting, grinding and experimenting with crystals for the past four years and discovered that a quartz crystal can be cut and ground and made to oscillate on its 1st, 2nd, 3rd and 4th harmonics of its fundamental frequency.

I have in my possession several of these crystals. One of them oscillating on 1820 kc, 3640 kc, 7280 kc and 14480 kc. Others ground to different frequencies repeating themselves likewise.

These cuts were discovered accidentally about a year ago and up to the present time I have not been able to produce this type quartz crystal at will. If this cut can be perfected it will be very useful for the high frequency bands because of its sturdiness.

These crystals were tested by Mr. G. F. Lampkins, in the G. F. Lampkins Laboratories in Cincinnati, and found to check with the tests of the writer.

I have also in my possession another type plate which oscillates on two distinct and separable frequencies in the same band.

Short Wave League

(Continued from page 106)

many QSO's you can get. If they are not working the band what difference should it make with them. But just the same it seems to make a difference and I think they should give us a reason.

If the 5-meter band was populated by licensed "hams" it would be different, but since it is not, I would advise the JEALOUS, so-called "amateurs" to quit the hollering and either populate or help us experimenters get it, so the commercial companies cannot get it. I am open for correspondence on this matter.

WYMAN M. WARREN,
249 North Market St.,
Wichita, Kansas.

YOW!! Who Said "Code-less" Exam!

Editor, SHORT WAVE CRAFT:

I am a member of the SHORT WAVE LEAGUE and I have enjoyed every issue of SHORT WAVE CRAFT for over two years. I am an ordinary, every day, amateur radio fan and am not looking for arguments, but after reading the silly, nonsensical and hypocritical letter written by Mitchell Barrett in your March issue, my blood started to boil! The only way in which I could cool off a bit was to write an article for the SHORT WAVE LEAGUE page to tell this gentleman what one "ham" thinks of his foolish ideas. Here goes!

Mr. Barrett states, that in addition to being selfish, all the present hams are "air hogs." For this gentleman's information, permit me to state that amateurs operate *only* on frequencies assigned to their use by the Federal Radio Commission. There is a severe penalty for those caught operating outside the legal amateur bands. As for being selfish, if his statement were true, I would never have been able to go on the air. Hams gave me every bit of advice and help possible to aid me in starting, which any real ham will do today for any new beginner. If the word selfish must be used, I wonder what we are to think of this gentleman who wants 40,000 hams to discontinue using code, so he can "blat" into a mike with a lot of useless chatter.

He states also, that the hams disturb him with their old dots and dashes, which he refers to as a lot of silly quacking. Allow me to tell this bird that during the East Indian hurricane a few years ago, during the earthquake at Japan, and during the recent earthquake at Long Beach, California, the amateurs with their dots and dashes, which this squirt chooses to call silly quacking, saved hundreds of lives and brought relief quickly to thousands. They did not use a phone rig for that service either! During the hurricane in Florida a few years ago, after all other means of communication had failed, one ham, whose station was wrecked, rigged up a make-shift code transmitter which he installed in a body of an old truck. There he stuck to the key for three days and nights directing relief work. Yet, Mr. Barrett who is too darn lazy to learn the code for the reason he doesn't want to learn anything that he may never get a chance to use, says all amateurs are selfish. Tsk! Tsk!

He even goes further to state that half the amateurs are "terrible" operators who send so irregularly that even the best operators can't read what is being sent. I wonder from whom he picked all that "phoney information," for he admits that he does not know the code and, furthermore, doesn't intend to learn it. I have been messing around with radio for about fourteen years. For the past three years, I have been operating my own station and, as yet, I have not contacted a ham that I was unable to read because of poor sending. The walls of my shack are covered with QSL cards which shows that I have been QSO with quite a few hams. Mr. Barrett states that if phone rigs were used exclusively, all this silly quacking would be done away with and we would hear *real English* on the air. I wonder if he calls: "OW'S MY 'OBULATION" real English? HI! HI!

Lackaday! I guess this is wasted effort as that bird wouldn't understand anyway! If we are to judge the fellows who favor the codeless license below five meters by this young squirt, I suggest we cut out this discussion and use space in SHORT WAVE CRAFT for something useful. What do you think?

I think someone should give Mr. Barrett a nickel. Maybe he would go out, buy himself an all-day sucker, and leave radio to those who really know what they are talking about.

I think Mr. Putich, of Natal, B. C., Canada, and Mr. Baldwin of Oakville, California, have explained the reason for having a code test better than I could. I take my hat off to both gentlemen. Concerning this young squirt in New York, I think he needs a good boiling in transformer oil!

I would appreciate any replies to this letter and all communications will be answered.

ARNOLD T. FRAUNE, W9DJX,
1125 W. Eighth St., Davenport, Ia.

Charlie Miller Thinks "Code" Should Stay

Editor, SHORT WAVE CRAFT:

I have been reading, in the recent issues of SHORT WAVE CRAFT, the arguments for and against the "Code-Less License" and am herewith giving my views on the subject.

Personally, I don't think anyone should be allowed on the air, below 6 meters or elsewhere, unless he is a capable CW operator and has an FCC "ticket" for same.

The chances are, if the code test were abolished, there would be a great many persons go on the air without knowing A from B as far as technical details are concerned. They would get a friend to fix up a (phone) transmitter for them and go on the air for the fun of it. Then, woe to the short waves, they would be all over the amateur band, instead of staying below 6 meters.

At present I am studying on radio and soon hope to have a "ham" license. My experience with code has been unique, to say the least. I think it is easy to learn if a person just uses his brain for a while. I went to a friend's house one night knowing only six letters in code and came home with the ability to receive five words a minute. After a few days' practice, I was able to receive seven or eight and had no trouble at all in sending about fifteen.

So, I say again that I favor the exam. on code and sincerely hope it is not abolished, below 6 meters or anywhere else.

CHARLES MILLER,
309 View Place,
Covington, Ky.

He Predicts "Terrific" Jam with "No-Code" Exam.

Editor, SHORT WAVE CRAFT:

● I HAVE made a survey of the letters in the SHORT WAVE CRAFT, November issue, and wish to voice my opinion as regards the "codeless examination" for 56 megacycles (frequency) and above.

One fact remains that cannot be disputed and that is, if there were a "codeless-exam." for 1 to 5 meters, about 100,000 fellows would try to transmit in this band, and it must be said with all sincerity that the interference would be terrific! The 46,000 amateurs have "jammed" the other five bands (10 meters excepted) and with the general increase in numbers, there must be some room for expansion.

We have a club in Bordentown, which was formed to aid the embryo "ham," and I am proud to say that in the six meetings we have held, we have "brought up" about ten fellows in the code and every one has remarked that the code is one of the *easiest* parts to learn in radio.

I believe that if the fellows would devote a little time to the code instead of making such a fuss about a practical impossibility, there would be less squawks about the present exam.

OSCAR E. GRAY, JR., President,
Bordentown Amateur Radio Assn.,
239 Spring St., Bordentown, N.J.

Short Waves and Long Raves

(*Continued from page* 83)

very faint and it faded badly. The short-wave stations in Canada and the United States come in fairly well; W8XK on 19 meters comes in with the loudspeaker and can be heard all over a three-room house. This is the first radio set I have ever built and my opinion is that it is the best for the beginner to start on. At the present time, while I am writing this letter, the long-wave coil is plugged in and CFQC, Saskatoon is coming in with great volume and very good tone. Well, I could praise this set all day; at any rate I am very well pleased and it has done what you claimed.

LOUIS DARROW,
White Bear,
Saskatoon, Canada.

(The Megadyne short-wave receiver using but one tube and a fixed crystal detector, has made a great many friends and we are pleased to note that you have had such excellent success with it, Louis. The great secret of success with the Megadyne receiver lies in the selection of a really sensitive crystal detector.—Editor.)

SET WORKS WITHOUT COIL!

Editor, SHORT WAVE CRAFT:

Some time since I decided to try out the one tube *Oscillodyne*, described by Mr. Worcester in the April issue, and built it on a cigar box using the cover turned back for the panel (I find cigar boxes quicker and better than table mounting) winding the coil according to the specifications given, and using a "37" tube.

I consider this one of my few failures, and I have been playing with wireless and "radio" since 1902. The set did not operate to my satisfaction, with the antenna condenser in the circuit, it was weak on the head-phones, by eliminating the antenna condenser it came in a bit louder, and was not selective, (not to be wondered at, we have about sixty stations in a radius five miles in diameter).

Started experimenting with it and found it would work at ordinary head-phone strength if the 50,000 ohm resistance contact was on the first turn of wire. *Then*, the antenna was hooked onto the wire leading from the antenna condenser to grid, still faint, started moving the coil in the socket, trying for bad contact; no result. Took the coil out to look at contacts, *and the music came in as good as before, and the local stations could be tuned in one after another, without any coil in the set.*

My antenna is forty feet long with a thirty-five foot lead-in, and have picked up all the European stations on a regenerative short wave set, using movable aperiodic primary, secondary, and tickler, airwound three-inch coils, and using RCA, 201 tubes bought in 1923 (in use ever since). The antenna is only about eight feet above the roof at the peak, stretched between two houses, sixteen foot alley between, but with sloping roofs, and only one end is within ten feet of the roof.

Have been predicting for the last couple of years that, one of these days, we shall be able to go to the store and say, "Give me two tubes, one to cover the 20 to 40 meter band and one to cover the broadcast band," and that will be all there is to it; no coils, and few wires in the set, the tube will do it all. Try this "wind a three-circuit tuner coil directly on the tube, use the usual circuit, and if it doesn't play a loud speaker for you, I've discovered something." Of course the wire will have to be stuck to the glass, but I'll leave that to the ingenuity of whoever tries it.

H. C. VARNUM,
House 8,
464 Rue Bourgeat,
Shanghai, China.

(Shades of Heinrich Hertz, what next! We have received some very glowing letters from readers who have built Mr. Worcester's "Oscillodyne," but it seems, H. C. V., that you have gone them all one better. At any rate you have given the boys something to think about; our hunch is that the signals that you heard without the coil in the set, must have been pretty strong and the signals were able to affect the grid of the tube, without the benefit of any tuning coil.—Editor.)

"CLIP COIL" SET BRINGS IN GERMANY!

Editor, SHORT WAVE CRAFT:

It is quite some time since I gave up constructing radio sets, but I buy your magazine to *keep up with the times.*

Recently I decided to try the "Clip Coil"—I got out the old "junk" box and got busy. I had no 3½" coil form so I heated an old hard rubber panel and easily cut three strips with a knife for the circumference. These I bent around a jar while warm and made three perfect circles. I fastened six strips, 4" long, to these circles and had my "forms". My other parts looked as though they came out of the "ark", relics of the days when a new circuit came out every week, I guess I built them all. My variable condenser should have had a counter-clock-wise dial, but it didn't. Likewise, I used just a knob for the regeneration control. I could not buy any batteries so I used two 1½ volt cells over three years old and an old eliminator with variable voltage taps. For tubes I used two bootleg 30's, also old and never any too good. Being in a hurry I did not give much thought to the best circuit, however, it *worked from the start* and the Pittsburgh, Schenectady, and other short-wave stations including Canada came rolling in! Finally I "bumped" into Germany, *which came in as strong as the locals!* If it works that well with my collection of odds and ends it must be good. I'd like to see it developed further.

E. J. FRENDENVALL,
Maywood, N. J.

(Hats off to you, E. J. F., for your very fine reception report with the "Clip-Coil Two." One of the interesting technical points about this receiver is that the antenna is really close-coupled to the grid circuit, through the medium of a single coil constituting an auto-transformer, which transfers a maximum of energy to the grid circuit of the detector. Loose coupling in the antenna circuit is frequently a very desirable and useful feature and by having the primary or antenna coil mounted on a pivot or loop in respect to the grid coil, improved selectivity can be obtained, when two stations come in very close together on the dial; also by changing the coupling between the antenna and grid coils "dead-spots" can be eliminated. However, the "dead-spot" trouble can also be remedied by adjusting the small series antenna condenser usually employed. Experience has shown in many cases that, providing sufficient selectivity is afforded by the usual tuned grid circuit, then—other things being equal, the auto-transformer circuit, where the same winding is used as the "grid" and "antenna" coil, will provide the maximum range and number of stations picked up. At least that is the experience of a great many practical experimenters.—Editor)

"POWERTONE" ROLLS 'EM IN!

Editor, SHORT WAVE CRAFT:

I haven't seen any log rolled up by the "Powertone 3-tube A.C. and D.C." short-wave receiver. I'm sending in my list of stations heard on the "Powertone." I have

been a reader of SHORT WAVE CRAFT since 1930.

My log is as follows:

W3XL—Bound Brook, N. J.
W8XK—Saxonburg, Pa.
W4XB—Miami, Fla.
YV1BC—Caracas, Venezuela.
DJC—Zeesen, Germany.
VK3ME—Melbourne, Australia.
GSC—Daventry, England.
W3XAU—Newton Square, Pa.
W1XAZ—Springfield, Mass.
DJA—Zeesen, Germany.
W2XAF—Schenectady, N. Y.
GSB—Daventry, England.
GBC—Rugby, England.
W3XE—Philadelphia, Pa.
W2XV—New York.
W8XA6—Jackson, Mich.
DOA—Coblenz, Germany.
W9XL—Chicago.
W2XO—New York.
VE9HX—Halifax, Nova Scotio.
LSN—Buenos Aires, S.A.
FYA—Pontoise, Paris.
G5SW—Rugby, England.
VK2ME—Sydney, Australia.
EAQ—Madrid, Spain.
OXY—Skamlebooek, Denmark.
VE9JR—Winnipeg, Canada.
GSE—Daventry, England.
I2RO—Rome, Italy.
VE9DR—Drummondville, Quebec, Can.
VE9GW—Bowmanville, Ontario, Canada.
GSA—Daventry, England.
W3XAL—Bound Brook, N. Y.
W9XF—Downers Grove, Ill.
W2XAD—New York.
W8XAL—Cincinnati, Ohio.
G6RX—Rugby, England.
W1XAB—Boston, Mass.
YV3BC—Caracas, Venezuela.
DJD—Zeesen, Germany.
GCW—Rugby, England.
W9XAA—Chicago, Ill.
VE9CA—Calgary, Alta., Canada.
VE9CL—Winnipeg, Canada.
WOO—Ocean Gate, N. Y.
VE9CU—Calgary, Canada.
W1XAL—Boston, Mass.
KEE—Bolinas, Calif.
VDB—Esquinalt, B.C.
LSX—Buenos Aires, Argentina.
CT1AA—Lisbon, Portugal.
GCU—Rugby, England.
W2XE—New York.
VQ7LO—Nairobi, Kenya, Africa.

NORMAN LARSEN,
44 Holland Ave.,
Floral Park, L.I., N.Y.

(A very nice "log," Norman, and we are sure that the designer of the Powertone 3-tube set will be more than pleased at the excellent "log" of stations you have rolled up on it.—Editor)

MALSBERGER SET OK!

Editor, SHORT WAVE CRAFT:

I constructed the receiver described by Curtis E. Malsberger in March 1934 issue of SHORT WAVE CRAFT. Have received so many foreign stations on this set *the thrill has completely worn off! This set is certainly F.B.* Although it isn't quite as selective as it should be, I am going to build a preselector, which will undoubtedly clear up this shortcoming.

Would like to hear from anybody who has constructed this set.

I think your mag. is F.B. (Fine Business.)

FRANK W. SCHWER,
2118 W. Eighth St.,
Muncie, Ind.

(Glad to know that Mr. Malsberger's receiver has given such excellent results, Frank. We have had quite a number of letters praising Mr. Malsberger's set and as the designer of that set did a lot of research on it before presenting it to the readers of SHORT WAVE CRAFT, *it should give somewhat "out of the ordinary" results. We believe that if you take particular care in redesigning the wiring of your set and the placement of your coils, chokes, etc., that you will find the set as selective as any other set.—Editor)*

FINE RESULTS WITH OUR SETS!

Editor, SHORT WAVE CRAFT:

Too much praise cannot be given to technical data published in each copy of SHORT WAVE CRAFT. The schematic diagrams if followed out studiously give results which speak for themselves. I constructed a 3-tube A.C. set from plans given in the March issue, and plenty of foreign stations "rolled in" *with volume to spare.* When "opened up" the headphones just rattled!

I was so pleased that when the June issue came along I dismantled the set and built the Mahco set, illustrated on page 93. However, instead of coupling the detector and audio stages with the two .25 megohm resistors, I employed a 3:1 ratio audio transformer (secondary and primary tied together) in the plate circuit, and a .75 megohm resistor in the grid. I find a 3-megohm, 1-watt resistor serves best as a grid-leak. I like the electronic coupling too and the ease with which volume is controlled by the use of the 50,000-ohm potentiometer. Instead of using a 57 tube detector as specified, use a 58. Added to this circuit is a No. 57 tube in an untuned R.F. stage. This decided improvement was worth the time spent in working it out. I purchased a vitreous insulator, tapered ¼ to 1 inch, such as is used in attaching coils for "ham" transmitters. I wound 70 turns of No. 36 enamel wire around this and it serves as an efficient aerial inductance. The number of turns does not seem to be critical.

However coils did not seem to be efficient on all frequencies desired. After experimenting as to different diameters and dielectrics, I found that cellophane wrapped over a form of the desired diameter, plus the use of No. 20 cotton covered wire (shellacked and varnished once and allowed to dry, after which the coil is removed) and an old tube-base, sawed off close to the prongs and the leads soldered in gives excellent results.

When you listed PRFS and JYM as unknown stations they were coming in R6 to R9 here. In fact I had sent for verifications before you published their frequencies.

The above set performs efficiently from 15 to 60 meters. The 49-meter band was noisy (October)—the South Americans being a little squawky most of the time. Today at noon FYA-GSE rolled in on R9. The best bets are FYA-DJ-GS stations on 19.25- and 31-meter bands, PHI on 16.88 meters, and EAQ until recently. CT1AA and ORK come in very well occasionally. PRF5 at Rio *roars in* on 31.5 meters. HJIABB at Barranquilla, S.A., speaks for itself. VK2ME and VK3ME have exceptionally strong carriers but do not seem to hold up—quite a bit of fading generally.

The "hams" on the 20-meter band I respect. Not the lousy "frequency jumping" bunch to be heard on the 80-meter band. The "20-meter boys" have perfect "rigs"; of the scores I have listened to, believe it or not, none have ever graded under R9 from Texas to Florida, to California to Long Island. This speaks well of this most efficient of all frequencies listened in to yet. The Federal Communications should have a lot of love for these operators. They know their resistances and inductances.

GEORGE A. FIELDHOUSE,
5300 39th Ave., So.,
Minneapolis, Minn.

(The "20-meter boys" will sure have to doff their hats real low to you, George, and as you say, it does speak well for them in that they are "right on the spot" when it comes to maintaining their frequency. Germany, Spain, and England have been rolling in swell style on the editors' receivers. We note what you have to say about the fine results you obtained with the coils wound on cellophane, but after all, the engineering laboratories' tests have shown that isolantite and other new forms of insulation now offered to the short-wave fraternity, do have the highest insulating and low-loss properties for short-waves.—Editor)

Transmitting Antennas

(*Continued from page 100*)

Matched impedance, etc., are merely variations of the Hertz. These different types of Hertzian antennas are the best adapted to amateur use and probably will always be for one reason. Namely: the Hertz is an ungrounded antenna and can be stretched up between two poles or houses, away from grounds and other objects which would be likely to absorb its energy, and it can then be fed "juice" by one of several means.

One of the first things to note about a Hertz antenna, is that it resonates at the even quarter waves, instead of the odd quarters as with the Marconi. The lowest frequency at which a Hertz can resonate, is found by the formula.

$$\text{Freq. in KC.s} = \frac{492{,}000}{\text{length in feet.}} \times K$$

Transposing the formula, we can find the length of antenna needed for any wavelength or frequency by: Length in

$$\text{ft.} = \frac{492{,}000}{\text{Freq. in KCs.}} \times K$$

Where K. is a constant which depends on the range of frequencies as follows:

Frequencies	*Constant, K*
Down to 3000 KC.	K is .96
3000 to 28,000	K is .95
28,000 and up	K is .94

The voltage and current is found to distribute itself along the Hertz antenna as in Fig. 3. From this, it can be seen that a Hertz will work on its *harmonics, i.e.*, on even multiples of frequency. Therefore, if you put up a Hertz for 3600 KC, it will resonate on 7200 KC and also on 14,400 KC. So, any "Ham" who wants to work the three major bands, 80, 40 and 20 meters, need have only one antenna.

Feeders—How Used

Thus far, we have only considered the *radiating antenna* itself. We must now decide how we are to *feed energy to it*. There are several different ways of doing this. Many arrangements use true *transmission lines*, while other "Hams" prefer those antennas known as Zeppelin feeders. A *transmission line* may be any length, whereas a *feeder* is to be tuned, and must be cut to special lengths to produce the desired purpose.

There are other distinctions between the two which will appear later. It is difficult to say what *antenna feed* system is best. At any rate a true transmission line is to be preferred if it can be erected. An old law of physics tells us that a maximum of power will be transferred from a generator to a load if the impedance of the two are equal or matched. This applies to transmission lines and is an important factor in their design. For those who are mathematically minded the standard formula for this work can be used.

$$Z = 276 \times \log_{10} \frac{\text{wire spacing in inches}}{\text{radius of wires}}$$

This is for two wire transmission lines only. An impedance of 600 ohms is usually used in antenna work and a simpler formula has been evolved to make it easier to construct 600 ohm transmission lines. It is: Distance between wires = 7.5 × d. where d is the diameter of the wire to be used. Number 14 wire is a common size and is to be recommended. It is .064" in diam. Therefore for a 600 ohm line we will space our wires 4.8 or nearly 5". We now wish to find some way to tap this onto the Hertz antenna so that we will get no *standing waves* on the line, and we will have an exact impedance match. Our finished antenna will look like this. See Fig. 4. We find its length by our formula,

$$L = \frac{492{,}000}{\text{freq.}} \times K.$$

If the frequency is to be 3600 KC. the length figures to be 131' 2". Distance M is found by formula $M = \frac{492{,}000}{\text{freq.}} \times Km.$ Km is another constant dependent upon frequency and is found thus:

Frequency	*Km*
1500-3000 KC.	.25
3000-28 M.C.	.24
28 M.C. Up	.23

Distance P is also required and is found by $P = \frac{492{,}000}{\text{freq.}} \times Kp$ Kp is a fixed constant which does not vary. It is .30. By calculation we find distance M to be 32' 10" and distance P to be 41'. We now have a *matched impedance* antenna which will work on 80, 40 and 20 meters. It is coupled to the tank coil of the transmitter by one of the methods illustrated in Fig. 5.

For a simpler, and very effective type of *transmission line* refer to Fig. 6. This works very well and involves a rather unique theory that it has an image of itself at a distance beneath the earth's surface, similar to your own image reflected by a pool of water. The *image* wire (the "reflection" of this wire within the earth's surface) is considered to be a factor in keeping the actual wire from *radiating* and to make it function as a real *transmission line*. We need not concern ourselves with its theory of operation; like any true *transmission line* it can be of any convenient length. It works well and luckily or otherwise it obtains an impedance of 500 to 600 ohms with a single wire. It is pictured in Fig. 6.

The distance D is found by simply multiplying the length by .14. The length is found as before by the formula:

$$L = \frac{492{,}000}{f.} \times K$$

For our 131' 2" *sky-wire* the distance from the center D is 18' 5".

Good Receiving Antenna

We may now consider an inexpensive method which is perhaps one of the best possible if one can erect it. This, by the way, is the *very best antenna for "receiving" I have ever tried! Try it yourself!*

It is the *twisted pair* transmission line. This is a current-fed arrangement and has a low impedance and low losses. First let us consider briefly its theory. It has been found that if a Hertz antenna is cut in two at its point of maximum current, the series impedance is somewhat on the order of 70 ohms. If the distance between the two parts is increased, the impedance goes up to perhaps 100 ohms. By the formula for *two-wire transmission lines* which is given above, it is found that the impedance to Radio Frequency of a twisted lampcord when properly terminated, is about 100 ohms. So we can attach our *twisted pair* to the center of our 3600 KC antenna and we have a fine transposed *non-radiating* transmission line with good impedance match. It will look like Fig. 7 and is coupled to the transmitter as shown. It's one fault is that it is useless for even harmonics. These three, the 2 wire matched-impedance, the single-wire transmission line, and the transposed current-fed transmission line, are true transmission lines, and must not be confused with Zepp and current fed arrangements which have standing waves on the feeder system. This can be readily proved by running a neon bulb along the feed wires. The bulb will glow brightly at points of maximum voltage and dimly or not at all at the current loops. On a transmission line, the bulb stays at the same brilliancy all along the wires. A diagram, showing what a Zepp actually is, appears below in Fig. 8. The well-known doublet, or current-fed, two-wire *feeder* type is pictured in Fig. 9.

These antennas are coupled directly to the transmitter tank by a coil; the feeders will be tuned with a parallel condenser if they are below a quarter-wave long, and will be tuned by a series condenser in each leg if they are over a quarter-wave length long. In reality a Zepp is a full-wave an-

tenna with a part of it folded back on itself; the current-fed scheme is a 3/2-wave antenna with part of its length closely paralleled with another part to stop the sections which are close together from radiating to ground and nearby objects, thereby carrying as much of the energy as possible to the flat portion in the air.

Using Hertz Antenna in Attic "Shack"

In case your "shack" is in the attic and you want to use a Hertz antenna, you may not have room to put up an appropriate feeder system or a transmission line. You may bring a short portion of the actual antenna into your station and not lose a great deal of efficiency by using the arrangement shown in Fig. 10. Although a *ground* is used, this is NOT a Marconi system. The tank coil, L2, is similar to your transmitter tank and is grounded at one end. It is then tuned to resonance like a wave-meter. Then the antenna is clipped on to this tank at some point part way up from ground. Try different settings and see which one you get the best results with.

The reason that you must use the separate tank coil is because the Federal Radio Commission won't let you clip the antenna directly to the transmitter tank; it is bad dope to do it anyway. Therefore you just construct a duplicate tank circuit, inductively coupled to the transmitter tank and there you are!

There is no limit to the number of combinations which can be used, but fundamentally there are only two antennas. Feed them as best you can, design your transmission line with care. If you use feeder spreaders, boil them in paraffine wax. If you use twisted lamp cord do the same with that. Insulate well throughout and you have the key to efficiency in the operation of your ham "rig". The highest power can do little or nothing without an efficient *radiator*. Ten watts power in your transmitter with an antenna of nearly 100 per cent efficiency, is far better than a 50 watt outfit with an anenna of only 20 per cent efficiency. Remember that that twisted wire pair antenna is a beautiful short-wave *receiving* arrangement. Measure it for the frequency you wish to try most of your listening on. If you run into any difficulties send me a self-addressed stamped envelope in care of SHORT WAVE CRAFT and I'll see what can be done.

NEW RADIO SWITCHES

New improved type of radio switch, No. 279.

● A CHICAGO concern is introducing additions to its line of rotor switches in the form of compact, single and double-pole, two position units. The new switches fill requirements for tone control applications, phonograph switches, and wave-band switches for midget radios.

Retaining the desirable characteristics of the Oak Junior types, the new RG type, available with grounded common poles, measures only ½" deep from bushing shoulder by 1½" long by 11/16" wide. The R type, of the same dimensions, has the common poles insulated from ground.

The single grounded pole S type is of the same construction and size as the RG type, except for its length which is only 1 1/16".

Three position units are now being developed. Standard bushings for both types are ⅜" by ¼" thread length, Standard shafts are ¼" diameter by length specified.

The superiority of these new switches will be readily recognized. As a result of undergoing the same rigid tests as the larger units in the well-known Oak line.

"Beginners Special"
4 tubes do the work of 5. Don't miss it —in the July number.

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Advertisements are inserted at 5c per word to strictly amateurs, or 10c a word to manufacturers or dealers. Each word in a name and address is counted. Cash should accompany all orders. Copy for the July issue should reach us not later than May 5th

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HICKOK ALL WAVE OSCILLator $38.00, Hickok Statiktester $95.00, Case $7.00, Multiplexes $5.00, Hammarlund Pro $60.00. Balabanow, Box 3, Roseville, Newark, N.J.

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OHM'S LAW CALCULATOR—Lightning Slide Rule: solves all problems of Voltage, Current and Resistance, Power, Wire Sizes, etc. Range: 1 micro-amp. to 1000 amps.; 1 micro-volt to 10,000 volts; 1 micro-ohm to 10 megohms; 1 micro-watt to 10 megawatts; wire sizes 0 to 36 B. & S. gauge. Introductory price $1.00 prepaid. The Datahrint Co., Box 322, Ramsey, N.J.

STEER HORNS SIX FEET spread for sale. Rare decoration for Station. Lee Bertillion, Mineola, Texas.

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FOUR COILS, 13-200 Meters. Low Loss Forms 40c. Isolantite S.W. Chokes, High efficiency 10c. Prompt. Postpaid. Guaranteed. Gordon, 28 Clinton, Santa Cruz, Calif.

4 BAKELITE PLUG-IN COILS, 15-210 meters. Wound on tube bases .30 set. Tall forms .40. Six prong .60. Broadcast .15. Noel, 728 Birch, Scranton, Pa.

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IN STOCK: SUPER-SKYRIDERS $59.95 prepaid. Skyriders $39.95 prepaid. Silver 5Cs $71.70 prepaid. PR-12s. RME9Ds. Nationals. Hammarlunds. Trade-in your receiver. Code machines rented. Write. Henry Radio Shop, Butler, Mo.

LONG SHORT WAVE KIT Requires no tubes or batteries, clear reception, only $1.00. Blue print instructions, 10c. Radio Sales, P. O. Box 68, New Haven, Conn.

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TUBELESS CRYSTAL SET Reports 2100 Miles. Blueprint, 17 Others 25c Coin. Particulars Free. Modern Radiolabs, 151-A Liberty, San Francisco.

TRANSCEIVERS

TRANS-CEIVERS ONLY $3.95—Guaranteed. Foreign reception, local transmission. For detailed information write—Burks Radio Company, 1418 W. Decatur, Decatur, Illinois.

See Page 114 for special subscription offer on Short Wave Craft

How to Eliminate Radio Interference

(*Continued from page* 92)

Electric Bells

The same suppressor device can be successfully applied as shown in Fig. 4 to an electric bell, an apparatus which is often a strong producer of disturbing noises. While the condenser and the resistor used for switches in the normal power line should be of first-class quality, the condenser used for interference elimination on electric bells may be an old one. A few feet of resistance wire wound around a bobbin will do the trick for the resistor. A much better way to eliminate interference from electric bells is shown in Fig. 5. Directly upon the contact breaking piece, interference impulses are created by minute sparks. The interference impulses travel upon the wires and since they are in phase with each other, the power is added, as shown in Fig. 5-a. By rewiring the bell as shown in Fig. 5-b—in a so-called "symmetrical" manner—the impulses radiated from the breaker contact cancel each other. In some cases it might be advisable to add to the contact a spark extinguisher as indicated in Fig. 5-b, by the broken line.

Electric Pads

Surprising as it may seem, electric pads are often a source of radio interference, especially the type containing a so-called automatic temperature contact. The pad must be opened and in parallel to the small glass tube containing the automatic contact, a small condenser of about 0.01-0.05 mf. should be connected. The condenser should be wrapped in cotton.

Small Motors

Much trouble can be avoided by a symmetrical rewiring of small motors, which are often used in the home. Fig. 7-a shows the usually unsymmetrical wiring of the field coils and the rotor. How the symmetrical rewiring has to be done is shown in Fig. 7-b. If this is not possible or makes too much trouble the circuit shown in Fig. 8 may be successfully applied. The condenser C 1, connected in parallel with the brushes of the rotor might be 0.02-0.1 mf., while the condenser C 2 to be connected with the frame of the motor might be about 0.005 mf. The circuit shown in Fig. 8 may of course be applied only for small transportable motors as used in the home, i.e., vacuum cleaners, hot-air blowers, sewing machines, fans, etc.

Small Transportable Motors

Transportable motors of larger size are often used for professional purposes and may be made "interference-proof" by using the circuit shown in Fig. 9. The condensers C 1 and C 2 are of the same capacity (0.1-.02 mf.) while the condenser C 3, to be connected with the frame of the motor, might be about 0.005 mf. To avoid trouble through a breakdown of a condenser, the fuses F 1 and F 2 may be inserted in the circuit.

Stationary D.C. Motors

For stationary D.C. motors of larger size the circuit as shown in Fig. 10-a may be used. The condensers C 1 and C 2 are of about 0.5-4 mf. The fuses F 1 and F 2 according to the current drawn by the motor (between 0.5-6 amperes). In some cases the use of the condensers only will not be enough to eliminate interference entirely. Therefore the two chokes such as shown in Fig. 10-b, and 10-c, may be added. Each of these chokes (diameter 2 inches) have 150 turns. The wire used for these windings must be selected ac-

● Index to Advertisers ●

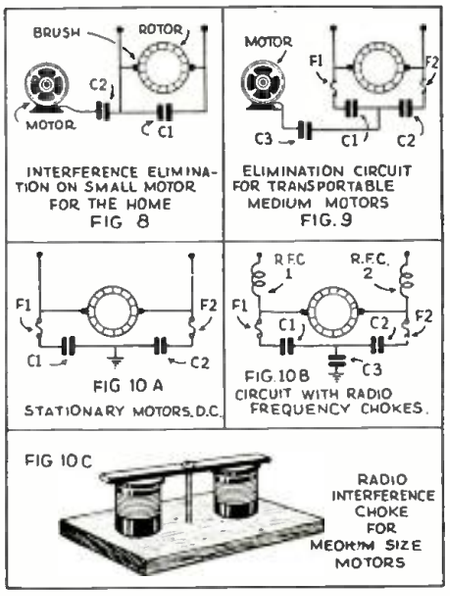
(While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.)

cording to the size of the motor with respect to its hp. or watts. The following table gives the necessary wire size in accordance to the hp. of the motor.

110 Volt Motors

Hp.	Watts	Amperes	Wire No.
0.125	170	1.5	19
0.25	280	2.5	18
0.33	330	3.0	18
1.00	950	8.6	17
2.00	1900	17.5	13
3.00	2700	24.5	11

In diagram 10-b there is a condenser C 3. This condenser sometimes helps a great deal to eliminate interference. Its capacity is about 0.005 mf. However, it is advisable to ground the condensers C 1 and C 2 as shown in Fig. 10-a, if a good ground line is available. It is also advisable to ground the frame of the motor.



Figs. 8 to 10-c above show various methods of by-passing electric motors with condensers and chokes, in order to eliminate interference noises in the radio set from such sources.

Spanish-English Class Broadcast

● STUDENTS of the Spanish class of the Schenectady high school interchanged ideas with members of the English class of the Spanish high school in Barranquilla, South America, in a half-hour two-way short-wave radio program recently presented over General Electric's short-wave station W2XAF.

W2XAF, operating on a wavelength of 31.48 meters, cooperated with station HJ1ABB in Barranquilla, operating on a wavelength of 46.50 meters, for this unique broadcast. Both stations carried both sides of the two-way conversations so that persons with all-wave receivers tuned to either station could hear the complete program.

The program was informal. Students in this country explained to their South American friends the difficulties experienced in learning Spanish, while the Spanish students responded by telling about their problems in attempting to master English. Teachers of both classes were present at the studios and participated in the exchange of ideas.

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Dual Channel Receiver—Tunes in 2 different stations simultaneously through a single set of tubes! In July Issue!

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NATION-WIDE *TESTIMONIALS* PRAISE THIS SET

Gentlemen:
I received your "Official Doerle A. C. 5" today, after being adjusted by your engineers. I have had the receiver turned on less than 10 minutes and at the present time I am listening to the American Hour coming from IRA Rome, Italy. It is a wonderful relief to listen in without hearing a lot of noise. I would like to at this time thank you ever so much for making this adjustment. You cannot tell how much I appreciate this favor. You can certainly count on me as one of your boosters and I shall spread your name and products to all of my friends.
GEORGE LESLIE ALLEN,
Morris Plains, N.J.

Dear Sir:
Just a letter of recommendation concerning the Doerle A. C. 5. What a set, oh boy, for bringing in the DX night after night. I receive about 10 stations a week, that are new programs, besides 50 I already received. Besides I logged 700 hams. Stations that aren't even listed in call books give me a thrill. I only use a 20 ft. antenna wrapped around a chimney.
FRANCIS KMEC, Allentown, Pa.

Gentlemen:
This will acknowledge receipt of my Doerle short-wave receiver. This 1935 model is the smoothest and best operating set I have ever operated, both on amateur and foreign reception. I have heard practically all of the South American stations, Russia, Spain, and of course, France, Germany, Japan, and lots of others. This little receiver is just as you say it is—the best for the money and I have seen sets selling for lots more, which do not come within a mile of this Doerle.
If anybody wants to know if you people will treat them white, just let me know and I will tell absolutely yes.
S. L. SMITH, Colorado, Texas.

Gentlemen:
I am very well satisfied with the set and here are some of DX stations which I have received on it:
On 20 meter coil: EAQ—Madrid, Spain; PRF5—Rio Grande, Brazil, S.A.; LSX—Monte Grande, Argentina, S.A.; DIQ—Germany (Koenig Wusterhausen); GSB—England (Daventry); COH—Havana, Cuba.
On 49 Meters: DJD—Berlin, Germany; H2-CRL—Guayaquil, So. America; 2RO—Rome, Italy; DKC and DKF—Germany; XEBT—Mexico City, Mexico.
Also many other South American Stations and Central American stations. Amateurs in more than 36 different states and including Canadian amateurs.
AUGUSTE THEBERGE, River Edge, N.J.

BEFORE you buy any other Short-Wave Receiver, be sure to take advantage of our FREE five day trial offer explained below. Satisfy yourself, in your own home and at your leisure that this IS one of the greatest values in radio, and that it DOES have features which are found only in more expensive receivers.

Will Outperform Many 10-Tube Expensive Sets

A powerful 5-tube "rig" complete with its self-contained hum-free power pack and dynamic speaker; all mounted on a single chassis and contained in a large handsomely finished black crackle cabinet with patterned screen speaker grill.

Two tuned stages—regenerative detector, 3AF stages with powerful 41 pentode output and perfectly matched dynamic speaker: all these features contribute to the enormous power and superlative performance of this Doerle short-wave receiver.

CONTINUOUS BANDSPREAD ON ALL BANDS. A special double-pointer, double-scale, airplane dial having a tuning ratio of 125 to 1 is employed.

Amateurs may now use this receiver for their daily communications work with the greatest of confidence. It is a real, reliable performer—A FULL-FLEDGED "HAM" RECEIVER.

All the fine features that you would expect to find in more expensive receivers are incorporated in this "ACE TOP-NOTCHER" of the entire Doerle line.

Either a short-wave doublet or standard antenna may be used. A new antenna-adjusting scheme permits perfect alignment of both tuned circuits without affecting the setting of the tuning dial. This means that all stations can be accurately logged on the single tuning dial and always found in their allotted places. Provisions are made to use headphones if desired, with a switch to cut out the dynamic speaker.

LOOK AT THIS DX-QSL LIST!

During its initial test, in one sitting, this receiver pulled in on its loud speaker, at good room volume, the following enviable log: **W1XAL, W1XAZ, Boston; W3XAL, Boundbrook, N.J.; W8XAL, Cincinnati; W9XAA and W9XF, Chicago; GSC, GSD, GSE, GSF, Daventry, England; DJA, DJB, DJC, DJD, Zeesen, Germany; HBL, HBP, Geneva; VE9GW Ontario; VE9DN Quebec; GE9DR Montreal; VE9HX Halifax; XETE Mexico City; YU1BC, YV3BC Caracas CP5 Bolivia; LSN Buenos Aires; COC Havana; EAQ Madrid; WQO and WEF,** testing with the Byrd Expedition and a whole flock of amateurs in practically every radio district of the United States. After that, we could no longer keep our eyes open so we "slipped off" to bed.

The testimonials printed on this page testify that, in actual use, our customers are attaining even greater success. Uses a simple regenerative circuit so simple as to be entirely fool-proof. Tubes, 1—6D6, 1—6F7 (actually two tubes in one), 1—37, 1—41 power output tube and 1—80 full-wave rectifier. Two gang tuning condenser; single dial control; FULL-VISION ILLUMINATED BAND SPREAD AIRPLANE DIAL. Ship. wt. 35 lbs.

No. 5000. "DOERLE AC-5" Short-Wave Receiver. Complete with Tubes, Speaker and 8 coils, 15 to 200 meters. Completely wired and tested. (NOT SOLD IN KIT FORM) YOUR PRICE **$27.55**

Set of 2 Broadcast coils $1.75 additional

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Name the item—it's in the catalog

Send post card or letter. Book sent by return mail. See pages 102, 125 and 126 for our other "ads."

RADIO TRADING CO., 101A Hudson St., New York City

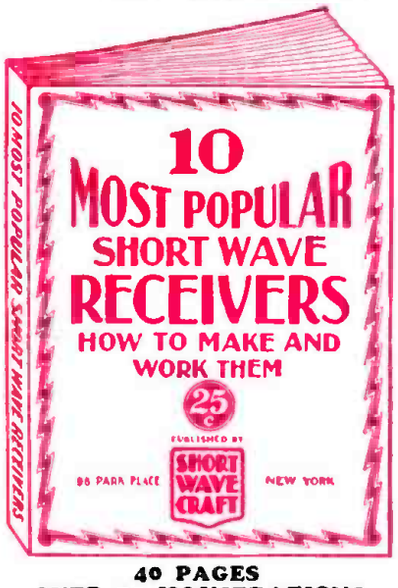
The 4 ESSENTIAL SHORT WAVE BOOKS

'ROUND THE WORLD FANS USE THESE GREAT SHORT WAVE BOOKS

These great books contain everything on short waves that is really worth knowing—they are books which have been most enthusiastically welcomed by short-wave fans. The cost of the books is extremely low in comparison with the valuable material which they contain.

There is not a short-wave fan, experimenter or interested radio-minded reader who will not want these books. Right up-to-the-minute with new material on outstanding developments in the short wave field. The books are authoritative, completely illustrated and not too highly technical.

Ten Most Popular Short Wave Receivers. How to Make and Work Them



This new volume is a revelation to those who wish to build their own short wave receivers. The editors of SHORT WAVE CRAFT have selected ten outstanding short wave receivers and these are described in the new volume. Each receiver is fully illustrated with a complete layout, pictorial representation, photographs of the set complete, hookup and all worthwhile specifications. Everything from the simplest one tube set to a 5-tube T. R. F. receiver is presented. Complete lists of parts are given to make each set complete. You are shown how to operate the receiver to its maximum efficiency.

CONTENTS

40 PAGES
OVER 75 ILLUSTRATIONS

IMPORTANT

THERE IS NO DUPLICATION BETWEEN THIS BOOK AND OUR OTHER VOLUME—"HOW TO BUILD AND OPERATE SHORT WAVE RECEIVERS." ALL THE MATERIAL PUBLISHED IN THE NEW BOOK HAS NEVER APPEARED IN ANY BOOK BEFORE.

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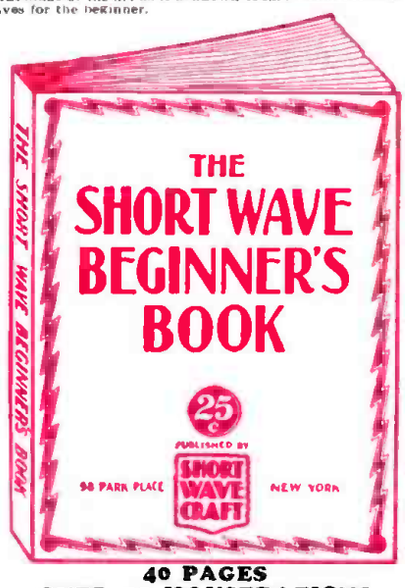
The Short Wave Beginner's Book

Here is a book that will solve your short wave problems—leading you in easy stages from the simplest fundamentals to the present stage of the art as it is known today. It is the only low-priced reference book on short waves for the beginner.

The book is profusely illustrated with all sorts of photos, explanations and everything worth while knowing about short waves—the book is not "technical." It has no mathematics, no "high-faluting" language and no technical jargon. You are shown how to interpret a diagram and a few simple sets are also given to show you how to go about it in making them.

It abounds with many illustrations, photographs, simple charts, hookups, etc., all in simple language. It also gives you a tremendous amount of very important information which you usually do not find in other books, such as time conversion tables, all about aerials, noise elimination, how to get verification cards from foreign stations, all about radio tubes, data on coil winding and dozens of other subjects.



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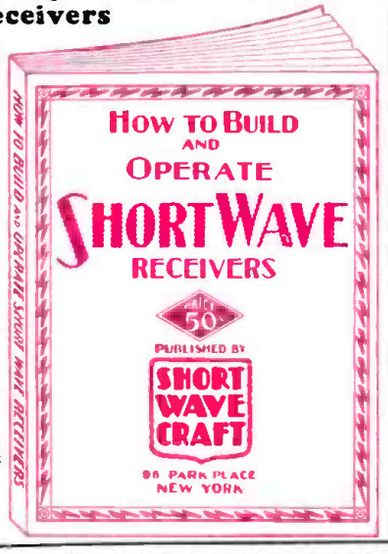
How to Build and Operate Short Wave Receivers

is the best and most up-to-date book on the subject. It is edited and prepared by the editors of SHORT WAVE CRAFT, and contains a wealth of material on the building and operation, not only of typical short-wave receivers, but short-wave converters as well. Dozens of short-wave sets are found in this book, which contains hundreds of illustrations; actual photographs of sets built, hookups and diagrams galore.

The book comes with a heavy colored cover, and is printed throughout on first-class paper. No expense has been spared to make this the outstanding volume of its kind. The book measures 7½x10 inches.

This book is sold only at such a ridiculously low price because it is our aim to put this valuable work into the hands of every short-wave enthusiast.

We know that if you are at all interested in short waves you will not wish to do without this book. It is a most important and timely radio publication.



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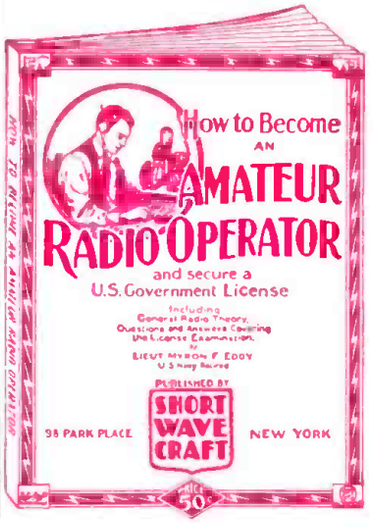

We chose Lieut. Myron F. Eddy to write this book because his long years of experience in the amateur field have made him pre-eminent in this line. For many years he was instructor of radio telegraphy at the U.S.A. Institute. He is a member of the I.R.E. (Institute of Radio Engineers), also the Veteran Wireless Operators' Association.

If you intend to become a licensed code operator, if you wish to take up phone work eventually, if you wish to prepare yourself for this important subject—this is the book you must get.

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