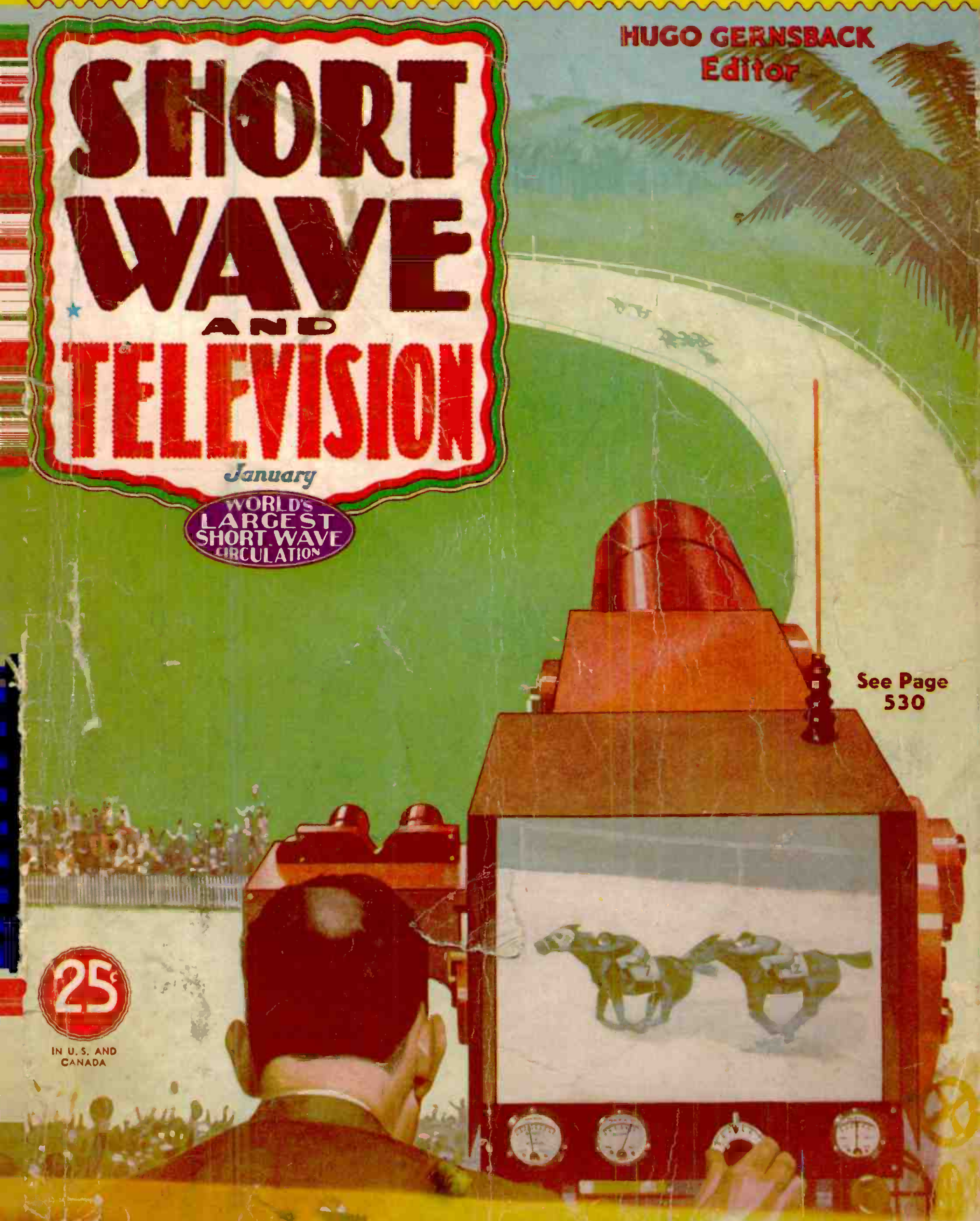
THE RADIO EXPERIMENTER'S MAGAZINE

HUGO GERNSBACK
Editor

SHORT WAVE AND TELEVISION

January

WORLD'S LARGEST SHORT WAVE CIRCULATION



See Page 530

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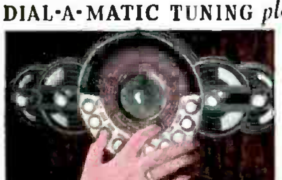

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Now, even a child can bring in ten perfectly tuned programs in ten seconds! It's a big thrill to whirl the dial . . . and then hear the station you want . . . come in instantly, automatically . . . as fast as you can press buttons!

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This exclusive Midwest feature cuts radio wattage consumption 50% . . . results in Midwest radios using no more current than ordinary 7-tube set . . . enables you to operate on voltages as low as 80 volts.

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Read what happened to these two men when I said:

I will Train You at Home in Spare Time for a GOOD JOB IN RADIO

These two fellows had the same chance. Each clipped and sent me a coupon, like the one in this ad. They got my book on Radio's opportunities.

S. J. Ebert, 104-B Quadrangle, University of Iowa, Iowa City, Iowa, saw that Radio offered him a real chance. He enrolled. The other fellow, whom we will call John Doe, wrote that he wasn't interested. He was just one of those fellows who wants a better job, better pay, but never does anything about it. One of the many who spend their lives in a low-pay, no future job, because they haven't the ambition, the determination, the action it takes to succeed.

But read what S. J. Ebert wrote me and remember that John Doe had the same chance: "Upon graduation I accepted a job as serviceman, and within three weeks was made Service Manager. This job paid me $40 to $50 a week compared with $18 I earned in a shoe factory before. Eight months later I went with station KWCR as operator. From there I went to KTNT. Now I am Radio Engineer with WSUI. I certainly recommend the N. R. I. to all interested in the greatest field of all, Radio."

Get Ready for Jobs Like These. Many Radio Experts Make $30, $50, $75 a Week

Do you want to make more money? Broadcasting stations employ engineers, operators, station managers and pay up to $5,000 a year.

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J. E. Smith.

Spare time Radio set servicing pays as much as $200 to $500 a year—full time Radio servicing jobs pay as much as $30, $50, $75 a week. Many Radio Experts own their own full time or part time Radio businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, paying up to $6,000 a year. Radio operators on ships get good pay and see the world besides. Automobile, police, aviation, commercial Radio and loud speaker systems offer good opportunities now and for the future. Television promises many good jobs soon. Men who have taken N. R. I. Training are holding good jobs in all these branches of Radio.

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Practically every neighborhood needs a good spare time serviceman. The day you enroll I start sending you Extra Money Job Sheets. They show you how to do Radio repair jobs that you can cash in on quickly. Throughout your training I send you plans and ideas that have made good spare time money for hundreds of fellows. I send you special Radio equipment and show you how to conduct experiments and build circuits which illustrate important Radio principles. My training gives you valuable, practical experience while learning.

Get My 64-Page Book Now Free

Mail the coupon now for "Rich Rewards in Radio." It's free to anyone over 16 years old. It describes Radio's spare time and full time opportunities and those coming in Television; tells about my Training for Radio and Television; shows you actual letters from men I have trained, telling what they are doing and earning; tells about my Money Back Agreement. MAIL THE COUPON in an envelope, or paste it on a penny postcard—NOW!

J. E. SMITH, President
National Radio Institute, Dept. 7AB3
Washington, D. C.

Get My Lesson on Radio Servicing Tips FREE

I'll prove that my Training gives practical, money-making information; that it is easy to understand—that it is just what you need to master Radio. My sample lesson text "Radio Receiver Troubles—Their Cause and Remedy" covers a long list of Radio receiver troubles in A.C., D.C., battery, universal, auto, T.R.F., super-heterodyne, all-wave, and other types of sets and a cross reference system gives you the probable cause and a quick way to locate and remedy these set troubles. A special section is devoted to receiver check-up, alignment, balancing, neutralizing and testing. Get this lesson Free. No obligation. Just mail coupon.

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J. E. SMITH, President, National Radio Institute
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Without obligating me, send your service manual "Radio Receiver Troubles—Their Cause and Remedy" and free book about spare time and full time Radio opportunities and how I can train for them at home in my spare time. I am particularly interested in the branch of Radio checked below.

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- ☐ Designing and Constructing Testing Equipment
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(If you have not decided which branch you prefer—mail coupon now, for information to help you decide.)

NAME...AGE..............

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IN THIS ISSUE: PROMINENT SHORT-WAVE AND TELEVISION AUTHORS

Kruse • Shuart • Hart • Johnson • Hooton • Palmer • Miller • Secor

HUGO GERNSBACK
Editor

SHORT WAVE AND TELEVISION

H. WINFIELD SECOR
Managing Editor

GEORGE W. SHUART, W2AMN
Associate Editor

Combined With

Official SHORT WAVE LISTENER

Contents for January, 1937

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Part 3—1937 Desk Type Transmitter, 5- to 80-meter Range, by G. W. Shuart, W2AMN.

Short Wave "Diathermy"—Fact or Fancy?, by H. W. Townsend.

The RGH Super—A Receiver for the "Fan," by Robert Herzog, E.E.

A simple Short-Wave Receiver for the "Fan," by Harry D. Hooton.

Special 10- and 20-meter "Medium-Power" Transmitter Using the Latest Tubes, by W2AMN.

Certified Circuits

● SHORT WAVE & TELEVISION goes to a large expense in verifying new circuits. When you see this seal it is your guarantee that such sets have been tested in our laboratories, as well as privately, in different parts of the country. Only "Constructional-Experimental" circuits are certified by us.

When you see our certified seal on any set described, you need not hesitate to spend money for parts, because you are assured in advance that the set and circuit are bona fide and that this magazine stands behind them.

SHORT WAVE & TELEVISION is the only magazine that certifies circuits and sets.

OUR COVER

● THIS month the cover illustration shows one of the thrills which the public will enjoy tomorrow, when television comes into its own. The day of "home television" is much closer than we imagine, judging from the excellent images recently demonstrated in New York by NBC. For details of this cover painting, see Page 530.

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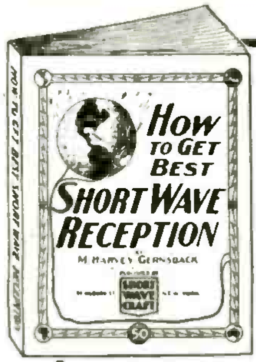
Here are the Six BEST SHORT-WAVE RADIO BOOKS!

Without doubt you will have to go a long way to buy better books on short waves than you find on this page. Each book is written by a well-known authority on short waves . . . each book has been carefully illustrated with photographs and diagrams to make the study of this field of radio much simpler. The volumes on this page are the finest books on short-waves which are published anywhere today. Order one or more copies today . . . find out for yourself how fine they are. Prices are postpaid.



How to Get Best Short-Wave Reception

By M. HARVEY GERNSBACK

This book tells you everything you ever wanted to know about short-wave reception.

The author, a professional radio listener and radio fan for many years, gives you his long experience in radio reception and all that goes with it.

Why is one radio listener enabled to pull in stations from all over the globe, even small 100 watters, 10,000 miles away, and why is it that the next fellow, with a much better and more expensive equipment, can only pull in the powerful stations that any child can get without much ado?

The reason is intimate knowledge of short waves and how they behave. Here are the chapters of this new book:

1. What are Short Waves and what can the listener hear on a short-wave receiver or converter?
2. How to tune and when to listen in on the short waves.
3. How to identify short-wave stations.
4. Seasonal changes in short-wave reception.
5. Types of receivers for short-wave reception.
6. Aerial systems for short-wave receivers.
7. Verifications from short-wave stations.

The book makes excellent reading matter. There are many tricks in short-wave reception that even some of the "old-timers" do not know. Be sure to get it.

40 Illustrations, 72 Pages. Stiff, flexible covers **50c**

101 SHORT-WAVE HOOKUPS

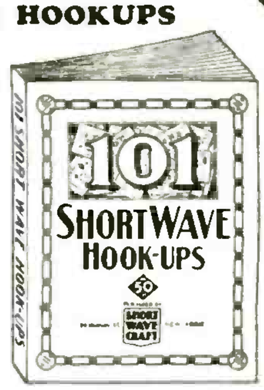
Compiled by the Editors of SHORT WAVE & TELEVISION

EACH and every hook-up and diagram illustrated is also accompanied by a thorough explanation of what this particular hook-up accomplishes, what parts are required, coil-winding information, values of resistors, etc., in fact, everything you want to know in order to build the set or to look up the data required.

To be sure, all of the important sets which have appeared in print during the past five years are in this valuable book. Sets such as the Doerle, Dinsmore, the "19" Twinplex, Oscillodyne, Denton "Stand-by," Megadyne Triplex 2, "Globe-Trotter," 2-Tube Superhet, Minidyne, "Loop" Receiver, "Doerle" 2-tube Battery, "Doerle" 3-tube Battery, "Doerle" 2-tube A.C., "Doerle" 3-tube A.C. Doerle "Signal Gripper," Duo R.F. 4-tube Receiver, The Sargent 9-33 Tapped Coil Receiver, Globe-Girdler 7, The 2-Tube "Champ"—2 Tubes Equal 3, Ham-Band "2-Tube Pee-Wee" Wyeth All-Way 6, Denton Economy 3, 2-Tube "Regenerative-Oscillodyne" will be found here, with full descriptions. In many cases, we have also included a picture hook-up for those who do not wish to follow the regular symbolic hook-up, but wish to have a regular wiring diagram.

This is a very handy volume, especially for those "fans" who wish to study the best sets in the short-wave art, from one tube up to ten tubes.

100 Illustrations, 72 Pages, Stiff, flexible covers **50c**



HOW TO BECOME AN AMATEUR RADIO OPERATOR

50c **150 Illustrations, 72 Pages, Stiff, flexible covers**

WE chose Lieut. Myron F. Eddy to write this book because his experience in the amateur field has made him pre-eminent in this line. For many years he was instructor of radio telegraphy at the R.C.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—this is the book you must get.

Partial List of Contents

Ways of learning the code. A system of sending and receiving with necessary drill words is supplied so that you may work with approved methods. Concise authoritative definitions of radio terms, units and laws, brief descriptions of commonly used pieces of radio equipment. This chapter gives the working terminology of the radio operator. Graphic symbols are used to indicate the various parts of radio circuits. General radio theory particularly as it applies to the beginner. The electron theory is briefly given, then waves—their creation, propagation and reception. Fundamental laws of electric circuits, particularly those used in radio are explained next and typical basic circuits are analysed. Descriptions of modern receivers that are being used with success by amateurs. You are told how to build and operate these sets. Amateur transmitters. Diagrams with specifications are furnished so construction is made easy. Power equipment that may be used with transmitters and receivers, rectifiers, filters, batteries, etc. Regulations that apply to amateur operators. Appendix which contains the International "Q" signals, conversion tables for reference purposes, etc.

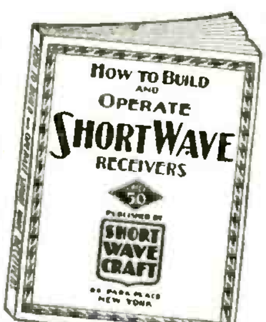
HOW TO BUILD AND OPERATE SHORT-WAVE RECEIVERS

THIS is the best and most up-to-date book on the subject. It is edited and prepared by the editors of SHORT WAVE & TELEVISION, 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.

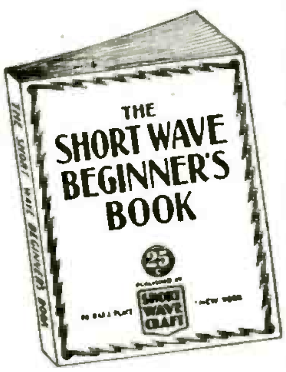
This book is sold only at a ridiculously low price because it is our aim to put this valuable work into the hands of every short-wave enthusiast.

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.

150 Illustrations, 72 Pages. Stiff, flexible covers **50c**



THE SHORT-WAVE BEGINNER'S BOOK



HERE is a book that solves 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—it is not "technical." It has no mathematics and no technical jargon.

It also gives you a tremendous amount of important information, such as time conversion tables, all about aerials, noise elimination, all about radio tubes, data on coil winding and other subjects.

Partial List of Contents

Getting Started in Short Waves—the fundamentals of electricity. Symbols, the Short Hand of Radio—how to read schematic diagrams. Short Wave Coils—various types and kinds in making them.

Short Wave Aerials—the points that determine a good aerial from an inefficient one.

The Transposed Lead-in for reducing Static.

The Beginner's Short-Wave Receiver—a simple one tube set that anyone can build.

How to Tune the Short-Wave Set—telling the important points to get good results.

Audio Amplifiers for S-W Receivers.

Learning the Code—for greater enjoyment with the S-W set.

Wave length to Kilocycle Chart.

Wire Chart—to assist in the construction of coils.

25c **75 Illustrations, 40 Pages. Stiff, flexible covers**

TEN MOST POPULAR SHORT-WAVE RECEIVERS

—HOW TO MAKE AND WORK THEM

THE editors of SHORT WAVE & TELEVISION 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 worth-while 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

The Doerle 2-Tube Receiver That Reaches the 12,500 Mile Mark, by Walter C. Doerle.

2-R.F. Pentode S-W Receiver having two stages of Tuned Radio Frequency, by Clifford E. Denton and H. W. Secor.

My de Luxe S-W Receiver, by Edward G. Ingram.

The Binneweg 2-Tube 12,000 Mile DX Receiver, by A. Binneweg, Jr.

Build a Short-Wave Receiver in your "Brief-Case," by Hugo Gernsback and Clifford E. Denton.

The Denton 2-Tube All-Wave Receiver, by Clifford E. Denton.

The Denton "Stand-By," by Clifford E. Denton.

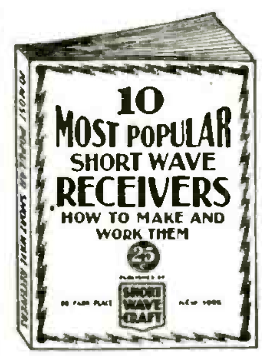
The "Stand-By" Electrified.

A COAT-POCKET Short-Wave Receiver, by Hugo Gernsback and Clifford E. Denton.

The S-W PENTODE-4, by H. G. Cisin, M. E.

Louis Martin's Idea of A GOOD S-W RECEIVER, by Louis Martin.

75 Illustrations, 40 Pages, Stiff, flexible covers **25c**



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( ) How to Get Best Short-Wave Reception....50c each
( ) 101 Short-Wave Hook-ups.....50c each
( ) How to Build and Operate Short-Wave Receiver.....50c each
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HUGO GERNSBACK, EDITOR H. WINFIELD SECOR, MANAGING EDITOR

SHORT WAVE AND TELEVISION

What of Television?

By DAVID SARNOFF

President of Radio Corporation of America

● FIRST, let me emphasize that television bears no relation to the present system of sound broadcasting, which provides a continuous source of audible entertainment to the home. While television promises to supplement the present service of broadcasting by adding sight to sound, it will not supplant nor diminish the importance and usefulness of broadcasting by sound.

In the sense that the laboratory has supplied us with the basic means of lifting the curtain of space from scenes and activities at a distance, it may be said that television is here. But as a system of sight transmission and reception, comparable in coverage and service to the present nation-wide system of sound broadcasting, television is not here, nor around the corner. The all important step that must now be taken is to bring the research results of the scientists and engineers out of the laboratory and into the field.

Television service requires the creation of a system, not merely the commercial development of apparatus. The Radio Corporation of America, with its coordinated units engaged in related phases of radio communication services, is outstandingly equipped to supply the experience, research and technique for the pioneering work which is necessary for the ultimate creation of a complete television system. Because of the technical and commercial problems which the art faces, this system must be built in progressive and evolutionary stages.

RCA's research and technical progress may be judged by the fact that upon a laboratory basis we have produced a 343-line picture, as against the crude 30-line television picture of several years ago. The picture frequency of the earlier system was about 12 per second. This has now been raised to the equivalent of 60 per second. These advances enable the reception, over limited distances, of relatively clear images whose size has been increased without loss of definition.

David Sarnoff, President of the Radio Corporation of America

From the practical standpoint, the character of service possible in the present status of the art, is somewhat comparable in its limitations to what one sees of a parade from the window of an office building, or of a world series baseball game from a nearby roof, or of a championship prize fight from the outermost seats of a great arena.

Television is a highly complicated system of transmitting and receiving elements with thousands of interlocking parts, each of which must not only function correctly within its own sphere of activity, but must also synchronize with every other part of the system. In broadcasting of sight, transmitter and receiver must fit as lock and key.

On the other hand, broadcasting of sound permits a large variety of receiver devices to work acceptably with any standard transmitter. Notwithstanding the great progress that has been made in sound broadcast transmission, a receiver set made ten years ago can still be used, although with great sacrifice of quality. This is not true in television, in which every major improvement in the art would render the receiver inoperative unless equivalent changes were made in both transmitters and receivers.

Important as it is from the standpoint of public policy to develop a system of television communication whereby a single event, program or pronouncement of national interest may be broadcast by sight and sound to the country as a whole, premature standardization would freeze the art. It would prevent the free play of technical development and retard the day when television could become a member in full standing of the radio family. Clearly, the first stage of television is field demonstration by which the basis may be set for technical standards.

Side by side with television, although in many respects nearer to final achievement, there is emerging from the field of radio experimentation high speed facsimile communication. By means of this new development, written, printed, photographic and other visual matter can be sent by radio over long distances and reproduced at the receiving end with amazing exactness. It is difficult to imagine limits of the use of such an invention. It should ultimately make the dot-and-dash system of telegraphy as outmoded as the pony express. Pictures, sketches, handwriting, typewriting and every other form of visual communication, will be transmitted as easily as words are now sent over a telegraph wire. Even in its earlier stages facsimile will be a medium for the instant dissemination of information of a hundred different types, from weather maps to statistics, from educational data to comic strips Far from displacing the existing media of information—and particularly the newspapers—facsimile should contribute to their progress providing them with swifter and more effective facilities.

In this new facsimile service we have also reached an advanced stage. R.C.A. Communications, Inc., has built an experimental facsimile circuit between New York City and Philadelphia, demonstrated publicly for the first time recently. It uses ultra-high frequencies linked into instantaneous transmission by automatic relays. This circuit will demonstrate the possibilities inherent in facsimile transmission and should also contribute to solving the difficult problems of relaying television programs on these ultra-high frequencies.

One of the triumphs of this (*Continued on page* 558)

First of a Series of "Guest" Editorials.

SHORT WAVE & TELEVISION IS PUBLISHED ON THE 1st OF EVERY MONTH

This is the January, 1937 Issue—Vol. VII, No. 9. The Next Issue Comes Out January 1

SHORT WAVE & TELEVISION, *Published monthly at* Mount Morris, Ill.
EDITORIAL *and* EXECUTIVE *Offices, 99 Hudson St.*, New York City

Television in England—The Marconi E.M.I. instantaneous television "camera" picking up an "outdoor" view at the Alexandra Palace. The ultra short wave aerials for transmitting the image and sound can be seen on the tower at the right.

TELEVISION IN EUROPE

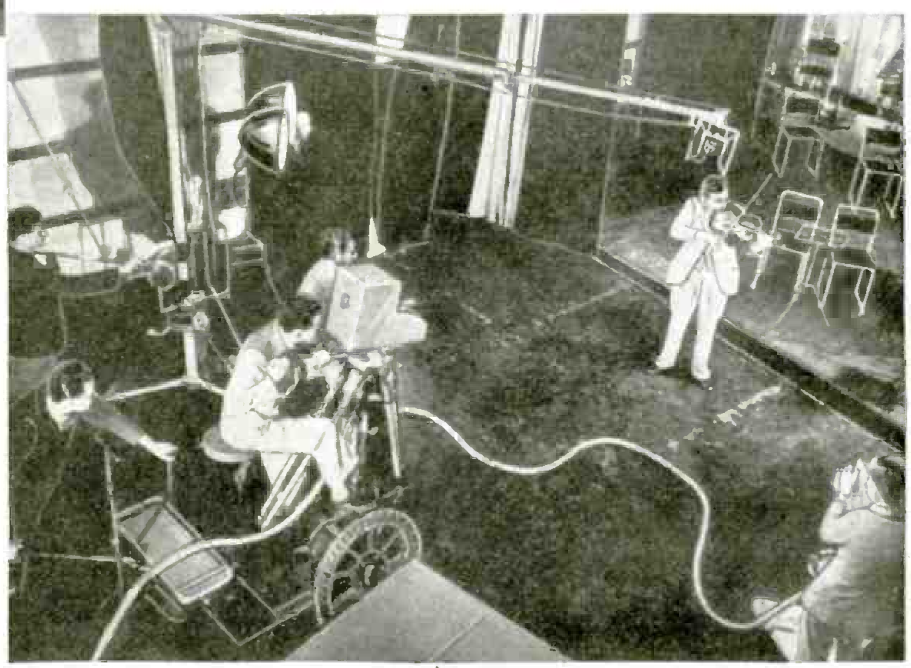
Television, in so far as the public is concerned, is apparently much farther advanced in Europe than it is in this country, as the accompanying photos testify. Television programs on ultra short waves are being broadcast daily.

● THE new London television station has started experimental transmissions. Programs have been broadcast from the Alexandra Palace, and picked up on receivers at the Radio Exhibition at Olympia, where they are now arousing keen interest among thousands of British and foreign visitors.

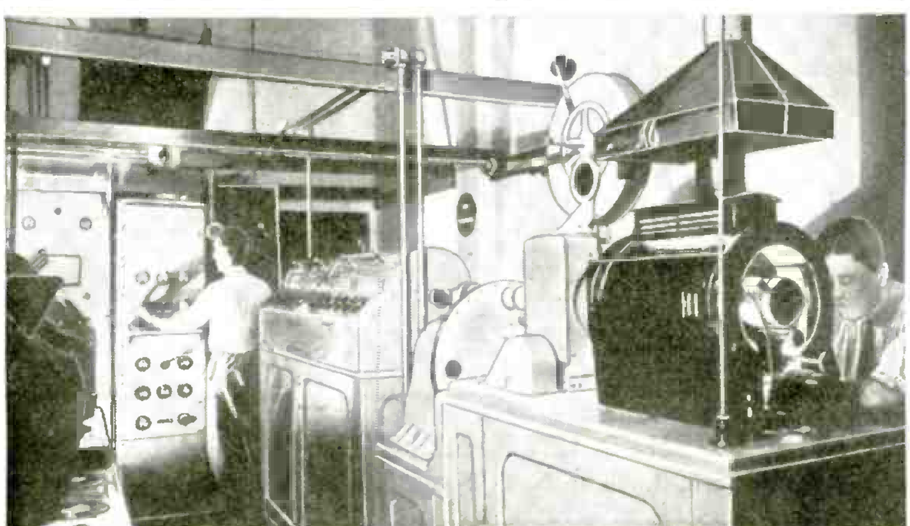
From a hill 306 feet above sea-level the BBC's new television station dominates London. It is built into a corner of Alexandra Palace—a North London landmark and pleasure resort for more than sixty years—and from the large bay windows of the upper offices below the aerial nearly all London can be taken in at a glance. The importance of height in this connection can hardly be over-emphasized, for under normal conditions the range of the ultra-short waves used for television is extended as the height of the transmitting aerial is increased.

Surmounting a tower, itself 80 feet high, is the tapering lattice mast, rising to a height of 220 feet. Thus the aerial array for *vision* transmissions, which is mounted at the summit of the mast, is more than 600 feet above sea-level! Immediately below the vision aerial is the aerial for the accompanying *sound* transmission.

Three Transmitters: The new station fulfils the recommendations of the Television Advisory Committee appointed to consider the development of television in Great Britain. Provision has accordingly been made for alternate experimental transmission by the systems developed by the Baird Television Company and the Marconi-E.M.I. Television Company respectively. Each Company has provided a complete television system, including both *vision* and *sound* pick-up apparatus and the television transmitter itself. The BBC has been responsible for the sound transmitter and its associated aerial.



Television studio in England (Alexandra Palace, London). This view shows the Marconi E.M.I. Studio with two Emitron Television Cameras in use. Note the "mike" above the violinist.



London again—a view of the Baird television scanners, showing the monitoring and control racks in the background.

In its main essentials, therefore, the equipment comprises a television studio for each system, with an associated "control room" and ultra-short wave television transmitter; and, in addition, an ultra-short wave sound transmitter common to both systems.

To these bare necessities, however, much has been added to provide, in the words of the Television Committee, "an extended trial of two systems, under strictly comparable conditions, by installing them side by side at a station in London where they should be used alternately—and not simultaneously—for a public service." Provision has been made for the comfort of art-

The pictures above tell in vivid fashion the story of the improvement in television scanning. The image at the extreme left was scanned with 90 lines, the next with 120 lines, the third image with 180 lines, and the one at the extreme right with the new Philips 405 line system. Note that with the 405 line scanning the lines are no longer visible. The Philco system in this country is about to experiment with 440 to 450 lines scanning, while the other companies interested in the newer system of electronic television in this country have been increasing the lineage repeatedly in an effort to obtain more perfect images.

ists in the shape of dressing rooms and a restaurant, for staff accommodation, for the viewing and editing of films in a miniature cinema (projection room), for the storing of properties and scenery, and for many other adjuncts necessary to a smooth-working program service.

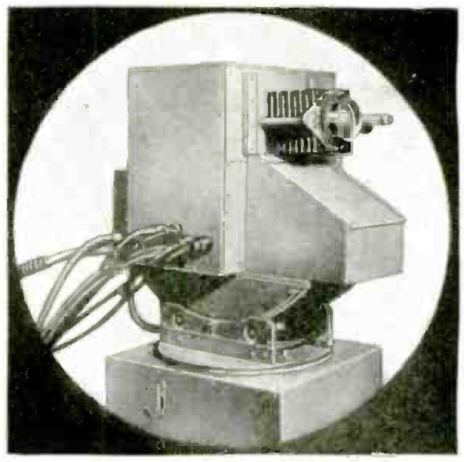
Photos on this page show the new Philips (Holland) Television apparatus and the results obtained with their 405 line scanning.

The Transmitter Floor: The entrance hall is at the base of the tower. To the right is the receptionist's desk, while immediately facing the visitor is the main door to the stairway leading to offices and studios. On the left is the entrance to the ground floor corridor which houses the three transmitters, projection theatre, restaurant, and scenery productions shop. Nearest to the entrance hall is the Marconi-E.M.I. television transmitter which, like its Baird equivalent, operates on a frequency of 45 megacycles per second (wavelength: 6.67 meters). All the apparatus at the station is finished in grey cellulose and chromium.

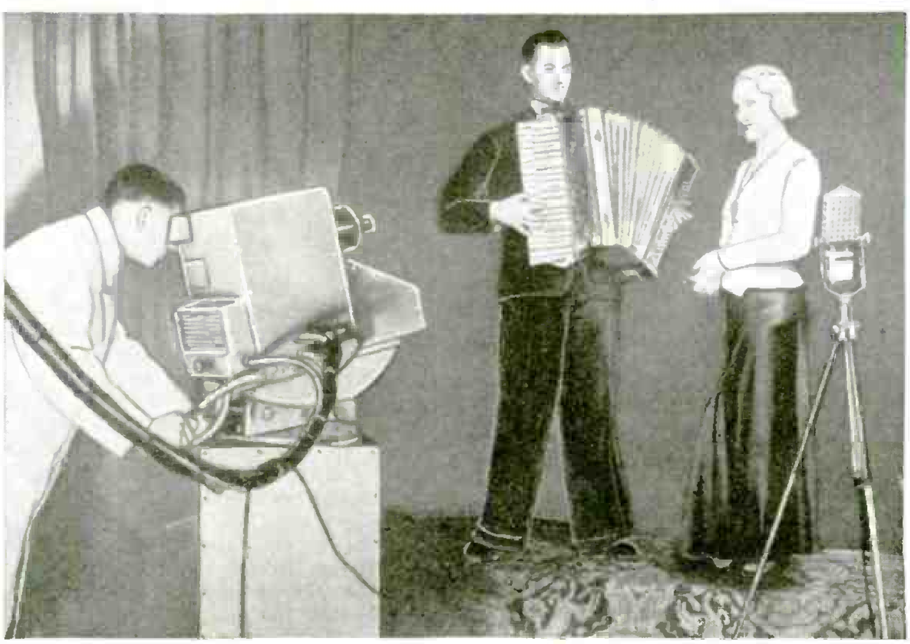
Next is the sound transmitter hall which accommodates an ultra-short wave installation of orthodox design for radiating speech and music accompanying the vision signals of both the Baird and Marconi-E.M.I. systems. Its operating frequency is 41.5 megacycles per second (wavelength 7.23 meters).

Miniature Cinema: Between the sound transmitter and the Baird plant is the film projection theater, or miniature cinema, in which film excerpts can be selected and timed for inclusion in the transmissions. At least thirty people can be comfortably accommodated.

The Baird "transmitter hall," with its control panel and array of generators and amplification stages, is at the south-west end of the corridor. Beyond this, at the south-west extremity of the BBC section of the Palace, is a large area intended either for scenery construction or for televising such objects as motor cars and animals which cannot be brought into the studio or televised outside. Trucks can drive straight in. A large opening in the roof enables it to be lighted and, if necessary, televised from above. Lifting tackle can take up scenery and properties weighing a ton through a trap-door in the roof to the second dock, 25 feet above.



↑The Philips television camera, which resembles an over-grown camera. This apparatus is used to pick up the image and may be used for "outdoor" views as well as "studio shots."



A view in the Philips television studio, showing pickup of image for 405 line scanning; the mike for picking up the sound appears at the right of the picture.

Outdoor Television: An interesting feature at this point is the ramp or sloping runway, down which the television camera can travel to a concrete "apron," approximately 1,700 square feet, on the terrace outside, forming a platform for televising "open-air" performances or special experimental programs.

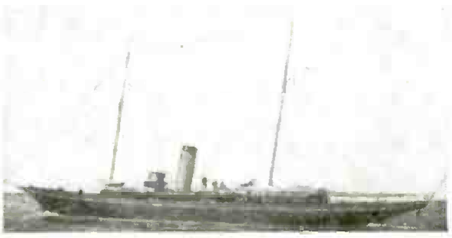
Beneath the productions shop is the boiler plant serving the whole of the BBC section of the Palace.

Studio Design and Furnishing: Leaving the tower on this floor we enter the Marconi-E.M.I. studio. Measuring approximately 70 ft. x 30 ft., with a height of 25 ft., this studio is divided into two stages (*Continued on page* 587)

SHORT WAVES plus

Sound Impulses

Chart "Coastal Waters"



The "Oceanographer," formerly J. P. Morgan's yacht "Corsair," now used by the U.S. Coast and Geodetic Survey for charting coastal waters.

Sono-Radio Buoys, which have recently been perfected, are replacing station ships in the United States Coast and Geodetic Survey.

IN May, 1936, a report appeared in the daily press of the discovery by the United States Coast and Geodetic Survey of a vast gorge charted off New York Harbor. Following the discovery of the gorge, the department was amazed to discover that their former reckonings were more than *three miles* above it! It was thereupon decided to *rechart* the entire waters around New York and New Jersey.

The *Oceanographer*, which formerly was the Corsair, property of J. P. Morgan, put out to sea and proceeded on the interesting work which brought to light the prehistoric bed of the Hudson some 3,600 feet deep. Modern hydrographic methods and sounding machines were used to *rechart* the ocean floor. Continuous succession of *automatic soundings* were taken by means of the fathometer or the echometer. This method of sounding has been in use for approximately the past twelve years.

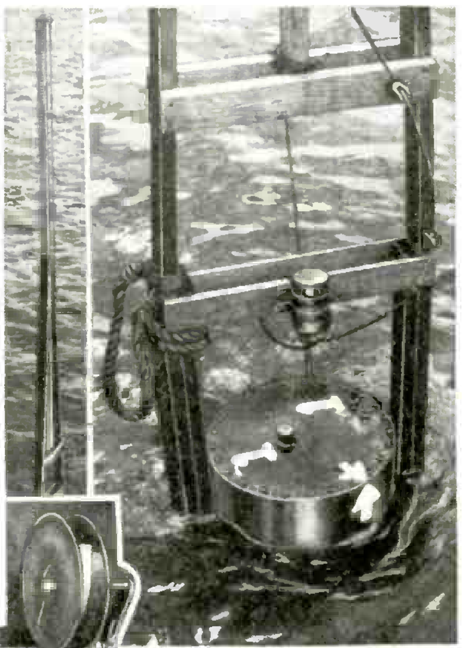
Accurate Location of Charting Vessel Important

The methods by which the gorge was charted are as amazing as the results. To some it might seem a simple matter to run a ship off shore and find depth of the water, but the question of knowing the *accurate location* of the *sounding* entails the use of an elaborate system of measuring. This system is based largely on the knowledge of the rate that sound travels through sea water.

From a known point ashore, a line of buoys was strung seaward by the *Oceanographer*. This line was continued at right angles having a distance of 45 miles. After being placed the distance between the buoys which were approximately seven miles apart was measured by stringing piano wire from one to the other. The wire was strung from a reel containing an ocean going tape-measure 140 miles long. After the distance had been measured in this fashion, the direction of one buoy from another was found by taking azimuths on the sun (azimuth is an arc of the horizon intercepted between the meridian of a place and the vertical circle passing through the center of a celestial body). The station ships were anchored at each of the two buoys in the line. As the *Oceanographer* moved along its course, bombs of T.N.T. were set off in the water. The sound passed through the water and was picked up by hydrophone (under-water sound detector) on the station ship. The arrival of the sound there sent an automatic radio message back to the *Oceanographer*. By checking the time it took for the sound to travel to each "station ship," the engineers aboard the *Oceanographer* could compute their vessel's exact position. Knowing its positions meant that the automatic soundings being taken by the fathometer could be placed in their proper *exact positions* on the chart.

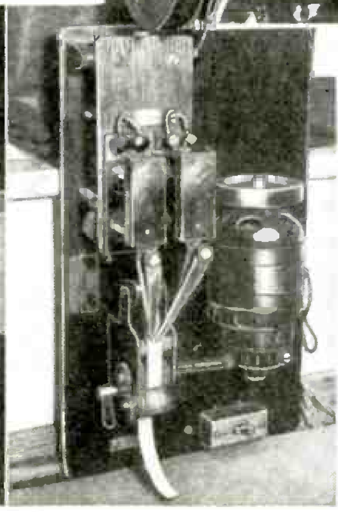
(*Continued on page* 579)

Above—Mr. T. J. Hickley, scientist of the U.S. Coast and Geodetic Survey, pointing to the hydrophone unit (sound detector) used to detect and indicate the arrival of the sound impulse; the hydrophone is suspended several fathoms below the buoy. Three cans of TNT with fuses are also shown, the larger can creating an explosion heard under water a distance of 60 miles.



Two photos above show sono-radio buoy at sea; it carries a hydrophone beneath the water to pick up the sound of the bomb explosion. The radio antenna can be seen at the extreme left. A close-up view of the buoy showing the automatic relay fastened to the anchor cable appears above.

Right—Lieut. H. O. Fortin, of the U.S. C. and G. S., examining the chronograph tape to determine the distance of the survey ship from the buoy.



Left—A close-up of the paper tape chronograph, with motor for moving the tape under the recording pens.

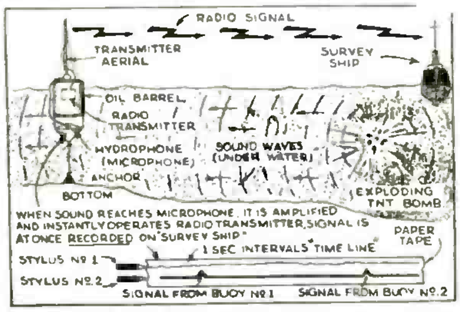
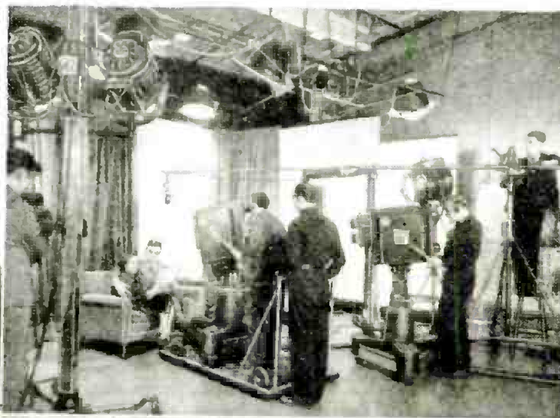


Diagram shows how sound waves from bomb exploded by survey ship are intercepted by hydrophone suspended from buoy. When sound impulse arrives at buoy, radio signal flashes back to survey ship and is recorded on paper tape.

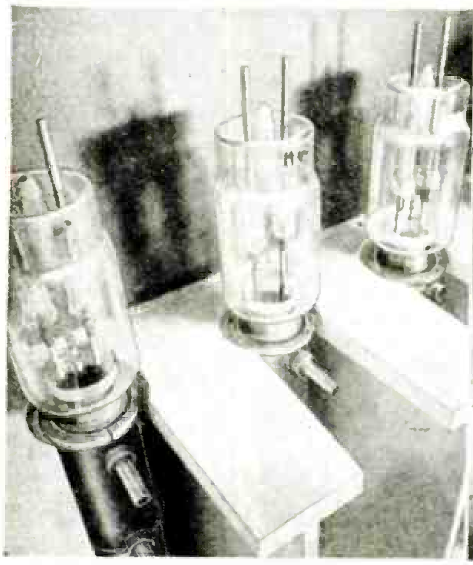
New Television Advances Shown in NBC Demonstration

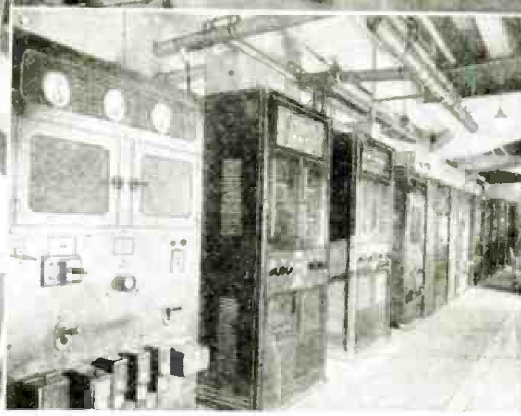
Photo at right shows pickup of scene in the television studio by means of the "Iconoscope" camera.

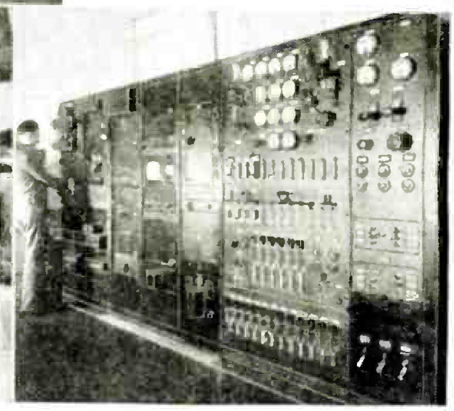
Below—Glimpse of some of the high-frequency tubes used in the RCA television transmitter in the Empire State Building in New York City. The tubes shown amplify the television picture signals.



Above—The RCA television receiver. Two photos below (center)—television transmitter room atop the Empire State Building. The pipes shown above the switch-boards contain wires arranged to form a special "antenna filter" in which the sound and picture signals combine. Below, control room.







● TELEVISION was presented to representatives of the press in New York City recently by the National Broadcasting Co., and undoubtedly many of those present who saw the new version of image transmission by radio were surprised at the great advances which have been made in the art.

News-reels, as well as *direct pickups*, were transmitted on approximately 6 meters from the 10 kw. transmitter atop the Empire State Bldg. As the accompanying drawing shows, the image was picked up together with the voice accompaniment at the RCA Bldg., in Radio City, about one-half mile distant.

The studio pickups were "piped" through a *concentric cable* installed underground between two buildings. An optional short-wave link for transmitting the studio shots to the transmitter at the Empire State Bldg. will shortly be available.

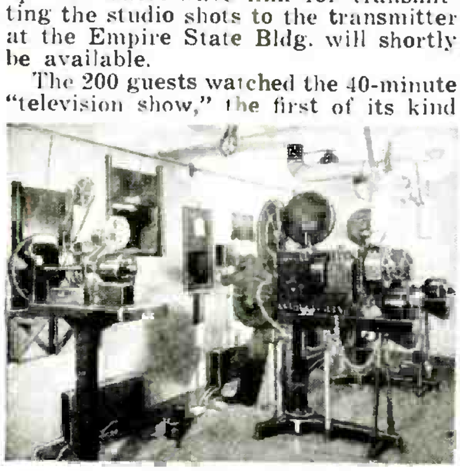
The 200 guests watched the 40-minute "television show," the first of its kind in this country, as reproduced on a battery of about 15 television receivers. The image was equivalent in clarity to the average "home movie" and measured about 6x7½ inches, the screen having a predominant green color. Two other special machines were demonstrated simultaneously, and these reproduced an approximately black and white image of somewhat larger size (7½"x 10") with surprising clarity.

While the television pictures as reproduced were fine and seem about ready for introduction into the homes, there are many other problems to be worked out, such as the erection of the large number of transmitters in various population centers, and also the matter of programs and sponsors or some other system to offset the tremendous cost of introducing television to America.

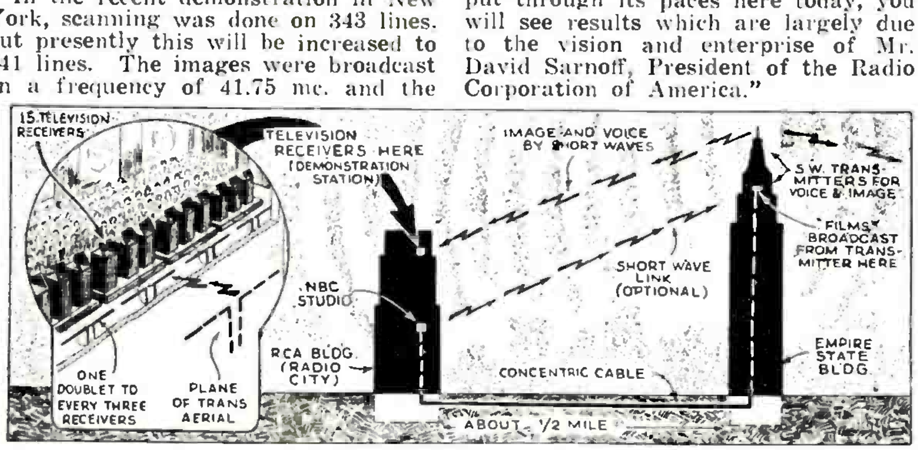
In the recent demonstration in New York, scanning was done on 343 lines, but presently this will be increased to 441 lines. The images were broadcast on a frequency of 41.75 mc. and the accompanying voice on 52 mc.; a single transmitter aerial was used. The receivers seemed quite stable and practically no adjustments were made on them once the "television show" had started.

A statement by Lenox R. Lohr, Pres. of the National Broadcasting Co., made while introducing Mr. Sarnoff "via television," is interesting.

"Our engineers are studying the economics of networking, so that several stations may be interconnected by either coaxial cable or short-wave relays, and are developing equipment for the making of outside pick-ups. With the experience that we are gaining daily, we feel that when the time is ripe to offer television to the public, the National Broadcasting Company will be prepared to do its part. As you see television put through its paces here today, you will see results which are largely due to the vision and enterprise of Mr. David Sarnoff, President of the Radio Corporation of America."



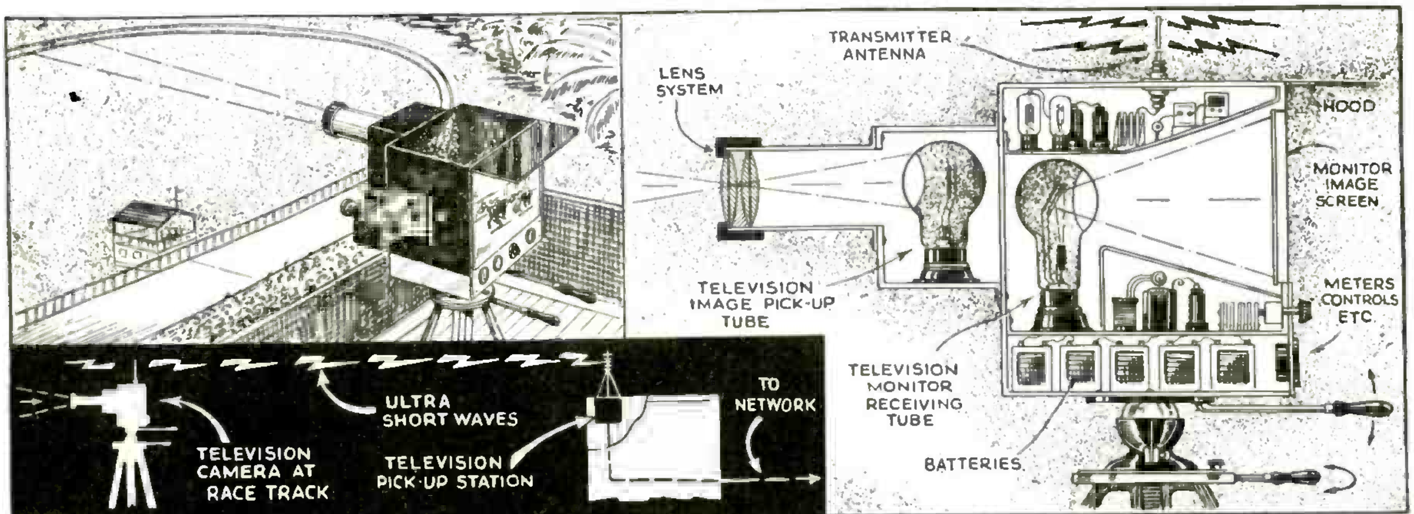
The film projector flashes the picture on to an "Iconoscope" camera placed on the other side of the wall behind the window shown.



This diagram shows how the recent NBC television demonstration was carried out in New York City. Over 200 representatives of the press saw the first large-scale television demonstration of this kind in this country. The image reproductions were excellent.

Televised Horse-Race A New Thrill!

Front Cover Feature



Our cover illustration shows an interesting application of Television Tomorrow! People living in northern climes may enjoy a real thrill indeed when horse-races in Florida or other warm regions are flashed across their televisor screen while the snow swirls around the house. The television camera may be self-contained and operated on batteries, flashing the image by ultra-short waves to a nearby "pickup" station.

● OUR cover illustration shows a glimpse of what may be a very common-place experience tomorrow when television arrives. Horse-races and other out-door sports will flash across the screen of our televisor, while the loudspeaker reproduces the accompanying sounds picked up at the actual scene.

The television camera here shown is of an advanced design and somewhat in the future just yet, but there is no doubt that we eventually shall have television pickup devices as compact and efficient as the one shown. Cathode ray tubes of the present type require a fairly high voltage, say 1,500 volts or more, but in the laboratory this type of tube has been operated with voltages as low as four or five hundred. A short wave transmitter working on a frequency of 60 megacycles or more could easily be operated from batteries and flash the image over a distance of a mile or so to a nearby pickup station, which might be mounted in a truck or else temporarily installed in a hotel or other building. As past experiments have shown the voice may be transmitted on the same wave with the image, and undoubtedly in the near future—when television apparatus has become fully developed and applied—this method of doubly modulating a single wave so that it will carry both the wave and voice impressions will be a simple accomplishment.

In the television camera shown on the cover, the operator is sighting the apparatus through a binocular eye-piece, but he could also focus the image on the monitor screen shown at the rear of the television camera. Vacuum tubes of special type, such as those devised by Zworykin and others, will undoubtedly be used in all types of television cameras tomorrow, and, in fact, are being used in the laboratory apparatus now under test by the well-known companies interested in this field.

2-Way S-W Radio Helps French Police

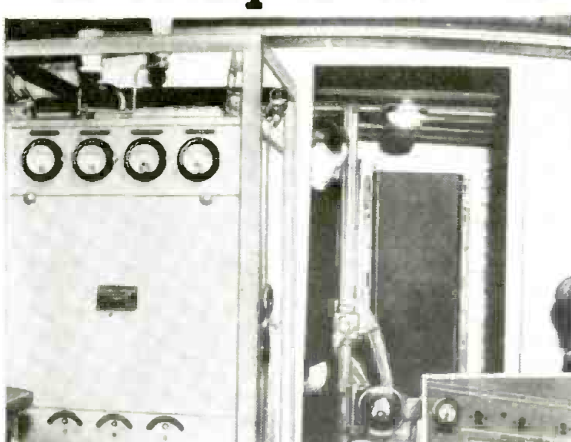


Photo below shows a view of the short-wave transmitting and receiving station operated at the Prefecture of Police in Paris. While very ingenious short-wave apparatus has been developed in a number of foreign countries, the American radio designers have been on the job and have provided ultra-short wave, two-way radio-phone apparatus which is extremely small and so simple that it can be operated by almost any one after brief instruction. One of these American systems operating on ultra short waves was described in the Oct. issue of this magazine, page 327.

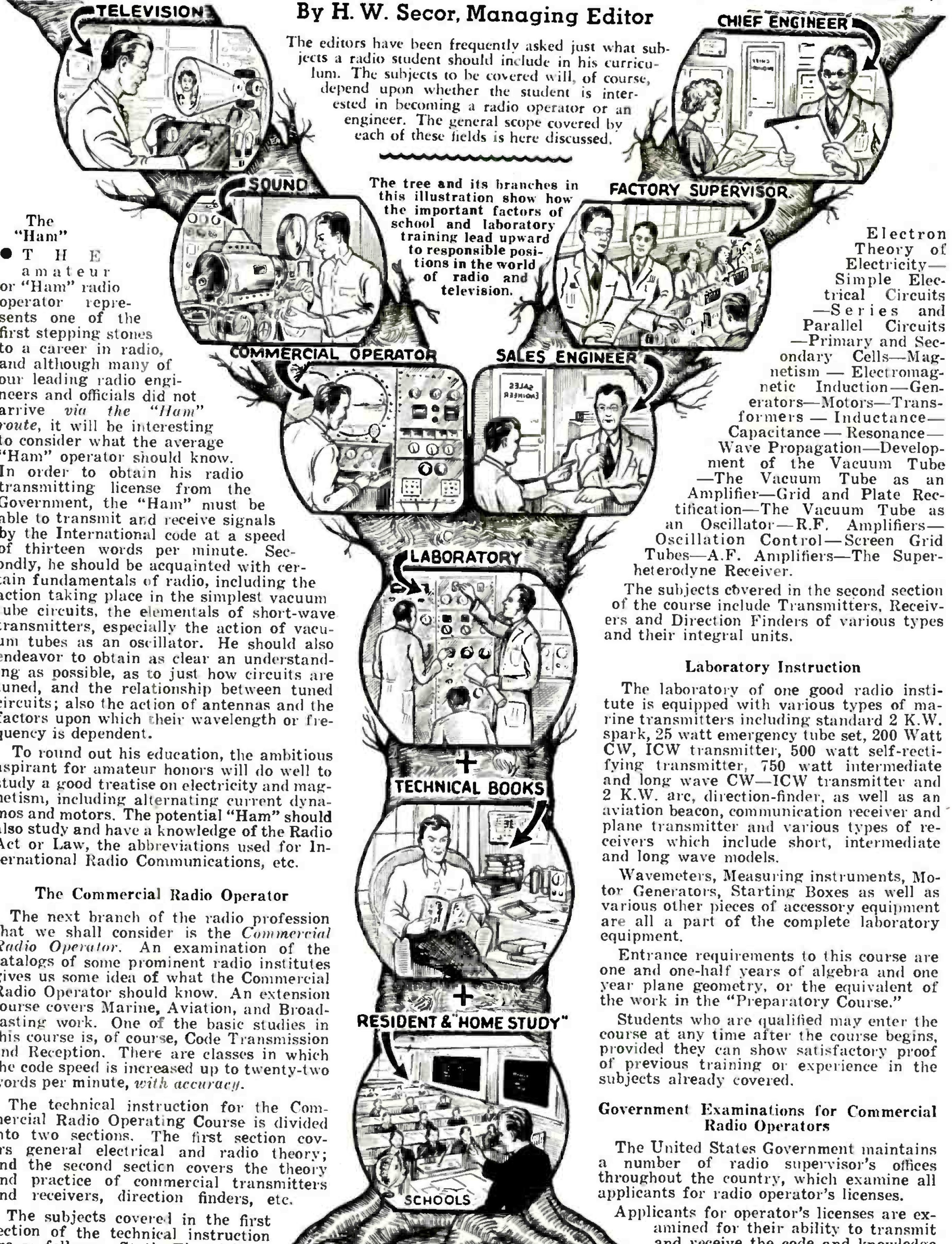
Short-wave receiving and transmitting sets have recently been installed in the Parisian Prefecture of Police. This has finally been decided upon as the most satisfactory method of transmitting orders and hearing reports throughout the entire police department. Incidentally, it is also being established in New York City for the Fire Department. In the central station of the two-way short-wave radio, experts are stationed to instruct the police in the receiving and taking of messages and the operation of the apparatus. Photo shows an interior view of the apparatus in one of the new police cars.

Photo above shows another angle of the French short-wave police system. This photo shows a rear view of a French police car. The short-wave transmitting and receiving set is placed in the back of the car and it can be easily transported to any desired point by the police. Two-way, short-wave systems are being rapidly adopted by various cities and towns in all parts of the world; thanks to this new application of science many criminals are apprehended, because of the important fact that the police can talk from the car directly to headquarters.

WHAT SUBJECTS SHOULD I STUDY FOR A SUCCESSFUL RADIO CAREER?

By H. W. Secor, Managing Editor

The editors have been frequently asked just what subjects a radio student should include in his curriculum. The subjects to be covered will, of course, depend upon whether the student is interested in becoming a radio operator or an engineer. The general scope covered by each of these fields is here discussed.



The tree and its branches in this illustration show how the important factors of school and laboratory training lead upward to responsible positions in the world of radio and television.

The "Ham"

THE amateur or "Ham" radio operator represents one of the first stepping stones to a career in radio, and although many of our leading radio engineers and officials did not arrive *via the "Ham" route*, it will be interesting to consider what the average "Ham" operator should know. In order to obtain his radio transmitting license from the Government, the "Ham" must be able to transmit and receive signals by the International code at a speed of thirteen words per minute. Secondly, he should be acquainted with certain fundamentals of radio, including the action taking place in the simplest vacuum tube circuits, the elementals of short-wave transmitters, especially the action of vacuum tubes as an oscillator. He should also endeavor to obtain as clear an understanding as possible, as to just how circuits are tuned, and the relationship between tuned circuits; also the action of antennas and the factors upon which their wavelength or frequency is dependent.

To round out his education, the ambitious aspirant for amateur honors will do well to study a good treatise on electricity and magnetism, including alternating current dynamos and motors. The potential "Ham" should also study and have a knowledge of the Radio Act or Law, the abbreviations used for International Radio Communications, etc.

The Commercial Radio Operator

The next branch of the radio profession that we shall consider is the *Commercial Radio Operator*. An examination of the catalogs of some prominent radio institutes gives us some idea of what the Commercial Radio Operator should know. An extension course covers Marine, Aviation, and Broadcasting work. One of the basic studies in this course is, of course, Code Transmission and Reception. There are classes in which the code speed is increased up to twenty-two words per minute, *with accuracy*.

The technical instruction for the Commercial Radio Operating Course is divided into two sections. The first section covers general electrical and radio theory; and the second section covers the theory and practice of commercial transmitters and receivers, direction finders, etc.

The subjects covered in the first section of the technical instruction are as follows: Static Electricity—Electron Theory of Electricity—Simple Electrical Circuits—Series and Parallel Circuits—Primary and Secondary Cells—Magnetism — Electromagnetic Induction—Generators—Motors—Transformers — Inductance—Capacitance — Resonance—Wave Propagation—Development of the Vacuum Tube—The Vacuum Tube as an Amplifier—Grid and Plate Rectification—The Vacuum Tube as an Oscillator—R.F. Amplifiers—Oscillation Control—Screen Grid Tubes—A.F. Amplifiers—The Superheterodyne Receiver.

The subjects covered in the second section of the course include Transmitters, Receivers and Direction Finders of various types and their integral units.

Laboratory Instruction

The laboratory of one good radio institute is equipped with various types of marine transmitters including standard 2 K.W. spark, 25 watt emergency tube set, 200 Watt CW, ICW transmitter, 500 watt self-rectifying transmitter, 750 watt intermediate and long wave CW—ICW transmitter and 2 K.W. arc, direction-finder, as well as an aviation beacon, communication receiver and plane transmitter and various types of receivers which include short, intermediate and long wave models.

Wavemeters, Measuring instruments, Motor Generators, Starting Boxes as well as various other pieces of accessory equipment are all a part of the complete laboratory equipment.

Entrance requirements to this course are one and one-half years of algebra and one year plane geometry, or the equivalent of the work in the "Preparatory Course."

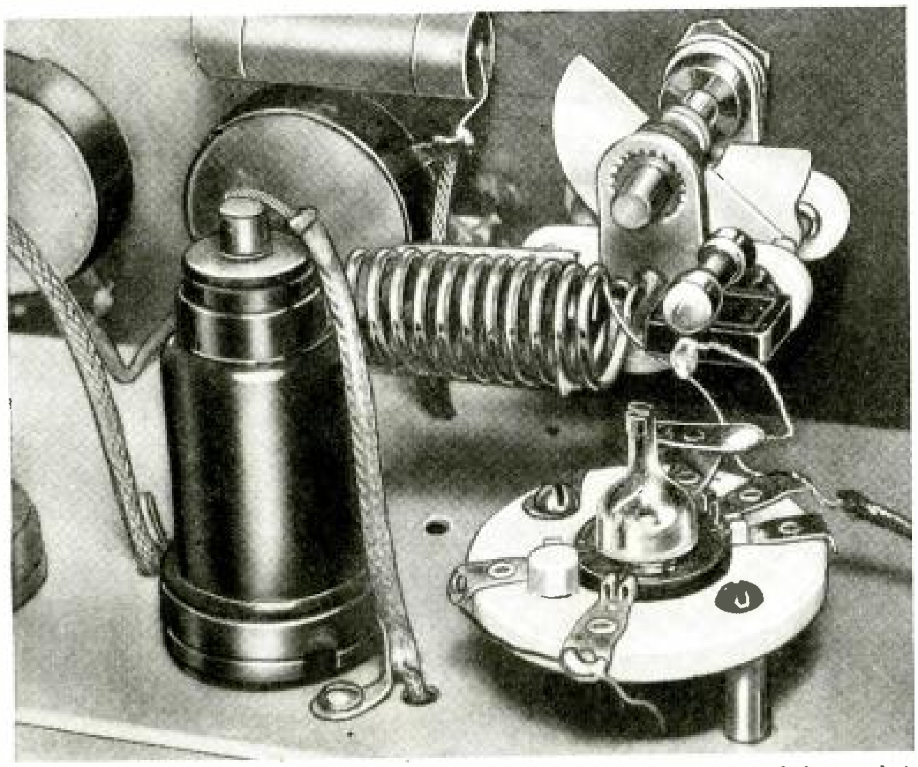
Students who are qualified may enter the course at any time after the course begins, provided they can show satisfactory proof of previous training or experience in the subjects already covered.

Government Examinations for Commercial Radio Operators

The United States Government maintains a number of radio supervisor's offices throughout the country, which examine all applicants for radio operator's licenses.

Applicants for operator's licenses are examined for their ability to transmit and receive the code and knowledge of techni- *(Continued on page 569)*

Improving Our 5 Meter

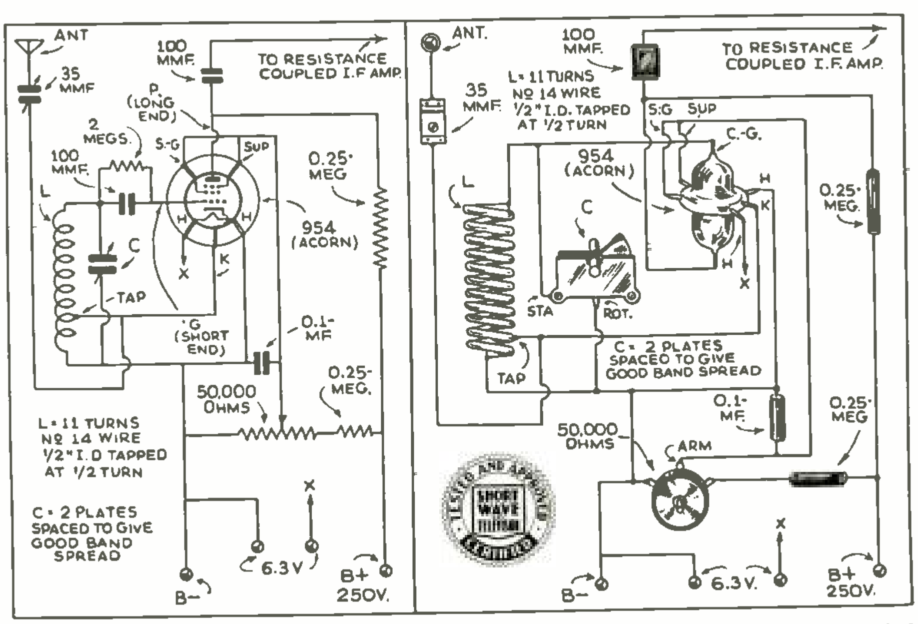


This photo shows how the Acorn tube is installed in the resistance-coupled superhet.

● IN the November and December issues of *Short Wave Craft* there appeared two *superheterodyne* receivers, both using standard metal tubes throughout. The one appearing in the November issue was of the resistance-coupled variety while the one in the December issue employed tuned I.F. transformers and was a "full-fledged" superheterodyne. Both of these receivers performed excellently and it can be said that they are a distinct advantage over the super-regenerator.

Acorn Tubes Essential as First Step!

One fault, however, that can be found with any of the ultra-short wave superheterodynes employing standard tubes is high noise level. Examination has shown that nearly all of this noise originates in the first detector stage and is due entirely to tube construction. It is one thing to bring the sensitivity of a receiver up by adding tubes and making more complicated circuits, but it is quite another to maintain a good *signal-to-noise* ratio at the same time.



The circuit diagram of the 954 "autodyne-converter" for the resistance-coupled superhet.

Dozens of circuit combinations employing the conventional tubes have been experimented with and it has been found that in each case when the sensitivity of the receiver is high, the noise-to-signal ratio is also high. It is almost impossible to improve the two receivers mentioned, employing the same tube line-up, by adding more tubes. The answer, of course, lies in the use of Acorn tubes, which are especially designed for *ultra-high frequencies.*

How Weak Signals Are Boosted!

In the resistance-coupled superhet described in the November issue, we substituted an Acorn tube type 954 for the 6J7 autodyne first detector. The sensitivity of the receiver remained the same; the signal-to-noise ratio, however, was improved to an almost unbelievable degree! For instance, with the *gain* control of the receiver wide open, the noise generated by the 6J7 first detector was almost as great as the ***hiss*** of the average *super-regenerator.* Of course, in this condition the receiver was very sensitive, but the extremely weak signals were lost in this R6 to 7 ***hiss***. The installation of the Acorn tube reduced this ***hiss level,*** formerly an R6 to 7, to an almost *unnoticeable* level, which in no wise interfered with the intelligibility of the signal being received. As an example—with the large tube, the 6J7, an extremely weak signal could be brought up to an R6, but the *noise-level* was so *high* that it was difficult to distinguish the signal from the noise! With the Acorn tube this "picture" was changed to the point where the signal was perfectly understandable, *without the slightest interference from noise generated in the receiver!*

Remember, we are not talking about *general background noise* picked up from the *outside*—the noise referred to in this article *originates in the first detector tube.*

For those who wish to improve operation of the two very popular 5-meter receivers described in the November and December issues of *Short Wave Craft,* the details are given in the accompanying article. The main "bugaboo" in ultra-high frequency receiver operation is "tube noise," and a series of tests have proven that the greatest value obtained by the use of the Acorn tube is the marked reduction of noise. Any ultra-high frequency receiver may be improved after the manner discussed in this article.

Should R.F. Amplifier Stage Be Added?

We have shown the diagram of the circuit used with the 954 which is identical to the one employing the 6J7. Adding an R.F. amplifier ahead of the 954 would, of course, offer some advantages. However, the advantages—it would seem—are not sufficient to warrant the additional complication of the receiver. We tried this experiment on a station

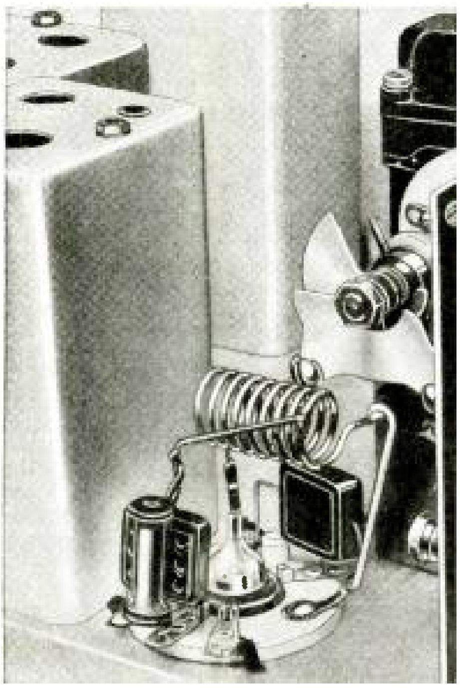
Superhets

By George W. Shuart, W2AMN

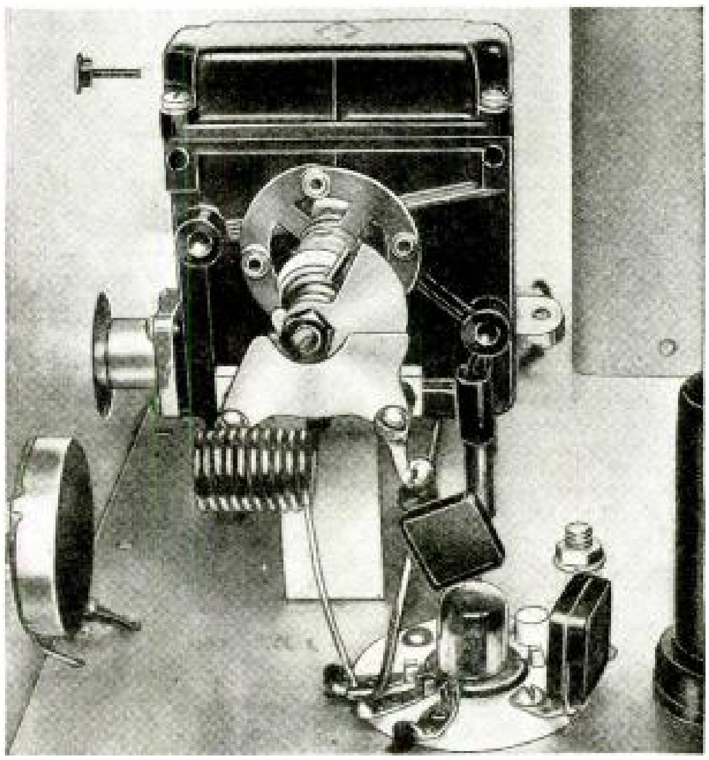
that was just barely audible, but not understandable with the detector alone. With the additional R.F. stage, the signal was *slightly louder*, but no more intelligible because of the increase in background noise from external sources. The main advantage of this I.F. stage, of course, is *increased stability* in the *detector*. However, if the antenna is carefully designed and properly coupled to the autodyne detector, no trouble should be experienced. As the most sensitive condition of the first detector is that point where the tube is well past the edge of oscillation, there is no danger of it flopping in and out of oscillation due to variations in line voltages or when the circuit is tuned across the band.

Improvement of Signal-to-Noise Ratio is Marked!

The superhet receiver employing tuned I.F. stages described in the December issue was also changed to employ Acorn tubes, and here too the improvement in signal-to-noise ratio was *tremendous!* However, the actual sensitivity of the receiver is not changed apparently. But signals that were down to the level of the noise created at the first detector circuit with the large tube, could be brought in at the same volume—minus nearly all traces of "hash" or hissing and resulted, of course, in perfect reception. The circuit employed here is slightly different from the previous one using metal tubes.



The Acorn first detector in the tuned I.F. superhet.



The oscillator stage of the tuned I.F. superhet employing the Acorn tube.

The first detector is a 954 and is made to regenerate by tapping the cathode onto the coil rather than by *grounding* it. Regeneration is controlled by varying the screen grid voltage. A 955 triode is used as the high frequency oscillator and the oscillator voltage is injected into the suppressor grid of the 54, by connecting the suppressor directly to the cathode of the 55 which was also tapped onto the coil, thus putting it at RF. potential above ground.

A Few Words Regarding Calibration

The combination of the 954 and the 955 converter circuit is extremely stable. There is no noticeable *interlocking* between the tuned circuits, and the (*Continued on page* 578)

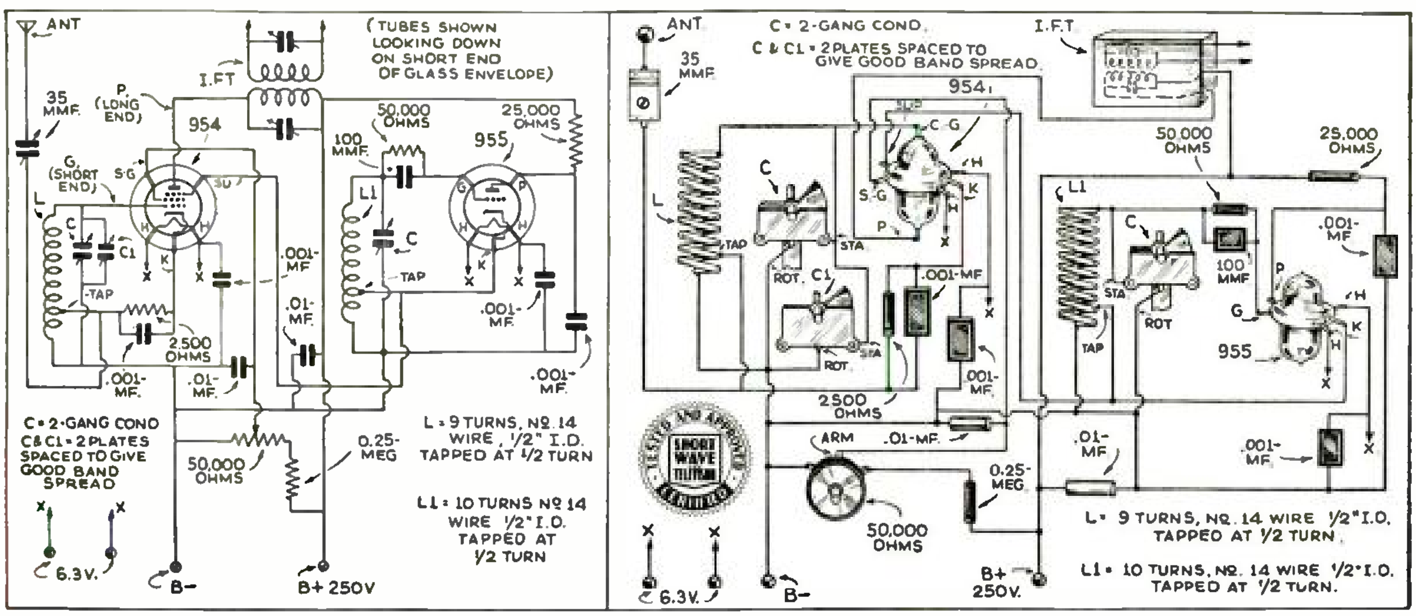
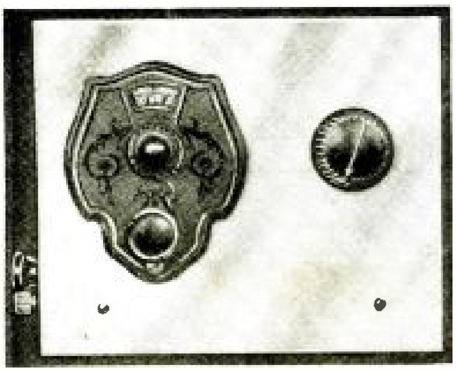


Diagram of the converter portion of the tuned I.F. superhet in which Acorn tubes are employed. This is an excellent converter and will work well with any other suitable receiver.



Front view of the "Forty-Niner"—a fine low-cost receiver for the S-W Beginner.

The "FORTY-NINER"— A Receiver for Lean Purses

By Stanley Johnson

Novel two tube set features space charge detector

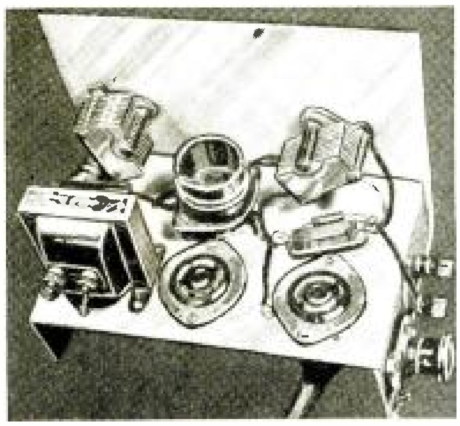
Here is a dandy receiver for the short-wave beginner. It uses two ordinary tubes and due to the circuit employed it only requires 12 volts plate potential. The "A" battery may consist of four flashlight units connected in series-parallel.

● THE cost of the *power-supply* is too seldom considered in the design of so-called "inexpensive" sets. Most simple receivers require a power supply which—whether it be a string of "B" batteries or a power pack—costs practically as much as the receiver itself! It was in an effort to reduce this power supply cost that this new short-wave receiver was designed. The compact set operates very efficiently with less than a dollar's worth of batteries furnishing the power. Although extremely simple to assemble and wire, when completed it demonstrates a "DX" getting ability which compares surprisingly well, even with that of complex superheterodynes.

49's Used As Det. and A.F. Amplifier

The receiver uses a type 49 tube as a regenerative detector transformer coupled to another 49, which serves as an audio amplifier. By the application of a *positive* potential to the inner grids of the tubes, the "space charge" is partially canceled and the tubes operate very efficiently on the twelve volt "B" supply, furnished by a handful of inexpensive flashlight batteries. A Canadian amateur, VE4EA, deserves the credit for first applying the space-idea to the type 49 tubes.

In order to avoid "inductive hum" from house wiring and to improve appearance, the set is built up on a metal chassis and panel. The 6½x7 inch metal panel was cut from a piece of scrap automobile body aluminum. It is often possible to purchase large sheets of this metal from junk dealers for a few cents. Boiling the panel for a few minutes in a strong solution of washing soda removes the paint and gives the metal a satin-like finish. If the builder desires, the 2x4½x7 inch chassis may be made from the same metal, although in order to avoid metal work the writer used one-half of a standard 2x7x9 inch cadmium-plated chassis, of the type available at most radio-supply stores at nominal cost.



Rear view of the 2-tube receiver.

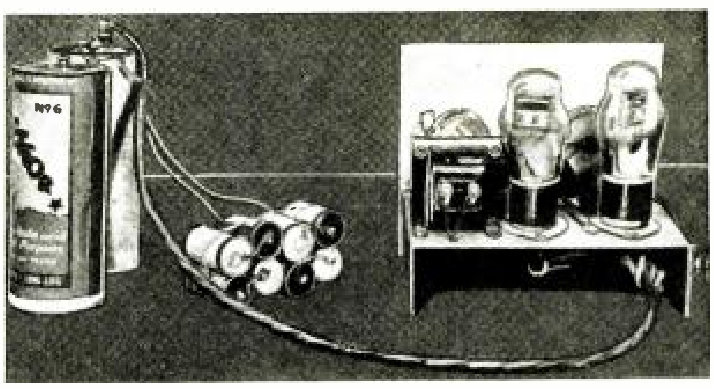
Line-up of Parts on Chassis

Looking at the photo which shows the top view of the chassis, we see the tube sockets and the audio transformer at the back of the chassis. At one end of the chassis are the *antenna trimming* condenser—fitted with a knob cemented on with china cement — and the two binding posts for headphones. The grid condenser and grid-leak, the coil socket, and the R.F. choke are also above the chassis. The two variable condensers are the only parts mounted on the panel. One serves for tuning and the other for regeneration. Most of the wiring, and two of the parts, the filament voltage-dropping resistor and the inner grid by-pass condenser, are underneath the chassis.

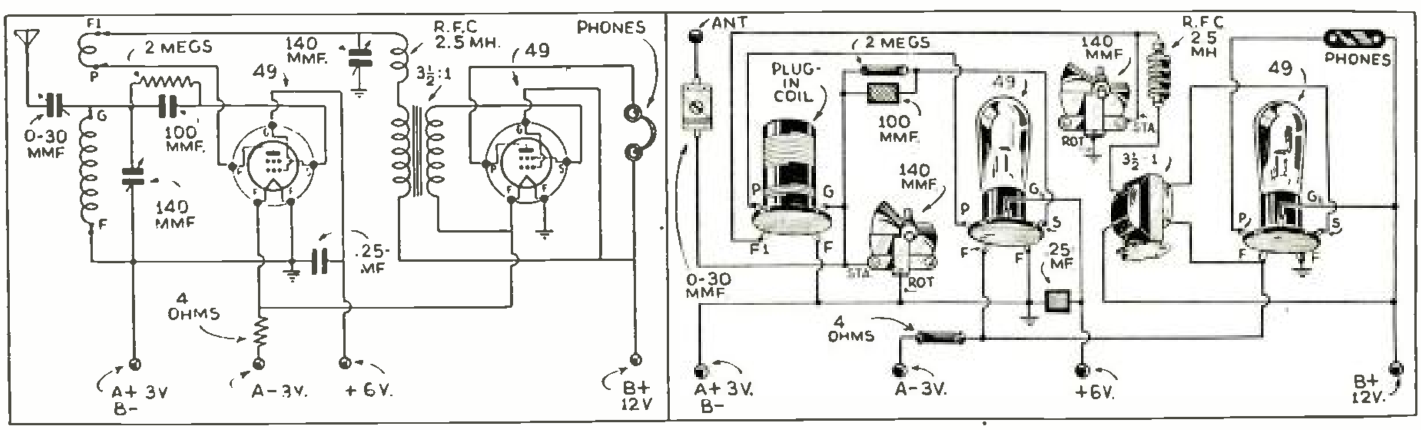
The wiring is perfectly straightforward and there is nothing about it which should cause trouble even for a novice. Of course, since this is a *short-wave* set, it is wise to observe the usual precautions: short leads, well soldered joints, all *ground* connections to a single point on the chassis.

The "B" battery consists of 8 (eight) 1½ volt flashlight batteries soldered together, with a tap at "plus six volts." These cells may be purchased from radio-supply companies for as little as 3½c each. Although the small No. 2 cells are shown in the photo, the larger No. 1 cells cost no more and have greater life. However, since the plate current drain is low, the life even with the

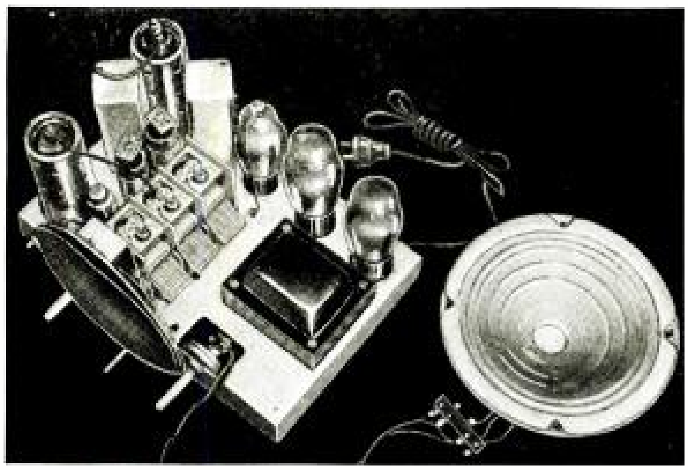
(Continued on page 561)



Complete set with batteries; Flashlight cells may be used for the "A" supply, instead of the large dry cells shown.



Wiring diagram of the Forty-Niner receiver—it uses two 49 tubes hooked up in "space-charge" style



The "Super-5"—the various bands are tuned in by means of a switch.

The "Super-5"

A Switch-Coil Type Superheterodyne

By George B. Hart

This superhet. will appeal to the short-wave "Fan" interested in receiving not only the distant short-wave broadcast stations, but the regular 200 to 550-meter broadcast stations as well. A plate supply circuit with filter is built in and five tubes are used.

● SUPERHETERODYNE short-wave receivers have unquestionably proved their superiority in short-wave reception—that is, superheterodynes that are *well designed* and use *high grade* parts. Again it is necessary for the "home-constructed" super to be designed so that actual construction will be simple enough for the neophyte to try his hand at its construction and be successful.

Primarily designed for use by the writer's wife, it was decided at the outset that the set would be simple to operate, and that it would give ample separation on all bands. For simplicity's sake then it was necessary to forego electrical bandspreading and employ the mechanical *bandspreading* facilities of a high ratio tuning dial. It was found that one of the new dials permitting a choice of 20:1 and 125:1 would be most satisfactory. In practice we have sometimes wondered if electrical bandspreading is worth the trouble.

Circuit is Orthodox

To achieve simplicity of construction a thoroughly orthodox circuit, employing a 6A7 oscillator-mixer, 6D6 as one stage of intermediate frequency, a 75 as second detector, automatic volume control and first stage of audio, driving a 42 in a conventional power audio amplifier was decided upon. An 80 supplies ample and well-filtered *direct-current* for the plates and screens.

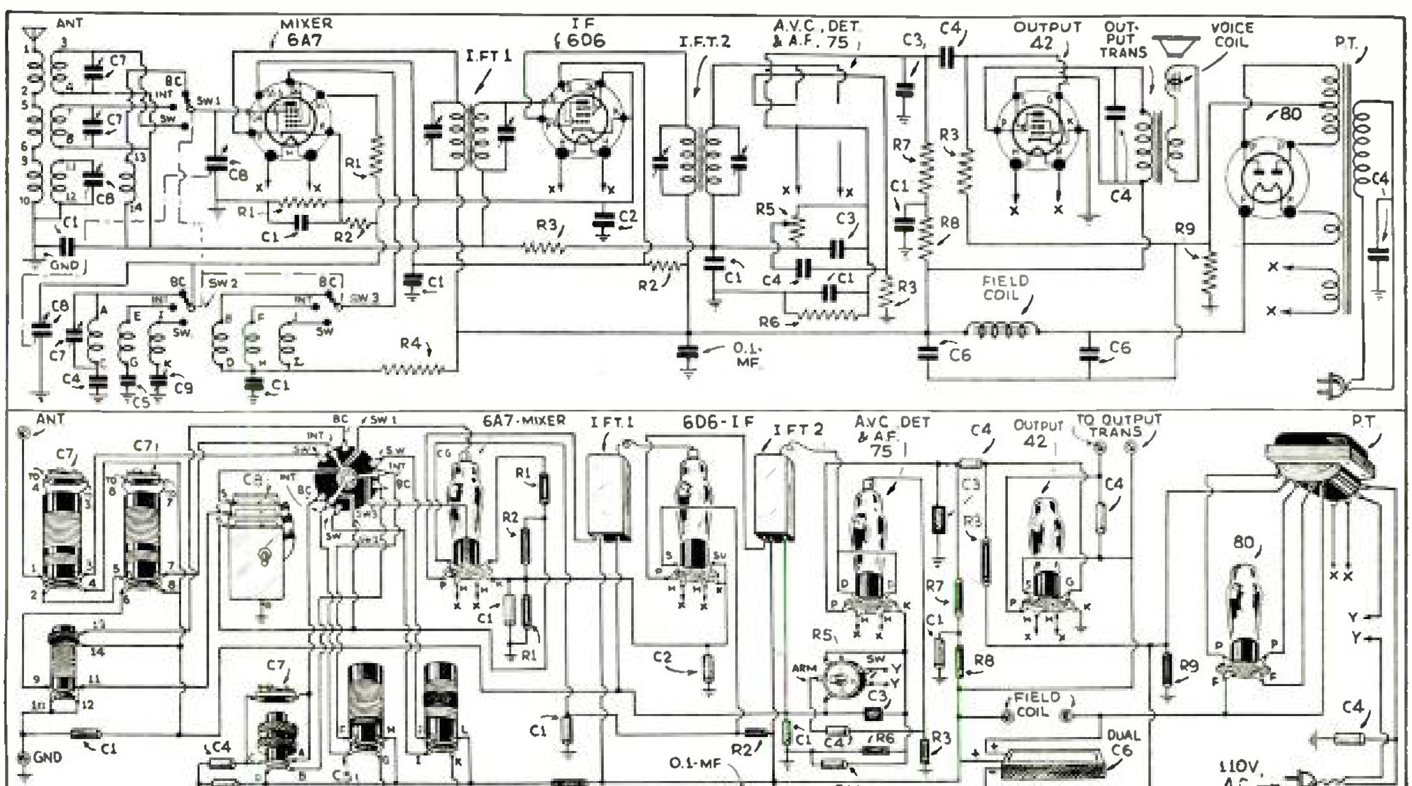
The set is the next logical step from a T.R.F. receiver of the regenerative variety and costs much less than one of the elaborate multi-tube affairs so popular—if you have the money. We wanted a better set than a T.R.F. and we did not have the price of one of the large supers, so we got the most out of the least.

Since the missus wanted the set we eliminated the *beat-frequency oscillator* at the start, but if you want one it can be easily substituted by using a 6F7 as I.F. and beat-frequency oscillator instead of the present 6D6 as I.F. alone.

Moreover, since a woman was to use the receiver, plug-in coils were "out"! The coils used were simple to build and simple to "track" once they were installed. The use of .00035 mf. variable condensers permitted the use of small coils and only three bands to cover from 17 megacycles to 540 kilocycles. This covers all the major "short-wave" broadcast and amateur bands, as well as the regular "broadcast" bands.

Set Unusually Selective

The set is unusually selective without r.f. amplification due to the use of a *pre-selector.* Although this necessitates a three-gang rather than a dual condenser, it permits of a more *selective* set since it tunes the antenna circuit to resonance. A fixed coil designed for *broadcast* operation is used here, since it was found that such an arrangement (*Continued on page* 564)

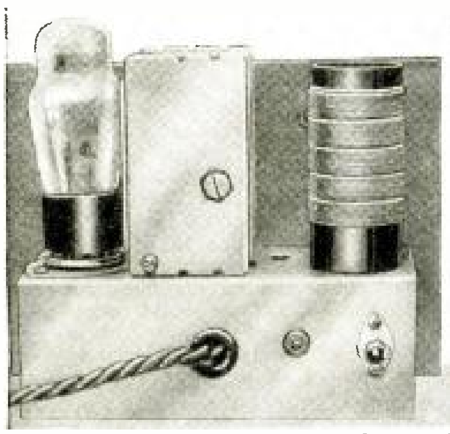


Wiring diagram for the "Super-5" receiver which is a switch-type, multi-band superhet. The major short-wave broadcast and amateur bands are covered by this set, as well as the regular broadcast band.

How to Build and Calibrate A Combined "BEAT" and "TEST" Oscillator . . .

By Harry D. Hooton, W8KPX

The accompanying article describes the constructional details for building a "beat" and "test" oscillator, including the construction of the bank-wound coil. The cost of building the oscillator is extremely small, compared with the many useful purposes it will serve.



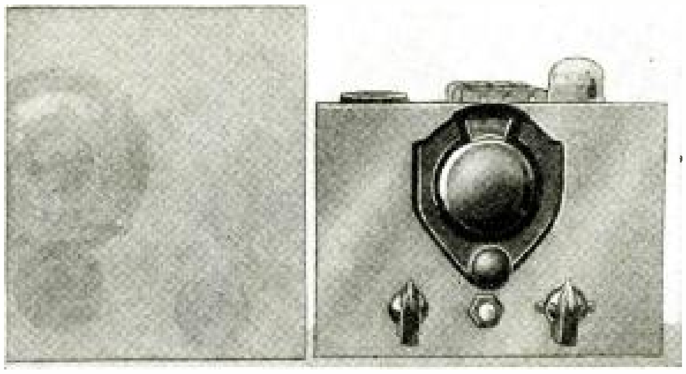
Rear view of the oscillator here described in detail by Mr. Hooton.

● WHEN making certain adjustments and tests upon short-wave receivers, especially during the *alignment* of the R.F. and I.F. circuits of short-wave superheterodynes, the use of a *calibrated signal source* is essential. There are several reasons why the signals from short-wave broadcasting stations are undesirable for this purpose: First, their *strength* varies from instant to instant, depending upon the time of day or night, the type of program being broadcast and the power of the station; second, the *frequency* of the signal required for the adjustment may be different from that of any station that can be tuned in, or the station may not be transmitting; third, the receiver may be so badly *out of adjustment* that no signals whatever can be heard.

The combined *beat-frequency and test oscillator* described in this article is designed to furnish a suitable signal for this purpose, and also to serve as a means of receiving unmodulated code signals on a standard superheterodyne receiver after the alignment process has been completed. As Fig. 1 shows, it is really a miniature broadcasting station under complete control of the operator. He can vary the frequency or intensity of the signal at will and he may modulate it or not as desired. When used with a suitable *output indicator* it is one of the most useful pieces of equipment in the test kit.

The oscillator, as shown in the photographs, is built up on a 5x7 inch panel and a 6x3x2 inch chassis, which are cut from aluminum sheeting and drilled according to Fig. 2. The four controls on the front panel, left to right, are as follows: *Beat-note pitch-control, tuning* dial and *attenuating condenser*. The "off-on" switch is located directly under the tuning dial. The stand-off insulator for connecting the output lead, the ground binding post, the battery cable and the two tip-jacks for connecting a separate modulator (if one is to be used) are at the rear of the chassis. The entire instrument, including the necessary batteries, may be placed in a shielding can or cabinet if desired.

The construction of the oscillator is extremely simple and is somewhat like that of a one-tube receiving set. The coil, L1, consists of 148 turns of No. 30 d.c.c. magnet wire wound on a 1½ inch dia. bakelite form, the winding being *bank-wound* every 20 turns; L2 is the tickler and is composed of either 27 or 41 turns of the same size wire, wound on a 1 inch form placed *inside* the coil, L1. Both coils are baked in an oven to remove any residual moisture and are then thoroughly impregnated with liquid Victron coil dope. This is extremely important and must be done or the calibration of the finished oscillator will not hold for any length of time. The two sections of the tuning condenser are connected in parallel to obtain the high capacity (.0007 mf.) necessary for a single-coil wide-range oscillator of this type.



Front view of the oscillator, here shown in use in connection with a receiver as a "beat oscillator."

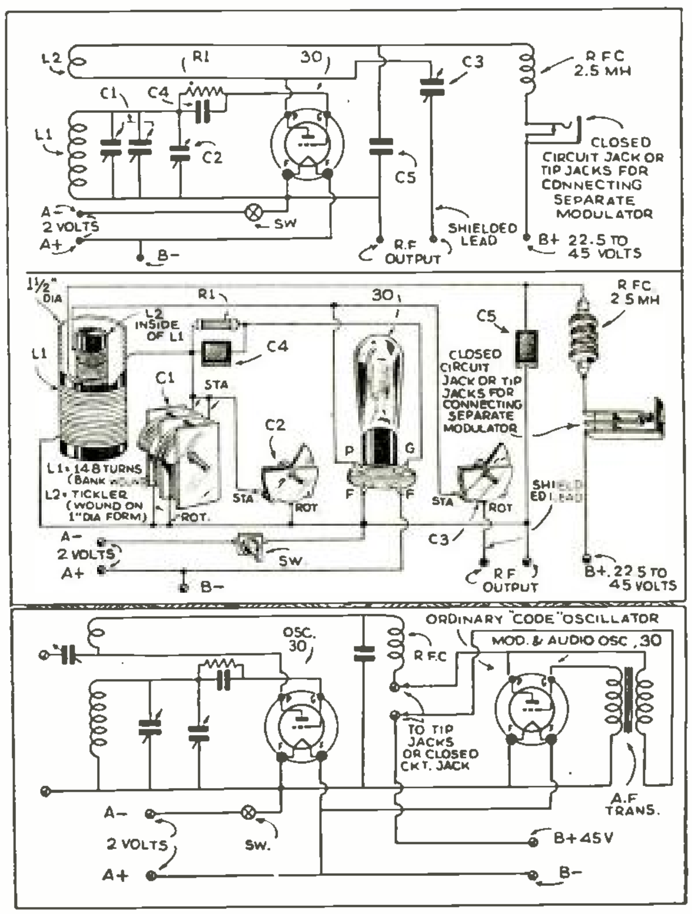
The wiring between the various parts should be short and direct and all connections must be well soldered. Tighten the nuts that fasten the tuning condenser to the chassis and seal them with a drop of solder. Use fairly heavy leads (No. 14) in all parts of the R.F. circuit, preferably solid wire, so that the *calibration will not be affected by a loose or vibrating wire!*

Calibrating the Oscillator

There are several methods by which the oscillator may be calibrated, namely the wavemeter method, the calibrated receiver method and the harmonic method. The last named is the most accurate from the average experimenter's point of view and is the one used in the actual calibration of this oscillator.

The first step in the calibration procedure is tuned in at least ten or more stations scattered over the dial of a 200-550 meter broadcast receiver (a regenerative or T.R.F. receiver is best), noting the dial settings. Now by means of a squared sheet of paper laid out as shown in Fig. 3, draw a rough calibration curve of the broadcast receiver tuning scale. If the condensers used in the receiver are of the straight-line-frequency type, the curve will be a straight line.

When the receiver has been calibrated as outlined above, we are ready to calibrate the oscilla- (*Continued on page* 580)

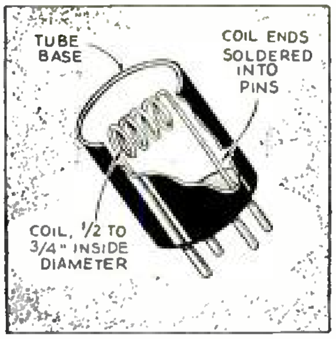


Diagrams above show all the connections of the few simple parts required to build this excellent "beat" and "test" oscillator.

$5.00 PRIZE

PLUG-IN 5-METER COIL

I am submitting the following kink which I believe will prove both economical and helpful. I remove the glass from a burned out tube and then employ it as a 5-meter plug-in coil. I wrap wire around any round object about ½ to ¾ inch in diameter,

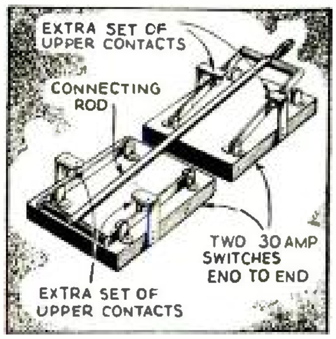


placing the end of the wire in the prong. This is best used with transmitters.—Albert Neubauer.

▼ ▼ ▼

CLEVER SWITCH IDEA

The following kink has proved helpful in my transmitter and equipment at my amateur station. This has been found exceptionally valuable in switching a number of circuits. A 2-position, 4-pole, 30 ampere switch is made by placing two 30 ampere switches end to end and connecting the

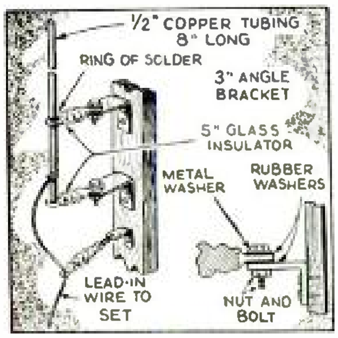


handle with a rod. This requires but little space. Two sets of extra contacts are necessary.—Francis Rose, W7ENH.

▼ ▼ ▼

ANTENNA MOUNTING

While trying to find a good way to insulate my 5-meter antenna, I hit upon the idea of using glass insulators. Two 3-inch angle brackets are used and are spaced about 20 in. apart. Two glass insulators are then fastened to the bracket by means of machine screws which have a



number of rubber washers cut from an inner tube. The ½ in. copper tubing may be too large to pass through the holes of the insulators; if such is the case, they should be filed to enable the tubing to pass through it. To prevent the tubing from sliding through the insulators a ring of solder should be placed above the top insulator.—Charles Zak.

▼ ▼ ▼

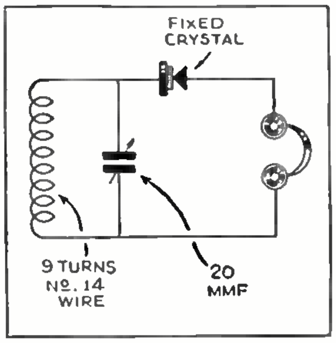
PHONE MONITOR

While operating my tranceiver I wanted to know the type of signal I put out, and therefore decided to use the circuit described herewith.

For 5 meters the coil should be about 9 turns of No. 14 wire. When operating this unit it should be placed in the vicinity of the antenna. In some cases it might prove advantageous to use an antenna about 10 inches long. Needless to say, this monitor will operate only on phone signals.—Homer Ross.

$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.



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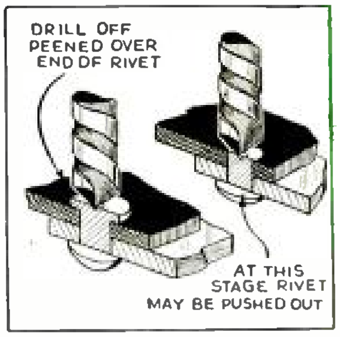
RIVET REMOVER

Occasionally I have found it necessary to remove some tightly riveted bakelite condenser bases from the chassis. In order to accomplish this feat without scratching or marring either the bakelite or the frame, I used this kink to advantage. Select a drill that has a metal-cutting bit with a diameter slightly larger than that of the rivet. Place the cutting end squarely on the hole in the rivet and carefully shave the rivet down to the frame. The rivet may then be easily removed as the illustration shows.—Jack Miller.



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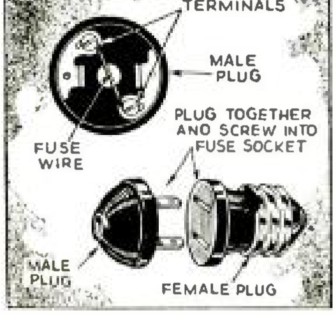
FUSE KINK

Because of the many fuses which are constantly blowing in my "lab.", I had to devise a new and more economical method of replacing one that was burned out. By taking the lamp cord out of a male plug and inserting a piece of fuse wire between the two terminals, we have a perfect fuse. Insert the male plug into the female plug and screw this into your fuse socket.—Julius Kotke.



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HIGH-SPEED SCREW-DRIVER

This is the kink I use for experimental work on my radio. After drilling holes in the chassis or panel, I use a screw driver to tighten the screws. A set of all-sized screw drivers is very handy and cuts your time in half.—Howard Clauges.

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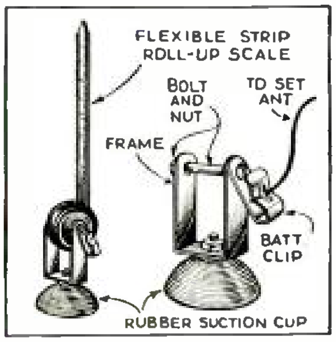
PORTABLE ANTENNA

Perhaps this kink isn't exactly a new wrinkle, but it is still a good idea. This is a portable antenna constructed of flexible steel rule. When not in use, it can be



rolled up into a light, inconspicuous bundle. This is a particularly attractive feature for portable sets used out of doors. The drawing will illustrate the idea and its adaptability.—Ralph Scott.

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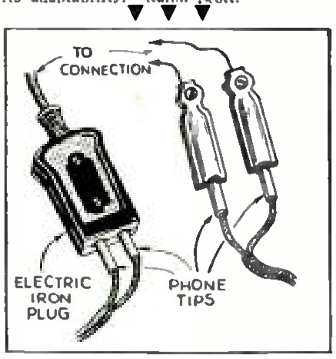


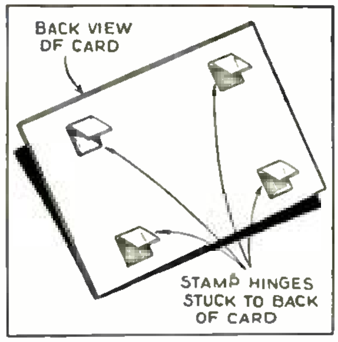
ELECTRIC IRON IDEA

I am submitting a wrinkle which has served me very satisfactorily. When I have a temporary connection to make to some part that hasn't any phone tip jacks, I use an ordinary electric iron plug. If these should happen to be too large, I use the clips from the plug alone. The accompanying illustration clearly shows just how this is worked out.—August Elias.

▼ ▼ ▼

MOUNTING VERI CARDS

A good way to mount verification cards is to use stamp hinges that philatelist's use, for mounting stamps. Fold these hinges in two, as shown in sketch, with half to card and half to wall. Use four hinges for each card. This has an advantage over other ways in that it saves walls from tack holes, prevents mutilation of cards, and saves time in removing the cards from the wall.—Jerry Tomoal.



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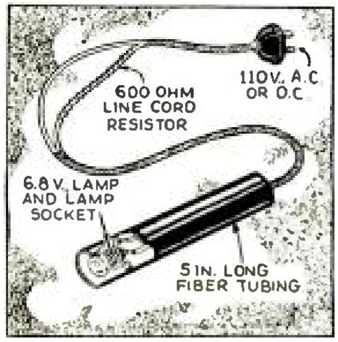
HANDY LIGHT

I hope some of your readers will get some use out of my kink. It is very simple to construct and will prove very useful. I have been a constant reader of your kink page and have finally decided to submit one of my own. The drawing clearly shows the necessary constructional details.—Philip G. Petermann.



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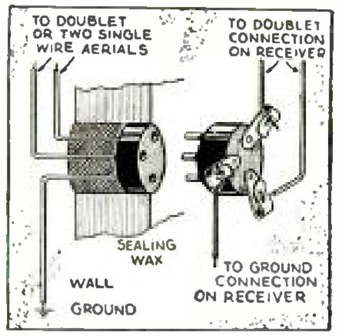
LEAD-IN PLUG

A neat and convenient antenna lead-in may be made by screwing a socket and plug from a discarded plug-in type battery. A hole is drilled into the wall the size of the socket. The socket is then made to fit flush with the wall. The leads from the back side of the socket are soldered to rubber covered wire and run through the wall. The diagram renders a better explanation of this system.—Byrum Huddleston.



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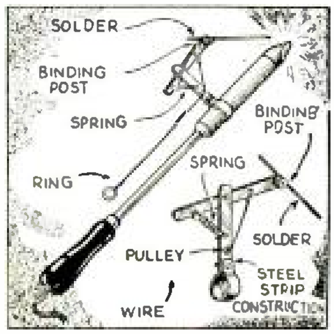
PAGE RUBE GOLDBERG!

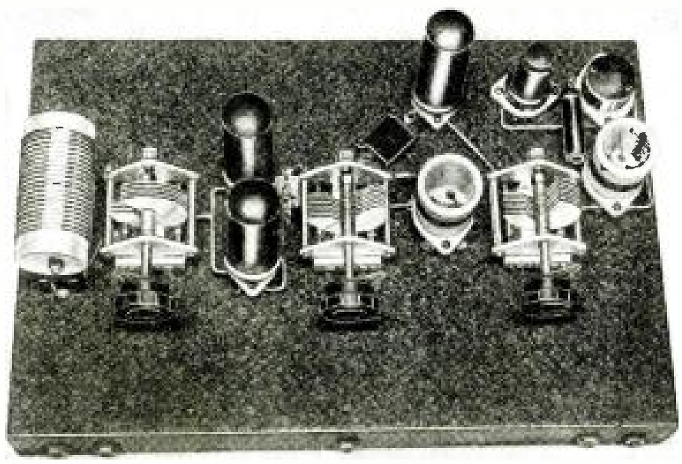
I believed that I have solved one of the biggest problems in radio. That is—what to do with the solder when you have the iron in one hand and wire in the other? When the ring is pulled the solder touches the point and is melted. It is best to use steel strip for the construction, as it doesn't conduct the heat as readily as copper or brass.—Orrin K. Bismarck.



A 1937 DESK TYPE Transmitter

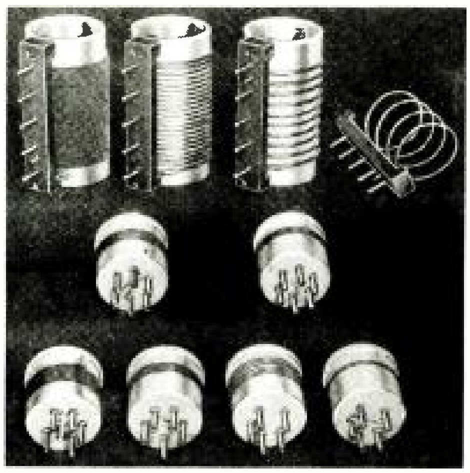
By George W. Shuart, W2AMN

This is the second installment on our "1937 Desk Type Transmitter." Herein is described in detail the portion which takes in the 80, 40, 20, and 10 meter bands. A special crystal-oscillator *multiplier* circuit is employed, in which quadrupling is possible, thus making one crystal serve for three-band operation.



Top view of the 80 to 10 meter Transmitter.

● THIS, the second installment describing our new Desk Type Transmitter, will be devoted to a description of the 80 to 10 meter unit. The first installment in the last issue described in detail the 5-meter MOPA which is used solely for operation in that band and for no other purpose. This unit is another complete transmitter which is crystal-controlled and which may be operated on any of the amateur bands from 80 down to 10 meters. The idea was to have *all-band* operation, including the 5-meter band, and the natural problems which arise almost entirely prohibit the possibility of the same transmitting unit being used for all these bands. In order to simplify matters, a separate transmitter is used for ultra-high frequency operation.



The entire coil group.

Choosing Circuits

The problem in this transmitter was choosing a suitable crystal oscillator and multiplier circuit. The conventional tritet using a 6L6 might have been employed. However, it is surprising to note the number of fractured crystals which have been the result of maladjustment in the tritet circuits. While the tritet 6L6 can be made to perform perfectly, it is a simple matter to make some wrong adjustment and thus ruin a perfectly good crystal. Many circuit combinations were tried in order to eliminate the danger of the average experimenter ruining his crystals. The one chosen and which added little complication to the general layout was the well-known les-tet circuit designed by W2AMJ. The only addition of parts over the tritet circuit are the 6C5 tritet and its socket. We feel that the extra dollar or so increase in cost is worth-while crystal insurance. With this circuit employing a 6C5 triode and a 6L6 pentode it is possible to *quadruple* with excellent results. An 80-meter crystal, for instance, can be used to operate all three bands—80, 40, and 20. While the 40-meter crystal may be employed permitting operation on 40, 20, and 10. This arrangement employing two crystals permits the choice of two frequencies on 40 and 20 meters and one on 80 for 10. The output of the 6L6 when used as a *quadrupler* is sufficient to drive the 6L6's in parallel which make up the final amplifier. Another desirable feature of this combination using the tubes shown in the diagram is that the output circuit may be tuned to the crystal frequency without the slightest sign of feed-back or instability and no external neutralizing circuits are required.

Two 6L6's Used in Parallel

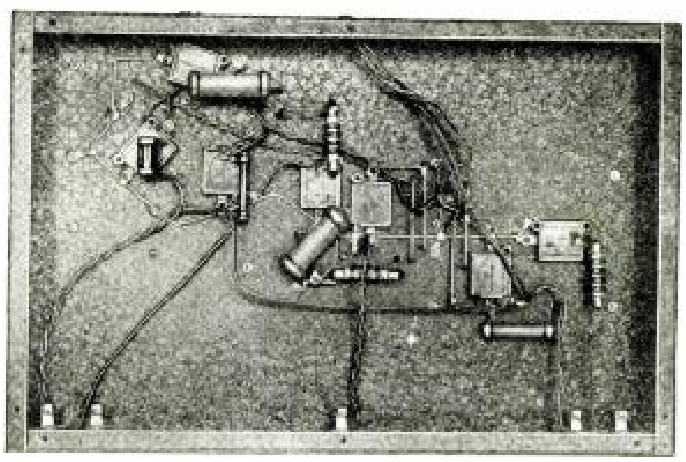
The 6L6 amplifier uses two tubes connected in parallel. Experiments have shown that this was a most satisfactory arrangement with the particular lineup which we employed. It would have been practically impossible to drive the 6L6's in *push-pull* with the single-ended output quadrupler. Down to 10 meters the parallel connection provides just as good efficiency as push-pull and, needless to say, the entire set-up is very much simplified.

The 6L6 amplifier is coupled to the multiplier stage with a 35 mmf. midget padding condenser. This, although shown variable in the diagram, was set at maximum capacity and provided the proper amount of coupling.

The first experimental tests with this transmitter were conducted with a neutralizing circuit in the final amplifier, but careful checking showed that this could be eliminated and still maintain excellent stability in the amplifier when excitation was applied to the grids. However, with the excitation removed, the 6L6 amplifier will break into oscillation, and for this reason it is recommended that all keying be done in the final amplifier, permitting the elimination of the neutralizing circuit and the necessity for a fixed bias of some kind to limit the plate current of the tubes. As a matter of precaution if one is not reasonably certain that the crystal will function at all times when the amplifier plate voltage is applied, a resistor of some 50 to 100 ohms may be incorporated in the cathode circuit of the amplifier in order to limit the plate current should the crystal fail, thus removing excitation. The entire line-up is extremely simple and very versatile. It lends itself remarkably well to rapidly changing bands, and all that is necessary is the changing of the plug-in coils. Adjustment is also very simple and even the most inexperienced can obtain excellent results by following standard tuning procedures.

425 Volts Applied to Amplifier

We have shown only 425 volts applied to the plates of the two amplifier tubes. While higher voltages may be used, this value insures longer tube life and provides ample power output. A full 40 watts is available on all bands in which this transmitter may be operated. The (*Continued on page* 562)



Bottom view, showing the method of by-passing.

Choosing the RIGHT TRANSMITTING TUBE!

—By Robert S. Kruse

How the "100 Watt" Family Clarifies the Problem

It is easy to choose between the many sorts of sending tubes, as soon as one bears in mind the simple rules which explain the sort of tube needed for each of the 9 tube-uses found in amateur transmitters.

● RULES are easy to remember when one works them out instead of just reading them. Thus it is fortunate that the tube-choosing rules needed by the radio-transmitting amateur can be worked out by simple examination of the very familiar "100 watt" family of tubes. These rules will be found to fit other sizes and sorts. The 100 watt family is the best to work from because it is our one and only complete sending-tube family, familiar from much use. It contains:

TRIODES

Low mu ....Type 845
Medium mu ....Type 211
High mu ....Type 203A
Very high mu..............Types 838 and 805
H. F. Oscillator ....Type 852

TETRODES

Low voltage ....Type 850
High voltage ....Type 860

PENTODES

Med. voltage ....Type 803

If we can arrive at a simple way of knowing which of these 9 tubes to use for our 9 amateur uses, other makes and types of tubes will not make us any trouble in the future. Let us see if we can. But let us first try to understand what is meant by a "100 watt" tube, and how one can tell whether a maker or seller is over-rating his tubes.

Is the Tube Over-rated?

More than half the tubes in the foregoing list use the same bulb and base, and all but one of them use a 32.5 watt filament. The one overgrown member of the 100 watt family (type 803 pentode) not only has a wider bulb, but uses a 50-watt filament and naturally can produce a very large "100 watts." However do not try to gauge proper output rating by means of filament wattage. If any guessing is necessary it is better to figure that for the "100 watt" size each filament watt justifies not especially more than 6 milliamperes of plate current when the tube is used as a class C amplifier, or as an oscillator. For smaller tubes 8 ma. is generally all right, while for really big air-cooled tubes one had better stick to smaller currents. (Water coolers are a different story because they use plain tungsten filaments.)

If the filament is big enough, the vacuum very hard, and the plate sufficiently rugged one may sometimes "rate up" a tube provided the bulb is of some hard glass such as pyrex, or the like. Few makers do it though. Generally the size of the tube is a pretty good indication of its proper class.

How Fast to Burn Them Up!

Now it is sometimes good economy to burn up a number of small tubes instead of a single larger one. Thus an 852 is properly a "100 watt" tube, and a pair of them are properly a 200 watt stage—but it would be cheaper to overload the pair than to use a single 831 if we happened to need a 250 watt phone carrier—because the 831 costs EIGHT TIMES AS MUCH as a pair of 852 tubes.

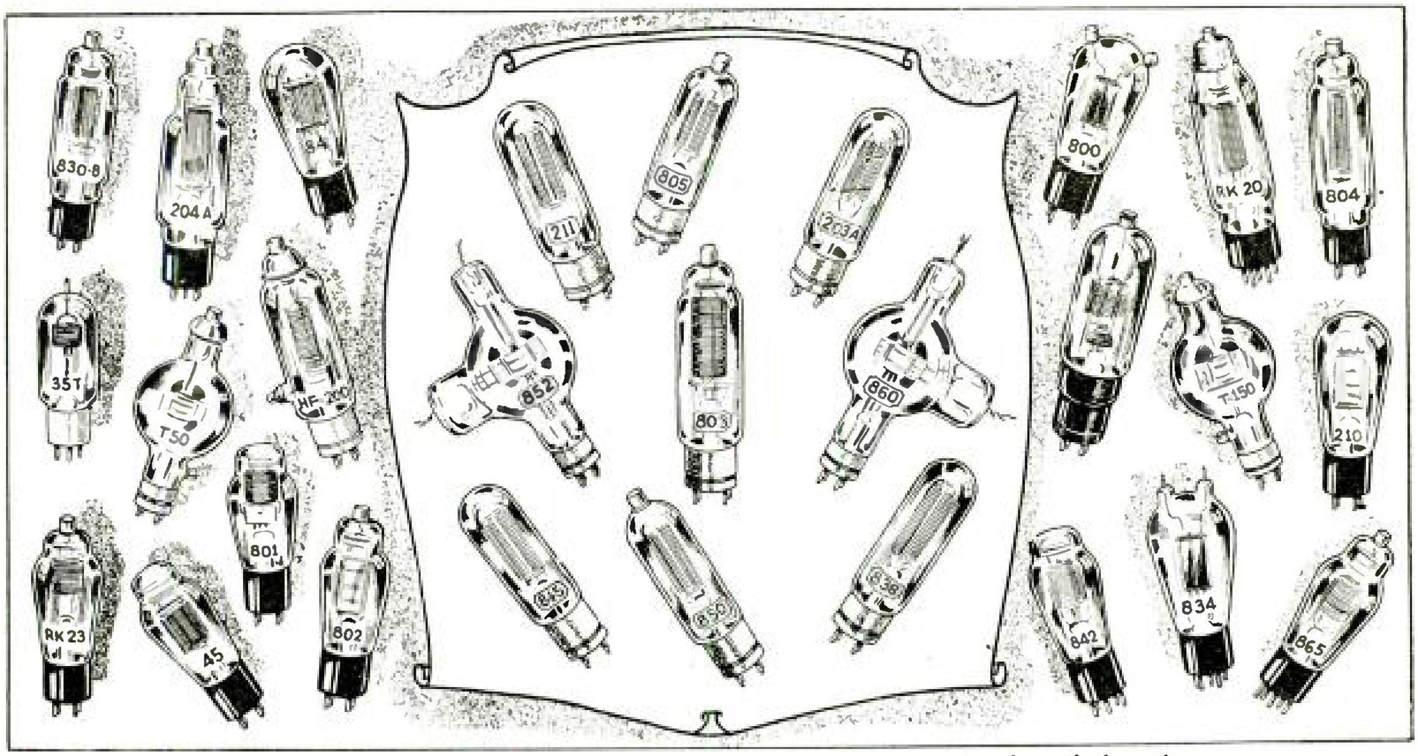
But we are getting into economics instead of tube types. Let's turn back and begin with the first tube-use—class A audio.

1—Class A Audio Tubes

The Class A audio tube of the 100 watt family is the 845 triode. Let us see why. This tube has a grid with very few wires which are widely spaced from each other and the filament. The electrons going from filament to plate pass easily through such a grid unless we make the grid "minus" by a great many volts. In fact if no bias is used the plate current will be over half an ampere at 1250 volts, immediately destroying the tube. We therefore use a bias of 210 "minus volts" to push the plate current down to 52 milliamperes. We can then swing the plate current momentarily to either higher or lower values by swinging the grid voltage which is, of course, done by supplying audio input to the grid. The plate current swings which result are the audio output.

Almost without knowing it we have found what a good class A audio tube is like. *The Class A tube must have an open mesh grid so as to have a low mu. Unfortunately it will always need a lot of grid bias but it requires practically no audio power input at all; almost any receiving tube can drive it.* How-

(Continued on page 581)



The "100 Watt RCA family" in the center group teaches the rules for all the others

SHORT WAVE . . SCOUTS

THIRTY-FOURTH TROPHY

Presented to
SHORT WAVE SCOUT
PIERRE PORTMANN
47-20 48th Street
Woodside, L.I., N.Y.

For his contribution toward the advancement of the art of Radio by

SHORT WAVE TELEVISION
Magazine

34th TROPHY WINNER

64 Stations—59 Foreign

● THE 34th Trophy is awarded to Pierre Portmann, of 47-20 48th St., Woodside, L.I., N.Y.

Mr. Portmann was the only contestant this month and easily walked off with the Trophy. His total of 64 verifications all came within the rules of the contest.

The receiver used by Mr. Portmann was a National AC. SW3, used with a home-made power supply and an amplifier using a pair of 45's connected to a dynamic loud-speaker. The antenna was a 108 foot flat-top with a 35 foot lead-in, consisting of a "twisted pair."

Mr. Portmann claims he had a little difficulty in obtaining these verifications, but after consistent effort was finally successful. He advises others who aspire to win this Trophy to "stick to their guns," even if it requires two or three letters to obtain a veri card. It may cost a few dollars, this writing more than once to a station, but the Trophy is surely worth it. All who have seen it have proclaimed it a masterpiece.

The list of short-wave stations heard follows.

● 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 & TELEVISION. 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
None this month

List of Stations Heard by Mr. Portmann

Call Freq. Name of Station and Location

YV2RC, 5800 kc., "Radio Caracas," Caracas, Venezuela.
HVJ, 15110 kc., "Laudetur Jesus Christus," Vatican City.
JVN, 1066 kc., Tokio, Japan.
JVP, 7510 kc., Tokio, Japan.
VK3LR, 9580 kc., Lyndhurst, Australia.
YV8RB, 5900 kc., "La Voz del Lara," Barquisimeto, Venezuela.
HRP1, 6330 kc., "El Eco de Honduras," San Pedro Sula, Honduras.
TG2X, 5940 kc., "La Voz de la Policia Nacional, Guatemala C., Gua.
YV5RMO, 5850 kc., "La Voz de Maracaibo, Maracaibo, Venezuela.
HC2JSB, 7854 kc., Guayaquil, Ecuador.
HP5B, 6030 kc., "La Voz de Panama," Panama City, Panama.
TIGPH, 5830 kc., "Alam Tica," San Jose, Costa Rica.
2RO-1, 6085 kc., Rome, Italy.
2RO-3, 9635 kc., Rome, Italy.

(Continued on page 568)

Trophy Contest Entry Rules

● THE rules for entries in the SHORT WAVE SCOUT Trophy Contest have been amended and 50 per cent of your list of stations submitted must be "foreign." The trophy will be awarded to the SHORT WAVE SCOUT who has logged the greatest number of short-wave stations during any 30 day period; (he must have at least 50 percent "foreign" stations). This period need not be for the immediate month preceding the closing date. The complete list of rules appeared in the September 1935 issue.

In the event of a tie between two or more contestants, each logging the same number of stations (each accompanied by the required minimum of 50 percent "foreign") the judges will award a similar trophy to each contestant so tying. Each list of stations heard and submitted in the contest must be sworn to before a Notary Public and testify to the fact that the list of stations heard were "logged" over a given 30 day period, that reception was verified and that the contestant personally listened to the station announcements as given in the list.

Only commercial "phone," Experimental or Broadcast stations should be entered in your list, no "amateur transmitter" or "commercial code" stations. This contest will close every month on the 25th day of the month, by which time all entries must be in the editors' hands in New York City. Entries received after this date will be held over for the next month's contest. The next contest will close in New York City December 24th; any entries received after that date will be held over till the next month.

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 percent of his "veries" 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!

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.

When sending in entries, note the following few simple instructions: Type your list, or write in ink, **penciled 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 owner; the expense to be borne by **SHORT WAVE & TELEVISION** magazine.

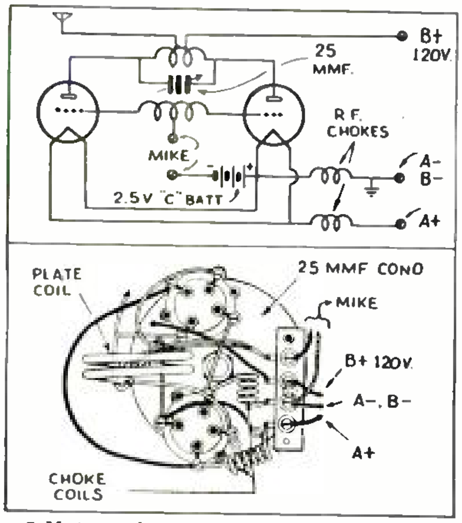
In order to have uniformity of the entries, when writing or typing your list, observe the following routine: USE A SINGLE LINE FOR EACH STATION; type or write the entries IN THE FOLLOWING ORDER: Station call letters; frequency station transmitts at; schedule of transmission if known (all time should 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. State total No. stations.**

WORLD-WIDE SHORT-WAVE REVIEW

—Edited By C. W. PALMER

A Portable 5-Meter Phone Transmitter

● IN THE latest issue of *Toute la Radio* (Paris) a tiny portable 5-meter station was described, including a one-tube modu-



5-Meter phone transmitter with grid modulation.

lated oscillator and a super-regenerative receiver.

The transmitter is of interest, because of its extreme simplicity and the circuit of this device is shown here. It uses two triode tubes connected in a tuned-plate circuit, with modulation introduced directly in the grid circuit.

Tuning is accomplished by means of a split-stator condenser of 25 mmf. capacity. The plate supply which is obtained from "B" batteries is fed through the plate inductance which is provided with adjustable taps for the purpose. The filament circuits are isolated by means of low-resistance chokes in each lead.

The appearance of the complete transmitter is of interest because of the unique method of construction. The condensers which tune the plate coils are fitted with a small circular insulated panel at the end, upon which the tube sockets and coils are mounted. The photo shows how tiny the entire assembly is thus made.

● 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 whenever 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.

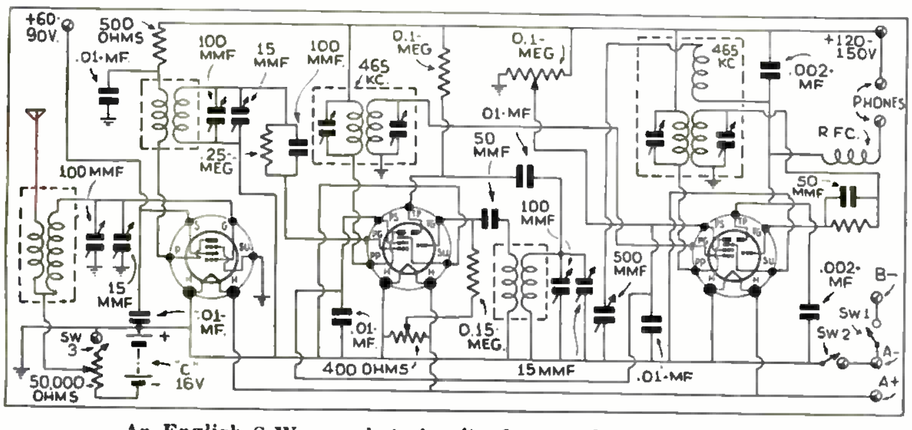
A Low Noise-Level S.W. Superhet

● A NOVEL application of an I.F. transformer designed for one operation and used for an entirely different purpose, is the principle of this superhet, which appeared recently in *Television and Short-Wave World* (London).

The set consists of an R.F. stage, a frequency converter using a tube similar to the 6F7 and a second tube of the same type connected as I.F. amplifier (pentode) and second detector (triode). The second I.F. transformer is one of the type designed for variable selectivity work, having a third winding which is ordinarily shunted by a variable resistor, so that the mutual coupling between the other coils can be reduced by a "losser" method. This third or losser winding is connected in the plate circuit of the second detector, as a regeneration coil, thus increasing tremendously the gain in the I.F. amplifier of the set.

This application of regeneration in the second detector is the secret of the low noise-level of the set. Since the number of tubes is kept at a minimum and the gain is concentrated in the regenerative I.F. amplifier, the operation of this simple little set should be unusually fine.

The tuning in this set is accomplished by two sets of ganged condensers—one is a 100 mmf. unit which adjusts the band and the other is a 15 mmf. condenser which operates as a band-spread tuner. The values of the parts are indicated on the circuit, for those experimenters who might wish to try it.



An English S-W superhet circuit of reputed low noise-level.

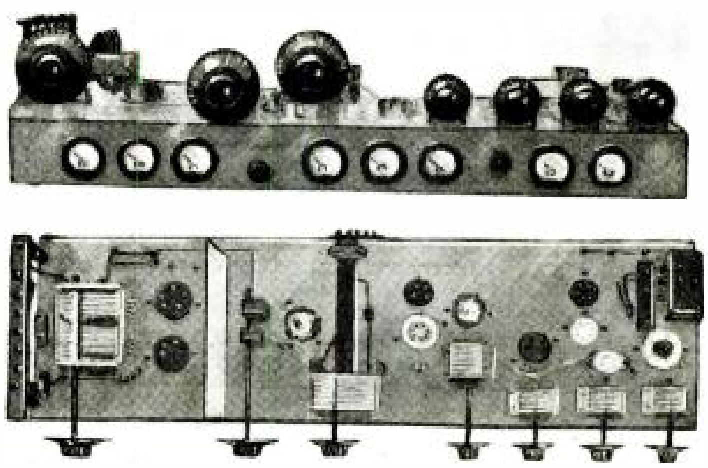
Experimental Transmitter Layout

● THE "ham" has one thing in common with the short-wave B.C.L.—that is, he is never satisfied with the rig but is continually making changes in an effort to make it better. This continual change from one circuit to another can be greatly facilitated by using some form of breadboard layout, as most of the "gang" has found after making a few such changes.

A very convenient method of facilitating changes in parts and circuits was illustrated recently in the *T. & R. Bulletin* (London). As shown in the photos here, it consists of a low panel on which the control meters which are required for any rig, regardless of what it may be (if it is to be made to work right) are mounted; individual meters being used for the various amplifier and oscillator plate current, bias and output circuits (as far as possible—depending on the thickness of the pocket-book).

The other parts, condensers, coils, transformers, resistors, etc., are mounted on flat metal panels which are bolted to the chassis frame. These flat subpanels are less expensive than the usual box chassis and they are easier to work on.

Also, they allow free access to the parts, wires, etc., which is a very desirable factor.



A good plan for laying out experimental transmitters—the meters are all mounted on the front of an extra deep sub-panel.

Short-Wave Line Filter

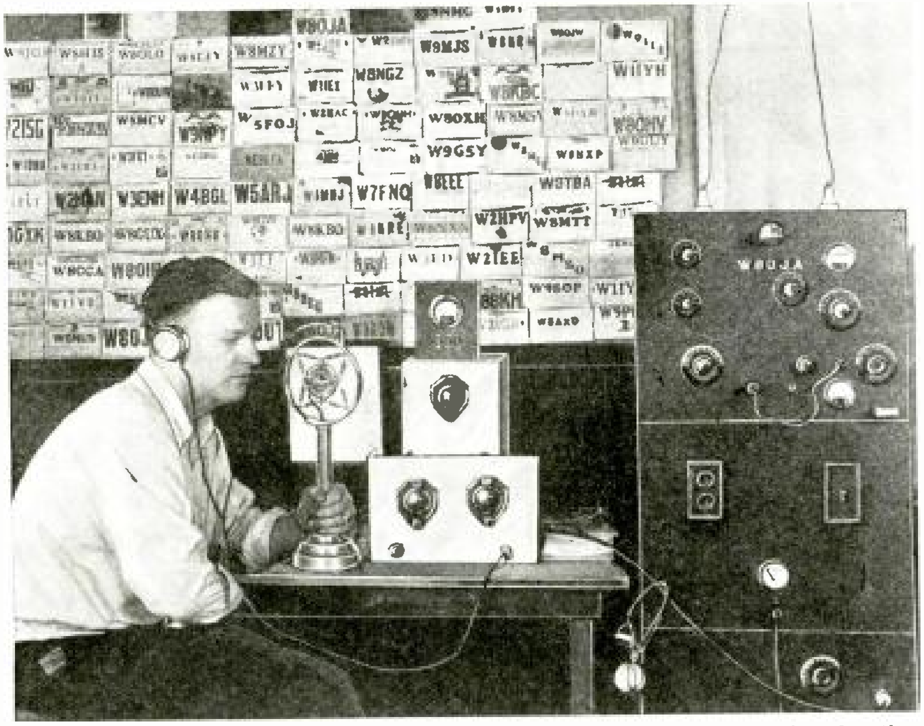
● IN the operation of short-wave receivers which cover the band from 10 to 200 meters, using the A.C. power lines to supply the plate and filament current, trouble is often experienced in eliminating the interference and noises which are picked up from these lines and carried through the receiver.

A recent issue of *Funkmagazin* (Vienna)

(*Continued on page 578*)

SHORT WAVES and • • • LONG RAVES
Our Readers Forum.

W8OJA, Arnold, Pa., Wins Prize This Month



Yowser! A pip of a "Ham" station—and some results! It is operated under the licensed call W8OJA, by Joseph Daylida, of 1416 3rd Ave., Arnold, Pa.

Editor, SHORT WAVE & TELEVISION:

Herewith I am enclosing a photo of my shack with the hope that you will find it acceptable for your page, *Short Waves and Long Raves*. My transmitter is xtal-controlled, using a 59 tritet, a 46 buffer doubler, and 46's in the final amplifier. This was constructed partially from the article by Jerrold A. Swank, W8HXR on his low-powered de luxe transmitter.

The receiver is built from a design which appeared in *Short Wave Craft* about three years ago. This employs a 56 as detector and a 56 as audio. My mike is a double-button type. The "rig" operates on 80 meters C.W. The monitor, which can be seen in the rear of the photograph, is also a product of *Short Wave Craft* designs.

I find *Short Wave & Television* very valuable for DX'ing. I've worked all U.S. districts and almost all Canadian on 80 meters, using a 2-tube receiver. My shack is known as the "Home of Aluminum," as I have printed my QSL cards on foil-backed paper.

JOSEPH DAYLIDA, W8OJA,
1416-3rd Ave.,
Arnold, Pa.

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

Closing date for each contest—75 days preceding date of issue; Dec. 15 for March 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.

(Nice going, Joe, and we certainly are proud to publish this photo of your "shack" in Short Wave & Television. We are flattered and pleased to note that you have made such good use of our constructional articles. Here's hoping you'll find that subscription which we are awarding you for your entry on this page of continued enlightenment and interest. Those QSL's certainly look like business above your FB equipment. As for you other "Hams," why not take a lesson from W8OJA and send in that photo of your "rig"!—Editor.)

He Built 4 "S.W.C." Sets and Likes 'Em!

Editor, SHORT WAVE & TELEVISION:

I am one of the many who can truthfully say that they got started in short-wave radio by reading *Short Wave Craft*. Last year in June, I came across a copy of the April, 1935 issue, and immediately became interested in the *Short Waves and Long Raves* column with photos of the different amateur stations. I made up my mind to someday become one of them.

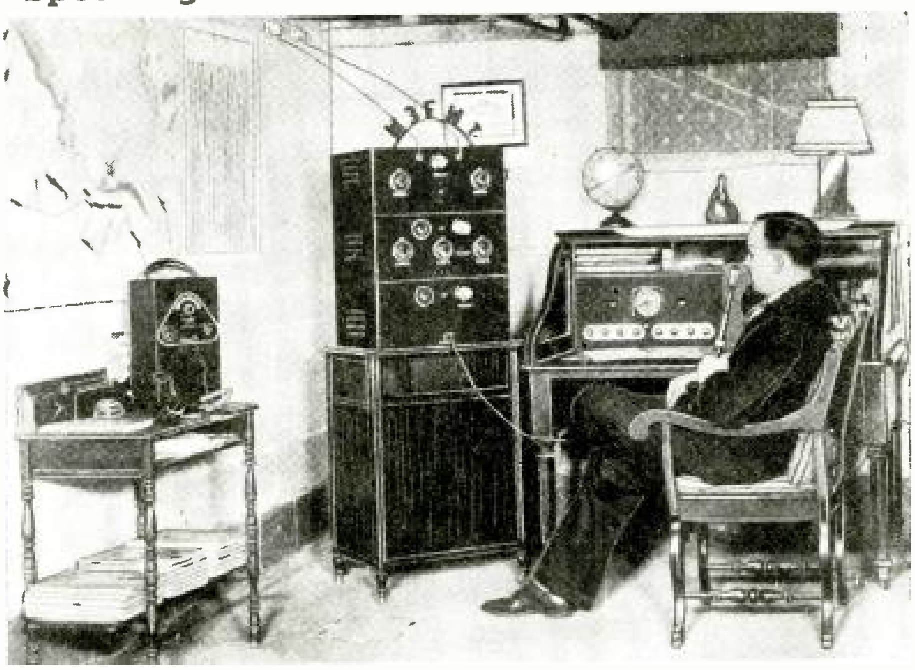
I've built four receivers described in *Short Wave Craft*—among them the original "2-tube Doerle" with which I've obtained excellent results. In June, 1936 I became a member of the *Short Wave League*. In August of 1936, I took the "exam." for the Amateur License and received the call W2KBZ.

By the time I was 14 (Feb. 1936), I was able to copy 10 W.P.M. However, I didn't take the exam. because of inadequate technical background. When I went down, I was stung with the new speed of 13 W.P.M., which I passed easily. The fellows who were sitting back waiting for the S.W.L. to have the code test abolished below 6 meters, should go down before the speed is increased to 15 W.P.M.

I like the *Editorials*, the *Question Box*, and the *Short Waves and Long Raves* departments the best. Right now I'm saving up for my 1937 subscription money for *Short Wave & Television*.

Bernard Bailey, W2KBZ,
16 West 117th St.
New York, N.Y.

Speaking of DeLuxe "Ham" Stations, Lookit!



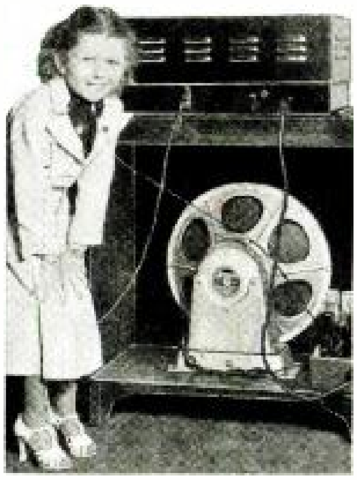
Down in Clarendon, Va., we find this deluxe amateur station, W3FWT. It is owned and operated by Gordon O. Stone. This crackerjack shack "sports" an RCA model ACT-40 transmitter, an RCA ACR-175 receiver, and last but not least—an RCA model ATR-19 Transceiver, which may be observed on the table at the left.

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.

Masterpiece V Has 20 Tubes and 2150 to 5 Meter Range

New custom-built 20-tube, all-wave set has special 18-inch dual cone speaker system reproducing sounds up to 9,000 cycles. 30 watt beam power amplifier incorporated, also beat oscillator, phono. and mike jack, and built-in "volume expander."



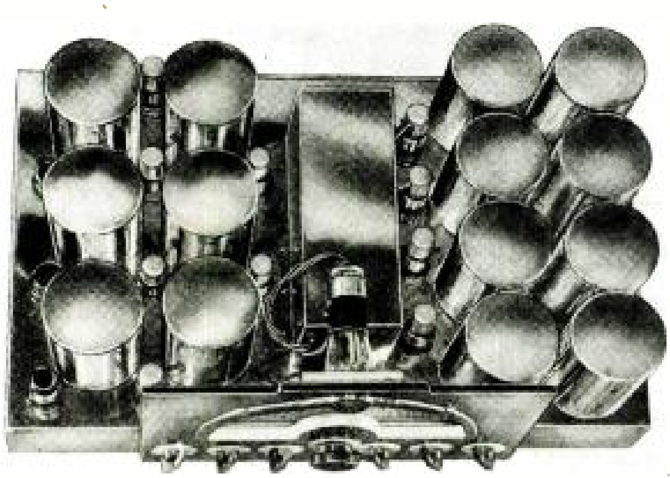
The 20-tube Masterpiece V, showing the giant 18" speaker. Betty Titus stands less than 4 feet tall.

● TWENTY tubes, when properly used in a well-engineered radio receiver, will result in super-fine DX reception, together with high-quality reproduction. Any up-to-date superhet receiver should have pre-amplification ahead of the first detector and the new Masterpiece V. designed by McMurdo Silver, has two tuned stages of pre-amplification.

Thanks to the careful engineering design followed in laying out this receiver, all internal noise has been reduced to a minimum and the stations, even the DX ones, roll in without the usual "steaming" background noise frequently heard in the average receiver, especially when the station is a very distant one or happens to be of low power. The electrical sensitivity of the Masterpiece V is stated by its makers to be one-half a microvolt absolute or greater from 140 to 18,000 kc., and 5.0 microvolt or better from 18,000 to 50,000 kc., where less sensitivity is needed for essentially medium distance reception of the new ultra-high fidelity 10 to 7.5 meter broadcast stations and 5-meter amateurs.

Wavelength range: This new receiver has an exceptional wavelength coverage and the European as well as the American broadcast spectrum are covered (2150 down to 10 meters) and this set works on down to the 5-meter amateur and television wavelengths, so that the entire new broadcast band now opened between 7.5 and 10 meters is covered.

The range of the audio amplifier and loudspeaker system in this new custom-built set is 20 to 9,000 cycles.



Looking down on the chassis of the new 20-tube all-wave receiver

Note the extra large 9" tuning dial provided on the Masterpiece V. The huge 44 lb., 18-inch dual speaker is mounted behind the grill in the lower cabinet.

Seventeen of the twenty tubes used are of the new metal type, while the two rectifiers and the "Magic Eye" tube are of the glass type. Individual top cap shields are provided for the grid caps at the top of each metal screen-grid tube.

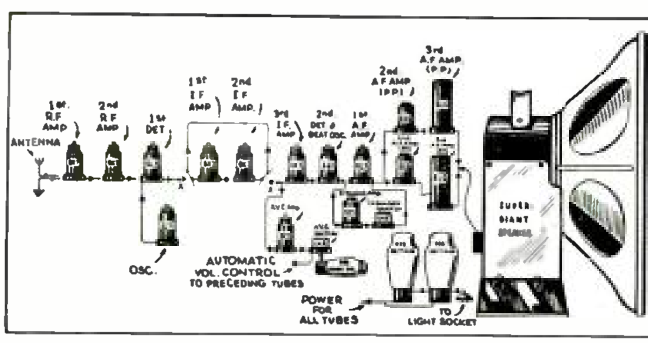
A new feature is a band-pass selectivity switch, which enables the operator to switch the set over for the complete fundamental musical tone range of 4,000 cycles or else to admit the full 9,000 cycle high-fidelity range without the usual *sloping off* at the extremes of these ranges, which frequently muffle and deaden the tone quality. In other words, true rectangular band-pass selectivity is attained in any degree of selectivity.

A newly developed *volume expander* is built into this set so as to restore to the all-musical programs their full original volume range and tonal expression. When receiving very weak stations this part of the circuit acts so as to reduce noise to a remarkable degree, thus enabling the reception of stations so weak as to be lost in the *local noise* on the average radio receiver.

The dial is 9" in diameter and all 5 wavelength scales are accurately calibrated in large easily-readable figures. The dial is fitted with a knife edge pointer thus eliminating the parallax reading error found on many dials. The dial is colored so as to differentiate its scales and reduce eye-strain.

A single tuning knob provided with a *free-wheeling* feature is provided; in operation the single large tuning knob moves the dial pointer at a 10 to 1 ratio as far as desired, and when turning it in the opposite direction it provides a 50 to 1 ratio for *one knob turn*, when the 10 to 1 ratio is automatically resumed.

(*Continued on page* 578)

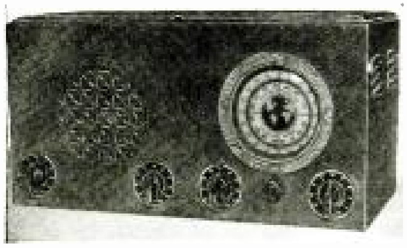


This diagram shows schematically the purpose of each of the 20 tubes used in the new Masterpiece V. (No. 586)

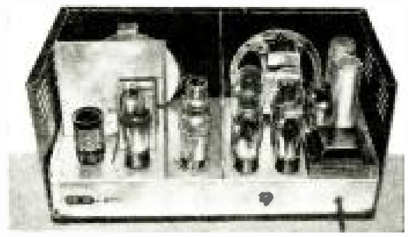
Names and addresses of manufacturers of apparatus on this and following pages furnished upon receipt of postcard request; mention No. of article.

The RX-17–A 7-Tube "Band-Spread" Receiver

By Guy Stokely, E.E.



Front view of the RX-17 receiver. (No. 587)



A rear view of the 7-tube receiver

● ONE of the latest additions to the Eilen line of short-wave apparatus is the model RX-17, a powerful, sensitive, and highly selective 7 tube bandspread receiver. Designed for the short-wave "fan" or the transmitting amateur who wishes a highly dependable communications type receiver, this model is proving to be extremely satisfactory.

Up-to-date in every detail, covering 8½ to 3,000 meters, using tuned radio frequency, electron coupling in the oscillator, a powerful high-fidelity audio system, bandspread tuning, special multi-colored illuminated airplane dial, smooth acting controls, and finally a controllable electron-tube noise suppressor for the elimination of certain types of noises, this model possesses those features found in only the finest of receivers.

The importance of the latter feature cannot be emphasized too much. On the average short-wave receiver, the background noise-level becomes very annoying when the listener tries to tune in very weak signals. The result is that literally dozens of those far-away stations are missed entirely by the average "fan." The newly developed *noise-suppressor system* as applied in the RX-17 overcomes this difficulty to a large extent by means of the electrical system R2-R3-R14-C1. The effectiveness of this arrangement is astonishing.

Examining the circuit diagram we find that this new set uses two 6D6, two 6J5G, one 76, one 42, and one 5Y3 hi-gain tubes as *tuned R.F.* amplifier, *tuned* electron-coupled regenerative detector, powerful 3 stage resistance-capacity coupled audio amplifier with a power-pentode output-stage delivering 3 watts of audio power to the built-in dynamic loudspeaker. Also there is a full-wave rectifier and a complete built-in hum-free power-supply.

Connections are provided for the use of either a single-wire antenna and ground combination or the use of a doublet antenna. An automatic head-phone jack allows the use of phones when desired. The latter feature is of some importance to the "fan" who wishes to operate his set late at night without disturbing the other members of the family. When the phones are plugged in, the speaker is automatically cut-off.

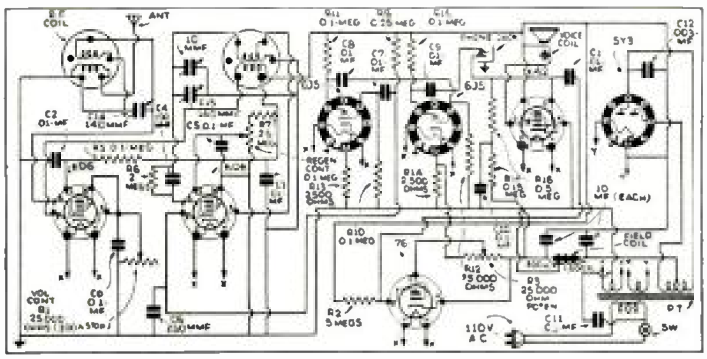
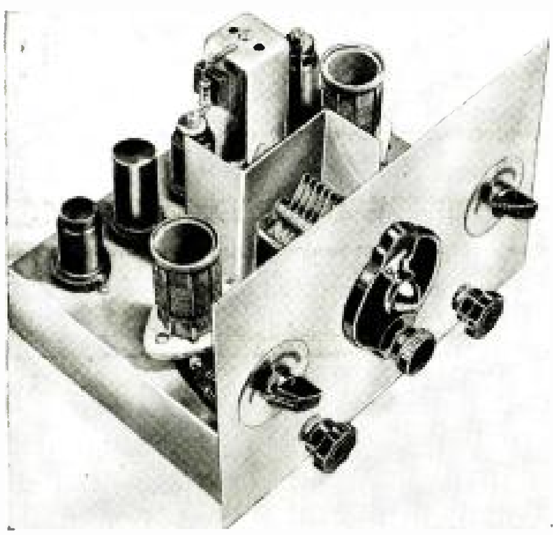


Diagram of the interesting RX-17, 7-tube receiver.

Ample shielding, a careful arrangement of parts and the use of electron-coupling results in a sensitivity and selectivity undreamed of by the average "fan." The use of interchangeable coils, well-known for their high electrical efficiency, low losses and convenience, is to a large extent responsible for the remarkable results obtainable. A thorough test of this model has demonstrated its capabilities for consist-

(*Continued on page* 577)

4-Metal Tube "Super-Gainer"



● IN spite of all the engineering that has been done, and all the multi-tube supers developed, it is not only possible, but practical to get six or seven tube results from only three or four tubes. It isn't necessary to make each tube perform only one distinct function, for there are available tubes which have been developed to handle two and even three jobs when correctly employed.

The newest version of the Super-Gainer is presented here for those who want good all-around performance, with a minimum of tubes, and not too much expense.

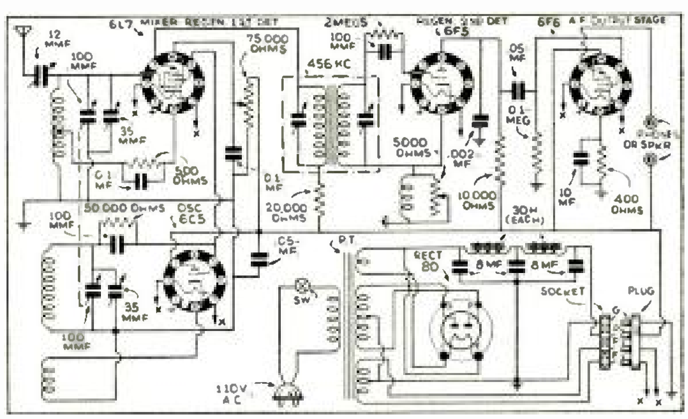
Only four tubes are used; a 6L7 as a mixer-regenerative first detector, a 6F5 as a regenerative second detector, a 6C5 oscillator, and a 6F6 pentode output stage. The regenerative first detector is extremely sensitive and tunes quite sharply, actually giving results that closely approximate those obtained by a straight mixer-detector, preceded hy a stage of preselection. Antenna coupling to this stage is accomplished by a very small variable condenser. This method allows sufficient de-coupling so that regeneration is still obtained in the first detector, even when a rather long antenna is used.

It is quite obvious that results are going to suffer if the oscillator stage is subject to frequency drift or wabble. Elimination of these two annoyances is handled very simply by using the modified Hartley, or electron-coupled oscillator. This circuit provides an unusually high degree of frequency stability, and signal drift is held to an absolute minimum.

The second detector in this case is quite a versatile stage. Here a single 6F5 performs the functions of three tubes; it operates as a conventional second detector, the use of regeneration lends additional amplification to the signal much the same as an I.F. stage, and regeneration also makes it possible to receive CW signals without the necessity of a beat oscilllator. Thus, the functions of an I.F. stage, beat oscillator, and second detector are all taken care of with but one tube, eliminating a lot of miscellaneous parts and yet retaining a degree of simplicity in keeping with the rest of the receiver.

Plenty of signal strength is provided by the 6F6 pentode output tube. In fact, it is possible to operate a small dynamic or magnetic speaker with fair volume on strong signals.

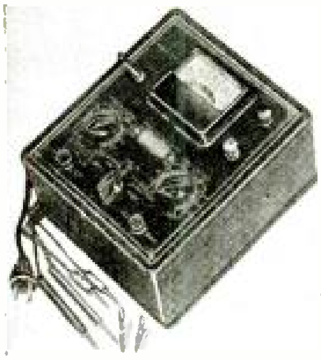
Construction of this receiver is remarkably simple. If one prefers to make his own chassis base from blank electralloy or aluminum, the dimensions given in the instructions may be followed. Or if preferred a punched and drilled electralloy base is available that has (*Continued on page* 577)



Hookup of the "Super-Gainer" which uses 4 metal tubes. (No. 588)

Names and addresses of manufacturers of apparatus on this and following pages furnished upon receipt of postcard request; mention No. of article.

NEW APPARATUS FOR THE "HAM"



Condenser tester, H75.

I.F. transformer, H76.

CONDENSER ANALYZER, H75

● WORKING on radio apparatus without adequate testing equipment is tantamount to working in the dark. With this thought in mind, the new Triplett condenser tester was designed. Complete tests of all radio condensers from .0001 to 10 microfarads—for breakdown, opens, shorts, leakages and capacity—are made with the Triplett Master Condenser Tester. Results of all tests are read directly on the dial.

Open circuited condensers and those having high-resistance leakages can be determined with every possible certainty. A.C. and D.C. voltages are available for breakdown tests up to 1,000 volts in steps of 2, 20, 60, 200, 600, and 1,000. The instrument pointer indicates infinitesimal leakages instantly.

For the capacity test, accuracy is maintained by a line voltage regulator with unique shadow-type indicator. Ranges of the instrument are: Scale A—.1 to 10mf.; Scale B—.01 to .6mf.; Scale C—.0001 to .05 mf. There is also a GOOD-BAD scale for electrolytics.

NEW I.F. TRANSFORMER, H76

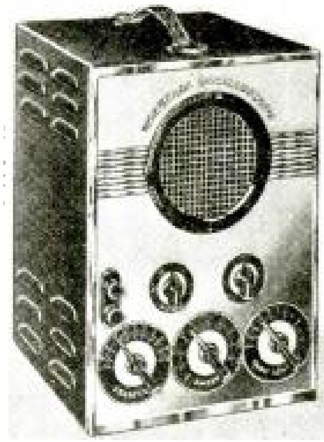
● THE photograph shows the new Meissner Ferrocart I.F. Transformer, which employs new specially designed trimming condensers, which were previously described in this department, and the new "iron core" principle. These are available in frequencies up to 3,000 kc., and are claimed to produce tremendous gain with excellent selectivity.

NEW OSCILLOSCOPE, H77

● THE oscilloscope shown in the photo makes use of a new Neon beam tube. The image is reflected on a revolving mirror so as to sweep it horizontally along the line of vision. This sweep is controlled by a variable-speed motor unit calibrated in R.P.M. The sensitivity of the instrument is extremely good; one microvolt input is sufficient to produce full-scale deflection of the image on the 4-inch calibrated screen. The entire unit measures 8¾"x10"x13" and weighes 25 pounds. The photograph shows its general appearance.

IMPROVED CONDENSER, H78

● A NEW midget condenser suitable for short wave transmitting and receiving apparatus has recently been announced by the Bud Radio. The photograph clearly shows the general construction of this instrument and among its features are Isolantite insulation, highly polished brass material given a special new treatment, which enables the condensers to retain their brightness over an indefinite period of time. The rear bearing, as can be seen from the photograph, is a heavy close-fitted collar to insure perfect shaft alignment, accompanied by a special spring which forms a constant contact on the shaft, insuring quiet operation and low contact resistance.



Oscilloscope, H77.

Improved condenser, H78.

A DIRECT-READING Modulation Percentage Meter

By F. E. Wenger

Above—Model 1295 Modulation Monitor.

● MODULATION of transmitters is probably the most misused term in the language of radio amateurs. In the past, operators of most phone stations have depended upon the ear, variation in the antenna ammeter, or the pickup loop with a light bulb to determine *carrier shift* and *modulation percentage*.

It is a commonly accepted fact that the human ear is insensitive to determine quantity or quality in the change of sound. The antenna ammeter and the loop and light method are equally unreliable.

Operators of voice transmitting stations have reason for being interested in a modulation monitor that will permit them to accurately determine modulation of their transmitters. In the first place, a transmitter not properly modulated wastes a percentage of the power generated by the oscillator. The amount of power lost is in direct proportion to the percent under 100 at which the transmitter is modulated. Very few operators are certain of the percentage of modulation of their transmitters, or how much distortion is present, and if so, whether or not it has to do with the audio or radio frequency end of the transmitter.

The newly designed Triplett Modulation Monitor overcomes the objections applying to modulation by observing variation of the antenna ammeter, or by the loop and light method. It indicates directly on the dial the percentage of modulation from 40 to 120. All readings are in full-wave peaks.

In addition to the modulation scale, there is a carrier meter that indicates the carrier reference level at which the monitor is to operate; and which, secondly, shows any carrier shift during modulation (an indication of inequalities in the positive and negative peaks).

The Model 1295 Modulation Monitor is factory calibrated and no further calibrations are needed. The Type 76 tube can be changed without affecting the calibration of the instrument.

There are no complicated connections, nor checking procedure, in operation of the *modulation monitor*. It is necessary only to connect the line cord to the A. C. line, throw the "OFF-ON" switch to the "ON" position; connect "GND" post to the ground, and *(Continued on page 587)*

IN THE NEXT ISSUE:

Every "Ham" should read the article by George Shuart, W2AMN, in the February issue describing a new 10 and 20 meter, medium-power transmitter of latest design and using the *newest* tubes!

* * *

The short wave "Fan" will find plenty of interesting articles in the February issue—among them simple receiver designs which can be easily constructed at nominal cost.

* * *

Part 3 of W2AMN's "1937 Desk Type Transmitter" will appear.

* * *

Television and Short-Wave News will be presented in our usual concise manner, with plenty of pictures and diagrams wherever necessary.

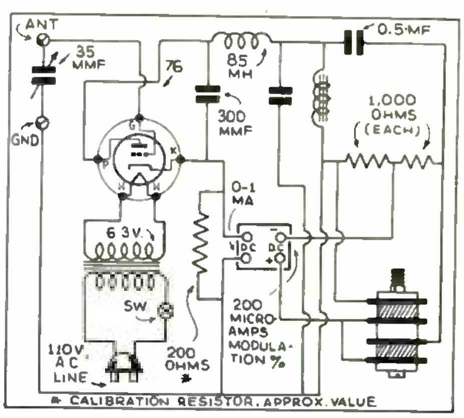


Diagram of the Modulation Monitor (593)

THE RADIO AMATEUR

Conducted by Geo. W. Shuart

Tubes of New Design for the Amateur

● MOST of our readers are familiar with the now famous 6L6 *beam* tube which gave excellent results at frequencies as high as 60 megacycles, despite the fact that it was not designed for that particular purpose. The new RCA 807 is especially designed for radio frequency operation and follows closely the outstanding features of the 6L6. Its elements are arranged in much the same manner as the 6L6, employing the new *beam* principle. However, they are enclosed in a glass envelope and provided with an isolantite base. To further improve the efficiency and internal shielding, the plate lead is brought out to a cap at the top of the envelope. Two of these tubes in a push-pull Class "C" amplifier are capable of delivering better than 50 watts, and with the addition of proper *shielding* can be put to all of the uses described in this magazine, wherein the 6L6 metal tube was employed.

It would seem that the *shielding* is a very important part in the operation of this tube in order to obtain full advantage of the *beam* principle; that is, shielding between the tube and other pieces of apparatus such as the coils.

The technical data for this new 807 tube, as provided by the manufacturer, is given in the following table for several classifications and should be followed within fairly close limits for long tube life.

The amateur experimenter interested in high-frequency transmission, will find the tubes herein described exceptionally valuable. They are the result of the natural trend of manufacturers toward increasing operating efficiency at frequencies of 14 megacycles and higher.

TRANSMITTING BEAM POWER R-F AMPLIFIER RCA-807 (PRELIMINARY DATA)

HEATER VOLTAGE (A.C. or D.C.)	6.3 Volts
HEATER CURRENT	0.9 Ampere
MUTUAL CONDUCTANCE, For plate cur. of 72 ma.	6000 Micromhos
DIRECT INTERELECTRODE CAPACITANCES:	
Grid-Plate (With external shielding)	0.2 max. mmf.
Input	11.6 mmf.
Output	5.6 mmf.
MAXIMUM OVERALL LENGTH	5¾"
MAXIMUM DIAMETER	2 1/16"
BULB	ST-16
CAP	Small Metal
BASE	Medium 5-Pin, Ceramic

MAXIMUM RATINGS
A-F POWER-AMPLIFIER AND MODULATOR
Class AB_1

D-C Plate Voltage	400 max. Volts
D-C Screen Voltage	300 max. Volts
Max.-Signal D-C Plate Current*	100 max. Milliamperes
Max.-Signal D-C Plate Input*	40 max. Watts
Plate Dissipation*	21 max. Watts
Screen Dissipation*	3.5 max. Watts

*Averaged over any audio-frequency cycle.

R-F POWER AMPLIFIER—CLASS B TELEPHONY
(Carrier conditions per tube for use with a max. modulation factor of 1.0)

D-C Plate Voltage	400 max. Volts
D-C Screen Voltage	300 max. Volts
D-C Plate Current	80 max. Milliamperes
Plate Input	32 max. Watts
Plate Dissipation	21 max. Watts
Screen Dissipation	2 max. Watts

PLATE-MODULATED R-F POWER AMPLIFIER—Class C Telephony
(Carrier conditions per tube for use with a max. modulation factor of 1.0)

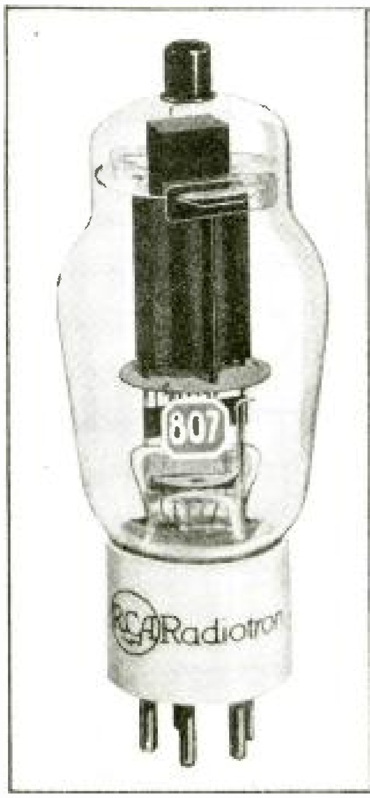
D-C Plate Voltage	325 max. Volts
D-C Screen Voltage	250 max. Volts
D-C Grid Voltage	−200 max. Volts
D-C Plate Current	83 max. Milliamperes
D-C Grid Current	5 max. Milliamperes
Plate Input	27 max. Watts
Plate Dissipation	14 max. Watts
Screen Dissipation	2 max. Watts

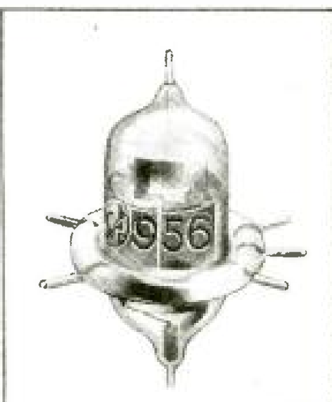
R-F POWER AMPLIFIER AND OSCILLATOR —Class C Telegraphy
Key-down conditions per tube without modulation*

D-C Plate Voltage	400 max. Volts
D-C Screen Voltage	300 max. Volts
D-C Grid Voltage	−200 max. Volts
D-C Plate Current	100 max. Milliamperes
D-C Grid Current	5 max. Milliamperes
Plate Input	40 max. Watts
Plate Dissipation	21 max. Watta
Screen Dissipation	3.5 max. Watts

Typical Operation:

Heater Voltage	6.3	6.3	Volts
D-C Plate Voltage	300	400	Volts
D-C Screen Voltage	250	250	Volts
D-C Grid Voltage	−50	−50	Volts
Peak R-F Grid Voltage	80	80	Volts
D-C Plate Current	95	95	Milliamperes
D-C Screen Current	10	9	Milliamperes
D-C Grid Current (Approx.)	3	2.5	Milliamperes



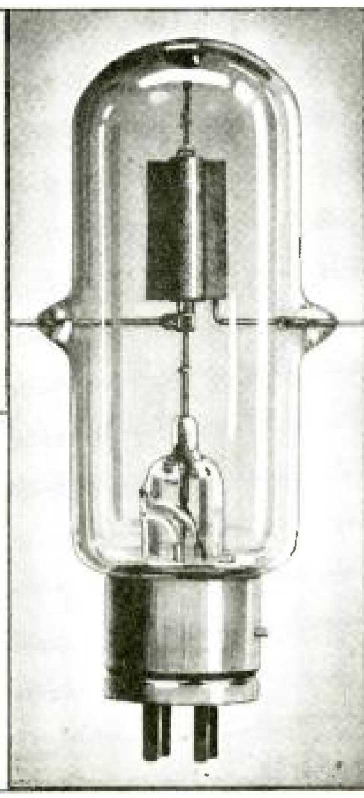


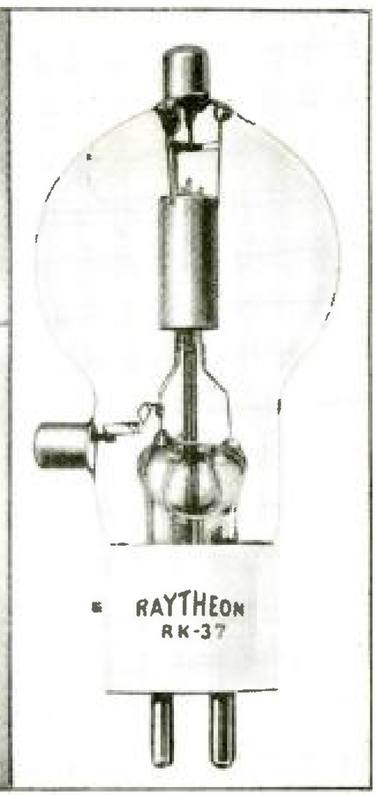
Left—The new 807 beam type pentode, designed especially for radio frequency service.

Above—The 956 variable mu Acorn pentode, designed for ultra-high frequency applications, especially in R.F. and I.F. amplifiers.

Right—The 154 Gammatron, a new ultra-high frequency transmitting triode, designed particularly for high-efficiency operation.

Extreme right—The RK-37 is also designed for ultra-high frequency operation as an oscillator or amplifier where high efficiency is desired.





Names and addresses of manufacturers of apparatus on this and following pages furnished upon receipt of postcard request; mention No. of article.

Driving Power (Approx.)	0.2	0.2 Watts
Power Output (Approx.)	17.5	25 Watts

*Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

956 Acorn Tube

An addition has been made to the family of Acorn tubes in the form of a super-control R.F. pentode. To make the picture clearer, this tube may be likened to the type 58, while the type 954 previously described in this magazine and well-known to our readers, is similar to the type 57. The use of this type tube permits the control of *gain* in an amplifier by varying the grid bias and is suitable for AVC circuits, greatly eliminating the danger of overload and cross-modulation.

This tube should take the place of the 954 in R.F. amplifiers which require a super-controlled R.F. pentode. The complete technical data is given in the following table.

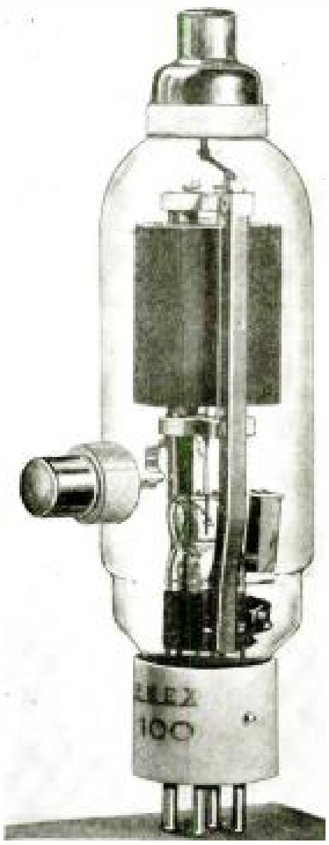
TENTATIVE CHARACTERISTICS (956)

Heater Voltage (A.C. or D.C.)	6.3 Volts
Heater Current	0.15 Ampere
Plate Voltage	250 max. Volts
Screen Voltage	100 max. Volts
Grid Voltage (Minimum)	−3 Volts
Suppressor	Connected to cathode at socket
Plate Current	5.5 Milliamperes
Screen Current	1.8 Milliamperes
Plate Resistance	0.8 Megohm
Amplification Factor	1440
Mutual Conductance	1800 Micromhos
Mutual Conductance (at −45 volts bias)	2 Micromhos
Grid-Plate Capacitance (With shield-baffle)	0.007 max. mmf.
Input Capacitance	2.7 mmf.
Output Capacitance	3.5 mmf.
Bulb	T-4½

154 Gammatron

The type 154 Gammatron represents for the amateur a tube of the medium voltage variety and is capable of functioning in a number of roles. This tube will operate at frequencies in

New High Frequency Tubes



the order of 60 megacycles with remarkably high efficiency.

As pointed out by the manufacturers, two of these tubes in a radio telegraph transmitter operating at 1,000 volts on the plate, should supply approximately 300 watts and in telephone service with the same voltage 250 watts may be obtained.

Referring to the following technical data supplied by the manufacturer, the reader will obtain a clear idea of just what can be done with this new tube.

154 Gammatron

	Plate Voltage	*Power Output*
Audio—Class A (single tube)	500 volts	3.5 watts
	750 volts	9. watts
	1000 volts	13.5 watts
	1250 volts	15.5 watts
Audio—Class A (2 Tubes push-pull)	500 volts	7. watts
	750 volts	20. watts
	1000 volts	35. watts
	1250 volts	40. watts

← New high frequency tube of interest to every amateur. Note the side cap terminal; both caps are of the heat-radiating type.

	Plate Voltage	*Power Output*
Audio—Class B (2 tubes) (Peak driving power 10 watts)	750 volts	150 watts
	1000 volts	200 watts
	1250 volts	225 watts
	1500 volts	250 watts

	Plate Voltage	*Carrier Power Output*
Radio—Class B (single tube) (Driving power 5 watts)	750 volts	18 watts
	1000 volts	25 watts
	1250 volts	26 watts
	1500 volts	28 watts

	Plate Voltage	*Carrier Power Output*
Radio—Class C (single tube) (Driving power 10-15 watts)	750 volts	85 watts
	1000 volts	125 watts
	1250 volts	165 watts
	1500 volts	200 watts

(*Continued on page* 584)

A High-Gain Single-Tube Phase Inverter

TO operate two tubes in push-pull, it is necessary to furnish the grids of these tubes with signal voltages that are equal in magnitude and 180 degrees out of phase. Practically, this requirement is satisfied when the single-voltage output of a second detector or a-f amplifier is converted into two voltages of proper magnitude and phase by means of either a suitable transformer or a resistance-capacitance network. The resistance-coupled arrangement, called a phase inverter, is often preferable for reasons of economy.

Phase inverters may be divided into two kinds: (1) those requiring two tubes and (2) those requiring only one tube for proper phase inversion. A disadvantage of the two-tube type is the relatively high circuit cost. The disadvantage of the usual single-tube type is the loss in gain due to degeneration in the cathode circuit; in some instances, it is necessary to compensate for this loss by an additional stage of amplification. The single-tube phase inverter described is non-degenerative and is capable of driving two 6F6's or 6L6's to rated Class A output.

The circuit of the proposed phase inverter is given here. The secondary of the i-f transformer feeds the diode (D_1) of a 6H6 to supply audio voltage; the primary of the transformer feeds the diode (D_2) to supply a.v.c. voltage. The audio voltage that appears across R_2 is fed to the grid of a 6F5 through a coupling condenser (C_2). The output of the 6F5 appears across resistors R_5 and R_6. Because the potentials of points (e) and (f) are equal in magnitude and opposite in polarity with respect to ground, the output tubes operate in push-pull.

In order that the a-c voltages across R_5 and R_6 will be equal in magnitude and 180 degrees out of phase, the capacitance across R_5 must be equal to that across R_6. This requirement places restrictions on the assembly and the physical size of the components. Condenser C_3 should be physically small and should be mounted as far from large grounded objects as space permits. R_1, R_2, R_3, C_1, and C_2 should be mounted close to the sockets of the 6H6 and the output tubes and to the volume control (R_4); it may be necessary to extend the shaft of the volume control in order that it be placed in the most desirable location. The lead to the cap of the 6F5 should not be shielded.

R_1 and R_3 are filter resistors. They serve to minimize the r-f voltage that can appear across the volume control and to reduce the effects of capacitance from point (a) or (b) to ground. If point

(*Continued on page* 586)

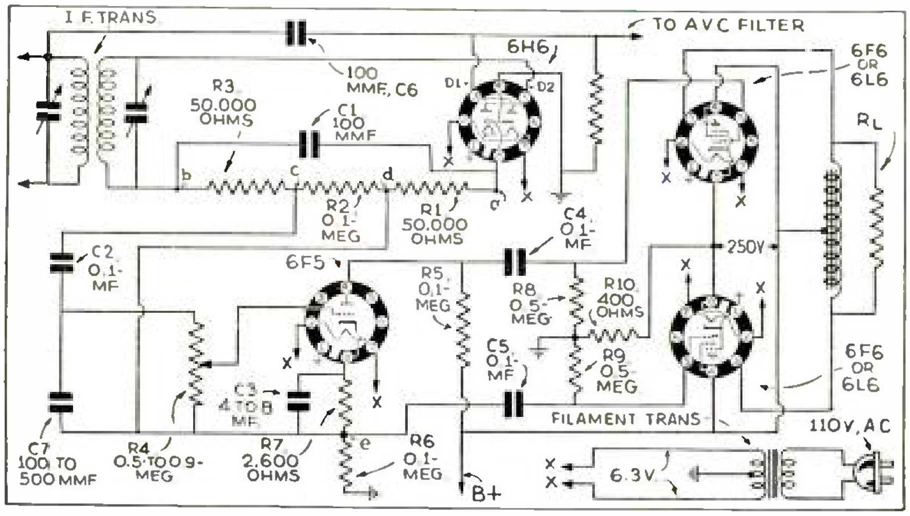


Diagram of new phase inverter circuit developed by RCA engineers. It is non-degenerative and is capable of driving two 6F6's or 6L6's to rated class A, output.

LET'S "Listen In" With Joe Miller

Our Short-Wave "DX" Editor

Winner of Thirtieth "S.W. Scout" Trophy.

This is the third article by Mr. Miller. We shall be glad to have our readers send us suggestions, as well as data on new stations not mentioned here. Queries should be accompanied by a 3-cent stamp.

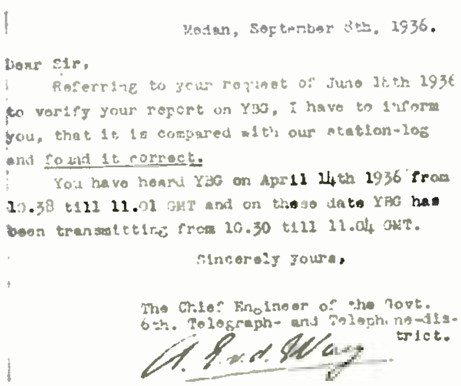
This "FB" DX catch was logged last December at 3:00 p.m. on 14044 kc. phone. Try for ZE1JR!

● HERE 'tis December again, and we always have a warm welcome for this harbinger of a season of quiet reception, with the resultant excellent DX weather experienced DXers have learned to expect.

This season brings with it such conditions that one can really "open up" his receiver, especially on the weaker or more distant signals, without hearing an imitation of the w.k. "frying pan."

We would like to stress here the importance in successful DXing of a thorough knowledge of one's dial. Accurate calibration of a receiver is of great assistance in identifying many distant and weak stations, which one could not readily identify, otherwise.

For instance, if a DXer wants to log CQN in Macao, China, and he has the correct dial reading of VK3LR in Australia, on 31.3 meters, and tunes every Monday and Friday from 7 to 8:30 a.m., *just to the low frequency side of 3LR*, he may one day hear CQN's signal well enough to log and verify! So, by using a known station's dial readings, one may be able to estimate closely a desired station's dial settings, or to identify an otherwise unknown or weak signal.



Medan, September 8th, 1936.

Dear Sir,

Referring to your request of June 18th 1936 to verify your report on YBG, I have to inform you, that it is compared with our station-log and found it correct.

You have heard YBG on April 14th 1936 from 10.38 till 11.01 GMT and on these date YBG has been transmitting from 10.30 till 11.04 GMT.

Sincerely yours,

The Chief Engineer of the Govt. 6th. Telegraph- and Telephone-district.

"YBG" Sumatra verifies! This rare veri is one which any DX'er would be proud to own!

Italian Africa Leads!

This last month (Oct.) has seen much activity in Italy's African colonies, and we are certainly grateful for the opportunity to add several African ACES to our log!

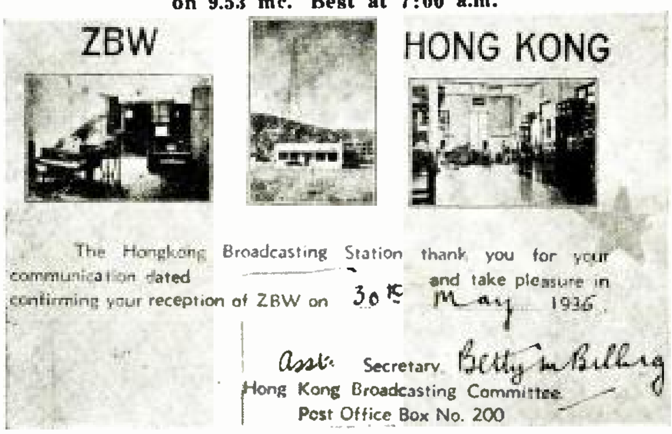
We now welcome a new Addis Ababa station to the African short-wave spectrum. IUG, on 15.45 mc., which has just made its presence known here. It was heard one morning at 7 a.m. calling Coltano, Italy, IAC, 17.76 mc., and Coltano coming right back. We heard music on 15.45 mc., just before 7 a.m., but thought this was just a SW "BC" (broadcast) station a bit off the 19 meter "BC" band, due to our dial slipping. But what a pleasant surprise to return shortly and find we had really heard a new Addis Ababa catch!

There's the thrill in short waves! The unexpected, that "One never knows what to expect" feeling!

Ashley Walcott, whose "dope" we certainly appreciate, forwards from San Francisco, the following data on IUG. Ashley has heard IUG daily out there from 9:15-10:30 a.m., phoning IAC on 17.76 mc. IUG will call "Pronto, proto, Coltano," and IAC will answer with "Pronto, Addis Ababa." IUG has a rather weak signal so *tune carefully*. IAC always has an R-9 signal.

IUC, also at Addis Ababa, 11.955 mc., continues to be a "regular," being heard almost daily around midnight with a good signal. (See previous issue for complete data.)

This "FB" QSL can be easily earned by trying for ZBW, now on 9.53 mc. Best at 7:00 a.m.



ITK, 16.385 mc., located at Mogadiscio, Italian Somaliland, is often heard in early mornings, about 5 to 6 a.m. You can hear this rare DX catch if you try daily for a week straight, at about the time given. Who wouldn't like to add this FB catch and new country to his log!

IDU, 13.38 mc., located at Asmara, Eritrea, is believed to be again phoning, after a long absence from the air—or so it would seem from the total lack of reports lately. This signal was heard several times, around 6 a.m. and at 1 a.m. As IUC was also on at the same time, it would be quite possible that these two were in "contact" with each other.

These four Italo-Africans usually work Italy, so we suggest checking with the following stations, if any of the above signals is believed to be heard. Finding one of the following stations also in operation, one can feel quite certain that he actually is hearing the African station.

Here goes: IRY, 16.12 mc., IQA, 14.73 mc., IBC, 17.62 mc.—all located in Italy. When reporting any of the Italian-African stations, address reports to, Ministero della Marina, Direzione Centro R. T. Autonoma R Marina, Rome, Italy. Send a "reply coupon," too!

Canary Islands

EAJ43, 28.9 meters or 10.38 mc., located at Tenerife, is a new "African" which anyone can log and verify, so good is their signal. The station manager, Senor Enrique Diaz Exposito, dropped us a letter requesting our report, so let's all answer his request, pronto, hi! This is a sister station of EA8AB, and has the same QRA: Radio Club Tenerife, P.O. Box 225, Tenerife, Canary Islands. The schedule is *daily* from 2 to 3:30 p.m. and 6 to 9 p.m. Power is 4 kw. and *six languages are used*, English included. Enrique adds, "Special news from Spain!" Enrique also adds having reports from the Philippines, Japan, Chile, Argentina and Peru, so they ought to be easy for you rabid DXers.

Java

We have a late communication from Ashley Walcott which informs us that after January 1st, 1937, the Javanese radio network will *not* verify any reports on the commercial telephone stations! This does not include the regular broadcasters, those stations broadcasting music. (*Continued on page* 576)

CORRECTED AND REVISED Monthly

World S-W Station List

Complete List of Broadcast, and Telephone Stations

All the stations in this list use telephone transmission of some kind. 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.

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

Around-the-Clock Listening Guide

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 these simple rules will save time.

From daybreak till 9 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 4 p.m.-5 a.m., the 19-35 meter will be found very productive. To the west of the listener this same band is generally found best from about 12 m. until 7 a.m. (After dark, results above 35 meters are usually much better than during daylight.) These general rules hold for any location in the Northern Hemisphere.

Short-Wave Broadcasting, Experimental and Commercial Radiophone Stations

NOTE: To convert kc. to megacycles (mc.) shift decimal point 3 places to left: Thus, read 21540 kc. as 21.540 mc.

31600 kc. W2XDU
-BX- 9.494 meters
ATLANTIC BROADCASTING CO.
485 MADISON AVE., N.Y.C.
Relays WABC daily 5-10 p.m., Sat., Sun. 12:30-5, 6-9 p.m.

31600 kc. W4XCA
-BX- 9.494 meters
MEMPHIS, TENN.
Relays WMC daily

31600 kc. W8XAI
-BX- 9.494 meters
STROMBERG CARLSON CO.
ROCHESTER, N.Y.
Relays WHAM daily 7:30 a.m.-12.05 a.m.

31600 kc. W8XWJ
-BX- 9.494 meters
PENOBSCOT TOWER
DETROIT, MICH.
Daily 6 a.m.-12:30 a.m.
Sun. 8 a.m.-12 M.

21540 kc. W8XK
-B- 13.93 meters
WESTINGHOUSE ELECTRIC
PITTSBURGH, PA.
7-9 a.m.; relays KDKA

21530 kc. GSJ
-B- 13.93 meters
DAVENTRY
B.B.C., BROADCASTING HOUSE, LONDON, ENGLAND

21520 kc. W2XE
-B- 13.94 meters
ATLANTIC BROADCASTING CORP.
485 Madison Ave., N.Y.C.
Relays WABC 7:30 a.m.-1 p.m.

21470 kc. ★GSH
-B- 13.97 meters
DAVENTRY
B.B.C., BROADCASTING HOUSE, LONDON, ENGLAND
3-5, 6-8:45 a.m., 9 a.m.-12 n.

21420 kc. WKK
-C- 14.01 meters
AMER. TEL. & TEL. CO.,
LAWRENCEVILLE, N. J.
Calls S. America 8 a.m.-4 p.m.

21080 kc. PSA
-C- 14.23 meters
RIO DE JANEIRO, BRAZIL
Works WKK 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.

20860 kc. EHY-EDM
-C- 14.38 meters
MADRID, SPAIN
Works S. America, mornings.

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

20040 kc. OPL
-C- 14.97 meters
LEOPOLDVILLE, BELGIAN CONGO
Works with ORG in morning

20020 kc. DHO
-C- 14.99 meters
NAUEN, GERMANY
Works S. America, 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

19680 kc. CEC
-C- 15.24 meters
SANTIAGO, CHILE
Works Buenos Aires and Colombia 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

19480 kc. GAD
-C- 15.4 meters
RUGBY, ENGLAND
Works with Kenya, Africa, early morning

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

19345 kc. PMA
-B.C- 15.51 meters
BANDOENG, JAVA
Calls Holland early a.m.
Broadcasts Tues., Thur., Sat., 10:00-10:30 a.m. Irregular

19260 kc. PPU
-C- 15.58 meters
RIO de JANEIRO, BRAZIL
Works with France mornings

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

19200 kc. ORG
-C- 15.62 meters
RUYSSELEDE, BELGIUM
Works with OPL mornings

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

19020 kc. HS8PJ
-B- 15.77 meters
BANGKOK, SIAM
Mon. 8-10 a.m.

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

18890 kc. ZSS
-C- 15.88 meters
KLIPHEUVEL, S. AFRICA
Works Rugby 6:30 a.m.-12 n

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

18680 kc. OCI
-C- 16.06 meters
LIMA, PERU
Works various S.A. stations daytime

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

18299 kc. YVR
-C- 16.39 meters
MARACAY, VENEZUELA
Works Germany, mornings

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

18200 kc. GAW
-C- 16.48 meters
RUGBY, ENGLAND
Calls N. Y., daytime

18135 kc. PMC
-C- 16.54 meters
BANDOENG, 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
DAVENTRY,
B.B.C., BROADCASTING HOUSE, LONDON, ENGLAND
6-8:45, 9 a.m.-12n.

17780 kc ★W3XAL
-B- 16.87 meters
NATIONAL BROAD. CO.
BOUND BROOK, N. J.
Relays WJZ. Daily exc. Sun. 9 a.m.-5 p.m.

17775 kc. PHI
-B- 16.88 meters
HUIZEN, HOLLAND
Irregular

17760 kc. ★W2XE
-B- 16.89 meters
ATLANTIC BROADCASTING CORP.
485 Madison Ave., N.Y.C.

17760 kc. DJE
-B- 16.89 meters
BROADCASTING HOUSE
BERLIN, GERMANY
12:05-5:15; 5:55-11 a.m.

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

17741 kc. HSP
-C- 16.91 meters
BANGKOK, SIAM
Works Germany 4-7 a.m.

17650 kc. XGM
-C- 17 meters
SHANGHAI, CHINA
Works London 7-9 a.m.

17520 kc. DFB
-C- 17.12 meters
NAUEN, GERMANY
Works S. America near 9:15 a.m.

17510 kc. VWY2
-C- 17.13 meters
KIRKEE, INDIA
Works Rugby 2-7 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

16240 kc. KTO
-C- 18.47 meters
MANILA, P. I.
Calls Cal., Tokio and ships 8-11:30 a.m.

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

15865 kc. CEC
-C- 18.91 meters
SANTIAGO, CHILE
Works other S.A. stations afternoons

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- 19.16 meters
NAZAKI, JAPAN
Phones Java 3-5 a.m.

15620 kc. JVF
-C- 19.2 meters
NAZAKI, JAPAN
Phones U.S., 3 a.m. & 4 p.m.

15460 kc. KKR
-C- 19.4 meters
RCA COMMUNICATIONS,
BOLINAS, CAL.
Tests irregularly

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.

15360 kc. DZG
-X.C- 19.53 meters
REICHSPOSTZENSTRALAMT,
ZEESEN, GERMANY
Tests irregularly

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

15340 kc. ★DJR
-B- 19.56 meters
BROADCASTING HOUSE,
BERLIN, GERMANY
8-9 a.m.

15330kc.★W2XAD
-B- 19.56 meters
GENERAL ELECTRIC CO.
SCHENECTADY, N. Y.
Relays WGY 10 a.m.-4:30 p.m.

15310 kc. GSP
-B- 19.6 meters
DAVENTRY
B.B.C., BROADCASTING HOUSE,
LONDON, ENGLAND
Irregular, 6-8 p.m.

15290 kc. LRU
-B- 19.62 meters
"EL MUNDO"
BUENOS AIRES, ARGENTINA, S. A.
Daily 7 a.m.-4:50 p.m.

15280 kc. ★DJQ
-B- 19.63 meters
BROADCASTING HOUSE
BERLIN, GERMANY
6-8, 8:15-11 a.m.
Sundays 11:10 a.m.-12:20 p.m.

15270 kc. ★W2XE
-B- 19.65 meters
ATLANTIC BROADCASTING CORP.
485 Madison Av., N.Y.C.
Relays WABC daily, 1-6 p.m.

15260 kc. GSI
-B- 19.66 meters
DAVENTRY,
B.B.C., BROADCASTING HOUSE, LONDON, ENGLAND
12:15-3:45 p.m.

15252 kc. RIM
-C- 19.67 meters
TACHKENT, U.S.S.R.
Phones RKI near 7 a.m.

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

(All Schedules Eastern Standard Time)

15245 kc. ★TPA2
-B- 19.68 meters
"RADIO COLONIAL"
PARIS, FRANCE
Service de la Radiodiffusion
98, bis. Blvd. Haussmann
2-3, 5:55-11 a.m.

15230 kc. HS8PJ
-B- 19.32 meters
BANGKOK, SIAM
Irregular, Mon. 8-10 a.m.

15230 kc. ★OLR
-B- 19.70 meters
PRAGUE
CZECHOSLOVAKIA
Irregular

15220 kc. ★PCJ
-B- 19.71 meters
N.V. PHILIPS' RADIO
EINDHOVEN, HOLLAND
Tues. 4:30-6 a.m.
Wed. 8-11 a.m.
Sun. 2:30-8:30 a.m.

15210 kc. ★W8XK
-B- 19.72 meters
WESTINGHOUSE ELECTRIC
& MFG. CO.
PITTSBURGH, PA.
9 a.m.-7 p.m.
Relays KDKA

15200 kc. ★DJB
-B- 19.74 meters
BROADCASTING HOUSE
BERLIN, GERMANY
12:05-5:15, 5:55-11 a.m.
Sun. also 11:10 a.m.-12:20 p.m.

15180 kc. GSO
-B- 19.76 meters
DAVENTRY
B.B.C., BROADCASTING
HOUSE,
LONDON, ENGLAND
3-5 a.m.

15180 kc. ZBW
-B- 19.76 meters
HONGKONG, CHINA
P. O. Box 200
Irregular 4-10 a.m.

15180 kc. RW96
-B- 19.76 meters
MOSCOW, U.S.S.R.
Sun. 1-2 p.m.

15150 kc. YDC
-B- 19.80 meters
NIROM
BANDOENG, JAVA
6-7:30 p.m., 10:30 p.m.-2:20,
5:30-9:30 a.m.

15140 kc. ★GSF
-B- 19.82 meters
DAVENTRY,
B.B.C., BROADCASTING
HOUSE, LONDON, ENGLAND
6-8:45, 9 a.m.-12 n., 4-5:45 p.m.

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

15110 kc. ★DJL
-B- 19.85 meters
BROADCASTING HOUSE,
BERLIN, GERMANY
12-2, 8-9 a.m., 11:35 a.m.-
4:30 p.m. Also 6-8 a.m. Sun.

15090 kc. RKI
-B, C- 19.88 meters
MOSCOW, U.S.S.R.
Phones Tashkent near 7 a.m.
and relays RNE on Sundays
10-11 a.m.

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

14970 kc. LZA
-B,C- 20.04 meters
RADIO GARATA,
SOFIA, BULGARIA
Broadcasts Sun. 12:30-8 a.m.,
12 n.-2:45 p.m., Daily 5-6:30
a.m., 12 n-2:45 p.m.

14960 kc. PSF
-C- 20.43 meters
RIO de JANEIRO, BRAZIL
Works with Buenos Aires
daytime

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

14940 kc. HII
-C- 20.08 meters
CIUDAD TRUJILLO, D.R.
Phones WNC daytime

14940 kc. HJA3
-C- 20.08 meters
BARRANQUILLA, COL.
Works WNC daytime

14845 kc. OCJ2
-C- 20.21 meters
LIMA, PERU
Works other S.A. stations
daytime

14653 kc. GBL
-C- 20.47 meters
RUGBY, ENGLAND
Works JVH 1-7 a.m.

14640 kc. TYF
-C- 20.49 meters
PARIS, FRANCE
Works Saigon and Cairo 3-7
a.m., 12 n.-2:30 p.m.

14600 kc. JVH
-B,C- 20.55 meters.
NAZAKI, JAPAN
Phones Europe 4-8 a.m.

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

14530 kc. LSN
-C- 20.65 meters
HURLINGHAM, ARGENTINA
Calls N.Y.C. afternoons

14500 kc. LSM2
-C- 20.69 meters
HURLINGHAM, ARGENTINA
Calls Rio and Europe daytime

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

14485 kc. HRL5
-C- 20.71 meters
NACAOME, HONDURAS
Works WNC daytime

14485 kc. HRF
-C- 20.71 meters
TEGUCIGALPA, HONDURAS
Works WNC daytime

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

14460 kc. DZH
-C,X- 20.75 meters
REICHSPOSTZENSTRALAMT,
ZEESEN, GERMANY
Irregular

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

13820 kc. SUZ
-C- 21.71 meters
ABDU ZABAL, EGYPT
Works with Europe 11 a.m.-2 p.m.

13690 kc. KKZ
-C- 21.91 meters
RCA COMMUNICATIONS,
BOLINAS, CAL.
Tests irregularly

13635 kc. SPW
-B- 22 meters
WARSAW, POLAND
Mon., Wed., Fri. 12:30-1:30 p.m.
Irregular at other times

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

13380 kc. IDU
-C- 22.42 meters
ASMARA, ERITREA, AFRICA
Works with Rome daytime

13345 kc. YVQ
-C- 22.48 meters
MARACAY, VENEZUELA
Calls Hialeah daytime

13285 kc. CGA3
-C- 22.58 meters
DRUMMONDVILLE, QUE.,
CAN.
Works London and Ships
afternoons

13075 kc. VPD
-X- 22.94 meters
SUVA, FIJI ISLANDS
Daily exc. 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
PISA, 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.

12325 kc. DAF
-C- 24.34 meters
NORDDEICH, GERMANY
Works German ships daytime

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

12250 kc. TYB
-C- 24.49 meters
PARIS, FRANCE
Irregular

12235 kc. ★TFJ
-B,C- 24.52 meters
REYKJAVIK, ICELAND
Phones England mornings.
Broadcasts Sun. 1:40-2:30 p.m.

12215 kc. TYA
-C- 24.56 meters
PARIS, FRANCE
Works French Ships in morning
and afternoon

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

12130 kc. DZE
-C,X- 24.73 meters
REICHSPOSTZENSTRALAMT,
ZEESEN, GERMANY
Tests irregularly

12060 kc. PDV
-C- 24.88 meters
KOOTWIJK, HOLLAND
Tests irregular

12000 kc. RNE
-B- 25 meters
MOSCOW, U. S. S. R.
Sun. 6-9, 10-11 a.m., 12:30-
6 p.m.
Wed. 6-7 a.m.
Daily 12:30-6 p.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

11900 kc XEWI
-B- 25.21 meters
MEXICO CITY, MEX.
Mon., Wed. 3-4 p.m.; Tues.,
Thurs., 7:30-8:45, 10:30 p.m.-
12m.; Fri. 3-4, 9 p.m.-12m.; Sat.
9-11 p.m.; Sun. 1-2:15 p.m.

11880 kc. ★TPA3
-B- 25.23 meters
"RADIO COLONIAL"
PARIS, FRANCE
2-5 a.m., 12:15-6 p.m.

11875 kc. ★OLR
-B- 25.24 meters
PRAGUE, CZECHOSLOVAKIA
Daily 1:30-4 p.m., Mon. and
Thur. 7-9 p.m.

11870 kc. ★W8XK
-B- 25.26 meters
WESTINGHOUSE ELECTRIC
& MFG. CO.
PITTSBURGH, PA.
7-10:30 p.m.
Fri. till 12 m
Relays KDKA

11860 kc. YDB
-B- 25.29 meters
N.I.R.O.M.,
SOERABAJA, JAVA
Sat. 7:30 p.m.-2 a.m. (Sun.)
Daily 10:30 p.m.-2 a.m.

11860 kc. GSE
-B- 25.29 meters
DAVENTRY,
B.B.C., BROADCASTING
HOUSE, LONDON, ENGLAND

11855 kc. DJP
-B,X- 25.31 meters
BROADCASTING HOUSE,
BERLIN, GERMANY
Irregular, 11:35 a.m.-4:30 p.m.

11830 kc. W9XAA
-B- 25.36 meters
CHICAGO FEDERATION OF
LABOR
CHICAGO, ILL.
Relays WCFL 6:30 a.m.-4 p.m.,
9 p.m.-12 m.

11830 kc. ★W2XE
-B- 25.36 meters
ATLANTIC BROADCASTING
CORP.
485 MADISON AVE., N. Y. C.
Relays WABC 6-10 p.m.

11820 kc. GSN
-B- 25.38 meters
DAVENTRY
B.B.C., BROADCASTING
HOUSE,
LONDON, ENGLAND Irregular

11810 kc. ★HJ4ABA
-B- 25.4 meters
P. O. BOX 50,
MEDELLIN, COLOMBIA
11:30 a.m.-1 p.m., 6:30-10:30
p.m.

11810 kc. ★2RO
-B- 25.4 meters
E.I.A.R.
Via Montello 5
ROME, ITALY
Daily 6:43-10:30, 11:30 a.m.-
5:30 p.m., 6-6:20 p.m.; Sun.
6:43-9, 11:30 a.m.-12:30 p.m.

11795 kc. DJO
-B,X- 25.43 meters
BROADCASTING HOUSE,
BERLIN, GERMANY
Irregular

11790 kc. W1XAL
-B- 25.45 meters
BOSTON, MASS.
Daily 5:15-6:15 p.m.
Sun. 5-7 p.m.

11770 kc. ★DJD
-B- 25.49 meters
BROADCASTING HOUSE,
BERLIN, GERMANY
11:35 a.m.-4:30 p.m.; 4:50-
10:55 p.m.

11760 kc. OLR
-B- 25.51 meters
PRAGUE,
CZECHOSLOVAKIA

11750 kc. ★GSD
-B- 25.53 meters
DAVENTRY,
B.B.C., BROADCASTING
HOUSE, LONDON, ENGLAND
12:15-5:45 p.m., 6-8, 9-11 p.m.

11730 kc.
-B- 25.57 meters
"RADIO PHILCO"
SAIGON, INDO-CHINA
Irregular 5:30-9:30 a.m.

11730 kc. PHI
-B- 25.57 meters
HUIZEN, HOLLAND
8:30-10:30 a.m., except Tues. and
Wed.

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

11715 kc. ★TPA4
-B- 25.61 meters
"RADIO COLONIAL"
PARIS, FRANCE
6:15-10:15 p.m.
10:45 p.m.-1 a.m.

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

11595 kc. VRR4
-C- 25.87 meters
STONY HILL, JAMAICA,
B.W.I. Works WNC daytime.

11560 kc. VIZ3
-X- 25.95 meters
AMALGAMATED WIRELESS
OF AUSTRALASIA
FISKVILLE, AUSTRALIA
Calls Canada evening and early
a.m.

11500 kc. COCX
-B- 25.96 meters
HAVANA, CUBA
Relays CMX irregularly
5 p.m.-1 a.m.

11500 kc. PMK
-B-C- 26.09 meters
BANDOENG, JAVA

11413 kc. CJA4
-C- 26.28 meters
DRUMMONDVILLE,
QUE., CAN.
Tests with Australia irregularly
in evening

11280 kc. HIN
-B- 26 meters
LA VDZ DEL PARTIDO
DOMINICANO, CIUDAD
TRUJILLO, D.R.
12-2 p.m., 7:30-9:30 p.m.

11200 kc. XBJQ
-X- 26.79 meters
BOX 2825,
MEXICO CITY, MEX.
Irregular

11050 kc. ZLT4
-C- 27.15 meters
WELLINGTON, N. ZEALAND
Phones Australia and England
early a.m.

11000 kc. PLP
-B, C- 27.27 meters
BANDOENG, JAVA
Relays YDB 5:30-10:30 or 11
a.m., Sat. till 11:30 a.m.

10970 kc. OCI
-C- 27.35 meters
LIMA, PERU
Works with Bogota, Col.,
evenings

10840 kc. KWV
-C- 27.68 meters
DIXON, CAL.
Works with Hawaii evenings.

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

10740 kc. ★JVM
-B,C- 27.93 meters
NAZAKI, JAPAN
Broadcasts Tues. and Fri. 2-3
p.m., Phones U.S. 2-7 a.m.

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

10670 kc. ★CEC
-C- 28.12 meters
SANTIAGO, CHILE
Broadcasts Daily 7-7:15 p.m.

10660 kc. ★JVN
-B,C- 28.14 meters
NAZAKI, JAPAN
Phones Europe 3-8 a.m.
Broadcasts daily 12 m-1 a.m.,
2-8 a.m.
Mon. and Thurs. 4-5 p.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

(All Schedules Eastern Standard Time)

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

10330 kc. ★ORK
-B-C- 29.04 meters
RUYSSELEDE, BELGIUM
Broadcasts 2:30-4 p.m.

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

10290 kc. DZC
-X- 29.16 meters
REICHSPOSTZENTRALAMET, ZEESEN, GERMANY
Broadcasts irregularly

10260 kc. PMN
-B-C- 29.74 meters
BANDOENG, JAVA
Calls Australia 5 a.m.
Broadcasts Daily exc. Sat. 6-7:30 p.m., 10:30 p.m.-2 a.m., 5:30-10:30 or 11 a.m., Sat. 5:30-11:30 a.m., 7:30 p.m.-2 a.m. (Sun.)

10250 kc. 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

10170 kc. RIO
-C- 29.5 meters
BAKOU, U.S.S.R.
Works with Moscow 10 p.m.-5 a.m.

10140 kc. OPM
-C- 29.59 meters
LEOPOLDVILLE, BELGIAN CONGO
Phones around 3 a.m. and 1-4 p.m.

10080 kc. RIR
-C- 29.76 meters
TIFLIS, U.S.S.R.
Works with Moscow early morning.

10070 kc. EDM-EHY
-C- 29.79 meters
MADRID, SPAIN
Works with S. America evenings

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

10055 kc. SUV
-C- 29.84 meters
ABOU ZABAL, EGYPT
Works with Europe 1-6 p.m.

10042 kc. DZB
-X- 29.87 meters
ZEESEN, GERMANY
Irregular

9990 kc. KAZ
-C- 30.03 meters
MANILLA, P.I.
Works with Java, Cal. and ships early morning

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

9930 kc. HKB
-C- 30.21 meters
BOGOTA, COL.
Phones Rio de Janeiro evenings

9930 kc. ★CSW
-B- 30.21 meters
NATL. BROAD. STATION
LISBON, PORTUGAL
4-7:30 p.m.

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 5:15-9:30 p.m.; Saturday also 12 n.-2 p.m.

9840 kc. JYS
-X- 30.49 meters
KEMIKAWA-CHO, CHIBA-KEN, JAPAN
Irregular. 11:30 p.m.-3 a.m.

9800 kc. LSI
-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. COCQ
-B- 30.77 meters
HAVANA, CUBA
Evenings

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

9675 kc. DZA
31.01 meters
ZEESEN, GERMANY
Irregular

9670 kc. TI4NRH
-B- 31.02 meters
AMANDO CESPEDES MARIN, APARTADO 40, HEREDIA, COSTA RICA
Daily 8:30-10, 11:30 p.m.-12 m.

9660 kc. ★LRX
-B- 31.06 meters
"EL MUNDO"
BUENOS AIRES, ARGENTINA
5-9 p.m.

9650 kc. YDB
-B- 31.09 meters
N.I.R.O.M.
SOERABAJA, JAVA
Daily exc. Sat. 6-7:30 p.m., 5:30-10:30 or 11 a.m., Sat. 5:30-11:30 a.m.

9650 kc. ★CT1AA
-B- 31.09 meters
"RADIO COLONIAL"
LISBON, PORTUGAL
Tues., Thurs., Sat. 4-7 p.m.

9650 kc. DGU
-C- 31.09 meters
NAUEN, GERMANY
Works with Egypt in afternoon

9645 kc. HH3W
-B- 31.1 meters
P.O. BOX A117,
PORT-AU-PRINCE, HAITI
1-2, 7-9:15 p.m.

9645 kc. YNLF
-B- 31.1 meters
MANAGUA, NICARAGUA
8-9 a.m., 12:30-2:30, 6:30-10 p.m.

9635 kc. ★2RO
-B- 31.13 meters
E.I.A.R., ROME, ITALY
Daily 12:40-5:30 p.m.
Mon., Wed., Fri. 6-7:30 p.m.
Tues., Thurs., Sat. 6-7:45 p.m.

9620 kc. HJ1ABP
-B- 31.19 meters
P.O. BOX 37, CARTAGENA, COL.
11 a.m.-1 p.m. 5-11 p.m.
Sun. 10 a.m.-1 p.m., 3-6 p.m.

9615 kc. HP5J
-B- 31.22 meters
APARTADO 867, PANAMA CITY, PANAMA
12n-1:30 p.m., 6-10:30 p.m.

9600 kc. RAN
-B- 31.25 meters
MOSCOW, U.S.S.R.
Daily 7-7:30 p.m.,
Sun., Wed. and Fri. 6-8 p.m.

9600 kc. CB960
-B- 31.25 meters
SANTIAGO, CHILE
9:30 p.m. on

9595 kc. ★HBL
-B- 31.27 meters
LEAGUE OF NATIONS
GENEVA, SWITZERLAND
Saturdays, 5:30-6:15 p. m.
Mon. at 1:45 a.m.

9590 kc. ★PCJ
-B- 31.28 meters
N. V. PHILIPS RADIO
EINDHOVEN, HOLLAND
Sun. 2-3, 7-8 p.m. Tues. 1:30-3 p.m. Wed. 7-10 p.m.

9590 kc. ★VK2ME
-B- 31.28 meters
AMALGAMATED WIRELESS, LTD., 47 YORK ST.
SYDNEY, AUSTRALIA
Sun. 1-3, 5-11 a.m.

9590 kc. ★W3XAU
-B- 31.28 meters
PHILADELPHIA, PA.
Relays WCAU
Daily 12n-8 p.m.

9590 kc. HJ2ABC
-B- 31.85 meters
CUCUTA, COL.
8 p.m.-12 n.

9590 kc. VK6ME
-B- 31.28 meters
AMALGAMATED WIRELESS, LTD.
PERTH, W. AUSTRALIA
5-9 a.m.

9580 kc. ★ GSC
-B- 31.32 meters
DAVENTRY, B.B.C., BROADCASTING HOUSE, LONDON, ENGLAND
4-5:45, 6-8, 9-11 p.m.

9580 kc. ★VK3LR
-B- 31.32 meters
Research Section, Postmaster Gen'ls. Dept., 61 Little Collins St., MELBOURNE, AUSTRALIA
3:15-8:30, 8:45-9:45 a.m., except Sun., also Fri. 10 p.m.-2 a.m.

9570 kc. ★W1XK
-B- 31.35 meters
WESTINGHOUSE ELECTRIC & MFG. CO.
SPRINGFIELD, MASS.
Relays WBZ, 7 a.m.-1 a.m.
Sun. 8 a.m.-1 a.m.

9565 kc. VUB
-B- 31.36 meters
BOMBAY, INDIA
11:30 a.m.-12:30 p.m., Tues., Thurs., Fri.

9560 kc. ★DJA
-B- 31.38 meters
BROADCASTING HOUSE, BERLIN
12:05-5:15 a.m., 5:55-11 a.m., 4:50-10:45 p.m.

9555 kc. HJ1ABB
-B- 31.38 meters
BARRANQUILLA, COL., S.A.
P. O. BOX 715
11:30 a.m.-1 p.m., 4:30-10 p.m.

9540 kc. ★DJN
-B- 31.45 meters
BROADCASTING HOUSE
BERLIN, GERMANY
12:05-5:15 a.m., 4:50-10:45 p.m.

9540 kc. VPD2
-B- 31.45 meters
SUVA, FIJI ISLANDS
AMALGAMATED WIRELESS OF AUSTRALASIA
Daily except Sun. 5:30-7 a.m.

9530 kc. ★W2XAF
-B- 31.48 meters
GENERAL ELECTRIC CO.
SCHENECTADY, N. Y.
Relays WGY 4 p.m.-12 m.

9530 kc. ZBW
-B- 31.5 meters
HONGKONG, CHINA
P.O. Box 200
11:30 p.m.-1:15 a.m., 4-10 a.m.

9525 kc. LKJ1
-B- 31.49 meters
JELOY, NORWAY
5-8 a.m., 11 a.m.-6 p.m.

9510 kc. ★VK3ME
-B- 31.55 meters
AMALGAMATED WIRELESS, Ltd.
167 Queen St.,
MELBOURNE, AUSTRALIA
Daily exc. Sun. 4-7 a.m.

9510 kc. ★GSB
-B- 31.55 meters
DAVENTRY, B.B.C., BROADCASTING HOUSE, LONDON, ENGLAND
3-5 a.m., 9 a.m.-12 n. 12:15-5:45, 6-8 p.m.

9500 kc. HJU
-B- 31.58 meters
NATIONAL RAILWAYS
BUENAVENTURA, COLOMBIA
Mon., Wed., Fri. 8-11 p.m.

9500 kc HJ1ABE
-B- 31.58 meters
P.O. BOX 31,
CARTAGENA, COLOMBIA
Daily 7:30-9 p.m.,
Mon. also 9:30-10:30 p.m.

9500 kc. PRF5
-B- 31.58 meters
RIO DE JANEIRO, BRAZIL
Irregularly 4:45-5:45 p.m.

9450 kc. TGWA
-B- 31.75 meters
MINISTRE de FOMENTO
GUATEMALA CITY, GUATEMALA
Daily 11 a.m.-1 p.m. 8 p.m. 12m. Sat. 9 p.m.-5 a.m. (Sun).

9428 kc. ★COCH
-B- 31.8 meters
2 B ST., VEDADO, HAVANA, CUBA
Daily 8 a.m.-7 p.m.
Sun. 11 a.m.-12 n., 8:30-9:30 p.m.

9415 kc. PLV
-C- 31.87 meters
BANDOENG, JAVA
Phones Holland around 9:45 a.m.

9350 kc. HS8PJ
-B- 32.09 meters
BANGKOK, SIAM
Thur. 8-10 a.m.

9330 kc. CGA4
-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

9150 kc. YVR
-C- 32.79 meters
MARACAY, VENEZUELA
Works with Europe afternoons.

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

9060 kc. TFK
-C- 33.11 meters
REYKJAVIK, ICELAND
Phones London afternoons.
Broadcasts irregularly.

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

8975 kc. VWY
-C- 33.43 meters
KIRKEE, INDIA
Works with England in morning

8950 kc. HCJB
-B- 33.5 meters
QUITO, ECUADOR
7:30-9:30 p.m., except Monday
Sun. 11 a.m.-12 n.; 4-10 p.m.
-B- 34.09 meters

8795 kc. HKV
BOGOTA, COLOMBIA
Mon. and Thurs. 7-7:30 p.m.

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

8765 kc. DAF
-C- 34.23 meters
NORDDEICH, GERMANY
Works German Ships irregularly

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

8750 kc. ZCK
-B- 34.29 meters
HONGKONG, CHINA
Relays ZBW
Daily 11:30 p.m.-1:15 a.m.
Mon. and Thurs. 3-7 a.m.
Tues., Wed., Fri. 6-10 a.m.
Sat. 6-11 a.m.

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

8665 kc. CO9JQ
-X- 34.62 meters
4 GENERAL GOMEZ
CAMAGUEY, CUBA
5:30-6:30, 8-9 p.m. daily except Sat. and Sun.

8590 kc. YNAV
-B- 34.92 meters
MANAGUA, NICARAGUA
7:30-9:30 p. m.

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

8400 kc. HC2AT
-B- 35.71 meters
CASSILLA 877
GUAYAQUIL, ECUADOR
8-11 p.m.

8380 kc. IAC
-C- 35.8 meters
Pisa, Italy

8190 kc. XEME
-B- 36.63 meters
CALLE 59, No. 517
MERIDA, YUCATAN
"LA VOZ de YUCATAN desde MERIDA
10 a.m.-12 n., 6 p.m.-12 m.

8185 kc. PSK
-C- 36.65 meters
RIO DE JANEIRO, BRAZIL
Irregularly

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

7975 kc. HC2TC
-B- 37.62 meters
QUITO, ECUADOR
Thurs., Sun. at 8 p.m.

7901 kc. LSL
-C- 37.97 meters
HURLINGHAM, ARGENTINA
Calls Brazil, night

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

7860 kc. SUX
-C- 38.17 meters
ABOU ZABAL, EGYPT
Works with Europe 4-6 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

7630 kc. ZHJ
-B- 39.32 meters
PENANG, MALAYA
Daily 7-9 a.m.
also Sat. 11 p.m.-1 A.M. (Sun.)

7626 kc. RIM
-C- 39.34 meters
TACHKENT, U.S.S.R.
Works with Moscow early morning

7610 kc. KWX
-C- 39.42 meters
DIXON, CAL.
Works with Hawaii, Philippines, Java and Japan nights.

7550 kc. TI8WS
-B- 39.74 meters
"ECOS DEL PACIFICO"
P. O. BOX 75 PUNTA ARENAS, COSTA RICA
6 p.m.-12 m.

7520 kc. KKH
-C- 39.89 meters
KAHUKU, HAWAII
Works with Dixon and broadcasts irregularly nights

7510 kc. JVP
-B,C- 39.95 meters
NAZAKI, JAPAN

7500 kc. RKI
-C- 40 meters
MOSCOW, U.S.S.R.
Works RIM early a.m.

7390 kc. ZLT2
-C- 40.6 meters
WELLINGTON, N.Z.
Works with Sydney 3-7 a.m.

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

7281 kc. HJ1ABD
-B- 41.04 meters
CARTAGENA, COLO.
Irregularly, evenings

7100 kc. HKE
-B- 42.25 meters
BOGOTA, COL., S. A.
Tue. and Sat. 8-9 p. m.; Mon. & Thurs. 6:30-7 p. m.

7080 kc. VP3MR
-B- 42.68 meters
GEORGETOWN, BRI. GUIANA, S.A.
Sun. 7:45-10:15 a.m.
Daily 4:45-8:45 p.m.

(All Schedules Eastern Standard Time)

7074 kc. HJ1ABK
-B- 42.69 meters
CALLE, BOLIVIA,
PROGROSO-IGUALDAD
BARRANQUILLA, COLOMBIA
Sun. 3-6 p.m.

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

6996 kc. PZH
-B- 42.88 meters
P. O. BOX 18,
PARAMIRABO, DUTCH GUIANA
Sun. 9:36-11:36 a.m.
Mon. and Fri. 5:36-9:36 p.m.
Tues. and Thur. 8:36-10:36 a.m., 2:36-4:36 p.m.
Wed. 3:36-4:36, 5:36-9:36 p.m.
Sat. 2:36-4:36 p.m.

6976 kc. HCETC
-B- 43 meters
TEATRO BOLIVAR
QUITO, ECUADOR
Thurs. till 9:30 p.m.

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.

6850 kc. TI6OW
-B- 43.8 meters
ONDA del CARIBE
PUERTO LIMON, COSTA RICA
Irregularly 8-9:30 p.m.

6800 kc. HI7P
-B- 44.12 meters
EMISORIA DIARIA de COMERCIO, CIUDAD TRUJILLO, DOM. REP.
Daily exc. Sat. and Sun. 12:40-1:40, 6:40-8:40 p.m.; Sat. 12:40-1:40 p.m.; Sun. 10:40 a.m.-11:40 a.m.

6780 kc. HIH
-B- 44.25 meters
SAN PEDRO de MACORIS
DOMINICAN REP.
12:10-1:40 p.m., 7:30-9 p.m., Sun. 3-4 a.m., 4:15-6 p.m.

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

6750 kc. JVT
-B,C- 44.44 meters
NAZAKI, JAPAN
KOKUSAI-DENWA KAISHA, LTD., TOKIO

6730 kc. HI3C
-B- 44.58 meters
"LA VOZ DE LA FERIA"
LA ROMANA, DOM. REP.
12:30-2 p.m. 5-6 p.m.

6710 kc. ★TIEP
-B- 44.71 meters
LAVOZ DEL TROPICO
SAN JOSE, COSTA RICA
APARTADO 257, Daily 7-10 p.m.

6690 kc. XGOX
-B- 44.84 meters
NANKING, CHINA
6:30-9 a.m.

6672 kc. YVQ
-C- 44.95 meters
MARACAY, VENEZUELA
Broadcasts Sat. 8-9 p.m.

6650 kc. IAC
-C- 45.11 meters
PISA, ITALY
Calls ships, evenings

6635 kc. ★HC2RL
-B- 45.21 meters
P. O. BOX 759, GUAYAQUIL, ECUADOR, S. A.
Sunday, 5:45-7:45 p.m.
Tues., 9:15-11:15 p.m.

6630 kc. HIT
-B- 45.25 meters
"LA VOZ de la RCA VICTOR,"
APARTADO 1105, CIUDAD TRUJILLO, D.R.
Daily exc. Sun. 12:10-1:40 p.m., 5:40-8:40 p.m., also Sat. 10:40 p.m.-12:40 a.m. (Sun.)

6625 kc. ★PRADO
-B- 45.28 meters
RIOBAMBA, ECUADOR
Thurs. 9-11:45 p.m.

6558 kc. HI4D
-B- 45.74 meters
CIUDAD TRUJILLO, DOMINICAN REPUBLIC
Except Sun. 11:55 a.m.-1:40 p.m.; 4:40-7:40 p.m.

6550 kc. TIRCC
-B- 45.8 meters
RADIOEMISORA CATOLICA COSTARRICENSE
SAN JOSE, COSTA RICA
Sun. 11 a.m.-2 p.m., 6-7, 8-9 p.m., Daily 12 n.-2 p.m., 6-7 p.m., Thurs. 6-11 p.m.

6545 kc. YV11RB
-B- 45.84 meters
"ECOS de ORINOCO",
BOLIVAR, VENEZUELA
6-10:30 p.m.

6520 kc. ★YV6RV
-B- 46.01 meters
VALENCIA, VENEZUELA
11 a.m.-2 p.m., 5-10 p.m.

6500 kc. HIL
-B- 46.15 meters
APARTADO 623
CIUDAD TRUJILLO, D.R.
12:10-1:40 p.m., 5:40-7:40 p.m.

6477 kc. HI4V
-B- 46.32 meters
CIUDAD TRUJILLO, D.R.
LA VOZ de LA MARINA
11:40 a.m.-1:40 p.m., 5:10-9:40 p.m.

6450 kc. HJ4ABC
-B- 46.51 meters
APARTADO 39
IBAQUE, COLOMBIA
11 a.m.-12 n., 8-11 p.m.

6450 kc. HI8A
-B- 46.51 meters
CIUDAD TRUJILLO, DOM. REP.
8:40-10:40 a.m., 2:40-4:10 p.m., Sat. 9:40-10:40 p.m., Sun 2:40, 4:40 p.m.

6425 kc. W9XBS
-X- 46.7 meters
NATL. BROAD. CO.
CHICAGO, ILL.
Relays WMAQ, irregular

6420 kc. HI1S
-B- 46.73 meters
PUERTO PLATA, DOM. REP.
11:40 a.m.-1:40 p.m., 5:40-7:40, 9:40-11:40 p.m.

6410 kc. TIPG
-B- 46.8 meters
APARTADO 225,
SAN JOSE, COSTA RICA
"LA VOZ DE LA VICTOR"
12 n.-2 p.m., 6-11:30 p.m.

6400 kc. YV9RC
-B- 46.88 meters
CARACAS, VENEZUELA
7-11 p.m.

6380 kc. YV4RC
-B- 47.02 meters
CARACAS VENEZUELA
5:30-9:30 p.m.

6316 kc. HIZ
-B- 47.5 meters
CIUDAD TRUJILLO
DOMINICAN REPUBLIC
Daily except Sat. and Sun. 11:10 a.m.-2:25 p.m., 5:10-8:40 p.m.; Sat. 5:10-11:10 p.m.; Sun., 11:40 a.m.-1:40 p.m.

6300 kc. YV12RM
-B- 47.62 meters
MARACAY, VENEZUELA
8-10:30 p.m.

6282 kc. CO9WR
-B- 47.76 meters
P.O. BOX 85,
SANCTI SPIRITUS, CUBA
4-6, 9-11 p.m.

6280 kc. HIG
-B- 47.77 meters
CIUDAD TRUJILLO, D.R.
7:10-8:40 a.m., 12:40-2:10, 8:10-9:40 p.m.

6243 kc. HIN
-B- 48 meters
CIUDAD TRUJILLO, D.R.
LA VOZ DEL PARTIDO DOMINICANO
12 n.-2 p.m., 7:30-9:30 p.m.

6235 kc. HRD
-B- 48.12 meters
LA VOZ DE ATLANTIDA
LA CEIBA, HONDURAS
8-11 p.m., Sat. 8 p.m.-1 a.m. (Sun.); Sun. 4-6 p.m.

6230 kc. OAX4G
-B- 48.15 meters
Apartado 1242
LIMA, PERU
Daily 7-10:30 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.
Wed. 6-10:30 p.m.

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

6171 kc. XEXA
-B- 48.61 meters
DEPT. OF EDUCATION
MEXICO CITY, MEX.
7-11 p.m.

6170 kc. HJ3ABF
-B- 48.62 meters
BOGOTA, COLOMBIA
7-11:15 p.m.

6160 kc. ★YV3RC
-B- 48.7 meters
CARACAS, VENEZUELA
11 a.m.-2 p.m., 4-10:30 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
8 p.m.-12 m.
Sun. 3-10:30 p.m.

6147 kc. COKG
-B- 48.8 meters
BOX 137, SANTIAGO, CUBA
9-10 a.m., 11:30 a.m.-1:30 p.m., 3-4:30 p.m., 10-11 p.m., 12 m.-2 a.m.

6145 kc. HJ4ABU
-B- 48.8 meters
PEREIRA, COL.
9-11 a.m., 7-8 p.m.

6140 kc. ★W8XK
-B- 48.86 meters
WESTINGHOUSE ELECTRIC & MFG. CO.
PITTSBURGH, PA.
Relays KDKA
9 p.m.-1 a.m.

6135 kc. HJ1ABB
-B- 48.9 meters
BARRANQUILLA, COL., S. A.
P. O. BOX 715,
11:30 a.m.-1 p.m.; 4:30-10 p.m.

6135 kc. HI5N
-B- 48.9 meters
SANTIAGO, D.R.
6:40-9:10 p.m.

6132 kc. HIX
-B- 48.93 meters
CIUDAD TRUJILLO, DOMINICAN REP.
Sun. 7:40-10:10; Daily 12:40-1:10 p.m., 4:40-5:40 p.m.; Tues. and Fri. 8:10-10:10 p.m.

6130 kc. TGXA
-B- 48.94 meters
GIORNAL LIBERAL PROGRESSISTA, GAUTEMALA CITY, GUAT.
Heard in the evening.

6130 kc. COCD
-B- 48.94 meters
"LA VOZ DEL AIRE"
CALLE G y 25, VEDADO, HAVANA, CUBA
Relays CMCD 11 a.m.-12 n., 7-10 pm., Sun. 12 n.-4 p.m.

6130 kc. ZGE
-B- 48.94 meters
KUALA LUMPUR, FED. MALAY STATES
Sun., Tue., and Fri., 6:40-8:40 a. m.

6130 kc. ★VE9HX
-B- 48.94 meters
P.O. BOX 998
HALIFAX, N.S., CANADA
Mon.-Fri., 9 a.m.-1 p.m., 5-11 p.m.
Fri. 1-3 p.m.; Sat., Sun. 9 a.m.-1 p.m., 2-11 p.m.
Relays CHNS

6122 kc. HJ3ABX
-B- 49 meters
LA VOZ de COLOMBIA
CALLE 14, No. 738,
BOGOTA, COLOMBIA
5:45-11:30 p.m.

6120 kc. ★W2XE
-B- 49.02 meters
ATLANTIC BROADCASTING CORP.
485 MADISON AVE., N. Y. C.
Relays WABC, 11 p.m.-12 m.

6120 kc. XEFT
-B- 49.02 meters
AV. INOEPOENCIA 28,
VERA CRUZ, MEX.
11 a.m.-4 p.m., 7:30 p.m.-12 m. Sat. also 6:30-7:30 p.m.
Sun. 11 a.m.-4 p.m., 9 p.m.-12 m. Relays XETF

6115 kc. OLR
-B- 49.05 meters
PRAGUE
CZECHOSLOVAKIA
Irregular

6110 kc. GSL
-B- 49.1 meters
DAVENTRY
B. B. C., BROADCASTING HOUSE, LONDON, ENGLAND
Irregular 4-5:45, 6-11 p.m.

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. HJ4ABB
-B- 49.14 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.

6100 kc. ★W3XAL
-B- 49.18 meters
NATIONAL BROADCASTING CO.
BOUND BROOK, N. J.
Relays WJZ
Monday, Wednesday, Saturday, 5-6 p.m., Sun. 12 m.-1 a.m.

6100 kc. ★W9XF
-B- 49.18 meters
NATL. BROAD. CO.
CHICAGO, ILL.
Tues., Thurs., Fri. 12 m.-1 a.m., 8 p.m.-11.59 p.m.
M., W., Sat., 12 m-1 a.m.
Relays WENR

6097 kc. ZTJ
-B- 49.2 meters
AFRICAN BROADCASTING CO.
JOHANNESBURG, SOUTH AFRICA.
Sun.-Fri. 11:45 p.m. 12:30 a.m. (next day)
Mon.-Sat. 3:30-7 a.m. 9 a.m.-4 p.m.
Sun. 8-10:15 a m.; 12:30-3 p.m.

6092 kc. HJ4ABE
-B- 49.25 meters
MEDELLIN, COLO.
Daily 11 a.m.-12 n., 6-10:30 p.m.

6090 kc. ★CRCX
-B- 49.28 meters
TORONTO, CANADA
Daily 6:30 p.m.-12:30 a.m.
Sun. 12:45 p.m.-12:45 a.m.

6090 kc. VE9BJ
-B- 49.28 meters
SAINT JOHN, N. B., CAN.
7-8:30 p.m.

6085 kc. HJ5ABD
-B- 49.3 meters
"LA VOZ DE VALLE"
CALI, COLOMBIA
12 n.-1:30 p.m., 5:10-9.40 p.m.

6083 kc. VQ7LO
-B- 49.31 meters
NAIROBI, KENYA, AFRICA
Mon.-Fri. 5:45-6:15 a.m., 11:30 a.m.-2:30 p.m. Also 8:30-9:30 a.m. on Tues. and Thurs.; Sat. 11:30 a.m.-3:30 p.m.; Sun. 11 a.m.-2 p.m.

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

6080 kc. HP5F
-B- 49.34 meters
CARLTON HOTEL
COLON, PANAMA
11:45 a.m.-1:15 pm., 7:45-10 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
-B,X- 49.34 meters
BROADCASTING HOUSE,
BERLIN, GERMANY

6072 kc. OER2
-B- 49.41 meters
VIENNA, AUSTRIA
9 a.m.-5 p.m., Sat. to 6 p.m.

6070 kc. YV7RMO
-B- 49.42 meters
MARACAIBO, VENEZUELA
6 p.m.-12 m.

6070 kc. HJ4ABC
-B- 49.42 meters
PERIERA, COL.
9-11 a.m., 7-8 or 9 p.m.

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.

6065 kc. HJ4ABL
-B- 49.46 meters
MANIZALES, COL.
Daily 11 a.m.-12 n., 5:30-7:30 p.m. Sat. 5:30-10:30 p.m.

6060 kc. ★W8XAL
-B- 49.50 meters
CROSLEY RADIO CORP.
CINCINNATI, OHIO
5:30 a.m.-8 p.m.; 11 p.m.-1 a.m.
Relays WLW

6060 kc. W3XAU
-B- 49.50 meters
PHILADELPHIA, PA.
Relays WCAU
8 p.m.-11 p.m.

6060 kc. OXY
-B- 49.50 meters
SKAMLEBOAEK, DENMARK
1-6:30 p.m.

6050 kc. GSA
-B- 49.59 meters
DAVENTRY
B. B. C., BROADCASTING HOUSE, LONDON, ENGLAND
Irregular 6-8 p.m.

6050 kc. HJ3ABD
-B- 49.59 meters
COLOMBIA BROADCASTING, BOX 509, BOGOTA, COL.
12 n.-2 p.m., 7-11 p.m., Sun. 5-9 p.m.

6045 kc. HI9B
-B- 49.63 meters
SANTIAGO
DOM. REP.
Irregular 6 p.m.-11 p.m.

6042 kc. HJ1ABG
-B- 49.65 meters
EMISORA ATLANTICO
BARRANQUILLA, COLO.
11 a.m.- 11 p.m.
Sun. 11 a.m.- 8 p.m.

6040 kc. W4XB
-B- 49.67 meters
MIAMI BEACH, FLA.
Relays WIOD 12 n.-2 p.m., 5:30 p.m.-12 m.

6040 kc. PRA8
-B- 49.67 meters
RADIO CLUB OF PERNAMBUCO
PERNAMBUCO, BRAZIL
1-3 p.m., 4-7:30 p.m. daily

6040 kc. ★W1XAL
-B- 49.67 meters
BOSTON, MASS.
Tues., Thurs. 7:15-9:15 p.m.
Sun 5-7 p.m.

6040 kc. YDA
-B- 49.67 meters
N.I.R.O.M.
TANDJONGPRIOK, JAVA
10:30 p.m.-2 a.m. Sat. 7:30 p.m., 2 a.m. (Sun.)

6030 kc. HJ4ABP
-B- 49.75 meters
MEDELLIN, COL.
Relays HJ4ABQ 8-11 p.m.

6030 kc. ★HP5B
-B- 49.75 meters
P. O. BOX 910
PANAMA CITY, PAN.
12 n.- 1p.m., 7-10:30 p.m.

6030 kc. VE9CA
-B- 49.75 meters
CALGARY, ALBERTA, CAN.
Thurs. 9 a.m.-2 a.m. (Fri.); Sun. 12 n.-12 m.
Irregularly on other days from 9 a.m.-12 m.

6025 kc. HJ1ABJ
-B- 49.79 meters
SANTA MARTA, COLO.
5:30-10:30 p.m. except Wed.

6020 kc. ★DJC
-B- 49.83 meters
BROADCASTING HOUSE, BERLIN
11:35 a.m.-4:30 p.m., 4:50-11 p.m.

6020 kc. XEUW
-B- 49.82 meters
AV. INDEPENDENCIA, 98,
VERA CRUZ, MEX.
8 p.m.-12:30 a.m.

6018 kc. ZHI
-B- 49.85 meters
RADIO SERVICE CO.,
20 ORCHARD RD.,
SINGAPORE, MALAYA
Mon., Wed. and Thurs 5:40-8:10 a.m. Sat. 10:40 p.m.-1:10 a.m. (Sun.) Every other Sunday 5:10-6:40 a.m.

6015 kc. HI3U
-B- 49.88 meters
SANTIAGO de los CABALLEROS, DOM. REP.
7:30-9 a.m., 12 n.- 2 pm., 5-7 p.m., 8-9:30 p.m., Sun 12:30-2, 5-6 p.m.

(All Schedules Eastern Standard Time)

6012 kc. HJ3ABH
-B- 49.91 meters
BOGOTA, COLO.
APARTADO 565
6-11 p.m.
Sun. 12 n.-2 p.m., 4-11 p.m.

6010 kc. ★COCO
-B- 49.92 meters
P.O. BOX 98
HAVANA, CUBA
Daily 9:30 a.m.-1 p.m., 4-7 p.m., 8-10 p.m.
Sat. also 11:30 p.m.-2 a.m.

6005 kc. HP5K
-B- 49.96 meters
BOX 33, COLON, PANAMA
7:30-9 a.m., 12 n.-1 p.m., 6-9 p.m.

6005 kc. ★CFCX
-B- 49.96 meters
CANADIAN MARCONI CO., MONTREAL, QUE., CAN.
Relays CFCF 7 a.m.-12:15 a.m.
Sun. 10 a.m.-11:15 p.m.

6000 kc. HJ1ABC
-B- 50 meters
QUIBDO, COLOMBIA
5-6 p.m., Sun. 9-11 p.m.

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

5988 kc. HJ2ABD
-B- 50.10 meters
BUCARAMANGA, COL.
11:30 a.m.-12:30 p.m., 5:30-6:30, 7:30-10:30 p.m.

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

5950 kc. HJN
-B- 50.42 meters
BOGOTA, COL.
6-11 p.m.

5940 kc. TG2X
-B- 50.5 meters
GUATEMALA CITY, GUAT.
4-6, 9-11 p.m., Sun. 2-5 a.m.

5930 kc. HJ4ABD
-B- 50.51 meters
LA VOZ CATIA,
MEDELLIN, COLOMBIA
8-11:30 p.m.

5915 kc. HH2S
-B- 50.72 meters
PORT AU PRINCE, HAITI
BOX A103,
7-9:45 p.m.

5898 kc. YV8RB
-B- 50.86 meters
"LA VOZ de LARA"
BARQUISIMETO, VENEZUELA
12 n.- 1p.m., 6-10 p.m.

5885 kc. HCK
-B- 50.98 meters
QUITO, ECUADOR, S. A.
8-11 p.m.

5875 kc. HRN
-B- 51.06 meters
TEGUCIGALPA, HONDURAS
1:15-2:15, 8:30-10 p.m., Sun. 3:30-5:30, 8:30-9:30 p.m.

5865 kc. HI1J
-B- 51.15 meters
BOX 204,
SAN PEDRO de MACORIS, DOM. REP.
12 n.-2, 6:30-9 p.m.

5853 kc. WOB
-C- 51.26 meters
LAWRENCEVILLE, N. J.
Calls Bermuda, nights

5850 kc.★YV5RMO
-B- 51.28 meters
CALLE REGISTRO, LAS DELICIAS APARTADO de CORRES 214
MARACAIBO, VENEZUELA
8:45-9:45 a.m., 11:15 a.m.-12:15 p.m., 4:45-9:45 p.m. Sun. 11:45 a.m.-12:45 p.m.

5830 kc. ★TIGPH
-B- 51.5 meters
ALMA TICA,
APARTADO 800,
SAN JOSE, COSTA RICA
11 a.m.-1 p.m., 6-10 p.m.,
Relays TIX 9-10 p.m.

5800 kc. ★YV2RC
-B- 51.72 meters
RADIO CARACAS
CARACAS, VENEZUELA
Sun. 8:30 a.m.-10:30 p.m.
Daily 11 a.m.-1:30 p.m., 4-9:30 p.m.

5790 kc. JVU
-C- 51.81 meters
NAZAKI, JAPAN

5780 kc. OAX4D
-B- 51.9 meters
P.O. Box 853
LIMA, PERU
Mon., Wed. & Sat. 9-11:30 p.m.

5720 kc. RV15
-B- 52.45 meters
KHABAROVSK, SIBERIA, U. S. S. R.
Daily, 1-10 a.m.

5720 kc. YV10RSC
-B- 52.45 meters
"LA VOZ de TACHIRA,"
SAN CRISTOBAL, VENEZUELA
6-11:30 p.m.

5713 kc. TGS
-B- 52.51 meters
GUATEMALA CITY, GUAT.
Wed., Thurs. and Sun. 6-9 p.m.

5500 kc. TI5HH
-B- 54.55 meters
SAN RAMON, COSTA RICA
Irregularly 3:30-4, 8-11:30 p.m.

5145 kc. PMY
-B- 58.31 meters
BANDOENG, JAVA
5:30-11 a.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

5000 kc. TFL
-C- 60 meters
REYKJAVIK, ICELAND
Calls London at night.
Also broadcasts irregularly

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

4790 kc. VE9BK
-BX- 62.63 meters
RADIO SALES SERVICE, LTD., 780 BEATTY ST., VANCOUVER, B.C., CAN.
Daily exc. Sun. 11:30-11:45 a. m., 3-3:15, 8-8:15 p.m.

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
Wed., Sat., 9:15-11 p.m.

4320 kc. GDB
-C- 69.44 meters
RUGBY, ENGLAND
Tests, 8-11 p. m.

4272 kc. WOO
-C- 70.22 meters
OCEAN GATE, N. J.
Calls ships irregularly

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.

3040 kc. YDA
-B- 98.68 meters
N.I.R.O.M.
TANDJONGPRIOK, JAVA
Daily exc. Sat. 6-7:30 p.m., 5:30-10:30 or 11 a.m., Sat. 5:30-11:30 a.m.

Alphabetical List of S-W Stations

By Call-Letter and Frequency

(Frequency in Megacycles)

CALL	FREQ.
CB960	9.06 mc.
CEC	19.68
CEC	15.87
CEC	10.67
CGA3	13.29
CGA4	9.33
CJA3	11.41
CJRO	6.15
CJRX	11.72
CNR	12.83
CNR	8.04
COCD	6.13
COCH	9.43
COCO	6.01
COCQ	9.75
COCX	11.5
COKG	6.15
CO9JQ	8.67
CO9WR	6.28
CP5	6.08
CRCX	6.09
CSL	6.15
CSW	9.93
CT1AA	9.65
CT1GO	12.40
CT2AJ	4.00
DAF	12.33
DAF	8.77
DFB	17.52
DGU	9.650
DJA	9.560
DJB	15.20
DJC	6.02
DJD	11.77
DJE	17.76
DJL	15.11
DJM	6.08
DJN	9.54
DJO	11.8
DJP	11.86
DJQ	15.28
DJR	15.34
DZA	9.68
DZB	10.04
DZC	10.29
DZE	12.13
DZG	15.36
DZH	14.46
EAQ	9.86
EDM	20.86
EDM	10.07
EHY	20.86
EHY	10.07
FTA	11.94
FTK	15.88
FTM	19.36
FTO	18.25
FZR3	16.23
FZS	18.35
FZS2	11.99
GAA	20.38
GAB	18.04
GAD	19.48

CALL	FREQ.
GAP	19.16 mc.
GAQ	18.97
GAS	18.31
GAU	18.62
GAW	18.20
GBA	13.99
GBB	13.59
GBC	17.08
GBC	12.78
GBC	8.68
GBC	4.98
GBL	14.65
GBP	10.77
GBS	12.15
GBU	12.29
GBW	14.44
GCA	9.71
GCB	9.28
GCI	8.73
GCJ	13.42
GCQ	8.76
GCS	9.02
GCU	9.95
GCW	9.79
GDB	4.32
GDS	6.91
GDW	4.82
GSA	6.05
GSB	9.51
GSC	9.58
GSD	11.75
GSE	11.86
GSF	15.14
GSG	17.79
GSH	21.47
GSI	15.26
GSJ	21.53
GSL	6.11
GSN	11.82
GSO	15.18
GSP	15.31
HAS3	15.37
HAT4	9.13
HBJ	14.54
HBL	9.60
HBP	7.80
HCETC	6.98
HCJB	8.95
HCK	5.89
HC2AT	8.40
HC2ET	4.60
HC2RL	6.64
HC2TC	7.98
HH2S	5.92
HH3W	9.65
HIG	6.28
HIH	6.78
HII	14.94
HIL	6.50
HIN	6.24
HIN	11.28
HIT	6.63mc.
HIX	6.13

CALL	FREQ.
HIZ	6.32
HI1A	6.19
HI1J	5.86
HI1S	6.42
HI3C	6.10
HI3U	6.02
HI4D	6.56
HI4V	6.48
HI5N	6.14
HI7P	6.80
HI8A	6.45
HI9B	6.05
HJA3	14.94
HJB	14.95
HJN	5.95
HJU	9.50
HJ1ABB	9.56
HJ1ABC	6.0
HJ1ABD	7.28
HJ1ABE	9.50
HJ1ABG	6.04
HJ1ABJ	6.03
HJ1ABK	7.07
HJ1ABP	9.62
HJ2ABA	6.18
HJ2ABC	9.59
HJ2ABD	5.98
HJ3ABD	6.05
HJ3ABF	6.17
HJ3ABH	6.01
HJ3ABX	6.12
HJ4ABA	11.81
HJ4ABB	6.11
HJ4ABC	6.45
HJ4ABC	6.07
HJ4ABD	5.93
HJ4ABE	6.09
HJ4ABL	6.06
HJ4ABP	6.03
HJ4ABU	6.15
HJ5ABD	6.09
HKB	9.93
HKE	7.10
HKV	8.80
HPF	14.49
HP5B	6.03
HP5F	6.08
HP5J	9.62
HP5K	6.01
HRD	6.24
HRF	14.49
HRL5	14.49
HRN	5.88
HRP1	7.03
HS8PJ	9.35
HS8PJ	19.02
HS8PJ	15.22
HSP	17.74
HVJ	15.12
HVJ	5.97
IAC	17.76
IAC	12.80

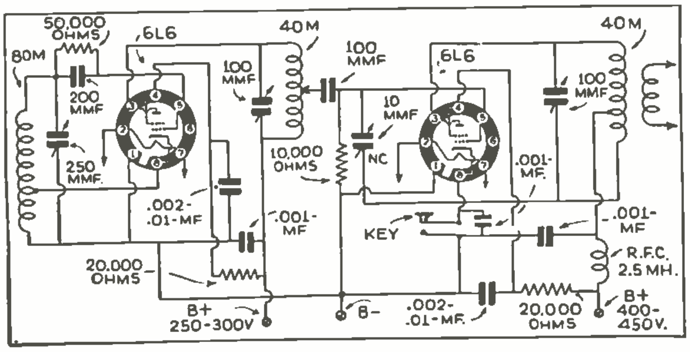
CALL	FREQ.
IAC	8.38 mc
IAC	6.65
IDU	13.39
(I)2RO	11.81
2RO	9.64
JVE	15.66
JVF	15.62
JVH	14.60
JVM	10.74
JVN	10.66
JVP	7.51
JVT	6.75
JVU	5.79
JYK	13.61
JYR	7.88
JYS	9.84
JYT	15.76
KAY	14.98
KAZ	9.99
KEE	7.72
KEJ	9.01
KEL	6.86
KES	10.41
KIO	11.68
KKH	7.52
KKR	15.46
KKZ	13.69
KTO	16.24
KWO	15.42
KWU	15.36
KWV	10.84
KWX	7.61
LKJ1	9.53
LRU	15.29
LRX	9.66
LSF	19.60
LSG	19.90
LSI	9.80
LSK3	10.25
LSL	15.81
LSL2	10.30
LSM2	14.50
LSN	9.89
LSN	14.53
LSN5	19.65
LSN6	21.02
LSX	10.35
LSY	20.70
LSY3	18.12
LZA	14.97
OAX4D	5.78
OAX4G	6.23
OCI	18.68
OCI	10.97
OCJ2	14.85
OER2	6.07
OLR	15.23
OLR	11.76
OLR	11.88
OPL	20.04
OPM	10.14
ORG	19.20
ORK	10.33

CALL	FREQ.
OXY	6.06 mc.
PCJ	15.22
PCJ	9.59
PCV	17.81
PDK	10.41
PDV	12.06
PHI	17.78
PHI	11.73
PLE	18.83
PLO	11.50
PLP	11.5
PLV	9.42
PMA	19.35
PMC	18.14
PMK	11.5
PMN	10.26
PMY	5.15
PNI	8.78
PPU	19.26
PRADO	6.63
PRA8	6.04
PRF5	9.50
PSA	21.08
PSF	14.96
PSH	10.22
PSK	8.19
RIM	15.25
RIM	7.63
RIO	10.17
RIR	10.08
RKI	15.09
RKI	7.50
RNE	12.0
RV15	5.72
RAN	9.60
RW96	15.18
SPW	13.64
SUV	10.06
SUX	7.86
SUZ	13.82
TFJ	12.24
TFK	9.06
TFL	5.0
TGF	14.49
TGS	5.71
TGWA	9.45
TGXA	6.13
TG2X	5.94
TIEP	6.71
TIGPH	5.83
TIPG	6.41
TIR	14.49
TIRCC	6.55
TI4NRH	9.67
TI5HH	5.50
TI6OW	6.85
TI8WS	7.55
TPA2	15.25
TPA3	11.88
TPA4	11.72
TYA	12.22
TYB	12.25
TYF	14.64

CALL	FREQ.
VE9BJ	6.09 mc.
VE9BK	4.79
VE9CA	6.03
VE9CS	6.07
VE9DR	6.01
VE9HX	6.13
VIZ3	11.56
VK2ME	9.59
VK3LR	9.58
VK3ME	9.51
VK6ME	9.59
VLJ	9.76
VLK	10.52
VLZ2	9.76
VPD	13.08
VPD2	9.54
VP3MR	7.08
VQ7LO	6.08
VRR4	11.60
VUB	9.57
VUC	6.11
VWY	8.98
VWY2	17.51
WCN	5.08
WKA	21.06
WKF	19.22
WKK	21.42
WKN	19.82
WLA	18.34
WLK	16.27
WMA	13.39
WMF	14.47
WMN	14.59
WNA	9.17
WNB	10.68
WNC	15.06
WND	4.10
WOA	6.76
WOB	5.85
WOF	14.47
WOG	16.27
WOK	10.55
WON	9.87
WOO	17.62
WOO	12.84
WOO	8.56
WOO	4.75
WOO	4.27
W1XAL	15.25
W1XAL	11.79
W1XAL	6.04
W1XK	9.57
W2XAD	15.33
W2XAF	9.53
W2XE	21.52
W2XE	17.76
W2XE	15.27
W2XE	11.83
W2XE	6.12
W3XAL	17.78
W3XAL	6.10
W3XAU	9.59
W3XAU	6.06

CALL	FREQ.
W3XL	17.31 mc.
W4XB	6.04
W4XCA	31.60
W8XAL	6.06
W8XK	21.54
W8XK	15.21
W8XK	11.87
W8XK	6.14
W8XWJ	31.60
W9XAA	11.83
W9XAA	6.08
W9XBS	6.43
W9XF	6.10
XBJQ	11.20
XEBT	5.99
XECR	7.38
XEFT	6.12
XEME	8.19
XEUW	6.02
XEWI	11.9
XEXA	6.17
XGM	17.65
XGOX	6.69
XGW	10.42
YBG	10.43
YDA	6.04
YDA	3.04
YDB	9.65
YDB	11.86
YDC	15.15
YNA	14.49
YNLF	9.65
YVC	13.35
YVQ	6.67
YVR	18.30
YVR	9.15
YV2RC	5.80
YV3RC	6.16
YV4RC	6.38
YV5RMO	5.85
YV6RV	6.52
YV7RMO	6.07
YV8RB	5.90
YV9RC	6.40
YV10RSC	5.72
YV11RB	6.55
YV12RM	6.30
ZBW	8.75
	9.53
	15.18
ZFA	5.03
ZFB	10.06
ZGE	6.13
ZHI	6.02
ZHJ	7.63
ZLT2	7.39
ZLT4	11.05
ZSS	18.89
ZTJ	6.10

• • • Short Wave



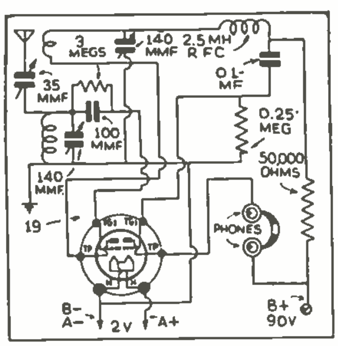
6L6 MOPA for C.W. transmission. (1024)

6L6 MOPA FOR C.W.

W1IYM, Fairfield, Conn.

(Q) Please print a circuit in your *Question Box* of a MOPA utilizing the new 6L6 metal tubes. The oscillator must be electron-coupled as an xtal is not available. I would appreciate this data and any further information you could give me regarding a 6L6 as E.C. oscillator, or what have you, will be appreciated.

(A) Although we encourage the use of crystal-controlled transmitters for the C.W. bands, we are complying with your request and showing a 6L6 MOPA employing two tubes. In all cases, the oscillator should be used as a combination oscillator and doubler. Results will not be satisfactory if the plate and grid circuits are tuned to the same frequency in the oscillator stage. We have indicated, as an example, the grid circuit tuned to 80 meters, the plate circuit to 40, and the final amplifier to 40. We have also shown a neutralizing circuit in the final amplifier. In most cases, this has not been found necessary but may be incorporated as a precautionary measure, by tapping the B plus to the plate coil approximately 1/5th of the total number of turns, the small portion of the coil being used for neutralizing as shown in the diagram.



Two-in-One receiver. (1025)

TYPE 19 AS 2-TUBE RECEIVER

Harry M. Mobridge, Whitlash, Mont.

(Q) Would you please print a diagram of a short-wave receiver using a type 19, 2-volt tube. Since reading *Short Wave & Television*, I have built 27 short-wave sets, 1- to 4-tube battery receivers, and have had fine results with my three *Doerle's* and one *Duo-Amplidyne* now in use. Have pulled in most of the regular foreign stations on my speaker with fair signal strength. Here's to *Short Wave & Television* and many more good sets.

(A) We have shown the circuit diagram of a 19 used as a regenerative detector and one stage of audio amplification. Resistance coupling is employed. The plate voltage which seems to work out best is 90 volts. For low voltages it may be found necessary to use transformer coupling between the two stages.

POWER SUPPLY DIAGRAM

John Loughlin, San Francisco, Cal.

(Q) Would you please print a diagram for a power supply in your *Question Box*. It must supply a "B" voltage of 250 volts; filament voltage of 1.5 volts, 3 volts, 4.5 volts, and 6 volts. Also, it should use a type 80 tube.

(A) We have shown the diagram of the power supply. However, we have only indicated a single 2½-volt winding. The odd voltages you require, such as 3, 4.5, and 6, we do not believe are readily obtainable on standard manufactured transformers. We suggest that you get in touch with transformer manufacturers.

"CODE-PRACTICE" OSCILLATOR

Thomas O'Connell, Chicago, Ill.

(Q) I would appreciate it very much if you would print a diagram of a *code-practice* oscillator using a 201A, an audio transformer and a rheostat to control the pitch.

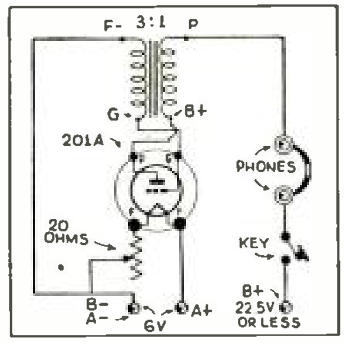
(A) We constantly receive requests for diagrams of *code-practice* oscillators, and we trust the one shown will satisfy the great number of inquiries. Any type tube may be used. For type 30, for instance, the filament voltage should be 3 volts and adjusted to the proper value by the rheostat. Adjustment of this rheostat will also change the tone to a considerable extent.

TRANSMITTING ANTENNA

B. J. Morton, Marshall, N.C.

(Q) I would appreciate your answering the following question in your *Question Box* in an early issue: I would like to know the dimensions of an antenna, single wire feed Hertz, using No. 8 solid copper wire. This antenna should operate near 3550 kc. Also give the size of wire to use for a feeder on this antenna.

(A) For all general purposes it has been found that No. 12 or 14 solid copper wire is entirely satisfactory for an antenna both for receiving and transmitting, and it would seem that it would be a waste of money to use a very much heavier wire. A number of formulas have been printed in various publications covering the construction of antennas, and also various methods for calculating the position of the single feeder. However, none for the latter are exact. For instance, the size of the wire, the height and various other conditions require some adjustment of the formula. For 3550 kc. an antenna which would give good results would consist of a single wire 132 feet long with the single feeder tapped 18 feet, 6 inches one side of the center of the antenna. We suggest that various positions for the feeder be tried within a range of 8 or 10 inches either side of the approximate position given. There should be no standing waves on the feeder when the proper point is located. This can be determined by the use of a Neon bulb moved along the feeder for a distance of one-quarter wave. No change in the brilliancy of the bulb will be noticed under perfect conditions. The feeder should also run away from the antenna at right angles for a distance of at least one-third the total length of the antenna.



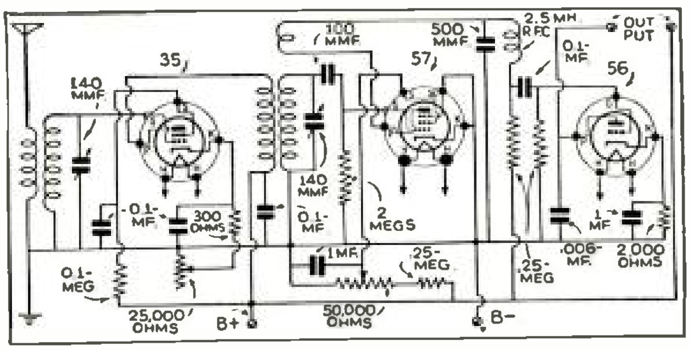
Code-practice oscillator. (1027)

3-TUBE DIAGRAM

Ralph Hadley, Dryden, Ont., Can.

(Q) Wants diagram of a 3-tube T.R.F. bandspread set using a 235, a 57, and a 56 resistance-coupled audio.

(A) We have shown a diagram using a 35 as an T.R.F. amplifier ahead of a 57 regenerative detector which, in turn, is resistance coupled to a 56 audio amplifier. Coil data for this receiver may be found in the August, 1936 issue of the *Question Box*.



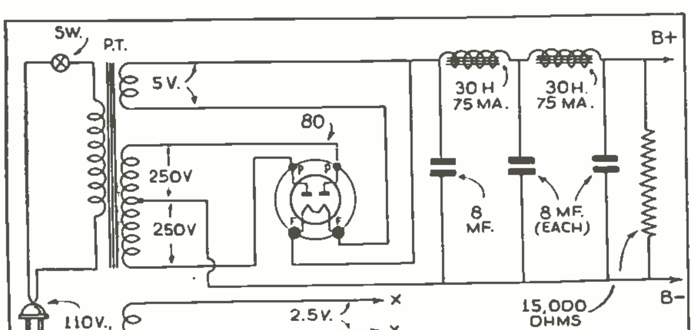
3 tuber with tuned R.F. stage. (1028)

4-TUBE A.C.-D.C. SET

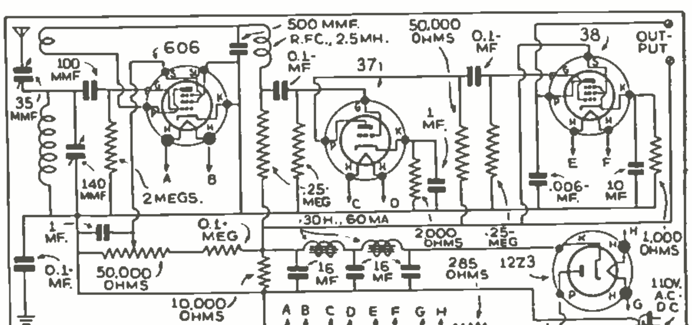
Ray Murray, St. Marys, Kan.

(Q) Please print in your *Question Box* a diagram of a 4-tube set using the following tubes: 6C6, regenerative detector; 37, audio; 38, output; and 12Z3, rectifier. I would like to use transformer coupling between the 6C6 and the 37, and resistance coupling between the 37 and the 38.

(A) We have shown the diagram of the 4 tubes mentioned in your letter. However, we recommend resistance coupling between the detector and first audio stage. If you wish to employ the transformer, we suggest that you use only the secondary and connect it in place of resistor "R" in the sketch.



Power-supply diagram for 250 volt output. (1026)



All-electric A.C.-D.C. receiver using 4 tubes. (1029)

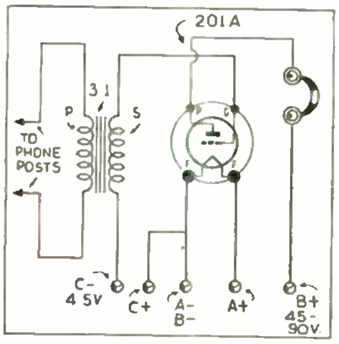
QUESTION BOX • •

● 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 remittance may be made in the form of stamps, coin or money order.

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.

EDITED BY GEORGE W. SHUART, W2AMN



Audio amplifier. (1030)

201A AMPLIFIER

David Tobins, Dayton, Ohio.

(Q) I have constructed a 1-tube battery receiver and would like to build a 1-stage audio amplifier for it using a 201A tube. Would you kindly print the necessary diagram in your *Question Box?*

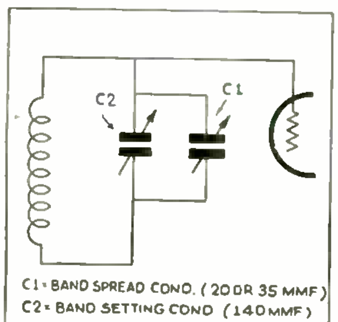
(A) We have shown the diagram requested. The input terminals of the amplifier (the primary terminals of the transformer) should be connected to the phone terminals of your present receiver. Adding this stage of amplification should improve results considerably.

BAND-SPREAD

L. W. Parrish, Scranton, Pa.

(Q) Please advise me in the *Question Box* if band-spread can be used in the *Space Explorer 6.* Also, if I add the capacities which you specify, will I have to make any alterations in the plug-in-coils?

(A) We have shown how band-spread may be employed in the *Space Explorer* receiver. This system may be employed in any short-wave receiver of the type mentioned. The plan is simple enough, a small condenser is used for tuning, while a large condenser is employed for setting the particular band you wish to tune, within the range of the smaller condenser. No alterations will be necessary in the plug-in coils when employing this system.



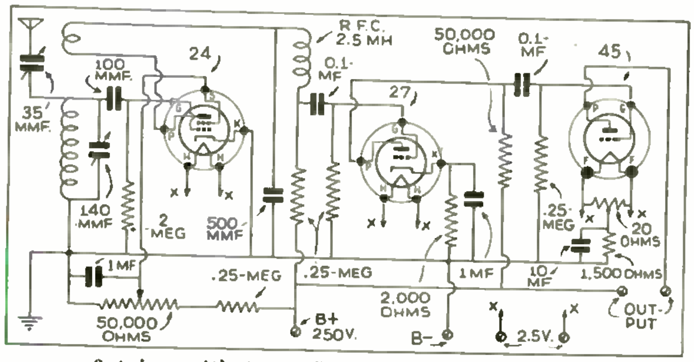
Band-spreading. (1032)

S-W RECEIVER WITH 45 AMPLIFIER

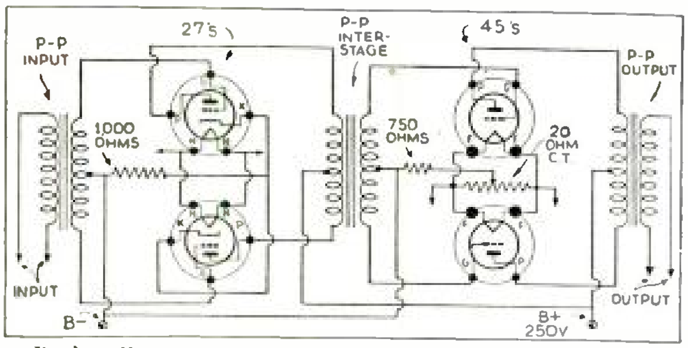
E. C. Richards, Edmonton, Alta., Canada.

(Q) Please show a diagram in the *Question Box* of a receiver using three tubes. I have a 24, 27, and a 45 tube. Would these three tubes make a good set?

(A) We have shown the diagram requested in your letter, and it employes a type 45 in the output tube. The 45 is noted for good quality but has exceptionally low amplification, and power output. In the average regenerative receiver quality should not really be important, and the use of a pentode such as a 2A5.



3 tuber with type 45 output amplifier. (1033)



Push-pull amplifier for high-quality reproduction. (1031)

PUSH-PULL A.F. AMPLIFIER

Edward DiPaulo, Greensburg, Pa.

(Q) I would be very grateful if you would print a 4-tube amplifier in your *Question Box.* This amplifier should use two type 27's transformer-coupled to a pair of 45's in push-pull.

(A) We have shown the diagram of an amplifier which includes two type 27's in push-pull, transformer-coupled to a pair of 45's. If high-quality transformers are used, real high-fidelity should be obtained with this amplifier. The out-put transformer should be designed to couple the two 45's in Class "A" to the speaker you intend to use. These transformers are usually attached to the speaker, and we suggest that you make sure the proper transformer is included.

COMPLETE A.C. OPERATED RECEIVER

N. L. Leitsch, N.S. Pittsburgh, Pa.

(Q) I have been a reader of your wonderful magazine, *Short Wave & Television* for two years, and also have a copy of your *Short Wave Guide* which I find very useful and interesting. I have a question to ask and hope you can help me. Will you publish a diagram using Hammarlund 6-prong coils and employing two 36's, one 38, and one rectifying tube. Thanks.

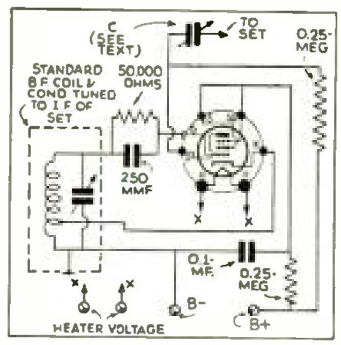
(A) The complete A.C. operated receiver as requested in your letter is shown in one of the diagrams on this page. This should give excellent performance and other experimenters who are interested in building a good short-wave receiver of simple design may well follow the layout provided.

BEAT OSCILLATOR

Ralph I. Hansen, So. Omaha, Nebr.

(Q) I would greatly appreciate it if you would publish a diagram of a beat frequency oscillator to be used with the Mitchell Superhet., described in the December, 1933 issue of *Short Wave Craft.* Thanks.

(A) The beat oscillator diagram shown employs a standard beat frequency oscillator coil and condenser combination. This is available from any radio supply house. These have the same appearance as an ordinary I.F. transformer. This oscillator may be coupled to any receiver of the superheterodyne variety. Condenser "C" in the diagram may be a two plate midget condenser or may consist of the capacity due to wrapping an insulated wire around the plate lead to the tube. The lead is then merely placed near the grid lead of the last I.F. amplifier in the receiver.



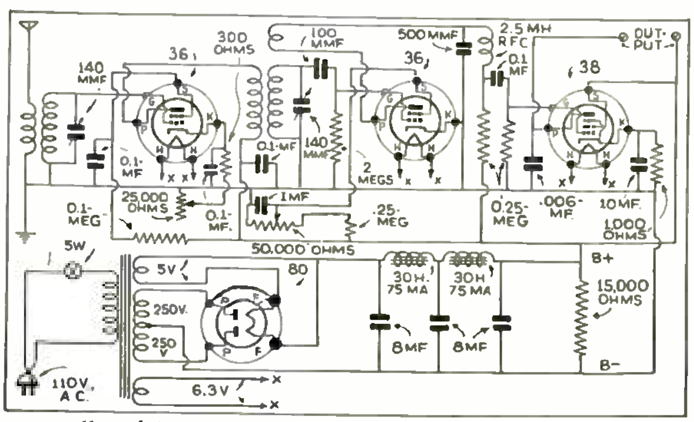
Beat oscillator for superhets. (1034)

2-TUBE RECEIVER

Raymond Jones, Endicott, N.Y.

(Q) I would like to know what issue there appeared a diagram of a 2-tube receiver using a 6F7 and 12A7 in an A.C.-D.C. circuit.

(A) In the May, 1935 issue, Page 12, you will find described a 2-tube receiver using the tubes mentioned in your letter. The functions of the 2 tubes are: untuned r.f. stage, regenerative detector, one stage of audio amplification, and rectifier. This is entirely A.C. or D.C. operated.



Complete A.C. receiver using 6.3 V. tubes. (1035)

SHORT WAVE LEAGUE

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When to Listen In

by M. HARVEY GERNSBACK

● WE have recently acquired a National NC-100X receiver on which all listening is now being done. This, plus the fact that our listening point has been removed from New York City to the suburbs of Long Island has had the effect of greatly extending our short wave reception area. In a few weeks' time the number of stations clearly audible has been more than doubled. We trust that this column will reflect this improvement in the future.

Here's 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.

CZECHOSLOVAKIA

● OLR, as the new station at Prague is now known, is operating on a new frequency. At present broadcasts occur daily from about 1:30-4 p.m. and on Monday and Thursday from 7-9 p.m. on a frequency of 11875 kc., sliced in between TPA3 and W8XK.

GERMANY

● THE current schedule of the Berlin stations is as follows: 12m-2 a.m. on DJL; 12:05-5:15 a.m. on DJA, DJB, DJE, and DJN. 5:55-11 a.m. on DJA, DJB, DJE and DJQ (from 6-8 a.m. DJQ uses a beam for S. America). 8-9 a.m. on DJL for N. America and DJR for Central America. 11:35 a.m.-4:30 p.m. on DJC, DJD and DJL. 4:50-10:45 or 11 p.m. on DJC and DJD for N. America, DJN for S. America and DJA for Central America. On Sundays the following additional broadcasts occur: 6-8 a.m. on DJL for Africa; 11:10 a.m.-12:20 p.m. on DJB and DJQ for N. and S. America. In addition DJP is frequently heard from 11:35 a.m.-4:30 p.m. sending the same program as DJD and DJL. DJO is also heard sending special programs to America together with DJB from 12n-4:30 p.m.

ARGENTINA

● LRU, Buenos Aires, is now on daily from 7 a.m.-4:50 p.m. and LRX from 5-9 p.m. LRU is not heard often but LRX is heard daily with a strong signal which suffers from flutter fading. Unfortunately this station does not modulate very deeply, so the signals are not very loud despite the strong carrier.

PORTUGAL

● CSW, Natl. Broadcasting Station, at Lisbon on about 9930 kc. is a new star station. This station is heard almost daily from about 5-7 p.m. On Saturdays it can be heard from about 4-7:30 p.m. The signals are very loud and clear. Announcements are made in several languages including English.

HERE AND THERE

● THE 31 meter (9.6 mc.) broadcast band is one of the liveliest of all bands at present. During the afternoon stations in Europe are heard well (GSB, CT1AA, CSW among many) and with the coming of evening the S. Americans are added to the list. The S. Americans heard well include COCQ 9.75 mc.; LRX, 9.66 mc.; HH3W about 9.64 mc.; HJ1ABP 9.615-9.620 mc.; HP5J 9.61 mc.; HJ1ABB 9.555 mc.; HJ1ABE 9.5 mc.; HJU 9.5 mc.; TGWA 9.45 mc. and COCH 9.43 mc. In addition HJ2ABC has recently been heard operating near 9.57 mc.

In the early morning hours the Australians, VK3LR and VK3ME, and on Sundays VK2ME, are heard and in addition the Fiji Isle station VPD2 on 9.54 mc. is heard from 5:30-7 a.m. Lastly a new station in Hong Kong on 9.58 has made its appearance from 4 a.m. on.

● HIN at Trujillo in the Dominican Republic is heard irregularly from 4-9 p.m. on 11.28 mc. According to the announcer at Radio Colonial in Paris, the new high power French station will commence operations by Jan. 1, 1937. This station has been expected on the air for 3 years and so many announcements of its opening have been made in the past that we are tickled about the latest news. We shall certainly be "all ears" for the new station, which is supposed to be rated at over 100 kw. YDC at Bandoeng, Java, is putting over a fair signal these fall mornings from about 5:30 a.m. on 15.15 mc. It sends the same program as YDB and PLP. Frequently on Sunday it relays PHI and PCJ.

ALL TIME IS EASTERN STANDARD

O.L.P. News from Freeport, Pa.

● THIS is my report for the month. A new Chinese station is broadcasting on about 15.18 meg. just below DJB; they have been on until 8:00 a.m. and occasionally until 9:00 a.m.

ZBW, in Hong Kong is on 8.75 meg.; they have been coming in very good lately, and their best transmission is from 3:00 to 7:00 a.m.

XGW, Shanghai, China, can be heard irregularly at about 9:00 a.m. phoning KWU.

TFJ, Iceland on 12.24 meg. is heard on Sundays at 1:40 p.m. E.S.T. with fair signal strength.

VK2ME, VK3ME, and VK3LR, of Australia, are coming in very good.

FO8AA, Papeete, Tahiti, 7.10 meg. is on every Tuesday and Friday, 11:00 p.m. to midnight. The "Marseillaise" is the selection played at the beginning of the transmissions.

RAN, Moscow, U.S.S.R., comes in very good at times; then at other times they can hardly be heard. At present, they are on 9.60 meg. after moving from 9.52 and 9.59 meg. They are on from 7:00 to 8:00 p.m. daily.

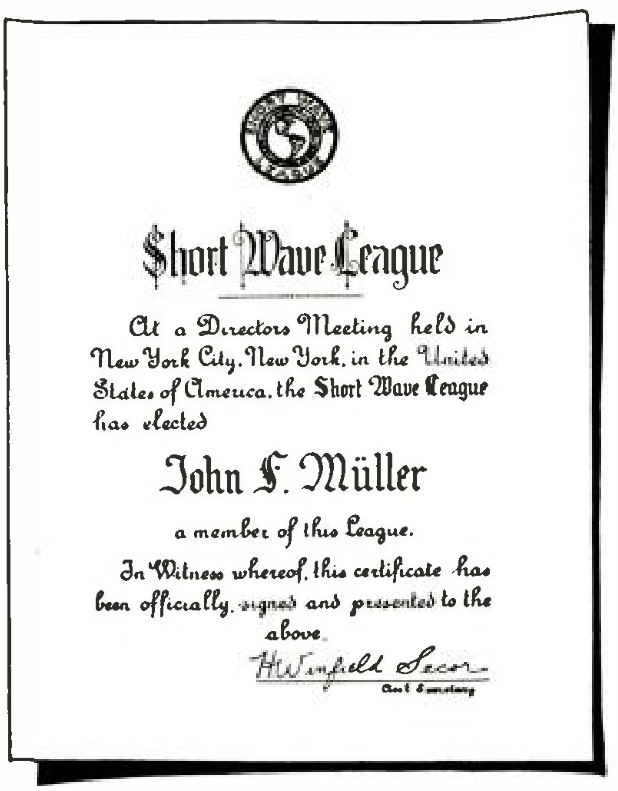
RIM, on 15.25 meg. phones RKI every morning till 10:00 a.m.

IRY, Rome, Italy, can be heard almost every morning phoning at 9:30 or 10:00 a.m. IAC, Piza, Italy, "works" ships every morning.

HIN, Trujillo, Dominican Republic, is heard on 6.24 and 11.28 meg.; they are very strong on 11.28 meg.

LSX, Buenos Aires, S.A., 10.35 meg., has

(*Continued on page* 583)

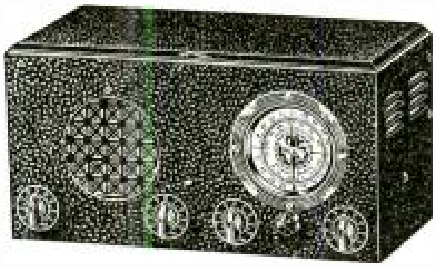


This is the handsome certificate that is presented FREE to all members of the SHORT WAVE LEAGUE. The full size is 7¼"x9½".

See page 592 how to obtain certificate.

"NEW 1937 SHORT WAVE APPARATUS—THE IDEAL CHRISTMAS GIFT"

(Guaranteed shipment of all orders within 24 hrs.)



Eilen

EILEN RX-17 7-tube BANDSPREAD RECEIVER

(8½ to 3,000 meters)

Our largest, finest, and most sensitive new 1937 receiver, unequaled in appearance, performance and value. Uses a special, highly efficient and selective circuit producing results which WILL satisfy even the most discriminating short wave fan.

RX-17 is equipped with the famous **EILEN NOISE SUPPRESSOR**, the latest development of our laboratories and which is skyrocketing itself into immense popularity. This remarkable development, exclusive with EILEN, enables you to enjoy reception from those far-off stations with excellent clarity and volume.

Constructed of the finest materials and to conform with the highest engineering standards, this instrument uses two 6D6, two 6J5G, one 76, one 42, and one 5Y3 high gain tubes as **TUNED RF AMPLIFIER, TUNED ELECTRON COUPLED SCREEN-GRID REGENERATIVE DETECTOR**, powerful 3 stage audio frequency amplifier with power pentode output stage delivering 3 watts of audio power to the built-in high fidelity dynamic loudspeaker. **VARIABLE NOISE SUPPRESSOR**, rectifier and complete built-in **HUM-FREE** power supply. **BANDSPREAD TUNING**—a special electron tube circuit enabling the operator to reduce or eliminate certain types of noises occurring in all short wave receivers—automatic headphone jack—smooth and noiseless controls—highly efficient interchangable inductors—doublet or aerial-ground connections—**POWERFUL** hi-fidelity audio system—large, illuminated airplane type vernier dial—sensitivity, volume, and selectivity that will amaze you—are features to be found in RX-17.

RX-17 in **BEAUTY**, as well as performance, is in a class by itself—heavy steel cabinet with hinged lid finished in durable black shrivel—colored dial lights behind black and white scale—chrome plated escutcheon—calibrated dial plates—plated chassis and shielding—Operates entirely from your 105 to 130 volts AC house current.

RX-17 under fair conditions will bring in dozens of foreign as well as domestic short wave stations with enormous volume. Try one and see for yourself!

RX-17, complete, READY TO USE, with 7 RCA or Sylvania tubes, 8 low-loss silver plated coils for 8½ to 200 meters, wired, in cabinet, and 7 page instruction booklet **$21.95**
Broadcast band coils (200-550 meters) extra $1.45
(If metal tubes are preferred over the glass type, add $1 to above price.)

For those who wish to build their own we offer:
KIT of all parts, coils for 8½-200 meters, (less tubes & cabinet) **$13.95**
Cabinet, extra $2.50
6 matched Sylvania tubes, extra 3.35
Long wave coils (550-3,000 meters) 1.95

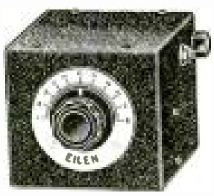
AMATEURS: Model RX-17-AB has same specifications as RX-17 except that it is equipped with plate voltage cut-off switch and special bandspread coils for 20-40-80-160 M bands spreading these bands 80% of dial scale. Add $1 to price of RX-17. (10 meter band coils if desired extra $1.45).

MODEL RX-18 and **RX-18-AB** are identical with the above model, but possess an eighth tube enabling the wave length range to be extended down to 1⅓ meters. Add $1.50 to price of corresponding RX-17 model.

Eilen

HF-19 One-Tube Transceiver

5 Meters



A masterpiece in simplicity! An unequalled value for the experimenter who is interested in an inexpensive transceiver which will enable him to maintain reliable 2 way communication with a friend. So simple that even a beginner may readily obtain remarkable results with it. Uses one type 19 (twin 2 in 1 tube) in special circuit producing great volume and signal strength. Operates from 2 dry cells and 90 to 135 volts of B battery.

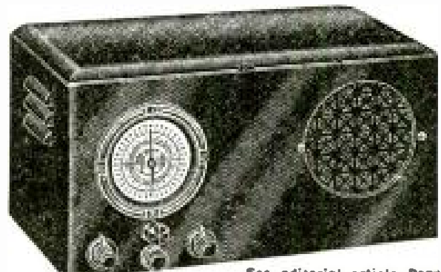
HF-19 TRANSCEIVER KIT, of necessary parts, and simple instructions, less cabinet, tube, microphone, unwired **$3.95**
Beautiful crackle finish cabinet extra....$1.25
Type 19 tube, extra .... $ .65
Wired and tested, extra 1.50
Microphone for above, extra 1.95

Eilen

BS-5

6-Tube Band switch Receiver

12 to 600 Meters



A powerful, sensitive, and selective SW receiver covering the entire wave-length span of 12 to 600 meters in 5 steps. NO PLUG-IN COILS are used. Simply turn the waveband selector switch and enjoy reception on any wavelength within this range.

Uses two 6D6, one 76, one 43, one K42A, and one 25Z5 tubes as RF amplifier, electron coupled screen grid regenerative detector, powerful 2 stage audio amplifier with pentode output stage, rectifier, and complete built-in power supply.

HUM-FREE—Hi-fidelity dynamic loudspeaker—illuminated, airplane type vernier dial—band spread tuning control—automatic headphone jack—extremely smooth acting controls—operates from your AC or DC house current—beautiful heavy, black shrivel finish chassis and cabinet.

See editorial article Page 482, Dec. issue S.W.C.

DELIVERS GREAT LOUDSPEAKER VOLUME ON THE GREAT MAJORITY OF SHORT WAVE FOREIGN STATIONS UNDER FAIR CONDITIONS.

PRICE, complete with 6 tubes, cabinet, wired, ready to use **$16.95**

BS-5 KIT, of necessary parts, including detailed instructions; less tubes, cabinet, unwired **$10.95**
SPECIAL: Complete kit, cabinet, tubes and instructions, unwired **$14.95**
(If metal tubes are preferred to glass type, add $1)

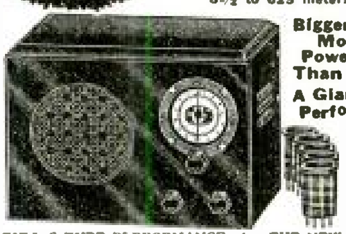
AMATEURS:
Model BS-5-AB has same specifications as BS-5 except that it has special bandspread circuit for 20-40-80-160 M bands and is equipped with plate voltage cut-off switch. Add $1.00 to above price.

Eilen

7C 5-Tube

Short Wave Receiver

8½ to 625 meters



Bigger and More Powerful Than Ever
A Giant in Performance

FULL 6 TUBE PERFORMANCE plus THE NEW K92A SERIES TUBE makes this an outstanding value. Equipped with a powerful 3 stage audio frequency amplifier.

Uses 6D6-6F7 (twin 2 in 1 tube)—76—K92A-12A7 (twin tube) tubes as R.F. amplifier, electron coupled screen grid regenerative detector, powerful 3 stage audio amplifier with pentode output stage, rectifier and complete built-in power supply. Operates entirely from 105 to 130 volt AC or DC light socket.

BAND SPREAD TUNING—smooth regeneration control—built-in high quality loudspeaker—automatic headphone jack—large, illuminated airplane type vernier dial—large low-loss inductances. Heavy, black shrivel finish metal chasis and cabinet. Must be seen to be appreciated. Satisfied owners report as high as 35 foreign countries on the loudspeaker with this model. You may do the same under fair conditions. ORDER YOURS TODAY! YOU WILL NOT REGRET IT!

EILEN 7C RECEIVER, wired, in cabinet, complete, **READY TO USE**, with speaker 5 RCA tubes, 4 coils for 8½ to 200 meters, and simple instructions.... **$12.95**
2 Broadcast Band Coils, extra $1.25
7C KIT, unwired, of necessary parts, 4 coils for 8½ to 200 meters, and instructions less cabinet, speaker, tubes **$7.25**
Beautiful metal cabinet, extra $1.25
5 matched RCA tubes 3.15
Special loudspeaker 1.45
(2) Broadcast band coils, 200-625 meters.... 1.25
Labor for wiring & testing, extra 1.50
SPECIAL: COMPLETE KIT, unwired, cabinet, 5 tubes, speaker, 4 coils for 8½ to 200 meters, and simple instructions **$11.45**
2 broadcast Coils, extra $1.25

AMATEURS: Model 7C-AB, same specifications as 7C except that has special tuning circuit and coils for spreading out the 20-40-80-160 M bands over 80% of dial. Also equipped with plate voltage cut-off switch. Same price as 7C. Model 6B or 6B-AB battery model of 7C. Operates from inexpensive dry batteries. Same price.

3-Tube Short Wave Radio Only $3.25

(less tubes, phones, unwired)

A REAL, powerful 3 tube short wave set that readily brings in amateurs, police calls, broadcast stations, experimental and foreign stations with good volume under fair conditions. **THE WORLD AT YOUR DOOR!**

A dependable receiver which is guaranteed to give results. Operates entirely from the AC or DC house current. Simple to build and easy to operate. Beautiful, black shrivel finish cabinet and instructions furnished. Wave-length range 12-600 meters. An ideal set for the beginner who wishes to learn the thrill of short wave reception.

THREE TUBE BATTERY SET, less tubes, phones, unwired $2.95
TWO TUBE BATTERY SET, less tubes, phones, unwired $2.00

KITS wired, extra 75c. Tubes, each 50c. Broadcast band coils (2), extra 95c. Cannonball double headphones $1.35.

Eilen

AN-5 Four Tube BANDSPREAD RECEIVER

A powerful and highly selective short wave receiver designed for the fan who prefers the use of headphones. Uses 6F7-6D6-76-84 tubes in five-tube performance circuit as TUNED RF amplifier, TUNED electron coupled screen grid regenerative detector, two stage audio amplifier, rectifier & built-in power supply. **HUM-FREE. POWERFUL.** Readily operates a speaker. Operates from your 105-130 volt AC house current.

AN-5, complete with 4 matched tubes, coils for 9 to 200 meters, cabinet, wired READY FOR USE **$15.95**
Broadcast band coils (2), extra $1.45

AMATEURS: Model AN-5-AB has same specifications as AN-5 except that has plate voltage cut-off switch and special bandspread coils for 20-40-80-160 meter bands. Add $1 to price of AN-5.

Eilen

HF-35 3-Tube SW Transmitter

A powerful and well engineered amateur band transmitter of great beauty and efficiency—**AT A PRICE WITHIN THE AMATEUR'S REACH.** Uses 59-46-46 tubes as **TRITET CRYSTAL CONTROLLED OSCILATOR—CLASS C RF POWER AMPLIFIER**—built-in antenna tuning system—beautiful, black shrivel metal case and shelving—Triplett meters—Eilen transmitting dials—highest quality construction — 35 watts of power output on 20-40-80-160 M bands. A transmitter that you can be proud to own. An excellent exciter unit for high power stages to be added later. 3 coils for any 1 band and instructions included.

HF-35, assembled, and ready to wire (less tubes, power supply, crystal, holder and additional coils) **$21.95**
Matched Arcturus Tubes (3) $2.15
Eilen quartz crystal (80 or 160) $1.95
Eilen crystal holder 1.00
Coils for additional bands, per set 1.45

HV-475 1-Tube power supply for use with HF-35, less tube (ready to wire).... **$12.95**
Labor for wiring extra $1.00
83 tube for HV-475, extra 65 cents

M-15 3-Tube Modulator for use with HF-35 and capable of modulating its entire output at 100%, priced at (less tubes) **$14.95**
Three Arcturus tubes, 56-53-53, extra..$1.95

FREE: New 1937 catalogue

of short wave receivers, transmitters, & 5 meter apparatus. Send stamp to cover mailing costs on YOUR copy.

JUST OFF THE PRESS!

Prompt service. 20% deposit on C. O. D. orders

EILEN RADIO LABORATORIES, Dept. SC 1, 136 Liberty Street, NEW YORK, N. Y.

What of Television?

By David Sarnoff

(*Continued from page* 525)

demonstration circuit has been its success in combining, for the first time in radio history, the simultaneous transmission of visual matter with automatic typewriter telegraph operation on the same radio channels. This ability to carry separate services simultaneously on a single frequency is of great importance.

It is the mastery of the ultra-high frequencies which is bringing television and facsimile within the area of practical use. We are steadily pushing farther into the higher regions of the spectrum which only yesterday constituted a "radio desert," now being made fruitful.

When television broadcasting reaches the stage of commercial service, advertising will have a new medium, perhaps the most effective ever put at its command. It will bring a new challenge to advertising ingenuity and a stimulus to advertising talent.

The new medium will not supplant nor detract from the importance of present day broadcasting. Rather, it will supplement this older medium of sound and add a new force to the advertisers' armament of salesmanship. Television will add little to the enjoyment of the symphony concert as it now comes by radio to your living room. Sound broadcasting will remain the basic service for the programs particularly adapted to its purposes. On the other hand, television will bring into the home much visual material—news events, drama, paintings, personalities—which sound can bring only partially or not at all.

Broadcasting has won its high place in the United States because—unlike European listeners—American set owners receive their broadcasting services free. Despite the greater cost of television programs, I believe that owners of television receivers in the United States will not be required to pay a fee for television programs. That is an aspect of the television problem in which the advertising fraternity will doubtless cooperate in finding the commercial solution.

Whoever the sponsor may be, or whatever his interests or purposes, he will be under the compulsion to provide programs that will bring pleasure, enlightenment and service to the American public. That compulsion operates today and must continue to operate if we are to retain the American system of radio broadcasting. The public, through its inalienable right to shut off the receiver or to turn the dial to another program will continue to make the rules. In television as in sound broadcasting the owner of a set will always be able to shut it off. In other words, the ultimate censorship of television, as well as of sound broadcasting, will remain between the thumb and forefinger of the individual American.

VALUABLE DATA IN BACK NUMBERS!

● Many short-wave set-builders frequently need constructional data on certain transmitters or receivers as well as converters and other allied apparatus.

Recently many inquiries have been received asking for data on "1-meter" sets, for example. The January, 1936 issue contains a very good article describing how to build and operate a transmitter and a receiver of modern type, tuning over a range of from ½ to 1 meter.

This shows how important it is to retain all back numbers of this magazine, as they may prove extremely valuable at any moment. Back numbers are available from the Subscription Dept.

Substantial binders are available for preserving these back numbers.

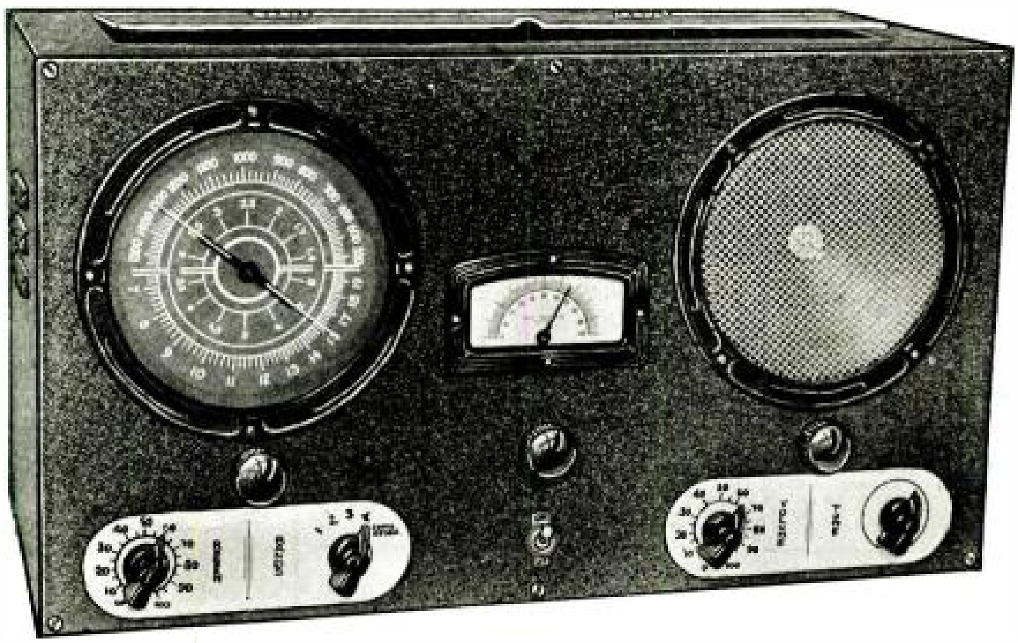
WE ARE PROUD TO ANNOUNCE

THE R-S-R CLIPPER

5 TUBES

Next Year's Receiver Today

DESIGNED BY A. J. HAYNES



HERE ARE SEVENTEEN FEATURES WHICH CONTRIBUTE TO THE HAYNES R-S-R CLIPPER'S OUTSTANDING PERFORMANCE!

1. Seven separate tuning bands.
2. Tuning range from below 5 meters to 555 meters; covers every foreign and domestic short wave broadcast and amateur band as well as airplanes, police, television, ship to shore and inter-continental radiophone; and brings them in on the speaker as loud as you want them.
3. Super-regeneration used below 10 meters; either super-regeneration or plain regeneration on the 10 meter band.
4. Includes special intermediate ultra-high frequency band between five and ten meters for the new high frequency broadcast and television stations.
5. A unique new circuit providing both regeneration and super-regeneration from the same detector.
6. Radio frequency amplification on *all* wavelengths including five and ten meters.
7. Full A.C. operation with built-in power supply and high voltage transformer.
8. 6L6 Beam power output tube with 4 watts output.
9. Large six inch dynamic speaker with full tone fidelity and volume.
10. All tubes are in use at all times.
11. Utilizes both electrical and mechanical bandspread on each band.
12. 5 inch dial; calibrated in kilocycles from 550 to 18,000 KC. with substantial overlaps.
13. Selector switch chooses desired wavelength band; interchangeable air-coils used below 10 meters.
14. Isolantite insulated three-plate condenser with vernier drive dial is used for both bandspread and ultra-high frequency tuning.
15. Separate Tone Control, Audio Volume Control, and R.F. Regeneration Control are provided.
16. Standby switch silences set without turning off filaments.
17. Earphone jack cuts out speaker when phones are used.

EIGHT months ago the original HAYNES R-S-R Regenerative, Super-Regenerative receiver was featured in the leading radio publications as the *first* commercial radio receiver to combine super-regeneration on the new ultra-high frequency bands with all-wave foreign and domestic broadcast reception. Through special arrangements with Mr. Haynes we became exclusive manufacturers of the Haynes R-S-R and have sold hundreds of these receivers throughout the world. Their record of fine performance and long distance foreign reception is well known. Every criticism and suggestion we ever received from users of the original R-S-R was turned over to Mr. Haynes. His new R-S-R CLIPPER is the result and we believe that you will agree that it incorporates every worth-while feature the experimenter could wish for in his *personal* receiver.

Please note that the R-S-R CLIPPER is designed specifically for long distance shortwave reception and although it includes the standard 200 to 550 meter broadcast band and provides very fine reproduction of the regular local broadcast programs by reason of its powerful amplifier and large dynamic speaker, still nothing has been sacrificed in favor of this low frequency band that would in any way detract from its shortwave performance.

The new Haynes R-S-R Clipper is always on demonstration at our laboratory where you can operate it yourself or any of our dealers will be glad to accord you the same privilege.

HAYNES R-S-R CLIPPER complete with 5 Sylvania tubes ready to plug in to A.C. outlet and operate **$28.85**

Shipping weight 20 lbs.

RACO

RADIO CONSTRUCTORS LABORATORIES

Dept. SW-1, 136 LIBERTY ST., NEW YORK, N. Y.

RACO

Book Review

PRINCIPLES OF RADIO ENGINEERING, by R. S. Glasgow, M.S. Size, 6½x9¼ in., 520 pages, 344 illustrations, cloth covers. Published by the McGraw-Hill Book Co., Inc., New York, 1936.

Radio students everywhere have undoubtedly felt that there was a distinct need for a thorough treatise covering the principles of radio engineering in an up-to-the-minute manner. Professor Glasgow has accomplished a fine piece of work in this book, which should find a place on every real radio student's bookshelf. The first part of the book deals with an analysis of alternating currents and Resonant Circuits. Some of the sub-titles are—Sharpness of Resonance (explained with graphs), Parallel Resonance With Various Conditions of Resistance, etc.

Next, we find an interesting discussion of the properties of coils and condensers, including a study of the inductance and distributed capacity of coils.

The action taking place in vacuum tube circuits is discussed, including the Input Impedance of a Triode, Radio Frequency Amplifiers of Different Types, et al.

Oscillators and radio frequency power-amplifiers are discussed at length, also modulation in different forms, The Vacuum Tube As a Detector, and Different Types of Receiving Circuits. Antennas and Wave Propagation are also discussed.

RADIO PHYSICS COURSE, Second Edition (Revised and Enlarged), by Alfred A. Ghirardi, E.E. Size 7x9 inches, 972 pages, over 500 illustrations, in half-tone and line, cloth bound. Published by the Radio & Technical Publishing Co., New York City.

The radio student who is looking for a complete course in one book will certainly find it in this latest edition of Mr. Ghirardi's very fine work.

Among the subjects covered are: Ohm's Law—The Simple Physics of the Ear—How Sound Waves are Related to Broadcasting, etc. The Electronic Theory and the Electric Current are very clearly explained with diagrams wherever necessary. Only the simplest of mathematics have been included and practically any one can read this treatise and understand the subjects as Mr. Ghirardi has presented them.

An excellent chapter on Electro-Magnetic Induction is given, also a fine clear discourse on Capacitance and Condensers. All types of condensers are illustrated and described. Later chapters deal with Alternating Current circuits, Electric Filters, Electro-Magnetic radiation, the Phenomena of Broadcasting, the *receiving station* and how the waves are picked up and transformed into sound, etc. An elementary study of the vacuum tube provides the student with an excellent ground work on this important subject. V.T. amplifiers of every type are discussed thoroughly. Loudspeakers, Power-Supply units, Automobile and Aircraft receivers, Short-Wave sets, Photo-Electric cells, Television, as well as instruction for testing and servicing sets conclude this monumental work.

ELECTRONIC TELEVISION, by George H. Eckhardt. Size, 6x9 in., 200 pages, 80 illustrations cloth bound. Published by Goodheart-Willcox, Inc., Chicago, Ill., 1936.

Among the chapter titles we find—Fundamentals of Electronic Television; The Farnsworth System, including the Image Dissector, etc.; The RCA System, including the Iconoscope. Other subjects covered are: High Definition Pictures, Electron Multiplier Principle, Different Systems of Scanning, Antennas for Television, Co-Axial Cables. Part II deals with Electronic Television Reception, including description with diagrams of the Cathode Ray Tubes used. Deflecting Coils, etc. The Oscillight—heart of the Farnsworth System—is described, also the Kinescope—the important element in the RCA System. The last section deals with by-products of Electronic Television Research including Secondary Electron Multiplication, Infra-Red Cameras, etc.

(Continued on page 571)

The "Forty-Niner"—A Receiver for "Lean" Purses

(*Continued from page* 534)

small cells is quite satisfactory.

Coils

It will be noticed in the coil chart that the "tickler" coil windings are rather large. It is suggested that the builder experiment with different coils, in order to obtain the best results and smoothest regeneration. The smaller coils may be wound on tube bases.

How Set Tunes

The set tunes much the same as any regenerative set. The regeneration control is advanced until oscillation—as shown by a soft hiss—is obtained and then stations are tuned in by rotating the tuning condenser. A *regenerative whistle* indicates that the set is tuned to the carrier wave of a station. Then the regeneration control is turned until oscillation stops and the station becomes intelligible.

With some tubes, there is a possibility of a peculiar "fringe howl" occurring at the point where oscillation begins. This may be eliminated by raising the plate voltage to 12½ or 15 volts. The inner grid voltage on the detector should remain at 6 volts. Since the set will operate on such low voltage, it is admirably suited for portable or emergency use. Four flashlight batteries connected in series-parallel can supply the filament voltage with four of the very small 3 volt "pen-lite" batteries serving as the "B" battery. Both the beginner and the old-timer, who maybe a licensed amateur, can find use for a receiver of this type; when wind or flood or storm leaves communication lines a tangled mess, it literally may be a *life-saver* to have a receiver powered by batteries found on the shelf of the corner drug store.

Trans-oceanic Range

Despite the low voltage, the sensitivity and output of the receiver is surprising. When testing the set the first afternoon, the writer picked up Berlin at 1:00 o'clock C.S.T. and listened for nearly three hours to a program which included interviews with members of the American Olympic team. Daytime reception of Germany is always "good DX" in central Nebraska and the reception is doubly remarkable, considering that it took place on a scorching July day when the temperature reached a maximum of 117 degrees. And as if this wasn't enough to discourage DX, the antenna in use at the time was a badly corroded inverted "L" broadcast-band antenna pointed in the general direction of Tokio!

Parts List

2—.00014 mf. variable condensers.
1—.0001 mf. fixed condenser.
1—0-30 mmf. trimmer condenser.
1—.25 mf. by pass condenser.
1—2 meg. grid resistor (½ watt).
1—4 ohm resistor.
1—2½ mh. R.F. choke.
1—3½ to 1 audio transformer.
2—5 prong wafer sockets.
2—type 49 tubes, RCA Radiotron.
1—metal chassis.

Coil Chart

20 meters
grid 5 turns
tickler 4 turns
40 meters
grid 10 turns
tickler 7 turns
80 meters
grid 22 turns
tickler 11 turns
160 meters
grid 45 turns
tickler 18 turns

All coils close wound on 1¼ inch dia. coil forms with number 26 D.C.C. wire. The four coils cover a continuous range of approximately 18 to 200 meters.

Don't miss the many fine articles in the "Feb" Issue!

voltage is reduced on the plate of the 6C5 crystal oscillator tube with a 20,000 ohm resistor. Increasing the voltage in the crystal circuit provided no greater harmonic output. The crystal in this circuit remains absolutely cold at all times, which is something that cannot be said of the average tritet circuit delivering the same power output, especially when operating on the fourth harmonic. No matter how one adjusts the various tuned circuits in this combination oscillator and multiplier stage, it is impossible to fracture the crystal or even cause it to heat, so that it can be said that it is absolutely safe and can be highly recommended to any one wishing to improve operation in the crystal stage of any "Ham" transmitter.

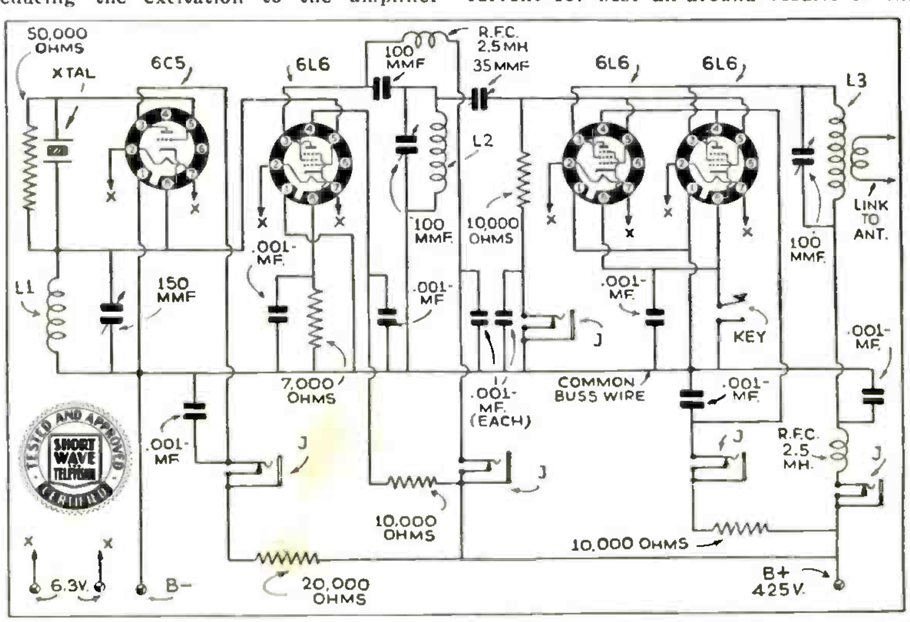
The plate current of the crystal oscillator will be found to be around 15 ma. This varies slightly in different bands. However, this approximate value may be accepted as generally correct. The plate current in the 6L6 frequency multiplier will be around 25 to 30 ma., depending upon which harmonic of the crystal it is tuned to. On the crystal *fundamental*, the plate current of this stage will drop to an extremely low level, 5 to 8 ma., while in the second harmonic it will dip down to between 10 and 15 ma., and on the fourth harmonic of the crystal a dip in plate current of about 2 or 3 ma. will indicate normal operating conditions. If the coupling between this multiplier and the final amplifier stage is greater than that shown, no dip at the fourth harmonic may be noticed at all. However, a neon bulb will indicate that there is sufficient power to drive the final amplifier. The grid current of the final amplifier is also another indication of ample excitation. When operating on the crystal frequency or the second harmonic of the crystal, the grid current of the amplifier may be anywhere from 8 to 12 ma. Optimum results were obtained with as low as 4 ma. grid current. On the fourth harmonic of the crystal it will be found impossible to drive the grid

A 1937 Desk Type Transmitter

(*Continued from page* 538)

current of the amplifier over 5 mills (ma.) and in many cases it will be in the neighborhood of 4 ma. However, this low grid current is entirely sufficient to provide maximum output of the amplifier. No difference in power output could be noticed when operating on 10 meters with 4 mills grid current, as against operation on 20 meters with 10 mills grid current.

While there is no indicated method of reducing the excitation to the amplifier when operating on the lower frequency bands, it is possible to reduce the grid current by adjusting the cathode tuning condenser in the 6C5 for lower output in the oscillator multiplier group. The screen current in the final amplifier will be found to vary with the load in the plate circuit. When the plate circuit is unloaded, i.e., not coupled to the antenna, the current may be as high as 25 to 30 ma. However, when the plate circuit of the amplifier is loaded for maximum output, this screen current will drop to about 15 or 18 ma., which is the proper value for normal operation of the tubes. The recommended plate current for best all-around results of the



Hookup of Transmitter

amplifier is between 125 and 150 ma. Under unloaded conditions, the plate current for this amplifier will drop down to about 10 ma. on 80, 40, and 20 meters, and to about 20 or 25 ma. in the 10-meter band.

Next month the entire transmitter in its cabinet will be described and illustrated, together with complete details of the *power-supply* unit.

Parts List

NATIONAL

1—150 mmf. variable condenser (TMS)
2—100 mmf. variable condensers (TMS)
4—Octal Isolantite sockets
2—5 prong Isolantite sockets
2—2.5 mh. R.F. chokes
1—30 mmf. midget padding condenser (M30)
1—6 prong Isolantite socket
2—XR-20 coil forms, 6 prong
4—XR-20 Steatite, 5 prong
4—XR-13 coil forms
4—type PB 5 plug assemblies
1—type XB 5 socket assembly
3—type 0 dials (not shown in photo)

ELECTRAD

1—50,000 ohm, 10 watt resistor
1—20,000 ohm, 50 watt resistor
2—10,000 ohm, 10 watt resistors
1—10,000 ohm, 20 watt resistor
(all vitreous enameled)

CORNELL DUBILIER

8—.001 mf. mica condensers, 1,000 volt

PAR METAL

1—17x11x2" crackle finish steel chassis with bottom plate
1—19x7x⅛" crackle finish panel (not shown in photo)

MISCELLANEOUS HARDWARE

5—single closed circuit jacks with insulating bushings

RCA

1—6C5 tube
3—6L6 tubes

BLILEY

1—80-meter crystal
1—40-meter crystal
(for operation on all bands from 80 to 10 meters.)

COIL DATA

80-Meter Band

Osc. cathode—14 turns No. 22 DSC
Buffer—20 turns No. 22 DSC
Amp. plate 30 turns No. 18 DSC close wound

40-Meter Band

Osc. cathode—7 turns No. 20 DSC
Buffer—8 turns No. 20 DSC
Amp. plate—16 turns No. 12 bare, spaced diameter of wire

20-Meter Band

Buffer—6 turns No. 20 DSC spaced to length of ¾ inch
Amp. plate 8 turns No. 12 bare, spaced ¼ inch

10-Meter Band

Buffer—2 turns No. 20 DSC spaced ⅛ inch between turns
Amp. plate 4 turns No. 12 bare, 1¼ inch diameter spaced ½ inch

All coils except the amp. plate are wound on National XR20 forms and close wound unless otherwise stated.

All amp. plate coils wound on National XR13 forms except the 10 meter coil which is self supporting. See photo of coils for details.

"CQ"

As announced in the November issue, we are endeavoring to incorporate in *Short Wave & Television* short items of popular interest, such as oddities and *real* news in the form of "CQ's", as shown below. If you have some hot news or interesting items such as the above, send them in and if they are published you will be awarded a year's subscription to *Short Wave & Television*. See November issue for rules.

* * *

● ALVA CLARK, W4DCG, gets qsl's addressed to Miss Alva and to W4DCG YL. A W3??? thinking that he was a YL asked for a photo. Wonder if Thomas Alva Edison was a YL? Hi!—Alva Clark, W4DCG.

"CQ"

In the locality of my home this last summer there has been one long-lived "Lightning Bug" that blinks SOS continually! Also, our train on arrival at the city limits sends "OA" on its whistle. The above facts were noted by W9DKY while "boning up" on the code for license exams.—David J. Shinn.

"CQ" News

After an intimate friendship of over thirty-five years between Dr. Burgess and Mr. Thordarson, the two companies, Thordarson Elec. Mfg. Co. and the Burgess Battery Co., combined and will be operated under one governing body.

The "Super-5"

(Continued from page 535)

gave very satisfactory results.

The I.F. amplifier uses only one stage, because two stages complicate the set, increased the construction cost and provided more noise than signal, unless a crystal filter is to be used. With only this one I.F. stage, operating at 456 K.C. no isolating condensers and resistors are needed in plate, screen-grid and cathode circuits. Again simplicity!

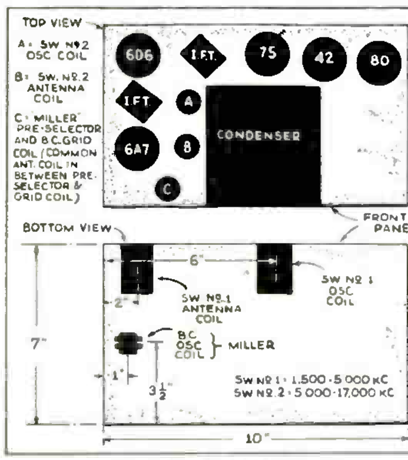
Rectified signal voltage is fed back through the 1-megohm resistor to the previous stages from the 75 for *automatic volume control*. It is a simple a.v.c. method and is *efficient!* The 75 easily performs its triple duties of detection, a.v.c. and audio amplification, driving the 42 so that ample loudspeaker volume is had. The volume is controlled by a 500,000 ohm variable resistor connected in the audio section of the 75. Tone quality is excellent, although only a 6-inch dynamic speaker is used.

Iron-Core I.F. Transformers Used

The I.F. amplifier uses a pair of the new Aladdin iron-core transformers, which have better selectivity and gain than ordinary air-core types. In the event that the fixed coils with their attendant wave-changing switch are substituted for by plug-in coils, these may be of the standard make. No difficulty will be experienced except that each coil will have to have a trimmer connected across its grid connection, in order that it may be properly adjusted so that the condensers will "track" throughout the dial.

Coil Data

The fixed coils should be wound on paraffin impregnated forms ¾ inches in diameter, or they may be purchased "ready-wound" from any dealer in radio equipment. We wound ours with considerable success. The *broadcast* coils were wound with No. 28 enamelled wire. 65 turns for the grid circuits and 25 turns for the antenna coil and the oscillator tickler. The short-wave coils are wound with No. 24 enamelled for the band from 1500 kc. to 5 megacycles, while the band from 5 megacycles to 17 megacycles employed No. 16 bare wire. The second band coils consisted of 25 turns in the grid circuit, and 12 in the antenna and tickler circuits; the higher frequency band consisted of 10 turns double-spaced in the grid circuit, and 10 turns in the antenna and oscillator tickler circuits. The grid circuit was



Coil Layout Diagrams

wound with No. 16 bare wire, while the other winding was wound between the larger winding's turns. The first two bands used ¼ inch spacing between coils.

Obviously it may be necessary to do a little juggling with the number of turns on the coils, particularly with the number of turns on the oscillator tickler winding. Just enough turns should be left here to keep the oscillator in a stable condition. Some turns may have to be added, but we achieved our results with the data given. Remember that circuit construction and layout will have some effect on these windings, particularly at the higher frequencies. If you have had no experience at this "coil business" we advise the use of manufactured coils such as those made by many leading coil manufacturers.

The 1100-ohm field coil of the loudspeaker serves as the only filter choke, but no evidence of hum is heard, although only 16 mf. of filter capacity are used in conjunction with it.

Chassis Layout

The chassis layout is simple, with the two-gang condenser in the center of the 8"x10"x2" chassis. On either side of it, from left to right, are the *selector switch* and the *volume control*. On the chassis itself we find the 6A7 and the pre-selector coil, at the left of the condenser gang and just to the rear of the selector switch. Next to the rear is the first I.F. transformer and the 6D6 at the rear; the second I.F. "can," the 75 42 and 80 are balanced across the rear of the chassis. The broadcast and 1500 kc. to 5 megacycle coils are mounted beneath the chassis, while the third set are mounted above it. The power transformer, which must be capable of supplying 250 volts D.C., is mounted at the right of the condenser gang.

In wiring, make all leads as short as possible and be sure to solder all connections well. This particularly applies to the joints at the *selector switch* and the *coils*.

Test Oscillator Used in Aligning Set

The alignment of this receiver requires the use of a *test-oscillator* that will cover the frequencies of 456; 600; 1400; 1800; 4000; 6000 and 14,000 kc's. and an *output-meter* to be connected across the primary or secondary of the output transformers. If possible all alignments should be made with the volume control on maximum, and the test oscillator output as low as possible, to prevent AVC from operating and giving false readings.

The intermediate frequency stage should be aligned properly as the first step. After the I.F. transformers have been properly adjusted and peaked, the *broadcast band* should be the next procedure; after which, either of the *short-wave* bands may be attempted.

Connect the test oscillator to the grid of the 6A7 through a .1 mf. condenser to align the I.F., and adjust the test oscillator to 456 kc. Then connect the ground on the test oscillator to the chassis. Align all four I.F. trimmers to peak reading on the output meter.

To adjust the *broadcast band* coils, connect the oscillator to the antenna through a .0001 mf. condenser and set the receiver and the oscillator to 1400 kc. and adjust the trimmer across the oscillator tuning condenser to maximum output. Now adjust the remaining two condenser trimmers.

Next re-set the dial on the receiver and the oscillator to 600 kc. Slowly vary the oscillator padding condenser C9, and at the same time tune back and forth across the signal with the receiver until a maximum reading is obtained on the output meter. Now check the 1400 kc. adjustments to see that this last adjustment has not upset the balance.

To adjust the 1500 kc. to 5 mc. band it is only necessary to adjust the trimmer across the antenna coil circuit. This should be done at 4000 kc.

To adjust the highest frequency coils tune the oscillator to 14,000 kc's. and connect it to the antenna post, with the receiver tuned to approximately this frequency. Now adjust the two trimmers on the r.f. coil and on the oscillator coil for maximum output at this frequency.

Never adjust the gang trimmers mounted on the condenser frame after they have once been adjusted for *broadcast* operation. This will just ruin all the broadcast alignment.

It may be found that a small trimmer similar to C7 will be necessary across the second band oscillator coil. In our case this was unnecessary.

As to results; we have been most fortunate with this receiver. During one hour's tuning and an antenna of only 15 feet of wire, laid on the floor of our apartment in a thickly populated district, the "missus" was able to tune in with excellent volume stations in England, France, Portugal, Holland, Spain, Germany and of course the motley crowd from "down below."

We thoroughly enjoyed the Olympic Game announcements of DJL each evening during their transmission at dinner time.

Legend of Parts

C1—.1 mf.
C2—.25mf.
C3—.00025 mf.
C4—.02 mf.
C5—.001 mf.
C6—8 mf.—450 volts working voltage.
C7—Trimmer condensers.
C8—350 mmf., 3 gang condenser.
C9—.001 mf. trimmer.
R1—250 ohm. 1 watt.
R2—25.000 ohms, 1 watt.
R3—1 megohm, ¼ watt.
R4—15.000 ohms. ¼ watt.
R5—500,000 ohms variable.
R6—8,000 ohms. ¼ watt.
R7—250,000 ohms, ¼ watt.
R8—100,000 ohms. ¼ watt.
R9—350 ohm. 1 watt.
CH—Field of speaker, 1100 ohms.

RCA Radiotron

Tubes—1 each. 6A7, 6D6, 75, 42, 80.

WAKE UP! FELLOWS!

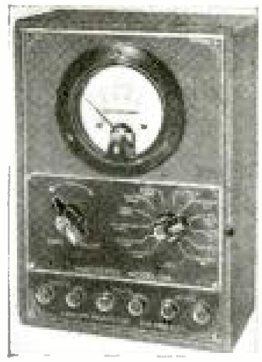
$20.00 Prize Monthly for Best Set

● **THE editors are looking for "new" receiving circuits—from 1 to 5 tubes preferably. A $20.00 monthly prize will be awarded to the best short-wave receiver submitted. The closing date for each contest is 75 days preceding date of issue (Dec. 15 for the March issue, etc.) In the event of a tie, an equal prize will be given to each contestant so tieing. Address all entries to: Editor, SHORT WAVE and TELEVISION, 99 Hudson St., New York City.**

Have you a Binder in which to keep your copies of SHORT WAVE and TELEVISION? Order one today—$1.25. Holds 12 copies. SHORT WAVE and TELEVISION, 99 Hudson St., N.Y.C.

BUILD YOUR OWN MULTITESTER

By M. Reiner



● ONE of the most useful instruments for general testing for the ham and service man, as well as the experimenter and student, is a combination ohmmeter, voltmeter and milliammeter.

The wiring diagram is shown herewith and a study of this diagram shows the great simplicity of the tester.

A D'Arsonval type of meter of 2% guaranteed accuracy is used, having a basic movement of 500 microamperes, which gives the desirable sensitivity of 200 ohms per volt on all voltage measurements. The six voltage ranges are 0-5, 0-50, 0-250 and 0-750 D.C.; also 0-5 and 0-750 A.C.

The ohmmeter is entirely self contained and has three individual ranges, 0-2000, 0-200,000 and 0-2,000,000 ohms. Battery voltage of 15 is required for the high range and a tap at 1½ volts is taken for the two lower ranges. A smooth zero-adjustment to allow for variations in battery voltage is provided in the tandem rheostat. One section (8 ohms) is used for the low range and the other section, 6600 ohms, is used for the higher ranges.

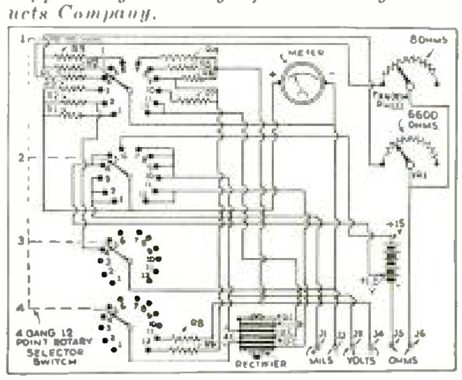
Current ranges of 0-500 microamperes and 0-50 milliamperes are also available. Shunt SI is calibrated for 62.5 millivolts with 49.5 milliamperes flowing through it.

The selector switch SWI is a four-gang switch with 12 active positions. This switch automatically connects the range and circuit when the knob is turned to the desired marking on the panel. The panel is neatly etched on aluminum, having a black background. The various ohm, volt and milliamperes scales are printed on the meter dial.

List of Parts Required

1—	Dependable	Microammeter 311; 500 Microamps.
1—	"	Resistor, Multiplier and Shunt strip with parts mounted.
		List of items on strip:
	"	R1—25 ohms.
	"	R2—2500 ohms.
	"	R3—25,000 ohms.
	"	R4—10,000 ohms.
	"	R5—100,000 ohms.
	"	R6—500,000 ohms.
	"	R7—1,000,000 ohms.
	"	R8—6,000 ohms.
	"	R9—250,000 ohms.
	"	S1—5 mil shunt.
	"	S2—50 mil shunt.
	"	S3—250 mil shunt.
1—	"	4 Gang Selector Switch SW. 0406.
1—	"	Tandem Zero Adjust 8 ohms for 1 section, 6600 for the other VRI.
6—	"	Insulated tip Jacks J1, J2, J3, J4, J5, J6.
2—	"	Bar Knobs.
1—	"	406 Panel 5½"x8" drilled and etched.
1—	"	Leatherette Case.
1—	"	Full wave copper oxide rectifier. Wire, screws, diagrams, instructions, etc.
1—	"	15 volt battery.

This article has been prepared from data supplied by courtesy of Radio City Products Company.



New All-Electric Kit Set

● THE new All-Electric Air-Scout Junior is an efficient broadcast receiver which requires no batteries whatsoever for its operation. It works from any A.C. or D.C. houselighting circuit and when used on A.C. will operate from any frequency.

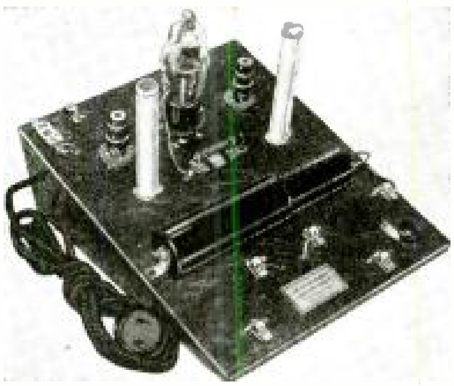
The set uses the dual purpose 12A7 tube which combines the function of a rectifier with that of a powerful regenerative detector. Due to the use of this tube, it is possible to use fewer parts and to simplify construction and wiring to such an extent that any novice can put the kit together in a very short time.

This set is powerful enough to operate a small loud speaker on the stronger stations, the weaker ones being received on ear-phones. An ordinary straight wire antenna, 50 to 100 feet in length is all that is required for efficient operation.

The set uses two lattice-wound Find-All coils and tuning is accomplished by means of a telescope type metal tube variable condenser. No previous knowledge of radio is required in putting this receiver together and getting it into operation, due to the use of a new idea in radio construction. The panel shown is 8½" by 11" and a paper sheet of exactly the same size is provided with the kit. This is fastened to the underside of the panel showing in full size, the exact location of each and every part. It shows where to drill mounting holes in the wood and where to connect each wire as drawn.

In addition to the set here described, a number of models are also available which can be built on the same 8½" by 11" panel, using the identical full-sized diagram idea.

This article has been prepared from data supplied by courtesy of the Allied Engineering Institute.



Appearance of All-Electric Radio Receiver Which Can Easily Be Assembled by the Beginner. (No. 591)

New Electro Cell

New photo-electric cell of interest to radio experimenters. (No. 592.)

● IN the photograph we see a newly designed photo-electric cell of the self-generative type. These units are available to the "Ham" and experimenter in sizes ranging from ¾" to 2⅝" diameter. This unit is so sensitive that it will operate a relay directly, when exposed to light rays, without the use of batteries.

They may also be used for *sound recording* at frequencies as high as 6,000 to 8,000 cycles and have unlimited life and temperature resistance up to 160° Fahrenheit. A 1½" diameter active element, for instance, will generate 20 milliamperes.

Those of our amateur readers who are desirous of constructing *power-output* measuring devices for their transmitters may employ this cell in conjunction with an electric bulb of suitable wattage and a low-range milliammeter. These elements are available either with or without bakelite casings.

This article has been prepared from data supplied by courtesy of Dr. F. L. Loewenberg.

New Crystal Microphone

● A NEW microphone known as the B-1 has recently been placed on the market. It offers at a lower price, though somewhat lower output, many of the operating features found in the Brush Sound-Cell microphones.

Internal spring mounting, eliminating external shock absorbers and other makeshift attempts at external cushioning, and permitting the stand or even the microphone itself to be handled while it is in use . . . non-directional pickup . . . and the ability to run long leads with only slight loss—are some of the features built into this new model. Thoroughly modern and attractive appearing wire mesh cases that permit the sound to pass through, eliminating the heavy bass and distortion of pressure doubling and permitting close speaking . . . small size . . . and rugged construction are others.

Size of the B-1 microphone, 3½" long, 1⅞" wide, ¾" thick. Weight, complete with the locking type plug and socket, 11 ounces. Output level minus 72 D.B.

This article has been prepared from data supplied by courtesy of The Brush Development Company.

Short Wave Scouts

(*Continued from page* 540)

2RO-4, 11810 kc., Rome, Italy.
DFC, 12985 kc., Berlin, Germany.
DFZ, 20020 kc., Berlin, Germany.
DJA, 9560 kc., Berlin, Germany.
DJB, 15200 kc., Berlin, Germany.
DJC, 6020 kc., Berlin, Germany.
DJN, 9540 kc., Berlin, Germany.
DZA, 9675 kc., Berlin, Germany.
DZB, 10042 kc., Berlin, Germany.
DZC, 10290 kc., Berlin, Germany.
DZH, 14460 kc., Berlin, Germany.
CT1AA, 9650 kc., "Radio Colonial," Lisbon, Portugal.
HAT4 9125 kc., Budapest, Hungary.
HAS3, 15370 kc., Budapest, Hungary.
PRF5, 9500 kc., Rio de Janeiro, Brazil.
HI1A, 6190 kc., "La Voz del Yaque," Santiago de los Cabaleros, D.R.
EAQ, 9860 kc., "Transradio Espaniola," Madrid, Spain.
SUZ 13820 kc., Cairo, Egypt.
SUX, 7860 kc., Cairo, Egypt.
HCJB, 8950 kc., "South America Calling," Quito, Equador.
TIRCC, 6550 kc., "Radio Emissora Catholica," San Jose, Costa Rica.
HBL, 9595 kc., "Radio Nations," Geneva, Switzerland.
HBP, 7797 kc., "Radio Nations," Geneva, Switzerland.
YV1ORSC, 5720 kc., "La Voz del Tachira," San Cristobal, Venezuela.
YV3RC, 5150 kc., "Radiodifusora Venezuela," Caracas, Venezuela.
HC2RL, 6670 kc., Guayaquil, Ecuador.
TIPG, 6410 kc., "La Voz de la Victor," San Jose, Costa Rica.
XEXA, 6180 kc., Mexico City, Mexico.
YV12RM 6300 kc., "La Voz de Aragua," Maracay, Venezuela.
HH2S, 5910 kc., Port au Prince, Haiti.
CJRO, 6150 kc., Winnipeg, Canada.
XEWI, 5975 kc., Mexico City, Mexico.
XECR, 7380 kc., Mexico City, Mexico.
ORK, 10330 kc., Brussels, Belgium.
ORG, 19200 kc., Brussels, Belgium.
CGA4, 9330 kc., Drummondville, Canada.
CGA8, 4905 kc., Drummondville, Canada.
OPL, 20040 kc., Leopoldville, Congo.
COCH, 9428 kc., Havana, Cuba.
COCO, 6010 kc., Havana, Cuba.
COCD, 6130 kc., "La Voz del Aire," Havana, Cuba.
XEBT, 6000 kc., Mexico City, Mexico.
FNSM, 13320 kc., S. S. "*Isle de France.*"
W2XAF, 9530 kc., Schenectady, N.Y.
W2XAD, 15330 kc., Schenectady, N.Y.
W3XAU, 9590 kc., Philadelphia, Pa.
W8XAL, 6060 kc., Cincinnati, Ohio.
W4XB, 6040 kc., Miami, Fla.
GBB, 13590 kc., Rugby, Eng.
GCP, 10770 kc., Rugby, Eng.
GCU, 9950 kc., Rugby, Eng.

RADIO INSTRUCTION

What Subjects Should I Study to Become a Radio Expert?

(Continued from page 531)

cal subjects; the percentages allotted to each subject are as follows:

Complete diagrams of a ship's radio installation	10%
Transmitting Apparatus	20%
Receiving Apparatus	20%
Motors and Generators	10%
Storage Batteries	10%
Radio Laws and Regulations	20%
General Principles of Electricity	10%
	100%

The radio student will find it valuable time spent in making a very close study of the outlines of the various radio courses offered. The courses cover for example such practical, modern subjects as "Sound"—Public Address Systems; Radio Servicing and a very interesting and timely one, *Radio Broadcasting*, which might be considered de luxe radio operator's course or a practical radio engineering course.

Those interested in the practical side of radio engineering will find very enlightening the outline of courses given by another radio school. This school presents five plans of study—one, Home Study; two, Residence courses; three, a combination of Home and Residence Study; four, an Evening Residence Course; and five, a Service and Public Address Engineering course.

Today, more than ever before, thousands of students, even those living in foreign countries, are taking radio and other engineering subjects by the "Home Study" method. A great deal of time has been expended in preparing the Home Study lessons given by the various schools, so that the student who may live in a small town may be able to easily understand the lessons when he receives them, for he may not be able to obtain the advice or help of an expert locally.

Let us have a glance at the list of subjects taught in a typical Home Study course. We find that this course begins with Communications Systems, and then progresses through Electricity and the Electron Theory, Current and Voltage, Ohm's Law, Alternating Current, Generators, Batteries, Meters, Inductance and Capacity, Circuits, Vacuum Tubes and V.T. Circuits, Forms of Power Output, Radio Broadcast and Telegraphic Transmission and Reception.

The Extension Course includes Algebra, Geometry, Trigonometry, Vector Analysis, Electron Theory, Propagation of Electro-Magnetic Field Through Space, Absorption and Skip Distance, Measurements of Antenna Constants, etc.

Other subjects covered are the Screen-Grid Tube, Multi-Element Tubes, Ultra-High Frequency Tubes, Radio and Audio Frequency Amplification, etc.

The Radio Engineer—His Studies

Today, the Radio Engineer has become so specialized in his line of work and study, and is so completely linked with all of the elements and phases of *electrical engineering*, that to be a good radio engineer one had best take an Electrical Engineering course first. Some of the special Radio Engineering courses offered by a number of schools have an outlined course of study which is so complete, that practically all of the important elements of electrical engineering are included, as they should be.

While pursuing the course in *electrical engineering*, his interest in radio subjects will cause him to branch out in his studies at every opportunity and select radio subjects for his *electives*. He should then have a very fine radio "background" when he finishes with his E.E. Course. Very fine "Home-Study" courses in electrical and ra-

RADIO INSTRUCTION

dio engineering are outlined in the catalog of several correspondence schools.

Completion of the general *electrical engineering* course, will provide the embryo engineer with an excellent knowledge of mathematics, physics, and at least one foreign language (French and German preferred, due to the great wealth of engineering information published in periodicals and books in these languages).

The *post graduate* work in radio engineering subjects can be arranged for, and at the end of say six or seven years the degrees of E.E. and R.E. will have been earned or awarded.

The question is often asked as to what specific subjects should be included in an *electrical engineering* course. In many cases students may not take the regular prescribed course as given by a certain school, whether resident or home study, and therefore some of the important subjects taught in a typical *home-study* course will prove both valuable and interesting.

An "E.E." course includes such subjects as elementary mathematics and then proceeds through algebra, plain geometry, and trigonometry, and includes logarithms.

The elemental and electrical subjects cover batteries—electrical appliances—meters, and how to use them—the principles of both A.C. and D.C. generators and motors, including their design—armature winding, etc. Other important subjects taken up in this course include—mechanical drawing—practical physics—maintenance of motors and generators—power stations and equipment—long-distance transmission of electrical energy—synchronous converters and A.C. rectifiers—machine design and mechanics—electric substations—transformer design, etc.

Subjects to Broaden the Engineer's Mind

The complete *electrical engineering* course, whether of the *home-study* or *resident school* type, usually does and should include a number of subjects which will broaden out the general training of the student, including Chemistry, one or two Foreign Languages, Principles of Economics, Applied Psychology, Personnel Management, Public Utility Economics, etc.

Many people who have a fairly good education in radio matters frequently desire to "brush up" on certain subjects on which they are a little "stale," or perhaps never studied at all. A number of very interesting catalogs are available from several schools and colleges which present some very attractive subjects at a comparatively reasonable tuition fee. One of the catalogs, for instance, outlines specialized courses in *radio* subjects and each subject may be taken separately. Other topics included in some of these catalogs are various divisions of mathematics, all the way up to and including the calculus. Other catalogs, the names of the schools and colleges sponsoring which will be gladly furnished upon request, contain many other practical, up-to-date subjects including those on sound, motion picture operation, television, various branches of radio operating and design, etc.

Intermediate Plan of Study

An *intermediate plan* of study for the radio and television student is the type of school where he learns to do things with his hands, while he masters the intricate study of the radio theory at the same time. Such a combined course of practical work and theoretical study is given by several well-known schools. One school has a large building containing all kinds of apparatus, even including television machines; here the student attends regular classes in which experts teach them the theory and later he learns by practical experience to operate the actual sets and projectors used in television, for example.

Many people have the idea that the average college-trained engineer is lacking in practical experience. Most colleges main-

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tain excellent laboratories and it is here that the embryo radio or electrical engineer goes through the actual work of making the tests on various classes of machinery and radio apparatus.

It goes without saying, of course, that the *home-study* student should endeavor to gain as much first-hand practical experience as possible, either by building apparatus himself in his "home laboratory" (or "Ham" station) or again by obtaining a position with a radio manufacturer or service company, where he can obtain practical experience while he is studying the course lessons at home.

"Home Shop" a Big Asset to Students

A well fitted *home work-shop*, equipped with a good drill press or a lathe, and possibly a motor-driven bench saw—is a distinct asset to every student of radio and electrical subjects. Today, practically all high schools have a Manual Training department wherein the students learn to apply with their hands the theory derived from their textbooks. One of the weakest spots in the average "course" today, whether given in home-study form or at a resident school, is that the average student does not receive sufficient training in the practical application of the theory taught in textbooks.

The well-balanced radio or electrical expert today is, and always has been, the man who knows how to use his hands as well as apply his mental training to the problem at hand. It is surprising what a difference a little experience with some home shop-tools will make, even in the case of the college trained man.

Aside from the practical shop experience, which greatly broadens out the student of pure engineering theory, there is a great deal of enjoyment to be found in operating a small home-shop fitted up with a good lathe, drill press, etc. Many business men spend much of their spare time in a home-shop or laboratory.

Value of Books to the Technical Student

No matter how excellent the technical course you may pursue, one salient point which you will soon learn, particularly after graduating and entering the commercial field, is that a great deal of reading and study of the newest books covering your particular field is not only advisable but essential.

Here is an example which will show a case in point. Not so many years ago, the average student pursuing an electrical engineering course was taught a few general facts, together with the use of the simple basic formulas given in the textbooks used in the course, covering the *calculation of the inductance of coils*. Unbeknown to the average student, a vast amount of mathematical research as well as laboratory measurements on inductance had been made by the U.S. Bureau of Standards in Washington, D.C. Also a great deal of research was conducted on the same subject at the University of Illinois and several other institutions on this highly important subject of *Coil Inductance*. The results of all these mathematical and other researches were made available in book form, at an insignificant cost to any one who knew of their existence. The engineer who did not follow all of the latest publications in his field frequently was not aware of these publications. If he tried to calculate the inductance of an average radio coil which had a length to diameter ratio of possibly 1:1 or 2:1, the formulas given in the older engineering courses were practically worthless, as these formulas are only good for coils which have a length of at least 20 times the diameter!

So you see how important it is for the technical man, whether he be a radio operator or a radio engineer, to constantly read the very latest textbooks in his chosen profession, or branch of engineering; not

BOOK REVIEWS

TELEVISION WITH CATHODE RAYS, by Arthur H. Halloran. Size 5x7¼ inches; illustrated; Loose-Leaf. Flexible cloth covers; pages held with patent binder. Published by the Pacific Radio Publishing Co., San Francisco, Calif.

The operating principles of the cathode-ray tube and its application to television are here explained in terms which can be understood by radio amateur operators and servicemen. The text constitutes the lecture notes for a course on television given under the auspices of the Extension Division of the University of California. The specific treatment is preceded by a description of the general manner in which television is accomplished, and is followed by an appendix telling how to read the mathematical language employed by technical writers.

The main treatment starts with the practical use of the cathode-ray tube as a voltmeter, without regard to its theory, which is later illustrated by replicas of the patterns observed on the screen of the instrument. The fundamental theory of electrostatic effects including capacitive reactance, of electromagnetic and high-frequency resistance effects, including inductive reactance, and of impedance effects including resonance, is thus gradually developed in terms of electronic motion, as a preliminary to a brief account of the use of the oscillograph in aligning tuned circuits. A novel feature of this treatment is the interpretation of a resonance curve as the relation between the tangent and cosine of the phase angle, thereby facilitating exact computation of circuit response to any off-resonant frequency. The purpose is to enable the reader to handle the instrument intelligently before introducing the complexities of its adaptations to television.

The concept of radiation is then developed from the electron theory and applied to the formation of optical images. This is the basis for an account of the action of electron lenses and of photoelectric and fluorescent effects as applied in television pick-up and delivery tubes. It completes the "physics of the cathode ray" as deduced from the conclusions of the latest theoretical research.

The preceding theory is finally applied to a simple explanation of the action of standard types of oscillographs and their modifications for the production of "television" images.

RADIO SERVICE BUSINESS METHODS, by John F. Rider and J. Van Newenhizen. Size, 6x9¼ in., 218 pages, illustrated, stiff paper covers. Published by the RCA Manufacturing Co., Camden, N.J., 1936.

An excellent outline of procedure for the radio serviceman, prepared by two experts in the radio field—J. F. Rider, widely known radio service expert, and J. Van Newenhizen, radio auditor and accountant, who has made a lengthy and comprehensive survey of thousands of radio service businesses. Topics that you will want to read and re-read are: Profit on Your Investment; What to Charge; Simplified Records and Bookkeeping—and other subjects closely allied with the conduct of a thriving radio service business. Typical Shop Expense and other "forms" for use by the radio serviceman are reproduced. The Preparation of Monthly and Cumulative Operating Statements are discussed, together with typical statement forms.

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only the textbooks placed on the market by the regular publishers, but also the special bulletins made available by such important agencies as the U.S. Bureau of Standards, for instance. A well-written textbook is as valuable to the technical student or graduate engineer, as is the saw and hammer to the carpenter or a pair of accurate calipers and a steel scale to the machinist.

Students May Now Learn Code by Machine

The *code-teaching machine* today has been brought thoroughly up to date, and with the instructions or "course" given with some of these machines, an embryo radio operator can—by using one of these machines daily—learn to send code characters at a fair rate of speed. One of the concerns supplying a new 110-volt type of code-teaching device, has incorporated a clever plan in the method of procedure suggested for the student using the machine; after the student has achieved a certain degree of proficiency, he is supplied with the names of several other students and this way he can exchange tapes (this particular machine enables the student to perforate his own tape) and the student will thus become acquainted with different types of sending—for no two operators will ever send exactly alike.

This idea of teaching code by a machine —driven by clockwork or an electric motor, represents a very important advance in teaching radio operators.

Another Good Code System

Aside from the code teaching machines, there is another home-study system that is highly recommended for beginners who want to master the necessary fundamentals in the handling of code, and for radio operators who desire to increase their speed and technique both in the handling of code and in the use of their typewriter in copying it by touch.

This system was formulated by a prominent commercial operator with many years' study and experience. It deals largely with the mind and lays special stress on *concentration*, the *coordinative principle*, *sound sense*, and develops the student both mentally and physically to such a degree that he can read code as easily as he reads ordinary print.

One of the first, and a very important basic principle, of this code system, is that whatever the student learns to do, he must learn to do it accurately from the beginning. Then he is taught scientifically to employ the tricks or short-cuts used by skilled operators. Certain practice schedules are planned and laid out for the student to follow.

This plan in brief is laid out somewhat on the same principle as a "memory course," and any one who has studied such a course knows the benefits to be derived from not only trying to think of a word or phrase, but endeavoring to think of it in a certain well-directed manner.

Schools and Courses

CANDLER SYSTEM, *Asheville, N. C.*
Home-Study Courses consisting of specially devised methods whereby students may learn code and simplified "touch typewriting," and radio operators learn to increase their speed and technique. Code Guild membership is included. Schedules of all amateur stations sending practice programs are furnished to students at regular intervals.

CAPITOL RADIO ENGINEERING INSTITUTE, *Riggs Bank Bldg., Washington, D.C.*
Features five types of courses: Home-Study., Residence (Combination of these two). Evening Residence Course. Service and Public Address Engineering.

DODGE'S INSTITUTE, *Valparaiso, Ind.*
Resident Courses in Radio offered, including Broadcasting, Aviation and Police Radio, Servicing, Marine Radio Telegraphy and Telephony, Morse Telegraphy and Railway Accounting.

ELECTRIC INSTITUTE, INC., *Hinsdale, Ill.*
Home-Study Course featuring home-shop-work carried out with equipment supplied with course

FIRST NATIONAL TELEVISION, INC., *Power and Light Bldg., Kansas City, Mo.*
Resident Courses offered in Television and Radio, with practical training with actual apparatus. Also Home-Study.

RADIO INSTRUCTION

INSTRUCTOGRAPH COMPANY, *912 Lakeside Pl., Chicago, Ill.*
Supply automatic perforated tape transmitter for teaching radio code. Machine also fed with key so that student can practice sending to himself.

INTERNATIONAL CORRESPONDENCE SCHOOLS, *Scranton, Pa.*
Home-Study Courses offered on the following subjects: General Radio; Radio Servicing; Radio Operating and Sound Technician's Course. Also complete course in Electrical Engineering.

LINGUAPHONE INSTITUTE, *73 Rockefeller Center, New York, N. Y.*
Unique system of teaching foreign languages by means of phonograph records.

MASSACHUSETTS RADIO SCHOOL, *18 Boylston St., Boston, Mass.*
Resident Course in all branches of radio operating.

McKINLEY-ROOSEVELT UNIVERSITY, *4241 Clarendon Ave., Chicago, Ill.*
Home-Study Courses, leading to Degrees in Arts and Sciences; Chemistry, Engineering, also courses in Public Speaking and Radio.

MISSOURI TECHNICAL SCHOOL, INC., *3907 North 25th St., St. Louis, Mo.*
Resident courses in Radio Engineering and Operating; also Home-Study Course. Operating, servicing, engineering, including amateur operators' training (code included). Laboratory equipment for home-study course supplied.

NORTHWESTERN RADIO-TELEVISION INSTITUTE, INC., *370 Sexton Bldg., Minneapolis, Minn.*
Resident course in Radio and Television Engineering. Also complete Home-Study course

NATIONAL RADIO INSTITUTE, *Washington, D.C.*
Complete Home-Study course on radio servicing and other branches of the radio industry, including Broadcast Station Operating, Ship Radio Operating, Radio Retail Sales Training, etc. Radio equipment is supplied the student for conducting practical experiments and trying out various circuits.

NATIONAL SCHOOLS, *4000 So. Figueroa St., Los Angeles, Calif.*
Resident Course given in Radio, Television, and Sound. Students receive training on actual radio and television apparatus. Also combination Home-Study and Resident Course.

NEW YORK YMCA SCHOOLS, *6 West 64th St., New York, N.Y.*
Extensive list of Resident Courses in Radio Sound, Television, Industrial Electronics, and other subjects offered. Students receive training in connection with actual service and sound apparatus Short Wave Diathermy and Therapeutics included.

RADIO SERVICE INSTITUTE, *3308-14th St., N.W., Washington, D.C.*
Offers "Home-Study" Course in Radio Servicing.

RADIO TRAINING ASSOCIATION OF AMERICA, *4525 Ravenswood Ave., Chicago, Ill.*
Home Study Courses offered in Radio Service Work with practice equipment.

RADIO AND TELEVISION INSTITUTE, *2150 Lawrence Ave., Chicago, Ill.*
Home-Study Courses, with experimental apparatus furnished, are offered on Radio Servicing; Television; Public Address System; etc.

RADIO DIVISION, COYNE ELECTRICAL SCHOOL, *500 So. Paulina St., Chicago, Ill.*
Resident Courses offered in Radio and Television, as well as Sound. Also courses on Electrical Refrigeration; Air-Conditioning; Diesel Engines. Actual training with the apparatus.

RCA INSTITUTES, INC., *75 Varick St., New York, N.Y.*
Features Resident Courses in radio engineering and operating as well as Sound and Broadcast engineering. They also offer a "Home-Study" Course Option of day and evening classes. Students receive experience in actual testing of radio apparatus.

SPRAYBERRY ACADEMY OF RADIO, *2548 University Pl., N.W., Washington, D.C.*
Home-Study Course in radio fundamentals and mechanics of radio service. With or without practical tool kit and other equipment. Radio test set included. Also 5 Service Manuals

TELEPLEX COMPANY, *72 Cortlandt St.; New York, N.Y.*
Radio-Code, course with automatic Code-Teaching Machine. Apparatus can also be used to perforate tape, so that students may listen to their own sending.

Radio Keys

T. R. McELROY, *23 Bayside St., Boston, Mass.*
Speed keys, also code-teaching oscillator with tone control.

THE VIBROPLEX CO., INC., *832 Broadway, New York, N.Y.*
Semi-automatic key for sending with less effort.

Radio and Technical Book Publishers

JONES RADIO PUBLICATIONS, *P.O. Box 3278, San Francisco, Calif.*

McGRAW-HILL BOOK CO., INC., *330 W. 42nd St., New York, N.Y.*

RADIO & TECHNICAL PUBLISHING CO., *45 Astor Place, New York, N.Y.*

RAMSEY PUBLISHING CO., *Bloomington, Ind.*

Shop Equipment

SOUTH BEND LATHE WORKS, *371 Madison St., South Bend, Ind.*

WALKER-TURNER COMPANY, INC., *Plainfield, N.J.*

Personal Advice on Learning Code

By T. R. McElroy, W1JYN

Official Champion Radio Operator of the World

● IT is quite needless for me to say that the prince of all hobbies is Amateur Radio; not from the standpoint of the passive listener-in, who at best, is only an outsider; but as a participant—an actor—an insider; or, if you please, one of the gang.

Scattered throughout the United States and Canada are more than fifty thousand radio amateurs recruited from every walk of life—lawyers, doctors, ministers, brokers, bankers, engineers, architects, contractors, dentists, farmers and those of every trade and profession.

Learning Code

When you apply for your amateur license, you ought to know code well enough to be able to send and receive it at fifteen words a minute. (13 words per minute now required.) This gives you a margin of safety. And, if you are properly trained in the fundamentals of code and its handling you will find this to be comparatively easy. In order to set you straight on learning code, I shall relate a bit of my own experience which I trust will help you.

Had I been asked, prior to my last championship code contest at Brockton, what my speed would be, I could not have answered. That statement may seem very strange to you, so I shall explain. I was up against four of the fastest radio operators in the world: Chaplin, Donnelly, Kearney and Carter. They had been working steadily as operators for many years, while I had done no work as a telegrapher for thirteen years. It would appear that if practice alone develops a high degree of speed, one of these fellows surely would win. But I happened to know that practice is only one of the essentials to code speed—of value only when the operator has been *scientifically trained*, as I had been, to use his mind. I had unlimited confidence but I did not know at what speed I would win, because I did not know just how long they could take it.

At 54 words per minute, the first run, the boys turned out good copies. At 61 words per minute their copies were not so good. Then at 69 words per minute I found myself to be virtually alone. I could not go on competing with myself, so I was awarded the championship at 69 words per minute. However, a few months previously, at Chatham I had officially copied 77 words per minute.

How I Acquired My Speed and Technique

Now comes the big question which I have had put to me many times since I won the championship: "Did I acquire my speed by practice alone?"

I shall answer that question in part by quoting my good friend, Dr. Mursell, Associate Professor of Education, Columbia University:

"The psychologist looks at you and one thing impresses him most: Your toleration in yourself of needless personal inefficiency. He sees you failing to acquire all sorts of abilities which would be enormous assets to you. He sees lost motion, incompetent self-direction.

"The psychologist knows that determined learning can achieve miracles, that when men are properly guided they move toward achievement with amazing speed. And so when you are tempted to believe that any particular ability cannot be learned—whether it be music, a foreign language, dancing, guiding others, etc.,—you should remember that all scientific knowledge points in the opposite direction."

Now, in order for you to understand this, I quote further from Dr. Mursell's book: "Streamlining Your Mind."

The Author—T. R. McElroy

"Everything depends on how you set about learning. A most striking conclusion of psychological investigations is that **mere repetition is not a cause of learning.** *Practice makes perfect. How often have we heard that said! How readily we accept it. You are told that if you want to improve your game of golf or bridge to play lots of golf or bridge. Yet it is obvious that one may repeat a performance innumerable times* without improving . . ."

Please do not misunderstand me. Practice is essential to skill. But, without a thorough knowledge of the necessary fundamentals of music, golf, tennis, swimming—code, etc., you will more than likely practice the wrong way and unknowingly acquire bad habits—hard to break. It is far more difficult to go back and unlearn something that was learned wrong, than it is to learn right at the start.

Dr. Mursell says: "Errors are very prone to block improvement unless one can hold the experimental as contrasted with the blindly repetitive attitude . . . . Learning (code) can take place when you are not practicing, hence space your practice periods widely. While you are taking a walk or sitting in a street car or driving from one town to another you can think about the skill for which you are striving. Thinking between practice is one of the most valuable means of learning . . ."

Give a code student a practice set of whatever kind or nature and let him practice, uninstructed in the necessary fundamentals of code, for years. Do you believe he will develop into a champion radio operator?

The end results of such hit-and-miss practice are really not worth the effort. "Practice does make perfect" if you are practicing the *right* way, following correct procedure. But if the wrong way, you are going further away from your goal.

In my code class at Harvard College I find the most difficult students are those who have tried to learn code by themselves by *practice alone*. Before they can begin right, they must unlearn much and rid themselves of bad habits, unknowingly acquired.

Proper Practice Equipment

Any standard practice set—key and oscillator—is all that is necessary to learn code fundamentals and to develop operating technique, if used in connection with proper instruction. In like measure, any practice set is of no value if the student has not been taught the *mental* and *physical coordinative processes*—the development of *"code-sense"*—of *sound consciousness*—that certain poise of mind and body that enables him to read code at varying speeds as readily as he reads print and to send code as easily as he talks. Such specialized training can be had only from a specialist in this field, a man who has devoted his life to the job of teaching code.

Telegraphing is a Mental Process

If you are not scientifically taught how to use your mind in sending and receiving code, you will never learn to telegraph with any degree of skill no matter how much you practice.

I do hope I have made myself clear to you fellows who are thinking of learning code with a view to going on the air with your own amateur stations or to taking up commercial telegraphing—a wonderful vocation. I know this article is understandable to those fellows who have been trying vainly to learn code uninstructed, by practice alone. They have been wondering what the trouble is. Many have given it up as a bad job, thinking they are not "gifted" or that they are too old or too young or too dumb.

A boyhood friend of mine in Boston, now a prominent attorney, decided a year or so ago that he was going to learn code within a few days by using some sort of patented gadget, and go on the air as a full-fledged amateur. For weeks and months he practiced without seeming to get anywhere. One day he asked me to visit him in his home and determine, if possible, what was holding him back. I went, and was actually amazed at what I found. His den was cluttered with practice equipment, or I should say machinery. Notwithstanding his high degree of intelligence, he was imbued with the idea that all he had to do in order to master code was to practice, and he had done plenty of it with no results and he felt something was wrong.

Something really was wrong. He could send eight to ten words per minute with no semblance of rhythm or uniformity, and could receive a little, but when he turned on his high priced receiver, he could not read one code signal.

I told him in substance what I have written here—that before he could hope to learn code he must know something about the fundamental principles, then to apply these principles in his practice. I gave him information relative to the specialized system I used in learning code and developing speed. He followed my advice and obtained this system. That was two months ago. Two or three weeks ago I visited him at his request and gave him a code test and found he could send 20 words per minute, perfect code, and receive approximately the same number of words. The following day he passed his examination easily. He now has his station on the air and is handling code like a veteran.

Editor's Note

That Mr. McElroy's observations are sound and that in his own language "learning code can take place when you are not practicing" is best shown by the following.

Many years ago (1911) the publisher of this magazine, Mr. Hugo Gernsback, wrote a fanciful novel which was timed in the year 2660. He forecast that all types of learning in the future would be done while you slept rather than when you were awake. He described the means by which this could be accomplished and he termed this fanciful machine the Hypnobioscope.

Much to Mr. Gernsback's surprise several years after the story had been published, he received a set of photographs from the United States Navy Training School at Pensacola, Florida, where Chief Radioman J. N. Phinney actually was teaching code to students while they slept by means of this method.

It was found by Phinney as by many students of the subject before him, that certain types of people find it almost impossible to learn code. So Phinney used the Hypnobioscope principle as follows:

The students wore a sort of an aviator's helmet with ear-phones inside. These phones were connected by wire line to a central point, and, while the students slept, code was sent to them for a number of hours at night. After a while, it was found that with a few lessons the students actually remembered what had been sent to them in code the night before.

One of Phinney's spectacular stunts to visitors was to show them twenty or more sleeping students while code was being sent to them. Then without warning, an S O S in the same code was flashed to the sleepers. They usually all woke up together, and it was a startling effect to see how the distress signal had actually penetrated their subconscious selves and awakened them.—Editor.

"Let's Listen In" with Joe Miller

(*Continued from page 548*)

Reports on PLP, PMN, YDC, YDB, PMH, etc., will continue to be verified. PMH, on 6.72 mc., at Bandoeng, is being heard with a weak to fair signal here, and reported very strong on the West Coast by Mr. Walcott. The programs are not similar to those of PLP-PMN, but are probably those of an eastern NIROM network. This station begins operations at 5:30 a.m. and continues as late as 10:30 a.m.

YDC, 15.15 mc., continues to be fairly well heard, best around 6:30 to 7:30 a.m. Try for PMY, 5.15 mc., also from 6-7:30 a.m. when best heard here. They send a FB QSL. PMN has improved lately, with PLP always a "regular."

Siberia

RV15, the Far East Soviet station, located at Khabarovsk, Siberia, on the Pacific Coast, has changed its wavelength after several years on 4.273 mc. and is now being heard with a surprisingly good signal on 5.71 mc. and we believe with the same schedule. This station can easily be located, being the only one operating in that vicinity, so try daily between 5-7 a.m. and you will surely hear this rare DX catch! Address reports to Far East Radio Station RV15, Khabarovsk, Siberia, USSR. (Full "sked" in station list.)

Hong Kong, China

ZBW, usually heard on 8.75 mc. has also been heard on 9.53 mc. lately, by a number of our best DXers, including John De Myer, Lansing, Michigan, and Charlie Miller of Covington, Ky. The 9.53 mc. station probably operates simultaneously wtih ZBW on 8.75 mc.

We wish to make a retraction regarding notice of VPD, being "no more." We had taken a report that this station was off the air, and we felt that VPD2 was just VPD moved to a lower frequency; so, without checking the report, we inserted this fallacious data in our article. We felt that there would hardly be two Fiji Islanders operating, but we were wrong! The only reason that we didn't check VPD is because we rarely tune around 1 a.m. and felt sure our information was O.K. Better luck next time! VPD2 on 9.54 mc. continues to be well heard daily, except Sunday, from 5:30-7 a.m. Try for them!

Chile

CED, operating on 10.23 mc. at Antofagasta, Chile, is being heard weekdays between 7-7:15 p.m. when it re-transmits news bulletins from CEC. CED is generally operating as a commercial phone and can be heard, when traffic necessitates, any day between 8 a.m. to 12 noon and 2-9 p.m. CED also operates on 8.035 mc. Power is 500 watts. QRA is Chief Operator, CED, Cia de Telephono de Chile, Antofagasta, Chile.

Portuguese China

CQN, at Macao, is being heard on 9.57 mc. now, by Ashley Walcott, San Francisco. This means they are the next station on the low frequency side of VK3LR. Full dope on tuning for this station given previously in this article. This catch would qualify any tuner as a real DXer!

Manchukuo

TDE, 10.065 mc., at Shinkio, is heard phoning JVO, 10.37 mc., Nazaki Japan, every night, becoming audible around 11 p.m. on the West Coast. This dope from Mr. Walcott. These stations call it a day around 9-9:30 a.m. Ashley adds that next month they will probably use TDD on 5.83 mc. for last few hours of service. He's right! We have a TDD veri of reception last Dec. 1, when we heard TDD phoning JVU, 5.79 mc. between 5-6 a.m. By the time this issue is out these two stations will already be in operation! Don't forget to look for these four Asiatics, you night-owls!

New Zealand

ZLT4, 11.05 mc., at Wellington, was heard by Vincent Poll, of Dubuque, Iowa, one morning in September, and he really heard ZLT4 sending a program, something we've never heard ZLT4 transmit, though we've heard this station numberless times. Vincent heard the clock chime twelve during the program, when his own clock read 6:30 a.m. C.S.T.!

Siam

HS8PJ is no longer being heard on 10.955 mc. according to Bill Harriman, of San Pedro, California, but is now putting in an R-9 signal out there on 32.09 meters, or 9.35 mc. and on this wave their schedule is Thursdays, 8-10 a.m.

HS8PJ also being heard on 15.77 meters or 19.02 mc. on Mondays from 8-10 a.m. by Eddie Schmeichel, our Midwest DX ace in Chicago.

Here's the latest reliable data on Siamese DX, and we'd like to find an excuse good enough to give the boss, so we could stay home Monday and Thursday and get these two. You lucky OMs who haven't got a nose tied down to a grindstone should "Go get 'em." Two real DX aces, and not too hard to get. Best o' luck!

India

VWY2, 17.54 mc., located at Poona, was heard contacting GAU at 7 a.m. unusually early for this phone circuit, usually operating from 8-9 a.m. VWY2 is always strong and clear and, listening to it, it's hard to believe one is hearing India!

JVF, on 15.61, mc. was heard phoning one morning at 6:50 a.m. with a good signal. Pierre Portmann of New York heard JVC signing off at 6 a.m. on 16.05 mc. Also JFCC, 17.60 mc., believed to be a ship, was heard by Pierre working GBC, Rugby, between 7:30-8 a.m.

We were surprised to hear JVH, 14.60 mc., several mornings around 7 a.m. with an orchestral program. Unusual fare for JVH at this hour when JVH always fones.

China

Huby Fey, also of New York, reports XGOX announcing call on 13.70 mc. one Monday at 7:15 a.m. As Ashley Walcott reports XGOX on 6.85 mc. daily from 6:30-9 a.m. with Chinese and European music being heard excellently, it is quite possible that Huby really heard XGOX's harmonic. Most unusual DX, and we sure hope Huby gets a veri! Will he strut! Hi!

Algiers, on 8.96 mc. still phones TYA2, Paris, on 9.04 mc., around 12:30-1:30 a.m. heard here often. Side-band secrecy is used, and voices can be heard by tuning to the edge of the carrier wave. FYD, 13.00 mc., Paris, was once calling the Ile de France at 6:40 a.m. Eddie Schmeichel, of Chicago reports, FZS, 11.99 mc., Saigon. Indo-China calling Paris at 6 a.m. and Eddie used our tip to snare XGM, 17.64 mc., at Shanghai, phoning GBA at 7:10 a.m. Also heard CNR, 12.83 mc., Rabat, Morocco, calling Paris 11 a.m. Siberian RTA, at 1 a.m. very loud, near CNR. JVO and TDE phoning near 4 a.m. daily!

Congrats on all that "FB" DX Eddie! You surely "go to town," OM, on your SW58, hi!

John De Myer sends in a special flash reporting a "tip" from IDA member T. P. Jordan, Scranton, Pa. Here it is—FR8VX, Reunion Island, on a frequency of 14.340 kc. is being heard between 11 a.m. and 5 p.m. daily, using 100 watts. FR8VX has an antenna *directional* to North America and has called United States amateurs, being very anxious to "contact" them. Try around 11 a.m. when Mr. Jordan hears them very well! Thanks a million for passing on this "FB" tip, John, you'll always have our vy 73!

We would suggest that all DXers keep a watch on the 20 meter amateur band throughout the month of December, between the hours of 9:30-11 a.m. and 2 to 5 p.m. when amateurs in Africa will be coming through well enough to log. These of course are on phone as we do no tuning of CW stations. Many fine African catches were heard last December, mostly in the afternoons. Reports indicate that listeners on the West Coast will find it profitable to tune between 9-11 a.m. several reports of actual reception indicating these hours as favorable for African 20 meter reception on the coast.

We wish to thank all of our friends who have so kindly written us and supplied us with much of the valuable data given above. We will look forward to hearing from others among you DXers who may have "tips" to offer, that would be of value in these articles, or who seek assistance in short-wave reception problems.

All the above data is reliable, practically all of it having been checked by actual reception, and we're certain that you'll hear at least a few of the DX catches listed, if you use the "tips" given. Go to it, and clean up the air waves, friend DXers!

(This month's tests were made on a National NC100 receiver, through the courtesy of the Sun Radio Company of New York City.)

The RX-17—A 7-Tube "Band-Spread" Receiver

(Continued from page 544)

ent foreign stations reception with remarkable regularity and tremendous volume.

For the transmitting amateur who is interested primarily in the 10-20-40-80 and 160 meter amateur bands, there is model RX-17-AB which is equipped with a plate-voltage cut-off switch for use during transmitting periods and special band-spread coils for these bands, each of which covers a large part of the tuning dial scale. Incidentally, these special coils are interchangeable with the regular coils furnished with the standard RX-17 model.

This article has been prepared from data supplied by courtesy of Eilen Radio Laboratories.

4-Metal Tube "Super-Gainer"

(Continued from page 544)

been made up to these specifications. The "S" shaped shield plainly noticeable in the photo is used to effectively *de-couple* the mixer and oscillator circuits.

After you are sure everything is correct, the power-supply, or batteries, whichever you are using, can be connected. Plug in the 40-80 meter coils in the coil sockets, insert the headphone cord tips in the tipjacks and everything is all set for the lining-up process.

Lining the set up isn't as difficult as one might be led to believe, and it can be done pretty accurately without the necessity of any expensive equipment. Let us review the controls and what they do.

The lower right-hand knob controls regeneration in the first detector, and actually will be found to operate very much like the volume control on most S-W receivers. There should be one setting of this control on most S-W receivers. There should be one setting of this control, about three-fourths of the way on, that will afford the most volume. Past this point the detector tube will have a tendency to oscillate, which will seriously affect the reception.

The upper right-hand knob is the first detector *band-setting*, or *tank* condenser, and the middle dial is the main tuning, or *bandspread* control. To the left of the tuning dial, the upper knob is the *oscillator*

Masterpiece V Has 20 Tubes and 2150 to 5 Meter Range

(*Continued from page 543*)

Band-spread tuning, although hardly necessary—thanks to the extra large and well spread out scales on the main tuning dial—is incorporated in the form of a second dial scale graduated to 200 degrees, located beneath the tuning knob. In this way, each wave band of the receiver is amplified ten times on the band-spread dial for the easy separation of stations on the crowded sections of the short wave spectrum.

Among other features found in this extraordinarily well-equipped all-wave receiver, we find: Headphone jack; special tuned and amplified automatic volume control; high-fidelity filter; extra complete shielding; amplified and calibrated "Magic Eye" to permit measuring "signal strength"; automatic oral tone compensator and provision for microphone operation for full 30 watt public address output. Separate antenna primary windings for all five bands are successively switched to two antenna and one ground binding posts, allowing most efficient use of special noise-reducing, doublet or single wire aerials as desired.

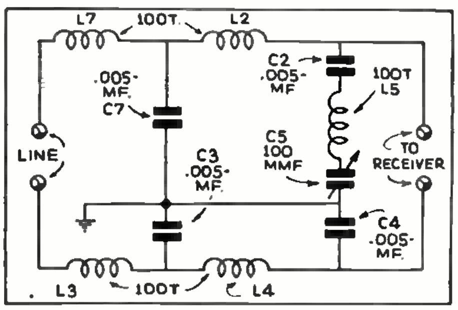
This receiver is custom-built, to order only, to the buyer's exact specifications and is intended to bring him the utmost in reception under his own particular installation conditions.

NEXT ISSUE!
Plenty of Television News—also an article on S-W DIATHERMY—Fact or Fancy?

band-setting, or *tank* condenser and the lower knob controls the I.F. or *second-detector regeneration*. This control is used much the same as the regeneration control on any regenerative two or three tube set. It not only increases the gain of the I.F. circuit, but serves to control the *beat note* for reception of CW signals.

The separate power-supply unit for the 4-tube Super-Gainer appears in diagram.

This article has been prepared from data supplied by courtesy of Allied Radio Corp.



A filter to "kill" noises picked up from 110 volt supply circuits.

World-Wide Short-Wave Review

(*Continued from page 541*)

contained a circuit and details for making a line filter, which is adjustable so that the best operating conditions for the particular wave-band in question can be obtained. As shown in the sketch here it consists of five choke coils and five condensers, one of which is variable.

The coils are all wound in the same manner and with the same number of turns, namely 100 turns of No. 14 enamel covered wire jumble-wound on forms 1 inch in diameter. The condensers C1, C2, C3, and C4 are mica insulated units having a capacity of .005 mf. each. The variable condenser C5 has a maximum capacity of 100 mmf. This should be a well made air condenser of the type used for short-wave tuning.

The entire unit is made in a small case with a plug for the electric light line and a socket for the receiver plug. The filter is adjusted by varying the condenser capacity until the noise is at a minimum. The filter is only effective in removing those noises which are picked up on the power lines and transmitted to the set through the power supply unit.

Improving Our 5 Meter Superhets

(*Continued from page 533*)

detector padding condenser may be swung back and forth past the resonance point without detuning the oscillator at all. Variations in the screen-grid voltage on the detector, however, do cause a noticeable shift in oscillator frequency. Therefore, it is advisable to adjust this to well below the point of oscillation in the detector stage, so that you will not require shifting, thus allowing a more accurate calibration of the receiver. If an attempt is made to calibrate the converter circuit, the regeneration control should always be turned to the same position, otherwise the calibration will not hold true. Due to the difference in capacities between the Acorn and the metal tubes, the tuning ratio of the condensers is not the same. The tuning condensers should be much smaller and if the same lineup is used as shown in the original receiver in the December issue, *one of the rotor plates should be removed from each condenser*.

Incidentally, the converter diagram employing the 954 and 955 may be employed *with any type of receiver*. For those who wish to convert their standard amateur receivers for 5-meter operation, we can highly recommend this circuit and with the constantly increasing number of stabilized signals appearing on the band, we believe it might be worthwhile. Eventually it will, of course, because it is a foregone conclusion that all transmitters will be *stabilized* and such a combination as this converter, operating ahead of the standard communications type of receiver will constitute an ideal line-up.

The only parts needed for making the changes recommended in this article are the tubes and their sockets.

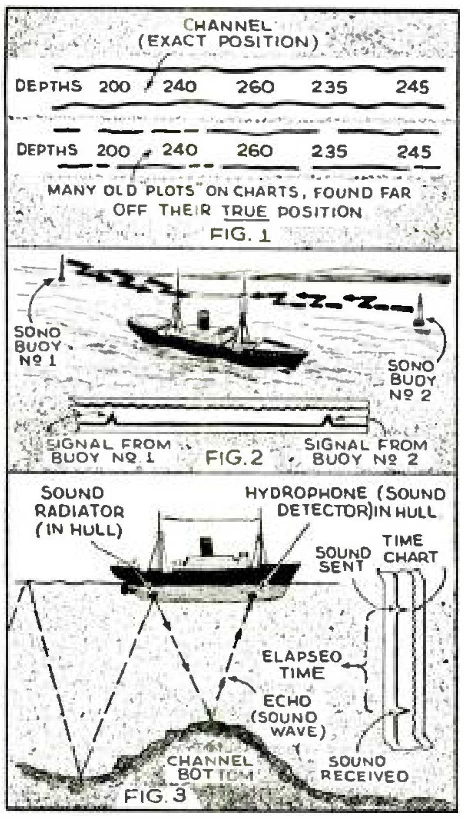
Short Waves plus Sound Impulses Chart "Coastal Waters"

(*Continued from page* 528)

How Depth is Measured

The *fathometer* is a device which records the depth by sending a sound to the bottom and recording the time it takes the echo to return. A ship passing over the upper end of the newly chartered gorge could record the time it took a vessel to sail between the 100 fathom curves, and thus enable it to determine its position *more accurately than by the use of astronomic sights with a sextant.*

However, this still did *not* eliminate the problem of the small station ships. These small boats would sometimes be anchored off shore for ten days at a time. Extremely rough weather would place them in danger and imperil the lives of men and ships. To overcome this, Dr. Herbert Grove Dorsey, scientist of the Coast and Geodetic Survey, recently perfected the "oil barrel" radio station. He was assisted in the field work by T. J. Hickley. The *sono-radio*



Diagrams show how new system charts channel accurately, also how chart boat finds it exact location by checking from 2 or more sono-buoys. Bottom—How sound echoes (or radio waves) register ocean's depths.

buoys have been in operation for the past four months and are replacing the station ships. The buoys are made of oil drums with the radio instrument sealed inside of them. They are anchored in depths up to 125 feet. A hydrophone is attached to the buoy's anchor cable. This is connected with a vacuum tube *amplifier* inside the barrel, and this in turn is connected with a *short-wave transmitter.*

When the *sound wave* from a bomb exploded by the survey ship reaches the buoy, it is picked up by a hydrophone and amplified. This sound automatically actuates the short-wave radio *which sends a signal back to the survey ship.* In other words, a *sound* message is received and a *radio* message is sent back from the barrel, without the intervention of human beings.

The *chronograph* (time recorder) which is on the survey ship is used to measure the time interval between the explosion of the bomb and the length of time the sound travels from the bomb to the buoy. The chronograph, by means of two pen-like attachments (known as stylus) records the exact time. The stylus on the right (see photograph) denotes the time by marking *one-second* intervals along what closely resembles ticker-tape. The stylus on the left will only go into action after a bomb has been exploded. It will then make a definite mark on the ticker-tape beside the time interval registered by the stylus on the right. The length of time consumed is then calculated by the interval from the time of the explosion to the time of relay, according to the number of seconds designated by the time stylus. Sound travels through sea water at a rate of approximately nine-tenths of a mile, (4700 ft.) per second, and it is then up to the officer in charge to compute the exact time. The position of the sono-radio buoys is definitely known.

This new method will be used to rechart the coastal territory of the entire country. It will result in a considerable saving for the Government in making unnecessary the placing of these station ships at various points. It will also eliminate the dangers attached to sending these small ships out many miles off shore as they have done in the past. In several instances due to severe and foggy weather, these ships have been in danger. Considerable progress has been made this year on the "off-shore" work.

Technical Questions and Answers

1. How many buoys are used in a given area while charting? *Answer*—2.
2. What is the source of supply of the Sono-radio buoy? *Answer*—Short-wave radio sets are placed in oil barrels by members of the United States Coast and Geodetic Survey.
3. How far from the survey ships are the radio buoys spotted? *Answer*—They are anchored in depths up to 125 feet, at a distance from zero to 45 miles from the survey ship.
4. On what wavelength (short-wave) do sono-radio buoys operate? *Answer*—Approximately 72 meters.
5. How can they tell on the chronograph which buoy is sending the sound recorded? For instance, if they operate two buoys in a given area, how can they tell which one is reporting? *Answer*—There will be a lapse of time between the markings on the chronograph. The one farthest away will come in after the first one, the length of time elapsing depends entirely on the distance. In extremely rare instances the survey ship may be exactly in the center between the two buoys, in which case the report from both will come in simultaneously.

Money for Your Ideas!!

● THE editors are looking for good articles describing the detailed construction of improved SHORT-WAVE RECEIVERS suitable for either "Ham" or "Fan" reception, or both. Other short-wave apparatus is also of interest. If you have a new and novel circuit, be sure to send a description and sketch of it to the Editor, and we shall be glad to give you a prompt opinion as to whether or not we would be interested in an article on the subject. All articles accepted and published will be paid for at regular rates.

If you submit an article, finished diagram drawings are not necessary, but the photo should be clear and as large as possible.

Beat and Test Oscillator

(Continued from page 536)

tor. Turn on the filament and plate current and allow the oscillator to warm up for ten or fifteen minutes. Make a small scratch on the panel near the beat-frequency pitch control about ¼ inch long with a sharp instrument and adjust the pointer to it as accurately as possible. Always return the knob to this position when taking frequency readings from the oscillator. Now remove the antenna wire from the broadcast receiver and connect in its place the *shielded* lead from the test oscillator. Set the tuning dial of the receiver to about 800 kc. and tune the oscillator, starting at the lower end of the dial scale, until the signal is heard in the speaker. If the coil data has been carefully followed, 800 kc. should appear at about 30 on the oscillator dial. Now, leaving the receiver dial alone, tune the oscillator dial to about 75 or 80, at which point the signal should again be heard in the receiver. This indicates that the oscillator is now operating on a frequency one-half as high as that to which the receiver is tuned, or, in other words, the receiver is tuned to the *second harmonic* of the oscillator. The receiver may now be tuned to any point on the broadcast band, the frequency of which is known, and the oscillator adjusted to *one-half* the frequency as outlined above. In this manner a calibration curve for the frequencies between 750 and 225 kc. may be worked out.

It is interesting to note that *the difference-frequency between any two consecutive harmonics is always equal to the fundamental frequency of the oscillator.* Thus if the oscillator is operating on 300 kc., the second harmonic will be 300 kc. plus 300 kc. or 600 kc. The third harmonic will be 300 kc. plus 300 kc. plus 300 kc. or 900 kc., etc. By keeping this simple rule in mind a very accurate calibration curve for the *I.F. frequencies*, the standard 200-500 meter broadcast band and the *short waves* can be obtained.

In order that the *test signal* can be heard on a *non-oscillating* receiver it is necessary to employ some kind of modulation in the oscillator. This is accomplished most easily by simply winding on about ⅓ more tickler turns than are needed to produce oscillations or using a high value grid-leak and condenser. In this particular circuit, it was found that 27 turns was necessary for unmodulated oscillations, while an increase to 41 turns gave a clear 500 cycle modulated note. *The modulated oscillator cannot be used for producing a beat note for code reception.* In order to allow the oscillator to be used as both test and beat-frequency oscillator, the author provided a pair of tip-jacks at the rear of the chassis so that a separate modulator can be attached as shown in Fig. 4.

For *aligning* the I.F. stages of a superheterodyne, the output of the oscillator is connected to either the control grid or the plate of the mixer tube and the oscillator dial is adjusted to the proper I.F. frequency. Now connect an output meter, speaker or headphones to the output of the receiver and with a *non-metallic* screwdriver, adjust each I.F. trimmer for maximum deflection of the meter or the loudest signal in the speaker. If the pointer of the meter goes off scale or the signal becomes very loud, the oscillator output should be reduced by turning out the plates of the attenuator condenser.

The harmonics of the oscillator are used for aligning the R.F. stages of either a T.R.F. or superheterodyne receiver. The procedure is as follows: Tune the oscillator so that some harmonic of its frequency will fall near the wavelength to which the receiver is tuned (the 21st harmonic of 300 kc., for example, is 6300 kc. or near the 49 meter broadcast band) and adjust each R.F. trimmer or padder until the maximum deflection of the output meter is obtained as was done during the I.F. adjustment. Usually the harmonics become weaker as the frequency increases, so more capacity in the attenuator condenser is required when adjusting to harmonics than when aligning I.F. circuits on the fundamental.

When being used as a beat-frequency oscillator, the output of the oscillator is connected to either the plate of the I.F. tube preceding the second detector or to the grid of the detector itself. The author has found that better results are usually obtained when the plate connection is used. For this purpose the tuning dial is tuned to the frequency of the I.F. stages and then the small 35 mmf. trimmer is adjusted to produce the desired beat note. This condenser has only a small effect on the calibration of the oscillator, but should always be returned to its marked position as mentioned above when using the oscillator for *alignment* purposes.

It is not absolutely necessary that the oscillator tube is of the 30 type; almost any type can be used if the proper heater and plate voltages are applied. However, the 30 is recommended inasmuch as it will operate on very low voltages which enables the batteries to be placed inside the shield can or cabinet. The calibration procedure is the same in either case.

List of Parts for the Oscillator

C1—Tuning condenser, .0007 mf. (2-gang .00035 mf. condensers in parallel) see text.
C2—Midget tuning condenser, 35 mmf. (.000035 mf.).
C3—Same as C2.
C4—Mica condenser, .0001 mf.
C5—Mica condenser, .001 mf.
L1—148 turns No. 30 d.c.c. on 1½ inch form. See text.
L2—27 or 41 turns No. 30 d.c.c. on 1 inch form. See text.
RFC—2½ mh. R.F. choke.
1—4-prong socket, spring mounting type.
1—Aluminum panel and chassis. See drawing and text.
1—Dial.
2—Pointer knobs.
1—Closed-circuit jack (see text for explanation).
1—"Off-on" toggle switch.
1—Shielded cable, 2½ ft. long.
Necessary binding posts, tube, etc.

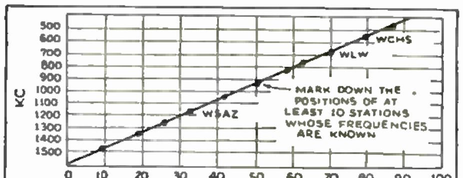


FIG. 3

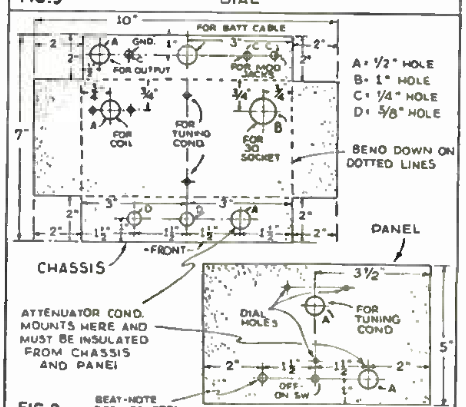
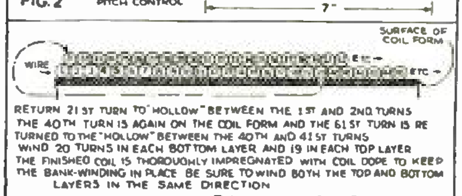


FIG. 2



DETAIL OF BANK-WINDING

Calibration chart, chassis dimensions and method of "bank winding" coil.

Choosing the Right Transmitting Tube

(*Continued from page 539*)

ever Class A audio in this tube size has become rather silly now-a-days. An 845 turns out about 25 watts which one can get just as well from a pair of 6L6 tubes costing ⅛ as much. Of course, in a big transmitter with lots of volts and cash available the 845 is fine. We shall meet it again.

If we try to escape the high bias of the 845 we must go to a tube in which a lesser bias will hold down the plate current, in other words a tube with a finer grid and higher mu. The 845 has a mu of 5.3 while the 211 has a mu of 12. Let us try the 211 whose bias is 80 volts instead of 210. Your uneasy suspicion that it will turn out even less audio is correct, for it gives us but 20 watts which we can get for $2.50 from receiving tubes. However the 211 at that isn't much worse than the 845, whereas it is tolerably good for a variety of other purposes. *Most of our "all uses" tubes turn out to have medium mu.*

By this time you are sure that a high mu tube is no good for Class A and are not surprised to find the 203A giving less than 10 watts, while the 838 and 805 are quite worthless for this job. To be sure the 852 is not much worse than the 211 for Class A but why use a high voltage tube?

Let us now jump to Class B audio. Audio work of the "A prime" or "A-B" sort can better be taken up later as can grid-modulated RF tubes.

2—Choosing a Class B Audio Tube

24 audio watts from a 100 watt tube isn't much. Why did we get so little? Here is why. When our 845 is not working we still have running into it 52 Ma. at 1250 volts, which is 65 watts wasted as plain heat. When the tube is working at full volume the same 65 wats goes in but now 24 watts come out again in the form of audio, leaving only 41 watts on the plate—therefore the plate cools off when the tube goes to work, which is, of course, a silly business. If we try to get more output we must have more input, causing the tube to overheat when "resting." Manifestly we get rid of this "resting" heating by making the grid bias so big as to "cut off" the plate current almost entirely. Now we have almost no plate heating when the tube is resting, but when audio is fed to the grid each positive grid swing lets thru a "bump" of plate current. The plate now heats with load as seems proper. We can secure more output before overheating. The catch is that the negative grid swings produce nothing at all because you can't push the plate current down when it is already zero. Accordingly there are spaces between the blobs of plate current and in Class B we must always use two tubes in push-pull, the goodness of the result depending on the success of the output transformer in pasting together the alternate bumps from the two tubes. If properly done the result is good If badly done it is pretty terrible. Furthermore the grid no longer gets along with voltage only for there is a grid current which quite invariably means that grid power is being used, perhaps five perhaps eight watts for the pair of tubes.

Which tubes shall we use? The 845 in Class B would require a bias of 260 volts which is foolish. We can get the same quarter kilowatt of audio from a pair of 211, 852, 203A, or 838 tubes, tho their "mu's" are widely different. The point is that when a grid is swung positive it operates much the same, regardless of its mesh, so there is now no point in using a low mu tube, while on the contrary—a very high mu tube, such as the 838 or 805—permits us to get along with no bias at all. Wondering which to choose, one perceives that the 838 has its plate connection coming out thru the base, while the 805 has it at the top of the bulb, therefore the 805 can safely be pushed on up to 1500 volts, which in Class B audio, means 370 watts per pair—an astonishing lot of audio! The medium mu 211 and the high mu 203A are also perfectly good Class B audio tubes if you don't mind providing bias.

3—Class A Prime or A-B Tubes

Since A prime or A-B operation is between Class A and Class B we of course, find the ever-present medium mu tube (211) adapted to this use. *However any tube with a Class A audio rating will work out in Class A-B.* Even pentodes reconnected as triodes and tetrodes similarly connected, make thoroughly good class A-B tubes. The 850, 860 and 803 can be so used.

3B—Comparison of A, A-B and B Audio

Putting them on the basis of a common voltage of 1250 we find a single 845 turning out 24 watts in Class A, a pair of the same giving 60 watts in push-pull Class A, while in Class A-B about 100 watts can be obtained from a pair of either the 845 or 211 tubes, which last performance could be equalled by a pair of 852 triodes or a pair of 860 tetrodes (connected as triodes) only if the voltage were doubled. (i.e.2500)

In Class B, better than ¼ kilowatt can be obtained from any of the following: the 211 with 100 bias volts, 203A with 45 bias volts, 838 or 805 with no bias at all. Once more the similarity between the 211 and 852 appears, since the 852 requires twice the voltage at *both* grid and plate, the mu being the same, but the impedance different.

4—Grid Modulated Tubes

There are several sorts of *grid modulation.* In the Phelps method, the grid is always *negative* but during full modulation is swung right down to zero bias, which resembles Class A-B audio operation. The obvious conclusion is that either low or medium mu tubes may be used and (are you ahead of me?) the ever-useful "medium mu" tube is once more the best. However, here we can for the first time say a kind word for the 852 as an amplifier. This very old tube was never designed as an amplifier but as a 5-meter *power oscillator.* The capacitances were reduced by wide spacing between grid plate and filament, whereupon the tube required 3000 volts. Nobody cared, for that was in the days of radio telegraphy with a.c. plate supply, which makes 3000 volts cheap enough. In fact we generally used 5000. A by-product of the construction of the 852 was excellent insulation, which does us real good in Phelps modulation. In such a stage, unlike Class A audio, there is an output before we start modulating. This output is, of course, the carrier, so the input isn't all turned into heat when "resting," and we can afford to run up the input by using higher voltage. Now the 211 does not digest 2000 volts well, but the 852 thinks nothing of 5000 if the plate current is small. Unfortunately 5000 volts of direct current are costly and as has been pointed out many times before, we need today a modernized 852 for this and other reasons.

A pair of 852 tubes with Phelps modulation produce only about 75 watts of carrier, despite the high plate voltage. Recalling the great increase in performance, when going to Class B audio, one immediately thinks of driving the grids harder with both r.f. and audio, the chief proponent of this scheme being Hawkins, who has also pointed out that the resulting distortions can be reduced by taking about 40% of the bias from a cathode resistor. The reduction in plate voltage is not as great as one might wish, since it must also provide this cathode resistor voltage. The 211 is once more the tube if the stem insulation holds up. This tube is the oldest member of the family and many are still about, which do not perform any too well at higher frequencies. The 852 is all right, if one does not mind 3000 volts. The carrier is roughly twice as great as for the Phelps system, but as in every scheme which swings the grid positive, we here need *watts* to make the grid go, 3 or 4 times as many watts as actually necessary at the grid being desirable, and twice as many being really necessary. The surplus in either case is to be wasted in a stabilizing resistor.

5—Class C Telegraph Amplifiers

In a reasonable and normal C.W. amplifier most of the tubes of the family give about the same results, despite loud opinion to the contrary. For instance we compared an 838 and a 211 in the final stage of the telegraph amplifier of W2QA, owned by Mr. Raymond Morehouse. This is a thoroughly conservative transmitter, employing a 47 oscillator and a type 10 doubler to drive the output stage. The 211 drew 200 ma. at 1400 volts, with a grid current of 4 ma., while the 838 with the same input and a grid current of 25 ma. produced about the same antenna power. The larger grid current of the 838 looks bad, but the grid wattages of the two tubes was almost identical, for one worked at a bias of 270 volts, the other at about 70 volts. This is confirmed by an unchanged plate current in the driving (doubler) type 10 tube. Many other examples could be given.

Unfortunately too many tubes are driven into the "short-life" region for the sake of a more impressive antenna meter reading, and perhaps slightly better signals. If this is done by simple increase of all voltages, the operator usually knows when the tube begins to suffer, but if it is done by violent "overdriving" of the grid and use of a high inductance plate circuit, the filament usually suffers before one knows it. Since the 100 watt family all have about the same size of filament this means little here, but for such operation one had better choose a tube with a metal plate which shows color when overdriven, and a glass envelope which has ample insulation. Obviously in the 100 watt family this describes the 852 triode and the 860 tetrode. While none of this high-efficiency operation is with the blessing of the tube-maker, one can generally get away with 50% overvoltage if an efficiency of 75% is attained.

7—Oscillators

Oscillators are touched on only because commonly accounted as being Class C. affairs. My own choice would instantly fall on the medium mu tube for a power-oscillator in the triode class, while amongst the triodes and tetrodes I'd prefer the 850 for its moderate voltages, if frequency requirements did not drive me to the 860. However we usually do not use a power-oscillator, but instead amplify up a lightly-loaded crystal oscillator, for which a 47 receiving tube is about as good as the next thing. If the crystal oscillator itself must produce power, the 803 pentode with the voltages limited is the best member of the 100 watt family, somewhat better than the 850 tetrode. The 860 is not good for this because of its high impedances. The various 1-tube oscillator—amplifier combinations, whether they employ a crystal or not, are, of course, all variations of the Dow electron-coupled oscillator and like their common parent they require a tetrode or a pentode. If a crystal is involved you may have your choice of the 803 pentode or the 850 tetrode as far as I am concerned, preferably at no more than 1000 volts. In a straightforward Dow oscillator, without crystal, I very much prefer the 860 tetrode —which is an excellent oscillator for frequencies of 100 megacycles and even more.

8—Buffers and Drivers

The job of a *buffer* is to "buff" that is to keep the output stages from working back to earlier stages. Receiver manufacturers without exception, and commercial transmitters with very few exceptions, support my strong belief that *this is no job for a neutralized triode but should be done by a tetrode or pentode with proper shielding.* I believe amateur transmitters to be 5 years behind the times in this regard. *Buffing* can usually be done at low power-levels with small tetrodes or pentodes, and by the time we get to the 100 watt class we intend to use the tube as an output tube or at least as a driver for an output tube. A *neutralized* output stage is not bad, because the antenna load helps to stabilize it, but on the other hand what's the matter with the 803 pentode as an output tube? It provides a 155 watt telephone carrier or a 200 watt c.w. carrier and needs no neutralizing. It will operate at full rating at 20 megacycles and isn't down to half rating at 60 megacycles! Even under the handicap of being suppressor-modulated or of being used as an amplifier after a modulated stage, the tube still turns out 50 watts. In all cases the r.f. grid demand is modest and the drive can be provided by economical tubes like the 47, the 802 and the 804. For frequencies above 60 megacycles the 860 begins to show considerable advantage, however.

9—Suppressor-Modulated Stages

A radio phone can be made from a 47 crystal oscillator driving a pentode which is suppressor-modulated and uses a plate voltage of 1250 or more. Two tuned circuits are needed. The same job can be done with the same number of tuned circuits, half the voltage and receiving tubes costing $15 or $20 less. The pentode arrangement requires no neutralizing, which is important. When both are turned over to c.w. the pentode produces about twice the watts of the cheaper "rig," a difference seldom noticed at the receiver. I see little excuse for suppressor modulation unless as an afterthought or auxiliary for a telegraph transmitter.

Summing Up

It has been indicated in several places that the 860 has a black eye it does not deserve. This tube is a thoroughly good 5 meter amplifier, and at 20 meters works easily at full rating, being at least as good as an 804 "70 watt" pentode in some applications, and about equal to two of them in other uses. There is no particular magic in pentodes at high frequencies, though in general it takes a little more grid input to make a tetrode go. Incidentally, while tetrodes and pentodes are much easier to drive than triodes, when in the negative-grid region, this condition gradually changes as the drive is increased until the amateur who flirts with violent "overdrive," and short tube-life in reaching for 80% plate efficiency, may be rather astonished to find the pentode harder to drive than the simple triode (which incidentally has a simpler structure and hence endures such monkey-business better). Surely, you know what is coming next—the best triode for the purpose is the *medium mu* kind. One begins to suspect that the great variety of such tubes may be due to the possibility that the tube manufacturers know their business.

Short Wave League
When to Listen In

(Continued from page 556)

been testing in the evening with California.

CFCX, Montreal, Canada on 6.005 meg. is on 8:00 a.m. till 11:15 p.m. They do not have very much power. Their address is: P. O. Box 1690.

LRX, Buenos Aires, S.A., on 9.66 meg. comes in very good.

HRD, La Ceiba, Honduras, is heard Sundays from 4:00 to 6:00 p.m.; week days 8-11 p.m. (6.235 mc.).

All of the DJ stations and GS stations, Germany, and London, Eng., respectively, come in very good.

2RO has been coming in very good, as has PHI and PCJ on 15.22 meg.; PCJ on 9.59 meg. is not heard till after 8:00 p.m. now, as W3XAU is back on and they use the same wavelength till 8:00 p.m.

EAQ is still rather weak, as is CT1AA, 9.65 meg. Lisbon, Portugal.

I wish to thank the following for their help in checking the stations in this report. Keith, Kilton, Illevoir, Clyde Ritter, Pennsylvania; Virgil Tyler, Kansas.

ANGELO CENTANINO,
Box 516,
Freeport, Pa.

Tubes of New Design for the Amateur

(Continued from page 547)

From the above it can easily be seen that a safe intermittent radio telegraph rating for a pair of "154's" operated at 1000 plate volts would be 300 watts.

Likewise, for radio *telephone* operation at 1000 plate volts, the safe rating of a pair of "154's" would be 250 watts. In this last case a second pair of "154's," operated at the same plate voltage in Class B audio modulators, would permit high quality modulation to 100%.

The general ratings of the Type 154 Gammatron are as follows:

Filament Voltage	5.0 volts
Filament Current	6.5 amps.
Plate Dissipation	50. watts
Plate Voltage	1500. volts (max.)
Plate Current	175. ma. (max. average)
Grid Current	30. ma. (max. average)
Plate Resistance	1750. ohms
Amplification Constant	6.7

RK-37

The RK-37 represents another high efficiency triode which may be operated at frequencies as high as 112 megacycles. Both the plate and grid leads are brought out in the glass envelope of the tube, providing very short leads and permitting operation at the very high frequencies with remarkable plate efficiency. According to the manufacturers of this RK-37, the tube maye be operated at 1,000 volts on the plate at 56 megacycles, and at 112 megacycles with 750 volts on the plate.

Complete technical data, together with recommended operating conditions are as follows:

RK-37

OPERATING DATA AND CHARACTERISTICS

Filament voltage	7.5 volts
Filament current	3.25 amperes
Amplification Factor	30

AVERAGE DIRECT INTERELECTRODE CAPACITIES

Grid to plate	2.9 mmf.
Input	3.2 mmf.
Output	.3 mmf.

OPERATION

Class "B" Audio

D.C. plate voltage (max.)	1250 volts
D.C. plate current (max.)	100 ma.
Plate dissipation (max.)	35 watts

Class "C" (Oscillator or R.F. Amplifier)

D.C. plate voltage	1250 max. volts
D.C. plate current	100 max. ma.
D.C. grid current	25 max. ma.
Plate dissipation	35 max. watts

TYPICAL OPERATION

D.C. plate voltage	1000 volts
D.C. grid voltage	−70 volts
D.C. plate current	95 ma.
D.C. grid current	20 ma.
Plate dissipation	35 watts
Peak R.F. Input	140 volts
Driving power	3.0 watts
Power output	60 watts

CLASS "B" R.F. AMPLIFIER

Modulation Factor of 1.0

D.C. plate voltage	1250 max. volts
D.C. plate current	66 max. ma.
Carrier Pl. dissipation	35 max. watts

TYPICAL OPERATION

D.C. plate voltage	1000 volts
D.C. grid voltage	−45 volts
D.C. plate current	50 ma.
*Peak R.F. Power input	2.3 watts
*Peak R.F. volt. input	120 volts
Carrier power	15 watts
Peak power	60 watts

*100% Mod.

GRID MODULATED R.F. AMPLIFIER

Modulation Factor of 1.0

D.C. plate voltage	1250 max. volts
D.C. plate current	66 max. ma.
D.C. Pl. dissipation	35 max. watts

TYPICAL OPERATION

D.C. plate voltage	1000 volts
D.C. grid voltage	−52.5 volts
D.C. plate current	50 ma.
Peak R.F. input	80 volts
Peak R.F. power input	2.3 watts
Peak audio voltage	45 volts
Peak audio power	.5 watts
Carrier power	15 watts

RK-38

The RK-38 apparently is a big brother to the previously mentioned RK-37. It is much the same in general construction although it is not shown in the photograph.

The plate and grid leads are brought out to caps on the envelope and an *isolantite* base is employed. The maximum plate voltage for this tube is 3,000 volts and it may be operated at this voltage at frequencies as high as 56 megacycles. Beyond that the manufacturers recommend that the voltage be reduced somewhat. This tube is rated at a plate dissipation of 100 watts and with 2,000 volts on the plate at 150 mills the output can be expected to be 225 watts. Various recommended operating conditions as supplied by the manufacturer are as follows:

RK-38

OPERATING DATA AND CHARACTERISTICS

Filament voltage	5.0 volts
Filament current	8.0 amperes
Amplification Factor	30

AVERAGE DIRECT INTERELECTRODE CAPACITIES

Grid to plate	4.5 mmf.
Input	3.9 mmf.
Output	1.0 mmf.

OPERATION

Class "B" Audio

D.C. Plate voltage (max.)	3000 volts
D.C. Plate current (max.)	165 ma.
Plate dissipation (max.)	100 watts

CLASS "C"

(Oscillator or R.F. Amplifier)

D.C. Plate voltage	3000 (max) volts
D.C. Plate current	165 (max) ma.
D.C. Grid current	40 (max) ma.
Plate dissipation	100 (max) watts

TYPICAL OPERATION

D.C. Plate voltage	2000 volts
D.C. Grid voltage	−200 volts
D.C. Plate current	150 ma.
D.C. Grid current	30 ma.
Plate dissipation	100 watts

Peak R.F. input	375 volts
Driving power	11.5 watts
Power output	225 watts

CLASS "B" R.F. AMPLIFIER
Modulation Factor of 1.0

D.C. Plate voltage	3000 max. volts
D.C. Plate current	100 max. ma.
Carrier Pl. Dissip.	100 max. watts
TYPICAL OPERATION	
D.C. Plate voltage	2000 volts
D.C. Grid voltage	−100 volts
D.C. Plate current	75 ma.
Peak R.F. power input	7 watts
Peak R.F. voltage input	300 volts
Carrier power	55 watts
Peak output	225 watts

GRID MODULATED R.F. AMPLIFIER
Modulation Factor of 1.0

D.C. Plate voltage	3000 max. volts
D.C. Plate current	100 max. ma.
Carrier Pl. Dissip.	100 max. watts
TYPICAL OPERATION	
D.C. Plate voltage	2000 volts
D.C. grid voltage	−150 volts
D.C. plate current	80 ma.
Peak R.F. input	160 volts
Peak R.F. power input	4.0 watts
Peak audio voltage	100 volts
Peak audio power	1.0 watts
Carrier power	60 watts

HF-100

The HF-100, shown in the photograph, is an especially designed high-frequency, low voltage, high efficiency amplifier and oscillator, with extremely low inter-electrode capacities. It is a high mu tube and has a high ratio of transconductance to inter-electrode capacitances. The table of characteristics and operating specifications show that this is rated at a plate dispatch of 50 watts at 120 megacycles and is capable of a power output of 60 watts at this frequency. Special heat radiating caps are provided at the points where the plate and grid leads are brought out of the glass envelope. Complete technical data together with recommended operation conditions follows.

HF-100
TENTATIVE CHARACTERISTICS

Filament:	Voltage 10 Volts
	Current 2 amps.
Amplification Factor	23
Grid to Plate Transconductance @ 100 ma.	4200
DIRECT INTERELECTRODE CAPACITANCES:	
Grid to Plate	4.5 mmf.
Grid to Filament	3.5 mmf.
Plate to Filament	1.4 mmf.
DIMENSIONS	
Height overall	7½ inches
Bulb diameter	2-1/16 inches
Base	Standard UX-4 prong
Plate terminal	Heat Radiating top cap Diameter .5 in.
Grid Terminal	Side cap diameter .5 in.

TENTATIVE MAXIMUM RATINGS

For operation at:	30 mc. (or lower)	60–75 mc.	120 mc.
Plate Dissipation	75 watts	60 Watts	50 watts
D.C. Plate Voltage	1500 volts	1200 volts	1000 volts
Modulated D.C. Plate Voltage	1250 volts	1000 volts	800 volts
A.C. Plate Voltage	1500 volts	1500 volts	1250 volts
D.C. Plate Current	150 ma.	130 ma.	120 ma.
D.C. Grid Current	30 ma.	30 ma.	20 ma.
Max. D.C. Grid Bias Voltage for Class C Operation	−300 volts	−225 volts	−150 volts
Max. attainable Plate Power out-put	170 watts	100 watts	60 watts

While the average "Ham" and experimenter may be dazzled by the constantly increasing number of new tubes which appear on the market, and might, in a moment of confusion, be at a loss to know just where to begin selecting tubes for his transmitter, we must state that every new tube represents a definite advance in the art of vacuum tube manufacture.

Each of the tubes described in this particular group represents a distinct advance over all previous types and allows the amateur to operate his transmitter more efficiently in the high-frequency regions. While, of course, all of these tubes will perform excellently at the lower frequencies, that is, below 14 megacycles, they really commence to "shine" at 14 megacycles and higher.

Those interested in operation on the 5, 10, and 20 meter bands and desiring the most number of watts per dollar expended, will find these tubes the answer to their past problems.

A High-Gain Single-Tube Phase Inverter

(*Continued from page 547*)

(c) or (d) should have a large capacitance to ground, the magnitude and phase of the signal voltage across R_6 will be changed. A shift in magnitude or phase of the voltage across R_6 is manifested by a decrease in power output, especially at high audio frequencies.

In order to determine the effects of stray capacitances on the operation of the *phase inverter*, a detector-amplifier was constructed as shown in the figure. Those components whose capacitances to ground might adversely affect performance were mounted at least one-half inch from the chassis. A cathode-ray oscillograph was connected to the grids of the output tube in order to determine the magnitude of each grid voltage and the phase-angle between them. A modulated r-f signal was applied to the i-f transformer.

The voltages at the grids of the output tubes were very nearly equal in magnitude and 180 degrees out of phase at 400 cycles. This relationship was indicated on the cathode-ray tube by a single-line trace, which was inclined 45 degrees. At 7,000 cycles, the output was 6 db lower than the output at 400 cycles. The trace on the cathode-ray tube was then a narrow ellipse; the slope of the major axis of this ellipse was slightly different from the slope of the single-line trace observed at 400 cycles. This difference indicated that a relative shift in magnitude and phase of one voltage had taken place. Below 100 cycles, the trace was also a narrow ellipse, the slope of the major axis of the ellipse was nearly the same as that of the straight-line trace observed at 400 cycles. The length of the major axis of the ellipse was slightly less than the length of the straight-line trace. These differences indicated that the phase of one voltage had shifted slightly and that the magnitudes of both voltages were reduced by the same amount. The output was down less than 1 db at 100 cycles compared to the output at 400 cycles. It should be noted, however, that the selectivity of the i-f transformer affected the frequency characteristic of the phase-inverter circuit.

With the volume control set at the maximum-output position, about 20 mmf. of capacitance, in addition to the stray capacitances that were inherent in the system, could be connected from point (b) to ground before the output at 6,000 cycles dropped 2 db below the normal 6,000-cycle output. With normal plate-to-plate load (R_L), rated power output could be obtained at 400 cycles. The voltage applied to the grid of the 6F5 is $R2/(R_1 + R_2 + R_3) \times E_d$, where E_d is the total audio voltage developed by the diode. For the values specified in the figure, $R_2/(R_1 + R_2 + R_3) = 0.5$. Thus, although only 50 per cent of the available audio voltage is used, the high gain of the 6F5 permits the output tubes to be driven to full output.

The phase-inverter circuit described may be used with any of the recommended Class AB_1 ratings of the 6F6 or 6L6. This circuit can replace the two-tube phase-inverter described in Application Note No. 62 with comparable results.—*Courtesy RCA Manufacturing Co.* (Copyright 1936 by RCA Mfg. Co.)

The Editors Want

articles describing in detail Television receivers on which short-wave experimenters may pick up the television images being broadcast by the RCA Station, atop the Empire State Bldg., in New York City, on about 5 meters, and also those being broadcast from the Don Lee Station on a similar wavelength in California. All articles accepted and published will be paid for at regular space rates. Send outline of article and what photos or diagrams available to: The Editor, Short Wave and Television, 99 Hudson St., New York, N.Y.

A Direct-Reading Modulation Percentage Meter

(*Continued from page* 545)

connect the "ANT" post inductively to the aerial of the transmitter.

The antenna connection may be a small piece of wire connected to the binding post marked "ANT," ½ inch or longer, depending upon the intensity of the field in which the *modulation monitor* is placed. In case the instrument is placed in a rather weak antenna field, it may be necessary to use a longer aerial up to three or four feet. However, this would be required only in very rare cases.

With the above completed, the operator then proceeds to connect one side of the inductive pickup to the aerial post and the other side to the ground post. The number of turns will be adjusted until the carrier reference meter reads 50, or one-half scale. The modulation meter will then read directly in percentage of modulation, indicating from 40 to 120 per cent.

There should be no indication of carrier shift when the meter shows 100 per cent modulation. Indications of carrier shift will show on the carrier meter if variation of the pointer is noticed. Of course, if carrier shift is shown, the transmitter should be adjusted. The instrument will be entirely free of frequency error and there is no need of calibration.

In the event the *power-output* of the transmitter is increased or decreased it will be necessary only to change the inductive couplings to a greater or lesser degree to make the carrier meter read at the required 50-mark, or half-scale. The same is true if the *modulation monitor* is moved to a different location.

This article was prepared from data supplied by courtesy of the Triplett Electrical Instrument Co., Mr. Wenger, chief radio engineer.

Television in Europe

(*Continued from page* 527)

—A and B—of which A, the larger, gives an acting area of approximately 24 feet square. Emitron instantaneous television "cameras" are used.

Next to the control room, already mentioned, is the Marconi-E.M.I. tele-ciné room containing two projectors and scanning cameras for televising films.

Leaving the Marconi-E.M.I. "territory," the Baird tele-ciné room comes next. It also is fitted with two projectors and the necessary equipment for film transmissions. Next to this room is an additional small studio to be used with the Baird Company's "spot light" system of direct television of three-quarter length portraits such as would be required for *announcements* and *talks*.

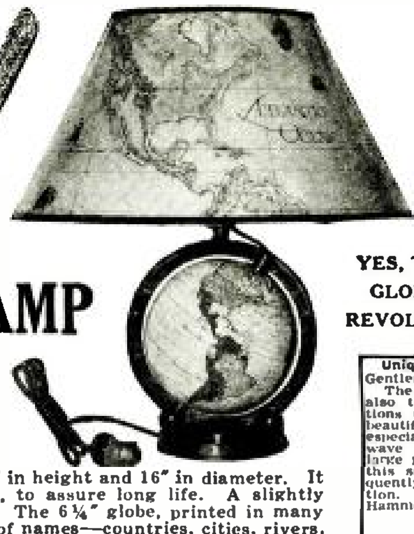
Philips New Television on 405 Lines

● The Philips Laboratories have been working in great secrecy with a new television system and the results which have been attained and now made public, are really surprising. For the first time in fact, it has been possible to transmit and receive pictures on 405 lines.

The flickering of the picture which presents such a serious disadvantage in the system on 180 lines. is being avoided in the Philips system by the *interlaced* method of scanning. In the classical process the order of succession of the lines is from top to bottom for each picture: 1, 2, 3, 4, 5, etc. . . whereas in the Philips system, the order of succession is for the first picture: 1, 3, 5, 7, 9, 11, etc.; for the second picture: 2, 4, 6, 8, 10, etc. . . and for the third it is again: 1, 3, 5, 7, 9., etc. . . and so on. By this process a complete picture may be transmitted fifty times over in a second, which corresponds to 25 pictures of 405 lines per second.

A special high frequency cable has been constructed to transmit the images from the televising studio to the ultra-short wave transmitter, which operates on a wave-length of 7 meters.

Free!



THIS USEFUL AND ORNAMENTAL

WORLD-GLOBE LAMP

NEVER in the six years that SHORT WAVE CRAFT has been published, have we found anything that is as useful and ornamental as the WORLD-GLOBE LAMP we now offer free to our readers.

This useful, beautiful WORLD-GLOBE LAMP measures 17½" high. It has an attractive colored shade, with nautical and map designs, is 8" in height and 16" in diameter. It is made of fine quality parchment, highly glazed, to assure long life. A slightly damp cloth quickly removes dust from the shade. The 6¼" globe, printed in many colors, has a full meridian, and rotates. Hundreds of names—countries, cities, rivers, oceans and others are clearly printed on the globe.

Ideal for SHORT-WAVE FANS!

YES, THE GLOBE REVOLVES!

WHAT THEY SAY ABOUT THE WORLD-GLOBE LAMP!

All Admired It

Gentlemen:
I am perfectly satisfied with your GLOBE-LAMP. It is just what you have said about it in every way. All my family and friends have admired it. It arrived in perfect condition. Many thanks and the best of good luck to you and your SHORT WAVE CRAFT.
(Signed) William Owens.
30 North Fifth Street, Bangor, Penna.

Wouldn't Take $15.00 For It

Gentlemen:
I received the Globe-Lamp and I am very much pleased with it. I think it is handsome and think a good deal of it. I wouldn't take $15.00 for it. The lamp sets on top of the radio and is handy to glance at when I hear the foreign stations.
Warren G. Ryder.
Barnstable Radio Shop, Barnstable, Mass.
P.S.: Many thanks for the lamp! WGR

Unique, Beautiful and Useful

Gentlemen:
The Globe-Lamp arrived today, also the magazine. Congratulations on a premium so unique, beautiful and, above all, useful, especially to DXers on the short-wave bands. I already have a large globe, but I expect to use this small one much more frequently and with equal satisfaction. It goes fine with the new Hammerlund "Super Pro."
T. H. Warnock,
99 Elm Street,
Meriden, Connecticut.

Very Well Pleased

Gentlemen:
I am very well pleased with my Globe-Lamp. It presents a handsome and novel appearance and is most appropriate when located near an all-wave radio set. When lighted at night, it sheds a warm, soft glow, and the parchment shade shows up most attractively. Unquestionably, the combination of the lamp and SHORT WAVE CRAFT for $2.50 is a real bargain.
William E. Sloan, Jr.,
67 Exchange Street,
Rochester, New York.

Another feature on this WORLD-GLOBE LAMP is the movable hour scale found at the north pole. This permits determining the correct time in any part of the world.

The metal parts are finished in antique bronze. A piece of heavy green felt is glued under the base, therefore it may be placed anywhere, without fear of marring table, desk, etc.

The weight of the WORLD-GLOBE LAMP is nearly three pounds. When packed for shipping, six pounds.

Here is the way to get this beautiful prize. Fill in the coupon in the left hand corner—cut it out and mail it to us together with your remittance of $2.50. You will receive a full year's subscription (12 months) to SHORT WAVE & TELEVISION—**the greatest short-wave magazine in the world today.** In addition, we will send you absolutely FREE one of these handsome WORLD GLOBE LAMPS. **Old subscribers** may renew their subscription now for another year following expiration of their present one and still receive this WORLD-GLOBE LAMP.

Only a limited number of WORLD-GLOBE LAMPS are available. Take advantage of this offer without delay in order to insure receiving your free gift. RUSH THE COUPON TODAY.

MAIL COUPON TODAY!

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99 Hudson Street, New York, N. Y.

Gentlemen: Enclosed you will find my remittance of $2.50 (plus ....cents shipping charges) for which enter my subscription for SHORT WAVE & TELEVISION for one year (12 issues). This amount entitles me to a WORLD-GLOBE LAMP free. **See chart next to coupon for shipping charges on WORLD-GLOBE LAMP.**

( ) Enclosed find my remittance of $2.50. Please send me the WORLD-GLOBE LAMP by express, collect.

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Send remittance in form of check or money order—register letter if it contains cash, stamps, or currency.

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SHORT WAVE & TELEVISION, 99 Hudson Street, New York, N.Y.

A *New* Variety of WORLD GLOBES

Here is a new variety of WORLD GLOBES which are indispensable to short-wave fans. Each globe contains a listing of several thousand cities in nations all over the world—and, such important features as; Admiral Byrd's trip to Little America; Lindbergh's flight to Paris; principal short-wave stations and call letters; steamship routes, etc. The globes have a graduated "Meridian" scale, also the movable hour scale at north pole which permits determining the hour in any part of the world.

The colors on the WORLD GLOBES are beautiful pastel shades, and harmonize with all surroundings. The globes are ideal for home, office, studio, den, etc. The map surfaces of all models are protected by a high, glazed water- and scratch-proof finish which can be washed by using a damp cloth. The finish will not fade or crack or become yellow with age.

World Globe Atlas No. R-12

World Globe Atlas No. R-12

This globe-atlas combination is excellent for home or office. The 12" library ball, with its brass-plated meridian, fits snugly into the finely constructed solid walnut stand. Provision is made below for the 383-page atlas which **accompanies each globe, at no extra charge. 67 short-wave stations are listed.** Height—16½". Shipping weight 12 lbs. PRICE **$6.85**

All globes are protected and carefully packed in original, corrugated cartons, assuring safe delivery. ORDER by number. Send check or money order, plus sufficient postage for delivery by parcel post. Globes are shipped from our Chicago warehouse. Register letter if it contains cash, currency or stamps. Specify if shipment is to be sent express collect. ORDERS FILLED PROMPTLY.

World Globe No. P-212

World Globe No. P-212

This 12" standard globe lists principal international short-wave stations and call letters. **67 prominent stations are printed on this map.** They are shown in red and easily distinguishable. Important data as steamship routes, ocean currents, mountain peaks, railroads, Lindbergh's flight and other useful information will be found on this globe. A 32-page booklet, illustrated, entitled, "The Story of the Globe" is included with this world globe. Height—16¼". Shipping weight—6¾ lbs. PRICE.... **$2.95**

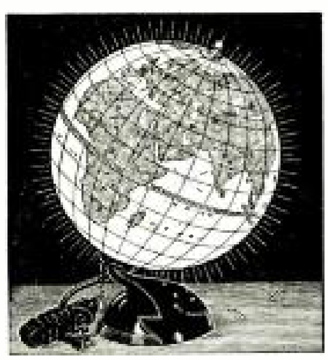
World Globe No. P-512

World Globe No. P-512

Here is a Floor Stand World Globe that is truly a remarkable value for its low price. It has 12" standard globe mounted on a hard-wood stand of Duncan Phyfe design. The stand is richly finished in walnut. The globe has a regular heavy, graduated die cast meridian which is free-moving and completely reversible. Clearly printed on the globe are over 5,000 name places, ocean currents, steamship routes, railroads, mountain peaks, Lindbergh's flight, Columbus' voyage, etc. *Principal short-wave stations are clearly printed in red.*
A 32-page booklet, well illustrated, entitled, "The Story of the Globe", is included free with this world globe. Height—34½". Shipping weight—9 lbs., 10 ozs. PRICE. **$4.45**

NEW! ILLUMINATED GLOBE

Illuminated World Globe No. IG-8



Plug the electric cord attached to this globe into any socket, and the entire globe becomes illuminated from within. The light within the globe transforms the colored map into a colorful setting, and makes the printing on the globe easy to read. This translucent globe, recently developed, has the same sturdy, reinforced construction as other globes. The surface is protected by a heavy, glossy coat to assure longevity. The Illuminated Globe is easily dismantled to make bulb replacement. Each model is equipped with 6-foot electric cord, unbreakable plug, tubular light bulb and pull-chain socket.
The revolving globe is 8" in diameter, mounted on an unbreakable die-cast base. Fittings are walnut brown. Lighted or unlighted this globe is a beautiful accessory for home, office, studio, etc. Height—10½". Shipping weight—3 lbs. 5 ozs. PRICE.............. **$2.80**

ORDER YOUR GLOBE TODAY!

SHORT WAVE & TELEVISION SWT-1-37
99 Hudson St., New York, N.Y.

Gentlemen: Enclosed you will find my remittance of $.............. for which please ship me the following World Globe.

( ) Illuminated World Globe No. IG-8 @ $2.80
( ) World Globe No. P-212 @ $2.95
( ) World Globe No. P-512 @ $4.45
( ) World Globe Atlas No. R-12 @ $6.85

Name ....

Address ....

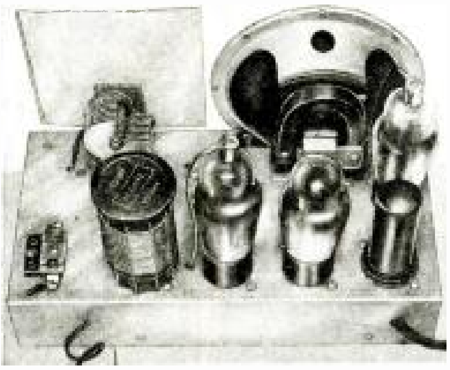
City .... State ....

Send remittance in check or money order—register letter if it contains cash, stamps or currency. GLOBES ARE SHIPPED FROM OUR WAREHOUSE IN CHICAGO. F.O.B. FROM THAT CITY.

SHORT WAVE & TELEVISION 99 HUDSON ST., NEW YORK, N. Y.

4-Tube All-Wave Receiver

● THE 1937 Regal All-Wave Four possesses many features which will appeal to the discriminating "fan" who likes to bring in the distant foreigns on the loud-speaker. Designed for full coverage of seven complete bands, this set is



a true all-wave receiver, covering from 10 to 2000 meters by means of efficient plug-in coils. Band-spread is provided, also phone jack and antenna control.

The receiver is equipped with a built-in power supply operating from any A.C. or D.C. source. This receiver uses a 6C6 pentode as a regenerative detector, a 76 as a first audio stage and one section of a 12A7 as the output stage. The other portion of the 12A7 is utilized as a half-wave rectifier. This set is equipped with the latest K-105-A metal ballast tube, thus eliminating the outmoded line cord. The ballast tube acts as a fuse.

This article has been prepared from data supplied by courtesy of Regal Radio Laboratories.

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.)

. . . SHORT WAVE ESSENTIALS

FOR MEMBERS OF THE SHORT WAVE LEAGUE . . .

Application for Membership SHORT WAVE LEAGUE

SHORT WAVE LEAGUE 1-37
99-101 Hudson Street, New York, N. Y.

I, the undersigned, herewith desire to apply for membership in the SHORT WAVE LEAGUE. In joining the LEAGUE I understand that I am not assessed for membership and that there are no dues and no fees of any kind. I pledge myself to abide by all the rules and regulations of the SHORT WAVE LEAGUE, which rules you are to send to me on receipt of this application.

I consider myself belonging to the following class (put an X in correct space): Short Wave Experimenter ☐ Short Wave Fan ☐ Radio Engineer ☐ Student ☐

I own the following radio equipment:

Transmitting ....

Call Letters ....

Receiving ....

Name ....

Address ....

City and State ....

Country ....

I enclose 10c for postage and handling for my Membership Certificate.

A FEW WORDS AS TO THE PURPOSE OF THE LEAGUE

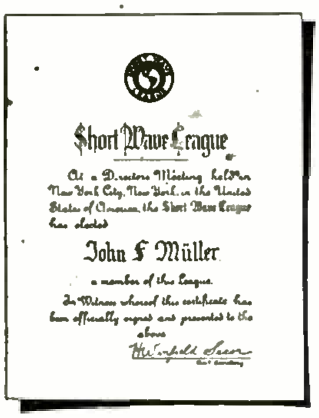
The SHORT WAVE LEAGUE was founded in 1930. Honorary Directors are as follows: Dr. Lee de Forest, John L. Reinartz, D. E. Replogle, Hollis Baird, E. T. Somerset, Baron Manfred von Ardenne, Hugo Gernsback, Executive Secretary.

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 pamphlet setting forth the LEAGUE'S numerous aspirations and purposes will be sent to anyone on receipt of a 3c stamp to cover postage.

FREE MEMBERSHIP CERTIFICATE

As soon as you are enrolled as a member, a beautiful certificate with the LEAGUE'S seal will be sent to you, providing 10c in stamps or coin is sent for mailing charges.

Members are entitled to preferential discounts when buying radio merchandise from numerous firms who have agreed to allow lower prices to all SHORT WAVE LEAGUE members.



If you wish your name engraved on the Free membership certificate, as illustrated above, please send 25c to cover cost.

SHORT WAVE ESSENTIALS LISTED HERE SOLD ONLY TO SHORT WAVE LEAGUE MEMBERS

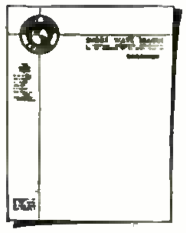
They cannot be bought by anyone unless he has already enrolled as one of the members of the SHORT WAVE LEAGUE or signs the blank on this page (which automatically enrolls him as a member, always provided that he is a short wave experimenter, a short wave fan, radio engineer, radio student, etc.).

Inasmuch as the LEAGUE is international, it makes no difference whether you are a citizen of the United States or any other country. The LEAGUE is open to all.

SHORT WAVE LEAGUE LETTERHEADS

A beautiful letterhead has been designed for members' correspondence. It is the official letterhead for all members. The letterhead is invaluable when it becomes necessary to deal with the radio industry, mail order houses, radio manufacturers, and the like; as many houses have offered to give members who write on the LEAGUE'S letterhead a preferential discount. The letterhead is also absolutely essential when writing for verification to radio stations either here or abroad. It automatically gives you a professional standing.

A—SHORT WAVE LEAGUE letterheads, per 100........ **50c**

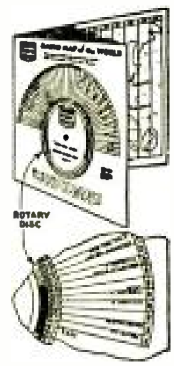


A—50c per 100

RADIO MAP OF THE WORLD AND STATION FINDER

The finest device of its kind published. The world's map on heavy board is divided into 23 sections, while the rotary disc shows you immediately the exact time in any foreign country. Invaluable in logging foreign stations. Also gives call letters assigned to all nations. Size 11"x22".

C—Radio Map of the World and Station Finder .....Prepaid **25c**



C—25c each

GLOBE OF THE WORLD

This highly important essential is an ornament for every den or study. It is a globe, 6 in. in diameter, printed in fifteen colors, glazed in such a way that it can be washed. This globe helps you to intelligently log your foreign stations. The base is of solid walnut, and the semi-meridian of a nickel-like metal. Entire device substantially made, and will give an attractive appearance to every station, emphasizing the long-distance work of the operator.

D—Globe of the World ....Prepaid **89c**

D—89c each

SHORT WAVE LEAGUE LAPEL BUTTON

This beautiful button is made in hard enamel in four colors, red, white, blue and gold. It measures three quarters of an inch in diameter. By wearing this button, other members will recognize you and it will give you a professional air. Made in bronze, gold filled, *not plated*. Must be seen to be appreciated.

E—SHORT WAVE LEAGUE lapel button..........Prepaid **35c**

EE—SHORT WAVE LEAGUE lapel button, like the one described above but in solid gold ....Prepaid **$2.00**

E—35c each

SHORT WAVE LEAGUE SEALS

These seals or stickers are executed in three colors and measure 1¼ in. in diameter, and are gummed on one side. They are used by members to affix to stationery, letterheads, envelopes, postal cards and the like. The seal signifies that you are a member of the SHORT WAVE LEAGUE. Sold in 25 lots or multiples only.

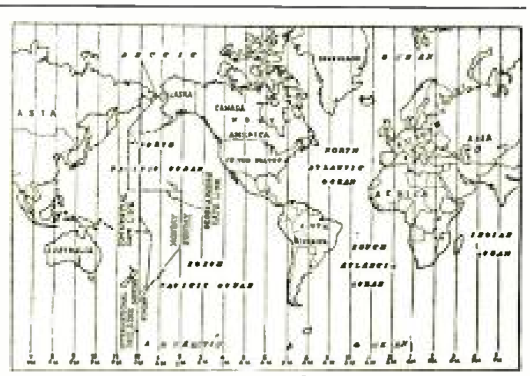
G—SHORT WAVE LEAGUE seals..........per 25, Prepaid **15c**

G—15c for 25

SHORT WAVE MAP OF THE WORLD

This beautiful map, measuring 18x26 in. and printed in 18 colors is indispensable when hung in sight or placed "under the glass" on the table or wall of the short wave enthusiast. It contains a wealth of information such as distances to all parts of the world, political nature of the country in which a broadcast station is located, etc., and from the manner in which the map is blocked off gives the time in different parts of the world at a glance.

F—SHORT WAVE Map of the World..........Prepaid **25c**



F—25c each

PLEASE NOTE THAT ABOVE ESSENTIALS ARE SOLD ONLY TO MEMBERS OF THE LEAGUE—NOT TO NON-MEMBERS.

Send all orders for short wave essentials to SHORT WAVE LEAGUE, 99-101 Hudson Street, New York City.

If you do not wish to mutilate the magazine, you may copy either or both coupons on a sheet of paper.

SHORT WAVE LEAGUE 99-101 Hudson St., New York, N. Y.

SHORT WAVE LEAGUE, 99-101 Hudson Street, New York, N. Y.

Gentlemen:

I am already an enrolled member in the SHORT WAVE LEAGUE ☐
I am a new member and attach my application to this coupon ☐
Please send me the following short wave essentials as listed in this advertisement:

....

for which I enclose $.......... herewith.

(The LEAGUE accepts money order, cash or new U. S. Stamps in any denomination. Register cash and stamps.)

Name ....

Address ....

City and State ....

1-37 Country ....

Pilot

Sales Are World-Wide
Quality Is World-Famous

"The Standard of Excellence" in the U. S. A. and 92 other countries

The following statements have been confirmed in hundreds of Side-by-Side Tests conducted in all parts of the world.

PILOT RADIO Model 193

Now the world-famed Pilot long-distance broadcast and short-wave reception is available at moderate price in the 3-band Pilot model 193. Repeatedly in Side-by-Side Tests model 193, which is guaranteed to outperform all 8-tube sets of other makes regardless of price, has brought in distant stations which could not be heard at all on sets of 15 to 25 tubes. This set, engineered for maximum efficiency in each circuit, runs rings around other makes where extra tubes are used to make up for less efficient design. Your local dealer can order this Pilot Radio for you.

$54.50

PILOT RADIO Model 393

Just forget all the claims you have read about various radios, and let the sets speak for themselves in a Side-by-Side Test against the Pilot model 393! Make this Test against sets of higher prices which you would expect to do better, and against sets of more tubes which should do better! When you hear the Pilot 393 outperform them all, you'll understand how Pilot's superior performance on long distance broadcast and short waves has built up Pilot Radio Corporation's world-wide sales and service organization in 92 foreign countries. Your local dealer can order this Pilot Radio for you.

$67.50

PILOT RADIO AC-DC 423

Pilot Radio, the largest manufacturers of DX all-wave AC-DC sets in the world, has now perfected a totally new type of AC-DC set which makes obsolete all AC-DC radios of 6 to 9 tubes. This new receiver is the 3-band model 423, with BEAM POWER AMPLIFICATION. The new Pilot BEAM POWER circuit, with the new tube specially developed for the Pilot 423, delivers performance such as has never been approached by any AC-DC set of moderate price. When you make a Side-by-Side Test with the Pilot 423 you'll agree that this new Pilot model has made all other AC-DC sets of 6 to 9 tubes seem simply antique, by comparison. Your local dealer can order this Pilot Radio for you.

$52.90

PILOT RADIO AC-DC 304

The very name of the 11-tube, Super-Power, AC-DC "Challenger" invites comparison! Indeed, Pilot Radio has always encouraged the use of the Side-by-Side Test, rather than idle claims, as the conclusive and indisputable proof of Pilot's superior performance. Right in the heart of New York City where receiving conditions are the worst, on steel ships filled with DC equipment, in far away parts of the world where the nearest station is more than 2,000 miles distant, the Pilot 304, operating on either AC or DC, delivers reception on broadcast and short waves equal to the finest straight AC sets. Your local dealer can order this set for you.

$94.50

SEND FOR FOLDER DESCRIBING PILOT RADIO 1937 MODELS

Pilot Radio Corporation

Radio Builders — Since 1908

37-01 THIRTY-SIXTH STREET, LONG ISLAND CITY, NEW YORK

CABLE ADDRESS: PILOTRADIO, NEW YORK