THE RADIO EXPERIMENTER'S MAGAZINE

OFFICIAL ORGAN OF SHORT WAVE LEAGUE

Aug. 32

# SHORT WAVE CRAFT

Edited by HUGO GERNSBACK

NOW 25¢

CONSTRUCT THE NEW "MEGADYNE". WORKS SPEAKER ON 1 TUBE

See Page 208

## IN THIS ISSUE

# I Will Show You Too
## *How to Start a Spare Time or Full Time*
# Radio Business of Your Own Without Capital

J. E. SMITH, *President*
*National Radio Institute*

The man who has directed the Home-Study Training of more men for the Radio industry than any other man in America.

## Here are a few examples of the kind of money I train *"my boys"* to make

**Started with $5 Now has Own Business**

"I started in Radio with $5, purchased a few necessary tools, circulated the business cards you gave me and business picked up to the point where my spare time earnings were my largest income. Now I am in business for myself. I have made a very profitable living in work that is play."—Howard Houston, Route No. 2, Box 454 E, Tucson, Arizona.

**$700 in 5 Months Spare Time**

"Although I have had little time to devote to Radio my spare time earnings for five months after graduation were approximately $700 on Radio, sales, service and repairs. I owe this extra money to your help during the time I studied and since graduation."—Charles W. Linsey, 537 Elati St., Denver, Colo.

**$7396 Business in 2½ Months**

"I have opened an exclusive Radio sales and repair shop. My receipts for September were $2,332.16, for October $2,887.77 and for the first half of November, $2,176.32. My gross receipts for the two and one-half months I have been in business have been $7,396.25. If I can net about 20% this will mean a profit of about $1,500 to me."—John F. Kirk, Kirk Sales and Service, Union Block, Spencer, Iowa.

My Free book gives you many more letters from N. R. I. men who made good in spare time or full time businesses of their own.

I give you instructions early in your Course for doing 28 Radio jobs common in every neighborhood. Many N. R. I. men begin making money soon after they enroll. I show you how N. R. I. graduates have built up good businesses of their own. I show you how to install and service all types of receiving sets. I give you Radio equipment and instructions for building circuits, testing equipment, and for making tests that will give you broad, practical experience. I give you a Money-Back Agreement and Lifetime Employment Service. Clip the coupon below and get my free 64-page book, "Rich Rewards in Radio"—it gives you a full story of the success of other N. R. I. students and graduates, and tells how you can start a spare or full time Radio business of your own without capital.

### Many N. R. I. Men Have Made $200 to $1,000 in Spare Time While Learning

Many of the more than sixteen million sets now in use are only 25% to 40% efficient. I will show you how to cash in on this condition. I will show you how the plans and ideas that have enabled many others to make $200 to $1,000 in spare time while learning. G. W. Page, 1606-B Fifth Ave., N., Nashville, Tenn., writes: "I made $935 in my spare time while taking your course."

### Get Ready Now for Jobs Like These

Broadcasting stations use engineers, operators, station managers, and pay up to $5,000 a year. Radio manufacturers use testers, inspectors, foremen, engineers, service men, and buyers for jobs paying up to $6,000 a year. Shipping companies use hundreds of operators, give them world-wide travel with board free and good pay besides. Radio dealers and jobbers employ hundreds of service men, salesmen, buyers, managers, and pay up to $100 a week. Talking Movies pay as much as $75 to $200 a week to the right men with Radio training. My book tells you of the opportunities in Radio, Talking Movies, Set Servicing, Aircraft Radio, and other fields.

### I Will Train You at Home in Your Spare Time

Hold your job until you're ready for another. Give me only part of your spare time. You do not need a high school or college education. Hundreds with only a common school education have won bigger pay through N. R. I. J. A. Vaughn jumped from $35 to $100 a week. The National Radio Institute is the Pioneer and World's Largest organization devoted exclusively to training men and young men by Home Study for good jobs in the Radio industry.

### You Must Be Satisfied

I will give you an agreement to refund every penny of your money if you are not satisfied with my Lessons and Instruction Service when you complete my course. And I'll not only give you thorough training in Radio principles, practical experience in building and servicing sets, but also Advanced Training in any one of five leading branches of Radio opportunities.

### My 64-Page Book Gives the Facts

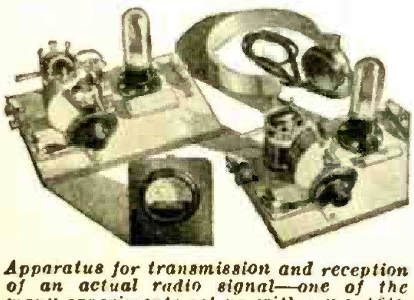
Clip and mail the coupon now for "Rich Rewards in Radio." It points out the money-making opportunities the growth of Radio has made for you. It tells of the opportunities for a spare time or full time Radio business of your own, the special training I give you that has made hundreds of other men successful; and also explains the many fine jobs for which my course trains you. Send the coupon to me today. You won't be obligated in the least.

**Get my new book It points out what Radio Offers You**


J. E. SMITH, President
Dept. 2HB3
National Radio Institute
Washington, D. C.

## .. NEW Radio Equipment for Broad Practical Experience *Given Without Extra Charge*

With the aid of this equipment you can work out with your own hands many of the things you read in our text books. From it you get the valuable experience that tells an expert from a beginner. In a short time you have learned what it would take years to learn in the field. It's training like this that puts the extra dollars in your pay envelope. Some of the many circuits you build and experiments you perform are: Measuring the merit of a tube, building an ohmmeter, tube voltmeter, and a Grid dip meter for service work. You actually make experiments illustrating the important principles in the 25 best known sets.



*Apparatus for transmission and reception of an actual radio signal—one of the many experiments set up with my outfits.*

## Special Free Offer

In addition to my big free book, "Rich Rewards in Radio," I'll send you my valuable manual, "28 Tested Methods for Making Extra Money." Never before available except to students. Now, for a limited time, it is free to readers of this magazine. How to make a good baffle for cone speakers, how to reduce hum in externally fed dynamic speakers, how to operate 25 cycle apparatus on 60 cycle current, how to operate 110 v. A. C. receivers on D. C., how to shield sets from local interference are five of the subjects covered. There are 23 others. Get this valuable book by mailing the coupon.


**THIS COUPON IS GOOD FOR ONE *FREE* COPY OF MY NEW BOOK** — mail it TODAY

J. E. SMITH, *President*
National Radio Institute, Dept. 2HB3
Washington, D. C.

Dear Mr. Smith: I want to take advantage of your Special Offer. Send me your two books, "Twenty-Eight Tested Methods for Making Extra Money" and "Rich Rewards in Radio." I understand this does not obligate me.

*Name*..........................................

*Address*..........................................

*City*...................*State*................ "J"

**IN THIS ISSUE: PROMINENT SHORT WAVE AUTHORS**

**Saxl • Denton • Lynch • Reinartz • Tanner • Werner • Silver**

# SHORT WAVE CRAFT

**HUGO GERNSBACK**
**Editor**

**H. WINFIELD SECOR**
**Managing Editor**

## CONTENTS FOR AUGUST, 1932



## FEATURES IN NEXT ISSUE

The Denton 2-Tube A.C. All-around Short Wave-Receiver—with Photos, Diagrams and Detailed Description Explaining How to Build It.
Crystal Oscillators and Crystal Control, by A. Binneweg, Jr. An article which has been requested by many readers.
A "Real" 3-Tube Receiver, by I. O. Myers; a Receiver That Has a Number of Interesting Features of Importance to All Short-Wave Fans.
A 20 Meter Transmitter, with photos, diagrams, and description.
Micro Rays or Quasi-optical Waves, by H. A. Pelton.
A 1-Tube Master Oscillator—Power Amplifier Transmitter, by A. J. Spriggs, W3GJ.
The Vacuum Tube—Plotting a Curve For It, by John L. Reinartz—third of the new series by Mr. Reinartz, entitled—"How to Become a Radio Amateur."
Methods of Controlling Regeneration in Short-Wave Receivers, by M. Harvey Gernsback.
8-Tube Portable Super-het, Part II—Conclusion, by Clifford E. Denton.

CONTENTS FOR AUGUST—*Continued*



## OUR COVER

How to Build a Short-Wave Megadyne—Which Brings in Many Stations on the Loud Speaker, with but One Tube and a Crystal. Described by Hugo Gernsback on page .......... 208

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# OPPORTUNITIES *are many* for the Radio Trained Man

**Don't spend your life slaving away in some dull, hopeless job! Don't be satisfied to work for a mere $20 or $30 a week. Let me show you how to get your start in Radio—the fastest-growing, biggest money-making game on earth.**

## Jobs Leading to Salaries of $50 a Week and Up

Prepare for jobs as Designer, Inspector and Tester—as Radio Salesman and in Service and Installation Work—as Operator or Manager of a Broadcasting Station—as Wireless Operator on a Ship or Airplane, or in Talking Picture or Sound Work—HUNDREDS of OPPORTUNITIES for a real future in Radio!

## Ten Weeks of Shop Training

**We don't teach by book study. We train you on a great outlay of Radio, Television and Sound equipment—on scores of modern Radio Receivers, huge Broadcasting equipment, the very latest and newest Television apparatus, Talking Picture and Sound Reproduction equipment, Code Practice equipment, etc. You don't need advanced education or previous experience. We give you—RIGHT HERE IN THE COYNE SHOPS—the actual practice and experience you'll need for your start in this great field. And because we cut out all useless theory and only give that which is necessary you get a practical training in 10 weeks.**

## TELEVISION *and* TALKING PICTURES

And Television is already here! Soon there'll be a demand for THOUSANDS of TELEVISION EXPERTS! The man who learns Television **now** can have a great future in this great new field. Get in on the **ground-floor** of this amazing new Radio development! Come to COYNE and learn Television on the very latest, newest Television equipment. Talking Picture and Public Address Systems offer opportunities to the Trained Radio Man. Here is a great new Radio field just beginning to grow! Prepare NOW for these wonderful opportunities! Learn Radio Sound Work at COYNE on actual **Talking Picture** and **Sound Reproduction** equipment.

## Many Earn While Learning

You get Free Employment Service for Life. And don't let lack of money stop you. Many of our students make all or a good part of their living expenses while going to school and if you should need this help just write to me. **Coyne is 32 years old!** Coyne Training is tested—proven beyond all doubt. You can find out everything **absolutely free. Just mail coupon for my big free book!**

**H. C. Lewis, Pres.** **RADIO DIVISION** **Founded 1899**

## COYNE Electrical School

**500 S. Paulina St., Dept. C2-2K Chicago, Ill.**

## All Practical Work
### At COYNE In Chicago

**ALL ACTUAL, PRACTICAL WORK.** You build radio sets, install and service them. You actually **operate** great Broadcasting equipment. You construct Television Receiving Sets and **actually transmit your own Television programs over our modern Television equipment.** You work on **real** Talking Picture machines and Sound equipment. You learn Wireless Operating on actual Code Practice apparatus. We don't waste time on useless theory. We give you the **practical training** you'll need—**in 10 short, pleasant weeks.**

**Mail Coupon Today for All the Facts**

**H. C. LEWIS, President**
**Radio Division, Coyne Electrical School**
**500 S. Paulina St., Dept. C2-2K Chicago, Ill.**

Dear Mr. Lewis:—Send me your Big Free Radio Book, and all details of your Special Offer.

*Name*..............................

*Address*..............................

*City*....................*State*............

# GET A CONVERTER FREE!

HERE at last you have it—a highly sensitive short-wave converter, 15 to 200 meters, that works on *any* set and that has its own A, B and C supply built in and that does not use plug-in coils for band shifting.

Two separate tuning condensers and two dials are used, so there *can not be any possibility of sensitivity loss* due to mistuning, as where ganging prevails. Also, any intermediate frequency may be used.

The little extra effort in tuning is well repaid by thousands of miles of extra reception. Stations all over the world have been tuned in, using this converter with a good broadcast set.

There are only three connections to make in teaming up the converter with a receiver.

Two coils are used, one for oscillator, the other for modulator, and two tube sockets are near these coils, underneath the top panel, not for tubes but so that you can move the flexible grid connecting wire of the two condensers to any one of four points for wave shifting. Simple, effective, inexpensive, infallible!

Three 237 tubes are used. These are of the automotive series and are most economical, the total consumption, A and B power being less than 10 watts, hence costing no more than one-tenth of a cent per hour to operate!

This converter works on superheterodynes as well as on tuned radio frequency sets, because IF ANY CONVERTER IS A GOOD ONE IT IS BOUND TO WORK ON ANY TYPE OF SET.

There are 16 mfd. of filter capacity and a 15 henry B choke, in the B supply, as well as a husky line transformer.

Do not suppose just because the offer of these parts is generous that this converter does not perform efficiently, for it is a knockout! What sensitivity! What power! What results! Send $12 today for a 2-year (104 issues) subscription for RADIO WORLD and get the parts for this converter free (less tubes). Order PR-NCV. A clear diagram is furnished with each kit. Note the kit is not wired. Shipments made by express at your expense. Order Cat. R-CNV.

TUBES USED: Three 237, supplied extra at $3.50, if desired. No subscription offer attaches to the tubes.

## PARTS FOR A MIDGET CONVERTER

No matter what type of broadcast receiver you have, you can get short waves by using a midget short-wave converter built of parts we can supply. The panel is only 5 x 6½ inches. There is only one tuning control. No squeals, howls or body capacity. This model is available for battery operation and uses three 227 tubes with heaters in series. Full details supplied with order.

All parts for the battery model (less three 227 tubes), free with a year's subscription for Radio World, @ $6.00. Order PR-3B.

The three 227 tubes can be supplied @ $2.00. No subscription goes with tubes. Converter shipping charges must be paid by you.

A set of three shielded coils on 1½ inch diameter to cover the broadcast band, with a tap on secondary that enables going down to 80 meters. For screen grid tubes, including vari-mu tubes. An aluminum cover (not shown) screws over the base. Send $3 for a 6 months' subscription, 26 issues, and order PR-TSC-3 for 0.00035 mfd. or PR-TSC-5 for 0.0005 mfd. We pay shipping expense on the coils.

## YOUR CHOICE OF NINE METERS!

To do your radio work properly you need meters. Here is your opportunity to get them at no extra cost. See the list of nine meters. Heretofore we have offered the choice of any one of these meters free with an 8-weeks' subscription for RADIO WORLD, at $1, the regular price for such subscription. Now we extend this offer. For the first time you are permitted to obtain any one or more or all of these meters free, by sending in $1 for 8-weeks' subscription, entitling you to one meter; $2 for 16 weeks, entitling you to two meters; $3 for 26 weeks, entitling you to three meters; $6 for 52 weeks, entitling you to six meters. Return coupon with remittance, and check off desired meters in squares. We pay shipping expense on the meters only.

**RADIO WORLD** (11th Year)

145-G West 45th Street, New York, N. Y.

RADIO WORLD, 145-G West 45th St., New York, N. Y.
(Just East of Broadway)

Enclosed please find $..............for..............weeks subscription for RADIO WORLD and please send as free premium the meters checked off below.

- ☐ I am a subscriber. Extend my subscription. (Check off if true.)
- ☐ 0-6 Voltmeter D.C. ........ No. 326
- ☐ 0-50 Voltmtter D.C. ........ No. 337
- ☐ 6-Volt Charge Testor D.C. ........ No. 23
- ☐ 0-10 Amperes D.C. ........ No. 338
- ☐ 0-25 Milliamperes D.C. ........ No. 325
- ☐ 0-50 Milliamperes D.C. ........ No. 350
- ☐ 0-100 Milliamperes D.C. ........ No. 390
- ☐ 0-300 Milliamperes D.C. ........ No. 399
- ☐ 0-400 Milliamperes D.C. ........ No. 394
- ☐ Enclosed find $12 for 2 yrs. subs. Send PR-NCV.
- ☐ Enclosed find $6 for 1 yr. subs. Send PR-3B.
- ☐ Enclosed find $3 for 6 mos. subs. Send PR-TSC-3.
- ☐ Enclosed find $3 for 6 mos. subs. Send PR-TSC-5.

NAME ..............................

ADDRESS ..............................

CITY .................... STATE....................

# AUGUST SPECIALS!!

EVERY month we list on this page certain *STAR* ★ items, which are NOT LISTED IN OUR CATALOG. These are all specials of which the quantities on hand are not sufficient to catalog them. *Once sold out, no more can be had.* First come, first served. Save yourself disappointment by ordering NOW.

*STOP SHOPPING.* The lowest prices are right on this page. *No one undersells us.* We meet any price on ANY NEW Merchandise. Order direct from this page and save money. 100% satisfaction on every transaction. Take advantage of these special offers. ORDER NOW, TODAY.

## IMPROVED READRITE MODEL 700 ANALYZER

**EIGHT METER SCALES AVAILABLE**

The "Model 700" is an extremely compact device. The outside dimensions of the carrying case are only 10¾ by 7¾ by 3¾ inches. The analyzer contains a D.C. voltmeter, an A.C. voltmeter and a milliammeter. The D.C. voltmeter has three ranges: 0 to 60; 0 to 200; and 0 to 600 volts. The A.C. voltmeter has also three ranges: 0 to 10; 0 to 140; and 0 to 700 volts. The milliammeter has two ranges; one for 20-mill. reading and the other for 100-mill. **This variety of ranges makes it possible to test every conceivable radio circuit;** high voltage secondaries of power transformers, current drain of all radio tubes, including the high power 250 and 210 tubes, etc.

**CONVENIENT SELECTOR SWITCH**

The instrument is equipped with a six-position bi-polar selector switch; by means of which readings may be obtained of "C" volts, "C" volts reversed, "K" volts, "K" volts reversed, plate voltage, and screen-grid voltage. A 4½-volt battery is supplied with the analyzer, to provide "C" bias, for grid tests, continuity tests, etc.

**TESTS PENTODES—"MULTI-MUS" '57's and '58's—and '80 RECTIFIERS**

There are two sockets on the panel of the analyzer, one for four-prong tubes and the other for five-prong tubes. There is a "grid-test" push-button. Pin jacks are available for the individual use of all meters, externally, in every range. There is a screen-grid pin jack, and there are two pin jacks for connecting the external battery. A two-way toggle switch controls the testing circuit for either regular or pentode tube.

**Tests Latest Type '57 and '58 6-Prong Tubes**


Both plates of the '80-type rectifier may be tested by use of a special adapter furnished. Charts are provided for measuring resistances and capacities.

**FREE**

We take pleasure in offering with the purchase of each analyzer **—ABSOLUTELY FREE OF CHARGE**—the latest radio publication to come off the press.

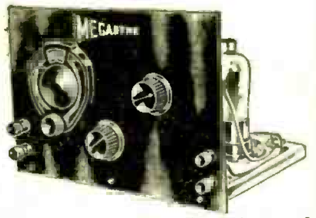
**"Radio Set Analyzers"** Contains detailed descriptions, photographs and circuit diagrams of all commercial set analyzers and testers.— **A Real Book.**

The Analyzer is furnished complete with test leads, connecting cables, Burgess 4½-volt battery, several battery leads, UY to UX adapter, '80 rectifier, adapter and resistance and capacity charts. Shipping weight, 8 lbs.

Model 710 Analyzer. List Price $35.00. Your Price .................. **$14.70**

## "MEGADYNE" ONE-TUBE PENTODE LOUDSPEAKER RECEIVER KIT

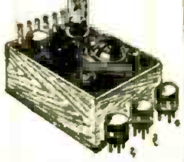
In the front part of our catalog—get your FREE copy now—there is presented a thoroughly illustrated discussion on the construction and operation of the MEGADYNE Receiver by Hugo Gernsback, editor. This ingenious circuit was originally described in the July issue of the RADIO CRAFT Magazine. FREE copy of which will be given with each purchase. This receiver is indeed one of the most outstanding developments in the radio industry. It is the first real one-tube receiver which will actually operate a loudspeaker. Thousands of experimenters and radio fans will want to build this remarkable receiver. For their convenience, we have compiled a complete list of parts required for its construction. These parts are of the highest quality and are exactly as specified by the author. The following parts comprise the complete kit.




1 B.M.S. Fixed Crystal Detector; 1 6-ohm Filament Rheostat; 1 3-circuit tuner for used with a .0005 mf. tuning condenser; 1 Na-ald type 481 UY 5-prong socket; 1 Hammarlund type ML-23 Variable Condenser; 2 sets of Cinch double binding posts; 1 Polymet .00025 mf. fixed condenser; 1 X-L Variodenser; 1 Polymet .00025 mf. fixed condenser, or 1 Polymet .0005 mf. fixed condenser (NOTE: Only one of the latter two condensers is actually employed in the circuit); 5 Fahnestock binding posts; 1 25-ft. roll of hook-up wire; 2 black Bakelite 1½" knobs; 1 Kurz-Kasch vernier dial with 0 to 100 scale reading clockwise; 1 type '38 pentode tube, "Triad" or "Speed"; 1 Bakelite Panel already drilled with all holes, size 7 x 10 x 3/16 inch; 1 hardware assortment. The wooden base is not included.

No. 2545—Megadyne Receiver Kit. Your Price **$10.25**

### WORLD-WIDE SHORT-WAVE SET

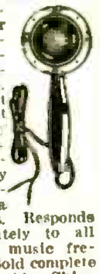


Range 18 to 200 meters. Employs low current drain 230 tube. Requires but 1/45 volt "B" battery, 2 No. 6 drycells and earphones to operate.

No. 1666—S.W. Set Your Price **6.25**

### R.C.A.-VICTOR HAND "MIKE"

Designed especially for home recording and personal entertainment. Requires but a 22½ volt batter to operate. Easily connected to any radio or amplifier in a few minutes. Responds indiscriminately to all speech and music frequencies. Sold complete with 6 ft. cable. Shipping weight 2 lbs.



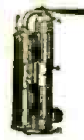
No. SP9064. RCA-Victor Hand "Mike." Your Price.... **2.75**

### ★METALLIZED PIGTAIL RESISTORS AT ROCK BOTTOM PRICES

A very fortunate purchase enables us to offer these fine resistors at prices which surprise even ourselves — prices more than three times lower than in our own catalog. Resistors are guaranteed to maintain their ohmage under even adverse operating conditions. **The resistance element is based on the famous metallized principle** which has proven its superiority wherever accuracy and uniformity are paramount requisites. The special ceramic casing of these resistors is of sturdy construction and affords **maximum heat dissipation.** A feature of these resistors is their molded end-caps, tapered so they can be mounted in all standard resistor mounts. By means of their pigtails, they may also be soldered in any convenient position. Available in the following sizes—all rated at one watt: 300, 450, 600, 8,000, 10,000, 12,000, 350,000. Act fast to take advantage of this offer, as the supply is limited. Sold only in lots of six or more.


No. SP2226. Metallized Resistors. NOW YOUR PRICE...... **6c** EACH
12 for 60c.

### AUTOMATIC BLOW TORCH



Heat intensity over 1200° Fahr. Requires no mouth-blowing. Entirely automatic. Used for heavy duty soldering, aluminum soldering, metal tempering, etc. Ship. wt. 1 lb.

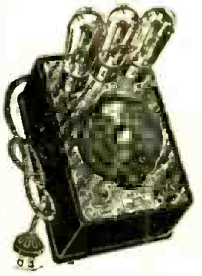
No. K1006—Torch. Your Price ...... **$0.60**

### ★8 MF. ELECTROLYTIC CONDENSERS

These guaranteed units will perform miracles in eliminating objectionable A. C. hum from A. F. and filter circuits. Easily mounted through use of bayonet socket. Shipping weight 1 lb.

No. SP 9054. Condenser. Your Price ...... **$0.49**

### A.C. SUPERHET S.W. CONVERTER



Converts any broadcast receiver into a full-fledged superhet S.W. Receiver. Range 20 to 115 meters. Requires no plug-in coils. Has built-in filament transformer for 110 volts 60 cycles A.C. Employs 3 227 tubes. Single dial control. Instructions included. Shipping wt. 8 lbs.

No. 1614—Converter. Your Price .......... **NOW $7.50**

### FREE RADIO AND SHORT WAVE TREATISE


The new and enlarged Summer edition of our Radio and Short Wave Treatise, No. 26, has just come off the press— **100 solid pages of useful information, radio items, diagrams and illustrations.** Positively the greatest book in print— **NOT JUST ANOTHER CATALOG.** Contains a large editorial section with valuable information not found anywhere else. Considerable space is devoted to a **TREATISE ON SHORT WAVES** for both beginners and regular "hams." Among the new technical information listed are the following: **Modernizing old radio sets—repairing speakers and headsets—making superhets out of old sets—data on constructing two-volt battery and automobile receivers—circuit of the famous Gernsback Megadyne One-Tube Loudspeaker Set—short wave coil winding data—discussion on S.W. adapters, converters and receivers, etc., etc.**

100 New Hook-Ups, Etc. 1000 Illustrations.

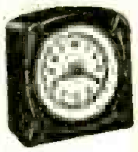
**WRITE TODAY.** Enclose 4 cents for postage. Treatise sent by return mail.

### MICROPHONE & PRE-AMPLIFIER OUTFIT

Excellently suited for P. A. work, inter-communication systems, etc. Comprises sensitive single-button microphone, microphone coupling transformer and battery, cut-off switch, gain control and output terminals. Put up in neat black crackle-finished metal case, equipped with convenient carrying handle. Measures 5"x6½"x6¾". Will correctly match the input impedance of practically all type amplifiers. Easily connected to the broadcast receiver for home recording. Ship. wt. 10 lbs.

No. 1654—Pre-Amplifier. Your Price ........................ **$8.25**

### ★ELECTRIC CLOCK



Act Now—Only Few Left

Naval observatory time right from your light socket! No spring to wind, no batteries. Never out of order. For 110 volts 60 cycle A.C. operation only.

No. 1689—Clock. Your Price ...... **$1.00**

### ★UTAH A.C. DYNAMIC SPEAKER

Operates from 110 volt 60 cycle A.C. line. 9" high by 9¼" wide by 7½" deep. Ship. wt. 19 lbs.

No. 1506—Speaker Your Price ...... **$7.45**

### RADIO MIRROR PENLIGHT

A clever device for looking around corners or other inaccessible spots on the radio chassis. Comprises pen flashlight and magnifying mirror. Complete with battery and bulb.

No. 1695—Penlight. Your Price ...... **$0.85**

### NEW PENTODE ADAPTER


A new and simple device for replacing the old '45 type power tube with the latest super-power pentode. Remove the '45, insert adapter in vacated socket and then place a pentode tube in the socket of the adapter. Gives added life and power to old receivers and amplifiers. Shipping weight ½ lb.

No. 1873. Adapter. Your Price...... **65c**

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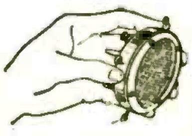

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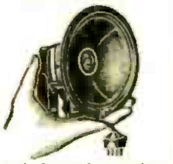

A real dynamic speaker with surprising volume and tone. 6¼" overall. 4½" diaphragm. Standard 2500 ohm field coil. Output transformer to match all type output tubes. Wt. 5 lbs.

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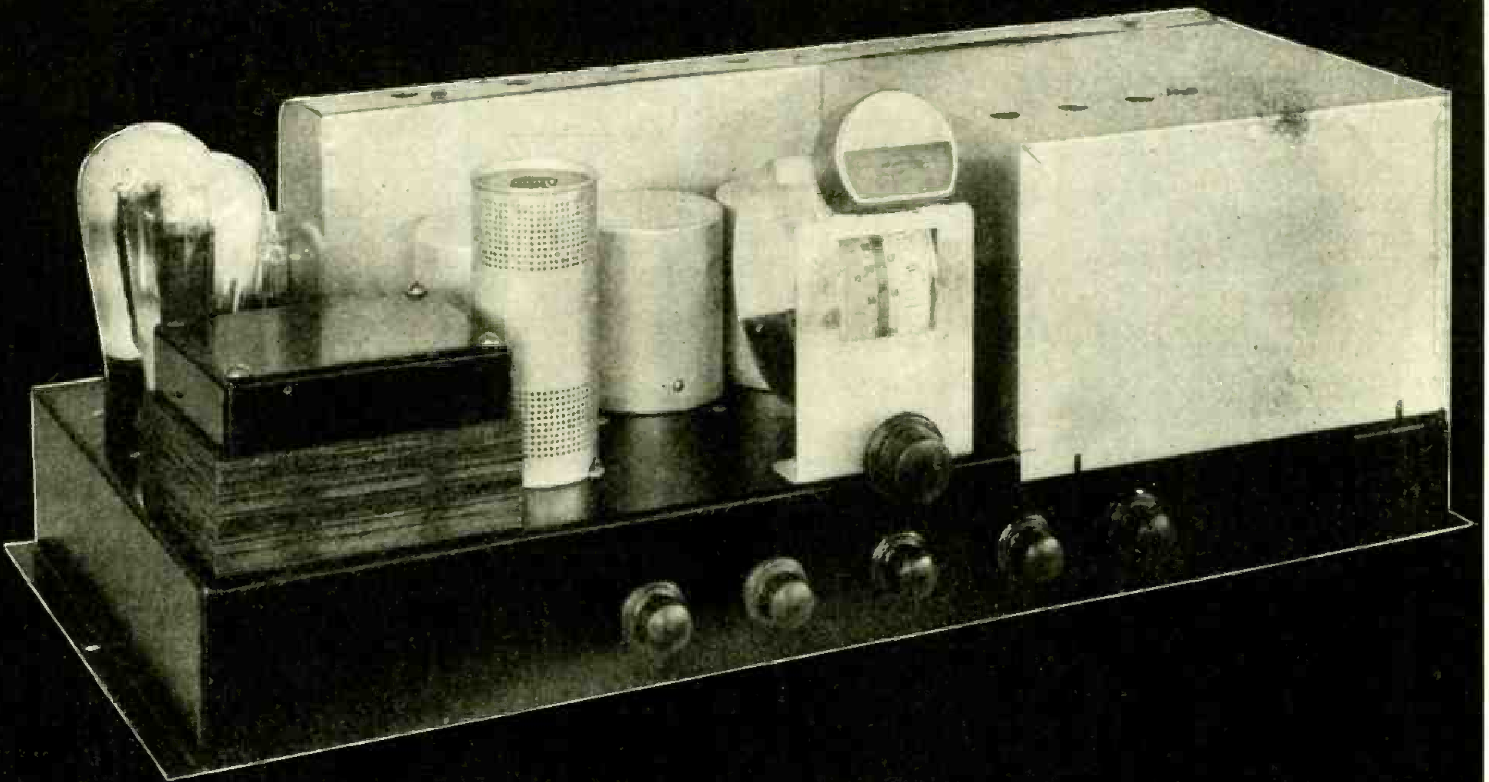
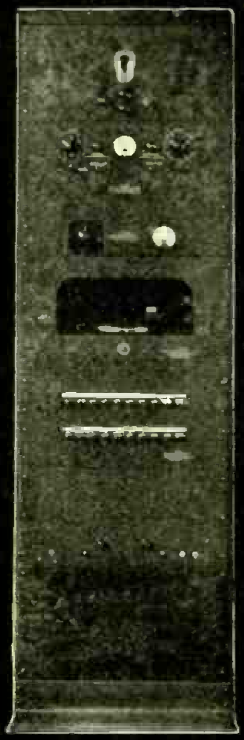
# A Complete Line of New Radio Equipment





Other excellent pieces of apparatus in the new S-M line are: 550 kc. to 2,500 kc. AC chassis; all-wave tuners, broadcast tuners, amplifiers, 2-volt air-cell battery supers, and a complete line of universal replacement parts.

And S-M now has a COMPLETE line of PA equipment. 10-12-15-25-50-watt amplifiers, mikes, trumpets, transformers, racks, and a panel for EVERY use. The quality is the highest—and the prices the lowest.

If you are in PA work, write for complete information.

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It is a 12-tube all-wave chassis, covering from 550 kc. to 23,000 kc. It uses 3-'45, 5-'56, 3-'58, 1-'82. The three '45s are used in the exclusive new "Class A-Prime" audio—two in push-pull with the third as a driver. It makes possible better than 8 watts, and easily handles crescendos of 12 watts or more. THAT'S tone quality.

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Of course the 728SW has the famous S-M "Q" circuit built into it—all-waves on one CALIBRATED dial. And it has true automatic volume control and meter tuning.

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Size: 20 1/4" long, 10 1/4" deep, 7 1/2" high.

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HUGO GERNSBACK, EDITOR

H. WINFIELD SECOR, MANAGING EDITOR

SHORT WAVE CRAFT

# "Location" in Short Waves

## An Editorial by HUGO GERNSBACK

● ALL short-wave experimenters are aware of the fact that there is such a thing as location—good or bad—when it comes to the reception of short-wave signals. It might be said here that not much is known about the subject, and that in many respects it is still a closed book with seven seals.

It has been noted time and again that you can take the identical short-wave receiver and move it from one location to another, and obtain totally different results. In one location the results may be poor or mediocre, and in another they may be excellent. I do not necessarily refer to the difference in reception between country and city, because it has often been proved that in certain locations, even in large cities, short-wave reception is extraordinarily good. As a rule, however, the large city, with its huge steel buildings, absorbs so much energy that in most cases results are not anywhere near as good as in the country. Again, however, there are many exceptions. In some instances, steel buildings can reflect short waves to such an extent that if conditions are favorable the signals will actually come in stronger than if the buildings were not there!

On the other hand, steel buildings might affect the receiving aerial in a directive manner. For instance, it often happens that signals from the west come in strong, while signals from the east cannot be received at all, or vice versa. These are the peculiarities of the short waves.

We still know next to nothing about the propagation of radio waves in space. We know nothing about what happens between the distant transmitting aerial and the receiving aerial; all we can do is guess at it.

If any general remarks can be made on the subject, they can be stated briefly as follows:

Broadly speaking, the reception of short waves is different from the reception of "broadcast" waves, and the shorter the waves, the greater becomes the difference.

It should be noted that an aerial of the "L" type is directional, and that the signal as a rule comes in best from the direction *opposite* to the free end of the "L". For this reason, "L" type aerials may not be the best for short-wave work. It would seem that the umbrella type aerial, which has a number of wires strung in the shape of an umbrella, would be best for reception from all points of the compass. A single vertical wire is also recommended.

The insulation of the short-wave aerial is frequently neglected by the experimenter, because he has been brought up to believe that any insulator is good enough. On the short waves, where the available energy is usually lower than on the broadcast band, particular care should be taken in the insulation of the aerial. Insulators should not be used singly. It is best to use three of the glass type, or at least two in tandem, to get the maximum insulation. Wherever connections are made to the lead-in, these must be soldered. Be careful not to have any sharp projections on the aerial itself. Every experimenter in high frequency work knows that points on conductors will make for leakage into the surrounding air. If you have to make turns, do not have sharp ends protruding from the aerial itself, but file them off, round them carefully and solder them over to do away with all sharp points. It is needless to say that all connections to the aerial must be soldered, if any worthwhile results are to be obtained.

Most important, however, is the distance separating the aerial from the building. *This is the one point on which practically everyone falls down.* Wires are carelessly strung parallel to buildings an inch or two away from walls, and in many cases even touching walls for long distances. You might just as well not have an aerial for short waves if you follow these tactics. It simply will not do in short-wave work.

The main aerial should be at least ten feet or more away from the roof, or any other obstruction for that matter, and the lead-in should never come closer than one foot to the wall of a building. If you must go around corners, you should erect a small pole, at the end of which is fastened a good insulator on which the lead-in itself is fastened. The pole will thus keep the lead-in away from the building as far as it is consistent to do so.

When it comes to the point of running the lead-in wire into the house, more sins are committed, because usually here is where most of the energy of the incoming waves is lost. Most amateurs use the usual insulated lead-in strip, which is about three-quarters of an inch wide and is laid flat under the window, connections being made to the two ends. Such a lead-in strip forms an excellent condenser, exactly where you do not want to have it, because it actually acts as a transferer of energy from aerial to ground (which is the building in this case) at a point where you can least afford the loss.

There is really only one good method of bringing the wire in, and that is drill a hole in the upper pane of the window and to put the wire through it. This gives a clear space all around the lead-in wire, and no energy will be lost.

In apartment houses it is sometimes impossible to do this (that is, drill holes in the glass), but the amateur can easily get around this by following a simple system which has proved itself valuable in many cases:

Obtain two pieces of heavy copper foil. Paste one piece on the outside of the window glass, the other piece on the inside. The foil should be four to five inches square. The pieces are shellacked to the window by means of good clear shellac. They should be exactly opposite each other, to form a condenser. The outside insulator should be first secured rigidly to a pole with an insulator anchored on same; then a thin insulated piece of flexible lamp cord is soldered to the outside lead-in, and also soldered to the heavy foil fastened against the outside of the window. Another flexible piece of lamp cord is soldered to the inside sheet of foil, from which point the connection is made to the set. Even on the inside of the room, care should be taken that the wire coming from the window is not nailed against the wall. It should run at least six inches away from the wall wherever possible.

As to the ground, no ground can be too good! It should only be a cold-water pipe ground, never a radiator connection. For the ultra short waves, no ground at all is necessary; an aerial comprising two pick-up sections (Hertzian di-pole) being used.

**SHORT WAVE CRAFT IS PUBLISHED ON THE 15th OF EVERY MONTH**

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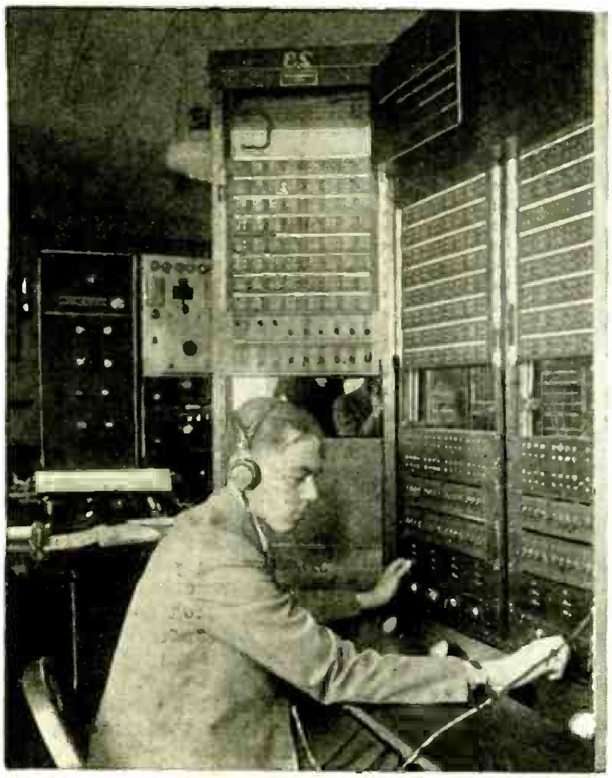
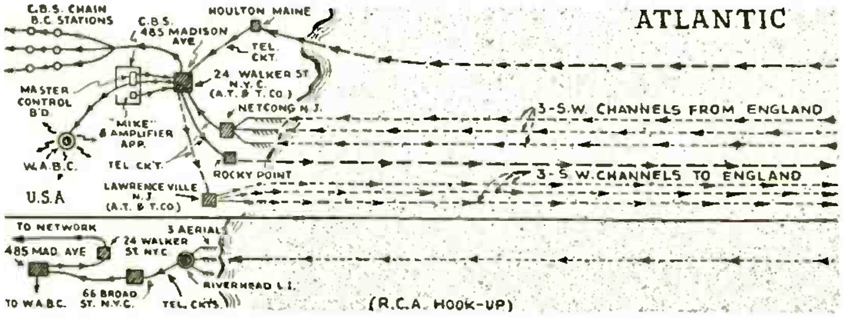


One of the operators at the master control board in the Columbia Broadcasting System Building, N. Y. City, where short-wave rebroadcasts are handled.

# How Columbia Short Wave




● WHEN a European statesman broadcasts from his capitol to America, or when a musical program is broadcast from some European city to this country, two high-powered transmitters employing four different wavelengths are used to span the Atlantic, and two multiple receivers are used on this side of the ocean to pick up the signals before they reach the master control room of the Columbia Broadcasting System in New York for retransmission over the nation-wide Columbia network.

A speaker from England, such as King George V or Bernard Shaw, addresses a microphone in the London studios of the British Broadcasting Corporation. For Columbia's regular series of Sunday transoceanic broadcasts at 12:30 P. M., E.D.S.T., each week during the spring, fall, and winter, there is no English audience, for the events are specially arranged for the American network. In many cases, however, Columbia rebroadcasts addresses or musical concerts which form a part of the B. B. C.'s regular programs, and then there may be as many as sixteen stations linked in the British network.

From the B. B. C. master control room the signals are passed to the long-distance department of the British Post Office telephone service, regardless of whether the program is to be sent to British stations or not. From the London telephone headquarters, they are relayed to Rugby, where the transmitters for transoceanic radiotelephone are located. The impulses are passed to four antennas, three operating on short wavelengths, between 14 and 30 meters, and the fourth on 5,000 meters. All four are then directed simultaneously towards the United States. All of the antennas are directional, so as to obtain the maximum possible efficiency with the power input used.

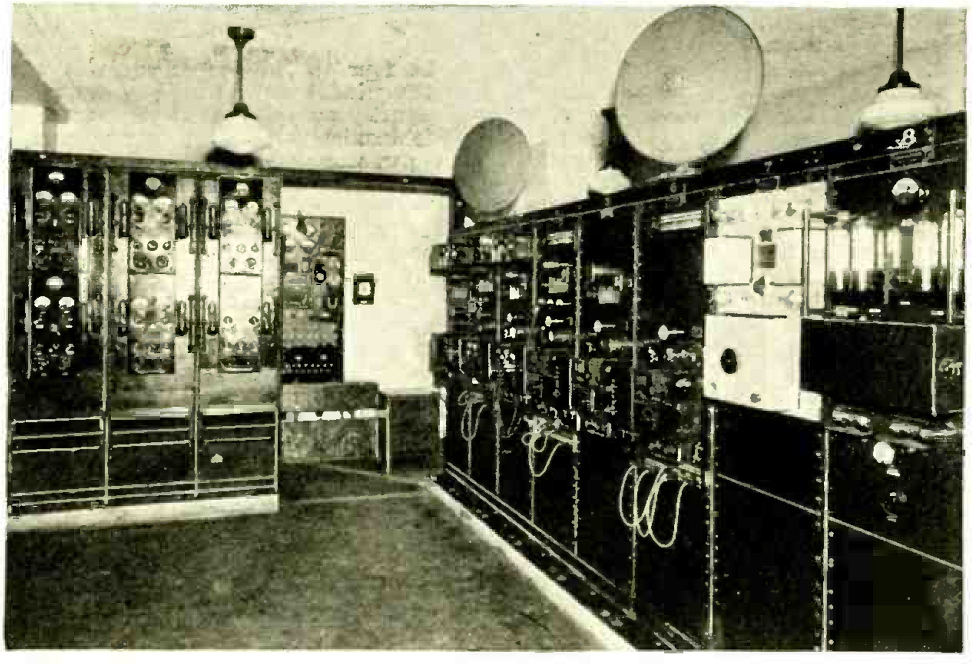
At Netcong, New Jersey, the American Telephone and Telegraph Company has a number of receiving antennas, also directional and pointing towards Rugby. These are specially constructed for short-wave work of this kind. The signals which they pick up, greatly weakened in power after crossing the Atlantic, are amplified enormously, and passed by land wire to the long lines headquarters of the A. T. & T. in New York. This arrangement takes care of the three short-wave signals sent out from Rugby.

The long-wave signal, on 5,000 meters, is not received at Netcong, but at Houlton, Maine, where special equipment for work on this wavelength is installed. Reception on this channel also is "piped" down to the long lines office, so that four different signals carrying the same program are received there simultaneously. The best of these is selected and relayed by leased wire to Columbia's master control room on Madison Avenue in New York City.

From this point the American distribution begins—to WABC's transmitter at Wayne, New Jersey, and to the line which joins the ninety-odd stations on the Columbia network.

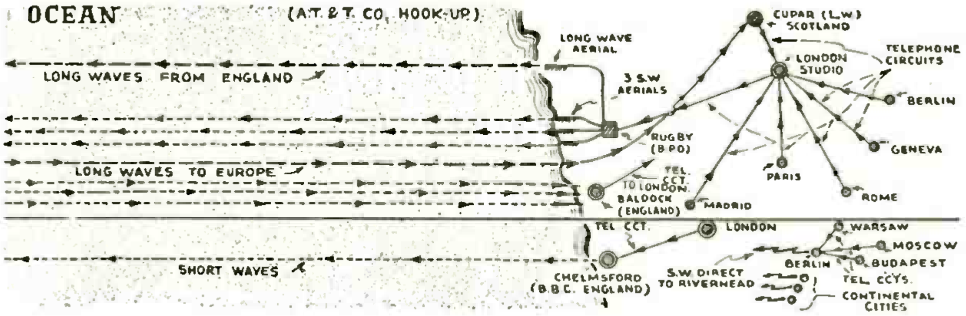
If the pick-up is to be made from the Continent of Europe, studios of the local broadcasting service generally are employed: those of the French government in Paris, the Geneva broadcasting station for the League of Nations' events, the Vatican station, the Berlin station, or other leading European stations. From these points the signals travel by land line to London before being passed on to Rugby for transmission in the usual way. In some broadcasts the signals may be sent direct from the European point to the A. T. & T. or R. C. A. pick-up points in the United States.

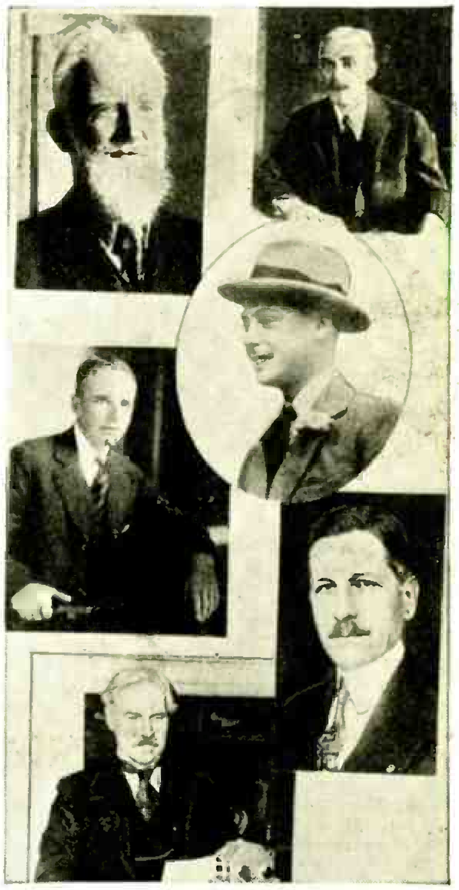
For west-to-east transoceanic broadcasts, such as those of the New York Philharmonic Orchestra recently or Co-



The master control board at C. B. S. headquarters, 485 Madison Avenue, New York City, through which all short-wave broadcast programs from Europe or other points are distributed.

# Network Handles Broadcasts



Celebrities who have talked over Columbia's short-wave hook-ups: G. Bernard Shaw, Andrew Mellon, top; center, Prince of Wales and Attorney General Mitchell; below, Ramsay MacDonald and Secretary of War Patrick J. Hurley.

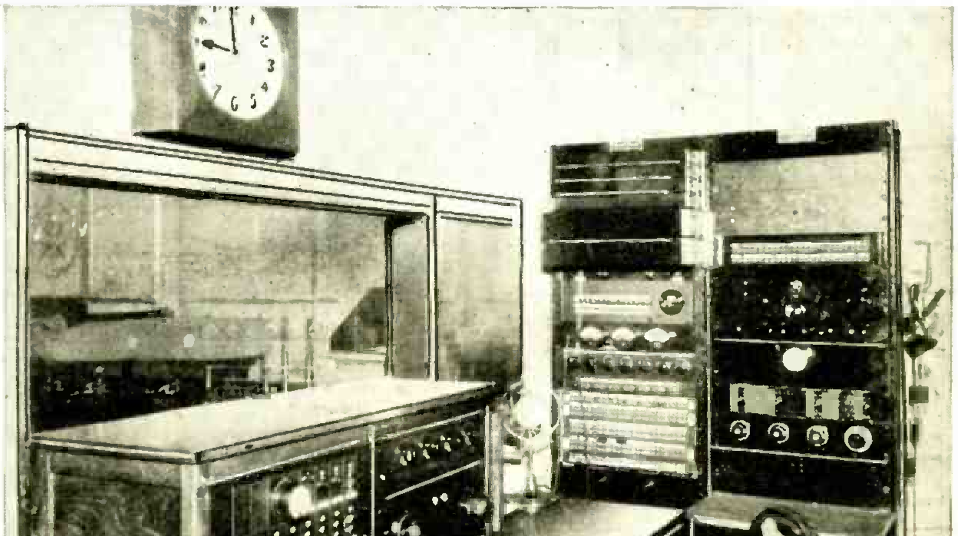
lumbia's special exchange programs like the recent "Broadway" program, the A. T. & T. facilities are again employed. Microphones on the stage of the Metropolitan Opera House, as in the broadcast by Arturo Toscanini, or in WABC's studios, connect with the master control room, which relays them to the long lines department of the telephone system. From this point they are fed to the short-wave transmitters at Lawrenceville, New Jersey, where a directional antenna points towards Baldock, England. Here a directional receiver is used to pick up the signals, which are then transmitted to the London telephone headquarters.

The New York long lines department, however, also feeds the transmitter at Rocky Point, L. I., operating on a *long* wavelength with 19,000 watts. This long wave transmits the program to Cupar, Scotland, where the British *long-wave* receiver is located, simultaneously with the short-wave transmission from Lawrenceville to Baldock. From Cupar, the signal travels by land wire to London, where the best signal is selected for relaying to the B. B. C., if it is rebroadcasting the program, and to the Continental countries linked for the relay. The Philharmonic concert, for instance, was sent to Paris for distribution to the French government network, and to Prague, Budapest, and Vienna for rebroadcasting; whereas the "Broadway" exchange program was sent to the B. B. C. for rebroadcast over the British network also.

At every stage along the journey, whether from east to west or from west to east, the signals have to be amplified thousands of times to make up for the attenuation in power caused by the distance covered. Thus a program from the Salle de la Reformation in Geneva would be amplified there, and again in Paris, London, Rugby, Houlton and Netcong, New York, and at different points along the circuit joining the Columbia network stations, as well as the stations themselves—a total amplification of literally millions of times before being picked up by the listener, and amplified by his own set to make it audible in his home.

All of this modern short-wave magic may appear quite tame on a piece of paper, but when we stop to consider a moment that it was only a few years ago that we considered the propagation of the human voice across the broad Atlantic to Europe a most remarkable and interesting scientific achievement, the short waves have certainly ushered in a new era in the long range transmission of musical and vocal programs. Among some of the interesting features of the transoceanic short-wave transmission and reception are the following. The wavelength is sometimes changed to a different value when severe static or fading occurs. Moreover, the wavelength can be changed without interfering with the transmission of the program. A tremendous amount of research and accurate daily records have been amassed by the engineers in charge of the short-wave work, so that it is now possible to tell quite accurately just what frequencies or wavelengths are best to use on a certain day, season and hour.

Recently there have been completed a number of new *high quality* speech transmission circuits spread over Europe.



View of studio switch-board and amplifier system in Columbia Broadcasting headquarters at 485 Madison Avenue, New York City. Short-wave "studio" programs for Europe pass through this switch-board.

# ON THE SHORT WAVES FROM EUROPE

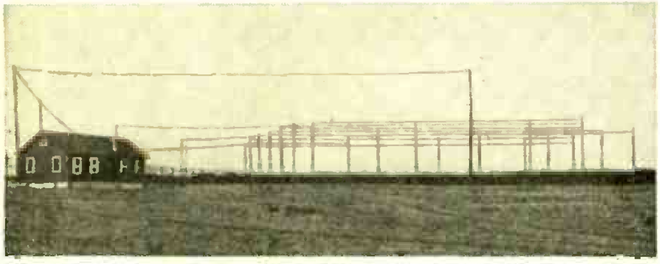
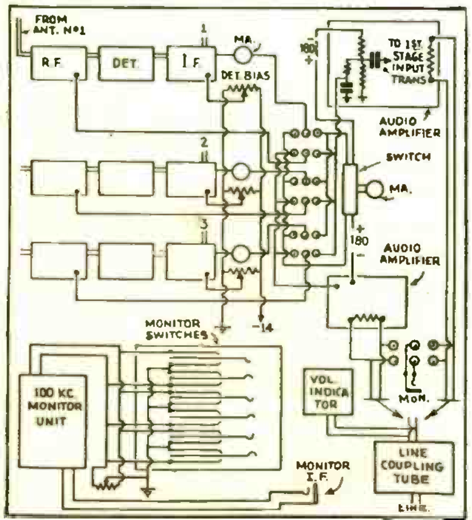
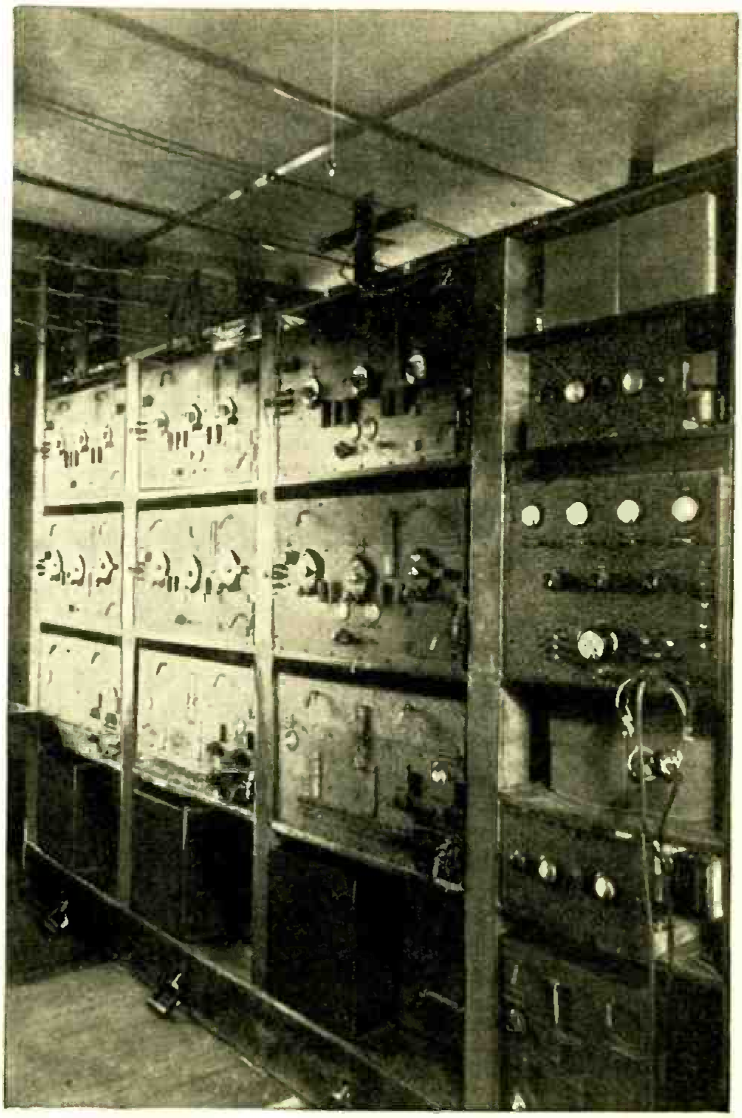



Photo above—Short-wave rebroadcast building at Riverhead, Long Island, where rebroadcast programs from Europe and South America are picked up; this view shows the group of antennas in the background.

The diagram below shows the interesting arrangement of three complete radio frequency and detector circuits, each picking up a signal from each of three distinct short-wave antennas. Automatic volume control is thus effected.

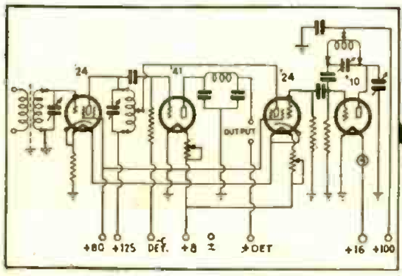


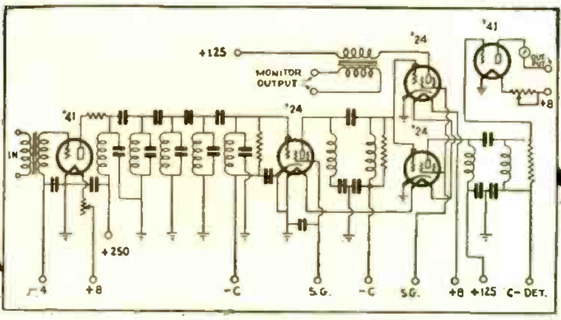
Right — A sight that would delight the heart of any short - wave fan or "ham" operator—the triple short - wave receiver installation in the rebroadcast building at Riverhead, L. I. Each R.F. amplifier and detector amplifies a signal from one of the three short wave receiving antennas erected at this location.

Below (Left)—Diagram of heterodyne tuner unit used in picking up transatlantic rebroadcast high frequency waves.

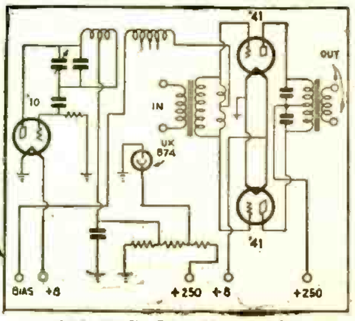
(Center)—Diagram of intermediate frequency amplifier of the superheterodyne S - W receiver system used at Riverhead. L. I. (Right) — Schematic circuit of monitor unit used at Riverhead.




Heterodyne tuner unit.



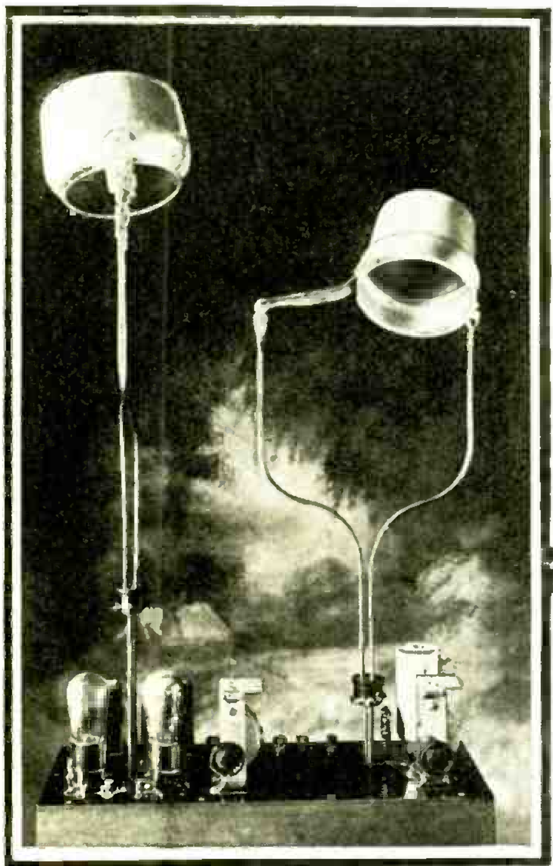

I.F. amplifier.




100 K.C. Monitor unit.

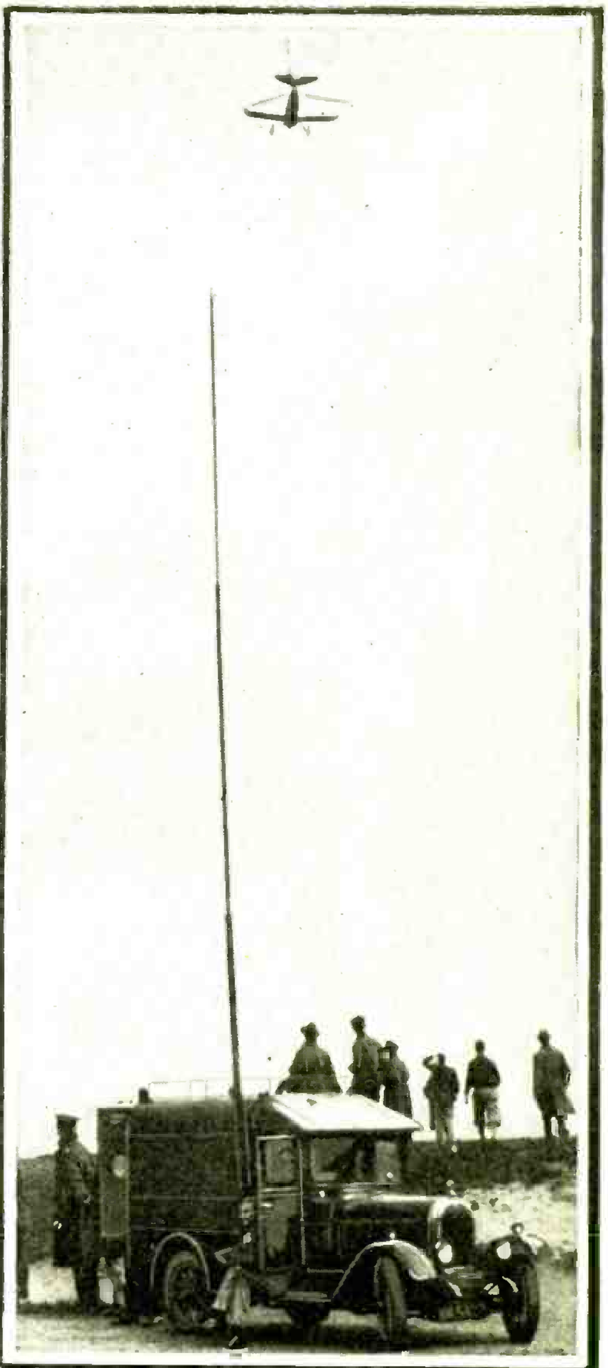
# ODDITIES
## IN SHORT WAVE NEWS

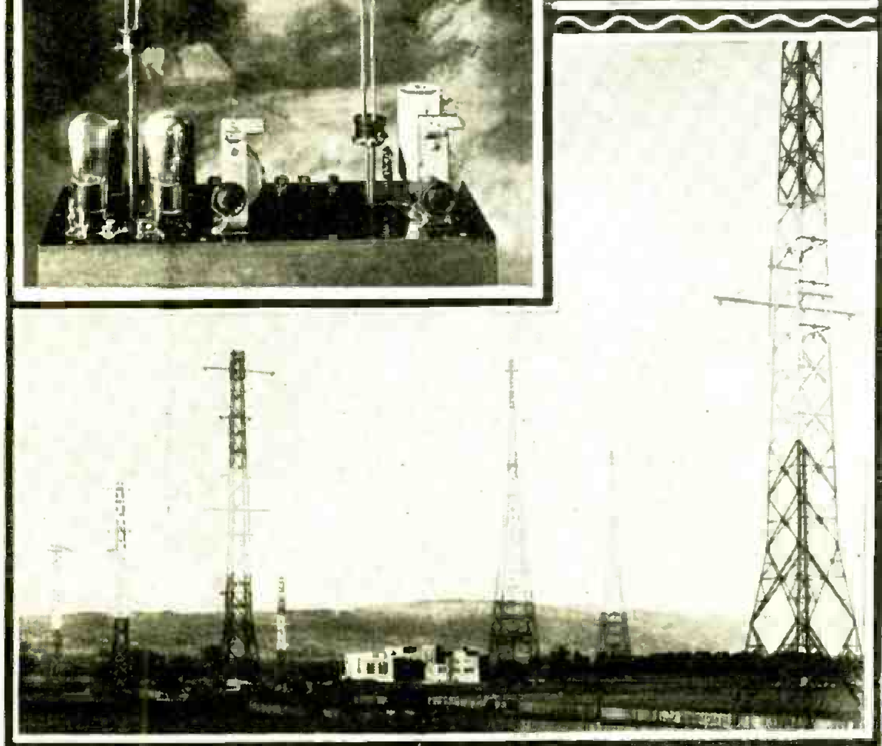
Short waves direct "Derby Day" traffic in England—Pots and pans serve as plug-in coils—Powerful new short-wave station at Geneva for "League of Nations."



**Right — Unusual photo taken in England, showing short-wave equipped autogiro flying above police radio car, the plane reporting the position of "traffic snarls" back to the radio car, which was in touch with police headquarters.**

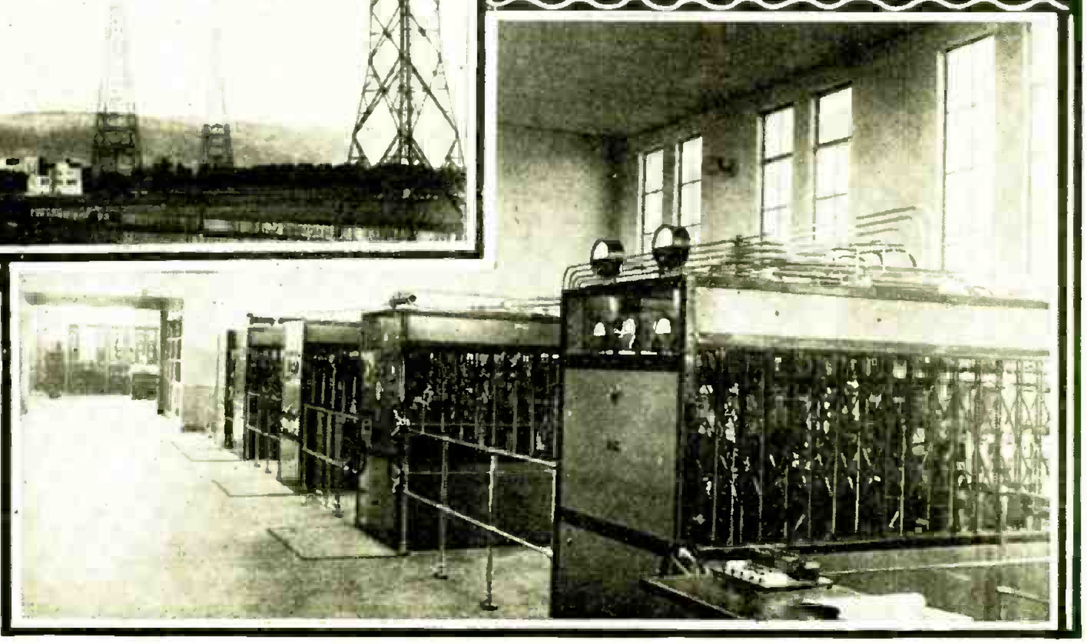
**Left—Pots and pans here take the place of plug-in coils—"Boston comes in on the bean pot" and John Melicharek of 6002 Center Street, Houston, Texas, reports that he is still trying to get "Java on the coffee pot."**





**Above—Array of short-wave antenna masts at the new League of Nations' short-wave station just opened at Geneva, Switzerland; painted black and white for the benefit of fliers.**

**Right—Some short-wave transmitter! A view of the short-wave transmitter panels in the new League of Nations' radio station at Geneva, Switzerland.**

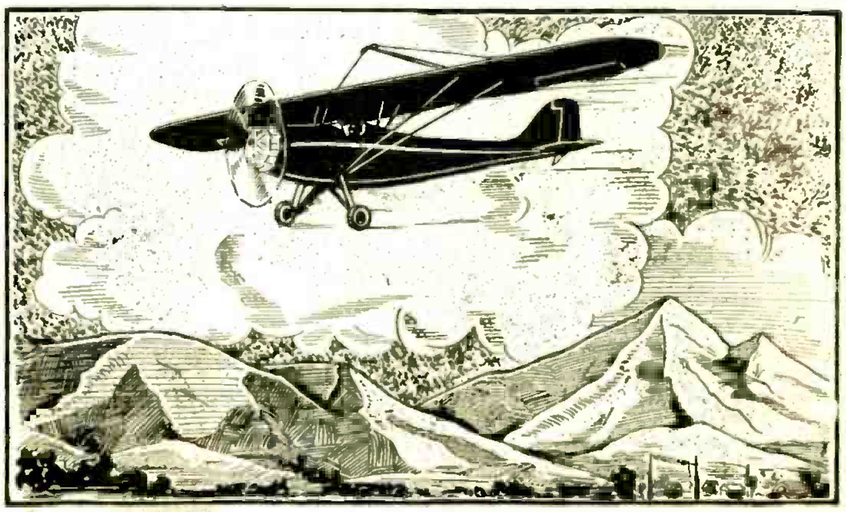


# How Short Waves

**By DR. IRVING J. SAXL**

Consulting Physicist

Fig. 6, above—Professor Leon S. Theremin, inventor of the induction music instrument, with his radio altimeter in plane cockpit just before a flight.



A plane in flight with special antenna for operating Professor Theremin's radio height indicator.

● A STORMY night. Rain pours down and the visibility is poor. A roaring airplane can be heard near over the earth. But the plane is invisible from the ground, and so is the ground to the pilot. The roar of the engine comes nearer; it must now be only a few feet over our heads. Then suddenly the plane appears, landing in the next fraction of a second in a perfectly smooth way, as if it knew all the time just how far it was above the ground. Human lives seemed to be in danger because human senses could not see the earth where the plane had to come down. And still the landing was a perfect one. How was this done?

It is of major importance for the airplane pilot to know at any time his exact distance from the ground. In flying by instruments, the apparatus indicating the altitude of the plane—the altimeter—is continuously observed. While a mistake in the direction of a plane is dangerous enough, it can be corrected if noticed. But if the pilot relies upon a wrong altitude indication, only for a short time, the plane crashes if it is near the ground.

Various methods therefore have been devised for the purpose of measuring the height of a plane over the ground, most of them relating principally to the barometric determination of the weight of air columns. This air pressure is less at higher altitudes and greater at the bottom of the air-ocean.

However, this determination of height with the aid of fine barometers, calibrated in feet, has serious drawbacks. One is that a barometer shows just the air pressure at a certain place. The total amount of this pressure changes in such a way that it cannot be forecast with perfect reliability. If the total air-pressure is reduced, as for instance in a barometric "low," then the altimeter in an airplane flying close to the ground will still indicate a considerable distance between the ground and the plane. As poor visibility usually exists during barometric "lows," the plane is in constant danger. Just there, when exact knowledge of the actual altitude is vital, the altitude meter of the barometric type is not fully reliable.

Now the development of radio science has made possible the determination of just these critical altitudes. It is now possible to measure directly the distance between plane and ground without any dependency upon the difference in the pressure of the air column above and below the plane, or the changes in the total air pressure, etc. In addition, irregularities of the earth surface are automatically accounted for. For instance, the actual distance is measured between the plane and the mountain, not merely the absolute air pressure.

A small instrument, about twice as large as a match box, as shown in picture 4, is all that is necessary now for reading directly the actual distances between the plane and the ground, continuously at any time. The radio altimeter can be inserted into the instrument panel of the plane and indicates those critical altitudes below 200 feet which are not indicated accurately by the barometric altimeter.

The principle on which these determinations are made is a well known one with which almost any radio fan has been confronted some time or other. It is the fact that changes in the capacity—and therefore in the frequency—of oscillating systems occur if a variation in the distance between such a system and a grounded object is made. If a grounded object, for instance, the hand of the experimenter, is placed near an oscillating system, then this system is detuned noticeably. If this system is one part of an entire set that operates on the principle on which the beat note oscillator works, then this detuning will result in a long drawn howl or a whistling which is only too well known to anybody who has worked with apparatus of this type.

Professor Leon S. Theremin, young Russian wizard of wireless musical in-


Fig. 4—Close-up of Prof. Theremin's radio altimeter, the dial of the meter being calibrated directly in feet. Note comparative size to match-box.

# Indicate Plane's Altitude

**Professor Theremin, who startled American audiences with his "induction music" produced by vacuum tubes, has turned a new trick and produced a "radio altimeter" which indicates the distance between the ground and a plane when about to land.**

struments, has used this fact, which is undesired as such in radio sets, to create a new form of sound production, the well known space-controlled instrument. And it was again he who pierced deeper into the basic facts which underly this effect and found new application of the phenomena in various fields where the importance of high frequency oscillating circuits did not appear at first sight.

One of these applications is the *measurement of distances* by the aid of similar instruments. Naturally, if a sound could be varied in its intensity and in its pitch by the movement of an object near an oscillating circuit, then, it is obvious, this sound or this intensity can be made a factor which indicates HOW FAR THE OBJECT IS AWAY from the oscillating circuit. The idea is clear.

For some years this phenomenon has been used for the determination of very small thicknesses, for instance, of paper. Now, the genius of Theremin has made it possible to use the same principle for the exact determination of the critical flying altitudes up to 200 feet.

How is the radio measurement of altitude actually done? Where does the factor of changes in the capacity enter into these considerations?

For understanding this we have to consider firstly what a plane over the ground, or an antenna on this plane, means physically. The plane and the ground actually may be considered as the two conducting plates of a huge condenser with a dielectric of air in between. The capacity of this condenser is *directly proportional to the height* of the top conducting plate (the plane or the antenna) over the ground.

In the Theremin system, an antenna is supported on an insulated rod which is attached to the front of one wing of the airplane. Flying in different altitudes, this antenna has a definite capacity against ground. *This capacity is only dependent upon the distance of the plane above the ground* and changes in a definite way if the plane flies at different altitudes.

● DR. IRVING J. SAXL, Consulting Physicist, Scientist, Inventor. Lives in New York City. Consultation practice in the various fields of radio, electro-acoustics and vacuum work. Lecturer and associate member at the New School. Member of Staff Museum of Science and Industry in the City of New York, Exhibition on Color 1930. Member N. Y. Electrical Society. Author of scientific papers and constantly contributing to various scientific publications and technical journals. Holds a great number of patents and developments in the electronic and other lines, among them: powerful radio tube for 18 centimeters wavelength transmission and reception. An amplifier tube for 3 meters wavelength. Improved methods for high speed communication; new powerful incandescent lamp; new instruments for measuring highest voltages; high efficiency earphones, microphones and many more.

The ground, on the other hand, constitutes a second condenser together with the conducting area of the airship itself. The capacity of the antenna on the wing of the plane against the airship will therefore be a double one: first, the direct capacity between antenna and plane, which may be neglected because it remains constant; and, second, the capacity of the two condensers in series: the capacity of the antenna against ground Ca and the capacity of the plane against ground Cp both put in series. (See Fig. 1.) As this change in the capacity is small for each condenser—and becomes smaller the higher the plane is above the earth—two or even more condensers (according to the number of separate antenna systems used) have to be applied.

Changes in this capacity between the double antenna system of the plane and the ground are now used in the radio altimeter to influence the frequency of an oscillating circuit. The natural frequency of this oscillating system will be varied if the capacity of the system is increased, as it is, for instance, when the plane approaches the ground. While it would be difficult to measure continuously the changes in this small capacity by one of the classical methods, it is possible to control by it a variation in the potential of the grid of a tube, which, as such, determines the plate current. (See Fig. 2.)

In this schematic arrangement the tube 1 generates oscillations in the circuit 2. These are impressed by resistance coupling upon the grid of a second tube, 3. It is now clear that the *plate current in this tube will depend upon the amplitude of the oscillations impressed upon its grid.* This amplitude, however, depends upon changes in the oscillating circuit. While the part 2 of the latter remains constant, changes in its natural frequency will occur if the antenna system 4, which is inductively coupled to 2, changes its electrical characteristics. These factors are influenced by the distance of a grounded object from this antenna. It is therefore obvious that the distance between the earth and the total oscillating system, acting primarily upon the capacity against ground of the antenna 4, will finally result in changes in the plate current of the tube 3 which can be measured with a fine milliammeter 5, which is calibrated in feet distance above the ground.

Another way of obtaining a similar effect is shown in Fig. 3. In this case the changes of the capacity of the antenna system, 4 detune the oscillating circuit 2, from which the energy is delivered to the filament of another radio tube 6, into which a constant frequency is fed from a transformer 7. From 6

(*Continued on page* 249)

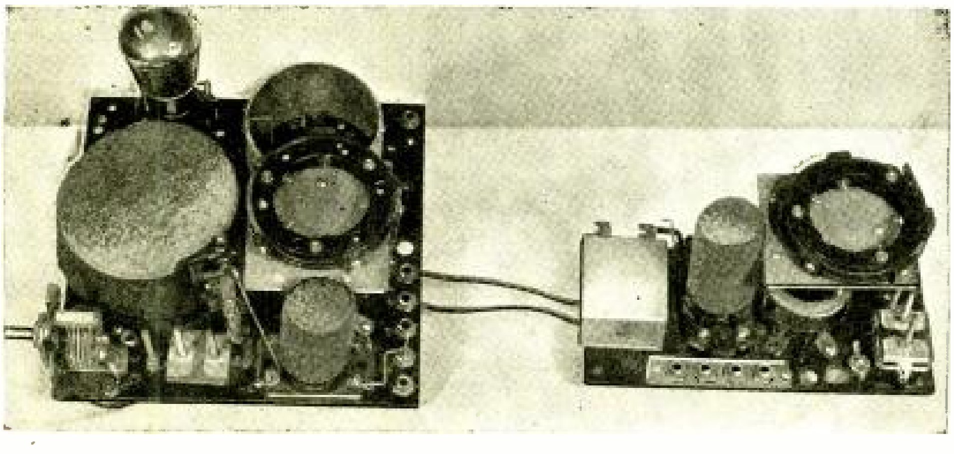
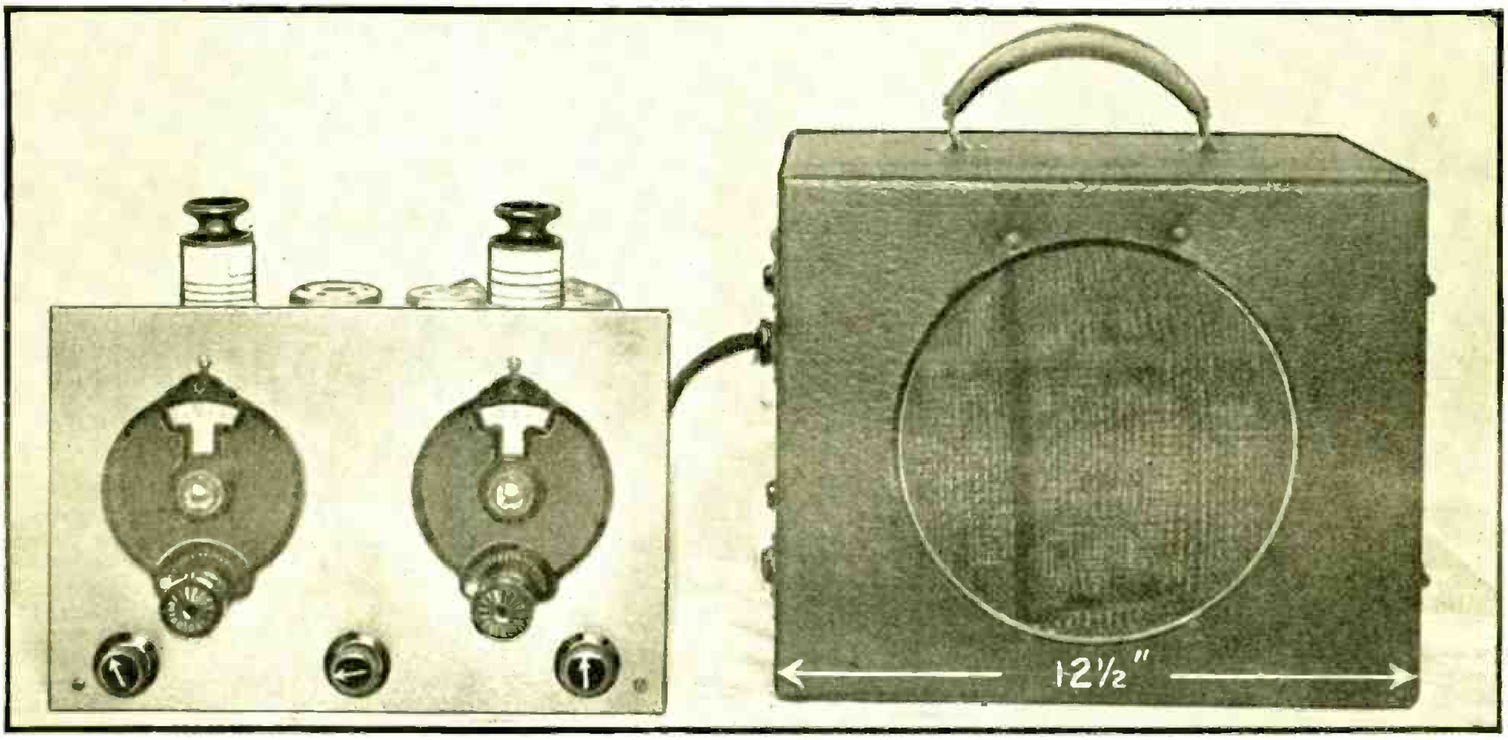


**Fig. 5—The complete altimeter apparatus as perfected by Prof. Theremin, including oscillator, ready to be installed in the fuselage of a plane. This apparatus is electrically connected with the height indicating meter, the meter being placed in front of the pilot on the cowl.**




This portable 8-tube superhet has the weight divided into two cases, one containing the batteries and loud speaker.

# 8-Tube Portable "All Wave" Super-Het—550 to 15 Meters

**By CLIFFORD E. DENTON**

Just the receiving set you've waited for—uses eight 2-volt tubes; it has weight of batteries and loud speaker distributed in two carrying cases.

● MANY readers have written requesting information on a two-volt receiver for short-wave reception. This article will describe a new receiver with a high degree of sensitivity, excellent quality and a power output of over 1.2 watts.

This receiver has many features not found in the average short-wave "super." Among them are: tone control, which is useful in reducing the effect of static and other foreign noises; sensitivity control—actually the volume control, located in the grid returns of the intermediate-frequency amplifier. The new variable-mu type two-volt tubes are used in the intermediate-frequency amplifier. These are known as the '34 type tubes and improve the characteristics of the I.F. amplifier. The danger of distortion due to detection at high signal levels is minimized by the use of these tubes.

Regeneration is used in the first detector circuit, improving the adjacent channel selectivity. The benefit of regeneration in this circuit manifests itself when the receiver is tuned to a station some distance away and another station on a nearby channel tends to swamp out the desired station. This is particularly noticeable when both stations are located a considerable distance from the receiver and on adjacent channels. Once the regenerative feature has been tried on a distance station the builder would not build a short-wave set without it.

The detector circuit uses grid circuit rectification in order that the maximum sensitivity can be obtained.

In the oscillator circuit there is little difference from any other standard circuit. Coupling between the oscillator and detector stages is obtained by induction between the oscillator and detector coils. These coils should be mounted six inches apart. Some constructors may want to lay the receiver out differently and shield the coils in shield cans. If that is done the secondary of the detector coil should have turns added. These turns are to be wound on the oscillator coil form to provide the coupling. The number of turns for the various wavelength ranges will be found in the coil table further on in the text.

The intermediate-frequency amplifiers provide the gain and stability. This receiver uses an intermediate frequency of 465 kc. This frequency was selected so that the set could be tuned in the broadcast band. A lower frequency could have been used if the frequencies above 1,500 kc. only were to be received.

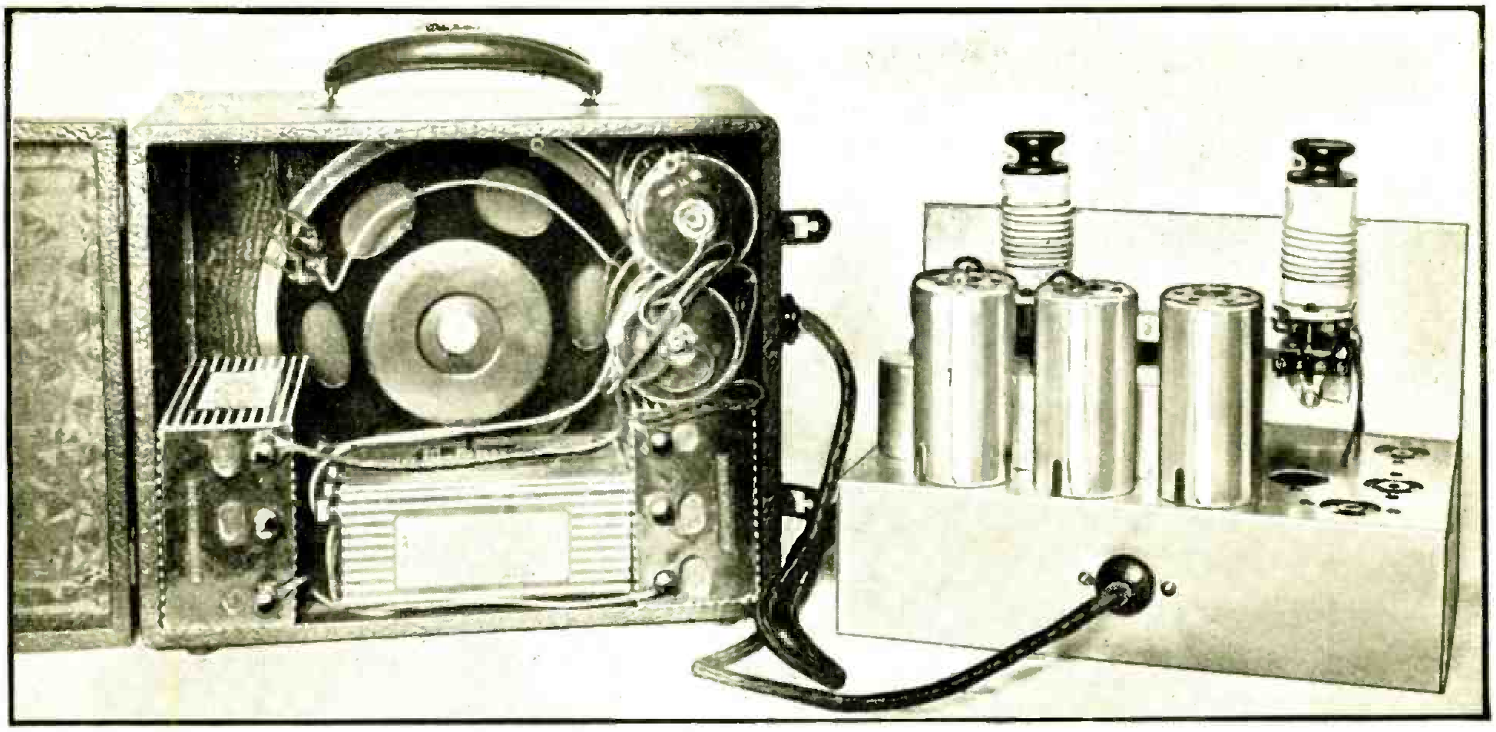
Mention should be made of the isolation of the grid return circuits of the two intermediate stages. It will be noted in the circuit diagram that a network of resistors is used to provide the variable bias for the '34 type tubes. As these grid returns would have a circuit common to both and a high impedance one at that, there would be a tendency for instability which is avoided by the isolation feature.

The second detector is of the plate bend or power type and derives the bias from the same "C" battery as the intermediate-frequency amplifier. Isolation is used here to decouple the second detector from the intermediate-frequency amplifier.

The first audio stage has a resistance coupled input and the output hooks into the push-pull input transformer feeding the push-pull output stage. The circuit as far as the audio stage is concerned is conventional.

The output stage uses two tubes in push-pull and these are the two-volt output pentodes, type '33. The power developed in this circuit for use in the speaker is a little over 1.2 watts. This is sufficient when used with a sensitive magnetic speaker. A distinct innovation is found in the speaker. The magnets are wound for use with the pentodes and the center tap is provided on the speaker so that no output transformer has to be used in the receiver, thus reducing the weight of the receiver and saving money on an expensive part.

The writer, as this went to press, received information on a new tube manufactured by the National Carbon Co., which provides push-pull or class "B" operation for two-volt filament operation. This new tube is known as the '49. This



This picture shows interior of loud speaker and battery cabinet and also chassis view of receiver, which fits in similar cabinet.

new type zero bias tube has a low power consumption filament rated at .12 ampere, which is much lower than the filament requirements of the '33. The power output of this new tube in push-pull is 3.5 watts. While no practical information will be given for the circuit and parts for use with these tubes at this time, it is hoped that the proper transformers will be available for descripion next month. If they are, a circuit with full constants will be given so that the builder will have a choice of output circuits.

Some readers may think that the use of a screen grid second detector would give better signals. Tests show that while the signal strength is a little better with the screen grid detector, the microphonic tendencies of the '32 when used in portable receivers make the '30 type tube more satisfactory. The overall gain of the receiver is so great that the additional sensitivity of the screen grid second detector is not needed.

The batteries are carried in the box or case with the speaker. The use of a separate box for the speaker is more satisfactory, as it reduces the effect of acoustic feedback. Small tubes of this type are great howlers and suitable precautions must be exercised when the set is used at high amplification levels.

The coils are wound on isolantite forms. Due to the grain on the surface of the form it is easy to space wind the coils by hand. Some may prefer switching arrangements instead of plug-in coils, but for simplicity and the minimum of losses the plug-in system is the best.

The wavelength ranges of the five sets of coils and the number of turns required are as follows:

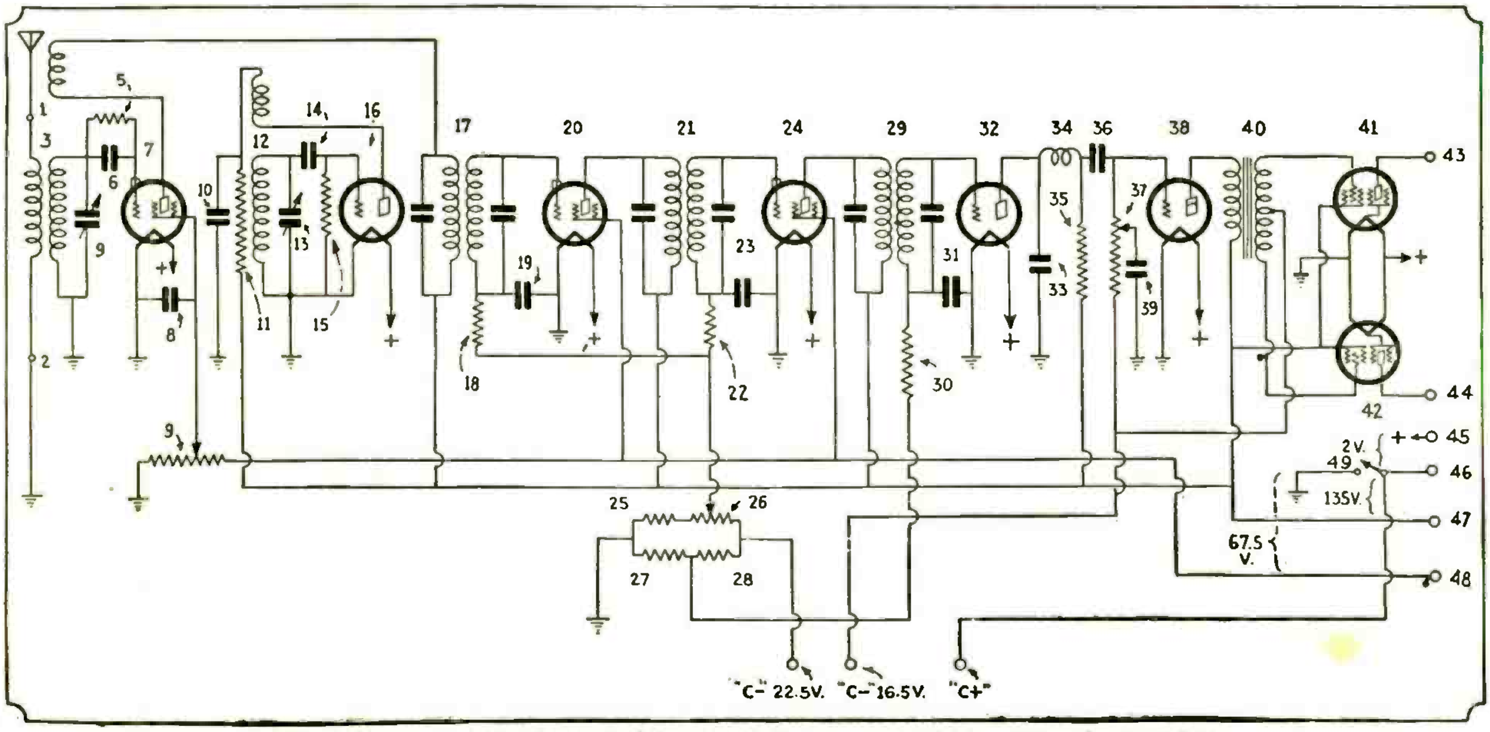
14 TO 30 METERS

| | |
|---|---|
| *Detector* | |
| Primary...... | 4 turns No. 30 D.S.C. |
| Secondary.... | 7 turns No. 20 Enam. |
| Regeneration.. | 5 turns No. 30 D.S.C. |
| *Oscillator* | |
| Plate........ | 4 turns No. 30 D.S.C. |
| Secondary.... | 6 turns No. 20 Enam. |
| Coupling..... | 1 turn No. 20 Enam. |

Detector secondary is space wound 6 turns to the inch with a winding length of 1⅛ inches scant.

Oscillator secondary is space wound 6

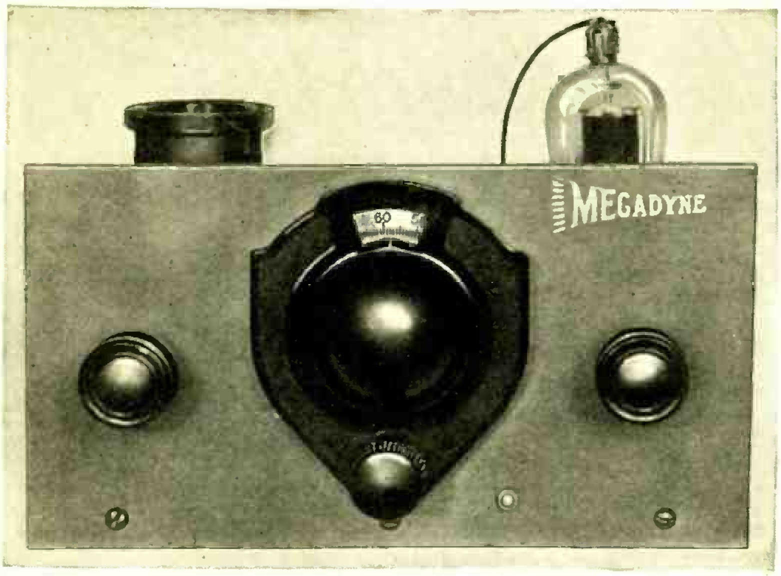
(*Continued on page* 253)




Wiring diagram of Mr. Denton's 8-tube portable superhet which utilizes 2-volt tubes.

# The Short-Wave Megadyne

**By HUGO GERNSBACK**




**The Megadyne receiver represents the culmination of nearly ten years research work by Mr. Gernsback and we are sure that all short-wave "hounds" will be tickled pink with this ultra efficient and economical receiver. The Megadyne uses but one tube and most stations can be brought in on the loud speaker with it.**

The Short Wave Megadyne One-Tube Pentode Set is an adaptation of the author's Megadyne One-Tube Loudspeaker Set for broadcast reception. While the author does not claim that stations are received generally with loud speaker strength, still we have actually listened to 'phone broadcasts of a great number of eastern amateurs, all of which were received with fair loud speaker strength; this, in New York City, where short-wave conditions are none too good. The author would be happy to hear from those who have built this really remarkable set.

RECENTLY, after quite a good deal of experimenting, which covered a term of several months, I devised a new circuit which is termed the "Megadyne" circuit. (*Megas*, the Greek for "great"; *dyne*, Greek for "power.") The circuit originally was devised by the author for the broadcast band, and is unique in that it is actually possible to operate a loud speaker from a single tube.

To those interested in the broadcast receiver, I refer to the July issue of RADIO-CRAFT and my article entitled the *Megadyne One-Tube Pentode Loudspeaker Set.*

Incidentally, this simple set, which anyone can build, brought in stations from Pittsburgh, Cleveland, Springfield, Mass., Hartford, Conn., with good loud speaker strength without any trouble.

The circuit is, to the best of my knowledge, new in that the tube really works "backwards." In this circuit, I also make use of my old Interflex idea, where the crystal is inserted directly into the grid circuit of the tube.

Having had such astonishing results with this little set, I thought it worthwhile to devise one for short waves also. Some modifications had to be made from the original broadcast set, and the short-wave set and its circuit are described in these pages.

Of course, I do not claim loud speaker strength on the Short Wave Megadyne, but I do claim that the signals that you get with this one-tube receiver are far more powerful than from any circuit which I have as yet tested or tried.

It may be possible in locations which are superior to New York City to receive certain short-wave stations on the loud speaker with the Short Wave Megadyne, and if this is the case I certainly would like to hear from those who have tried the combination.

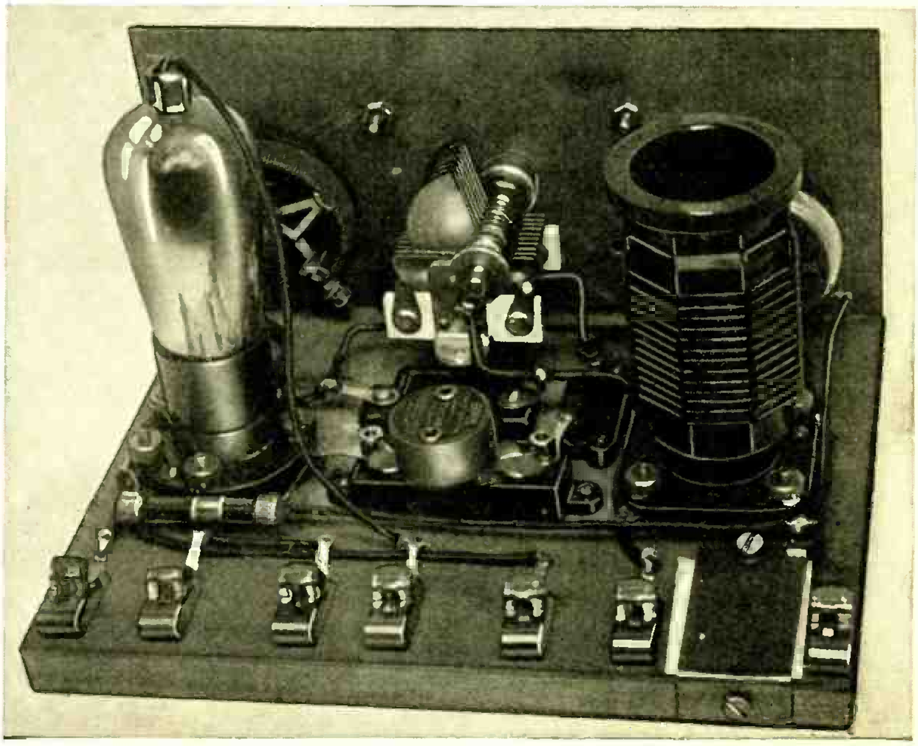
I have also given the specifications for an extra coil termed "broadcast coil," which can be plugged in, in which case the set becomes a one-tube loud speaker type for broadcast purposes. However, the tuning of this broadcast coil is somewhat broad, and the set cannot be used in the proximity of a powerful broadcast station. Out in the country, and away from stations, it will perform excellently.

## The Circuit

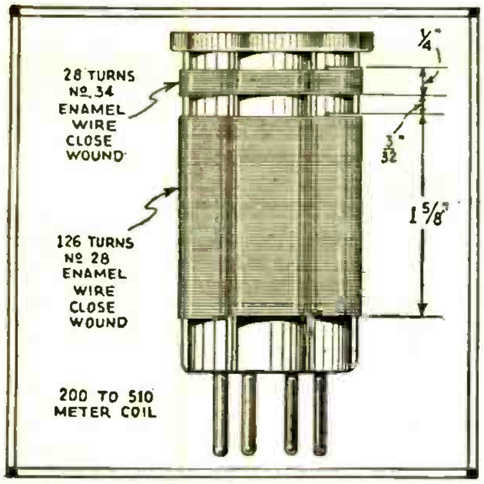
The Short Wave Megadyne circuit differs slightly from the original circuit of the Megadyne for *broadcast* reception. In the latter, regeneration was obtained by connecting the tickler coil in the control grid circuit of the tube and coupling this coil to the input coil, which was connected in the screen grid circuit. The screen grid in the Megadyne is used as a control grid.

In the Short Wave Megadyne, regeneration is obtained in the conventional manner, with the tickler coil in the plate circuit. This gave better control of regeneration, which was found more critical for short-wave reception when a number of plug-in coils were used with fixed tickler windings than for broadcast reception with a single tuner with a variable tickler winding.

The elementary circuit is shown in Fig. 1. It employs a type '38 pentode tube (although any pentode or any screen-grid tube has been found satisfactory). The tube is connected as a

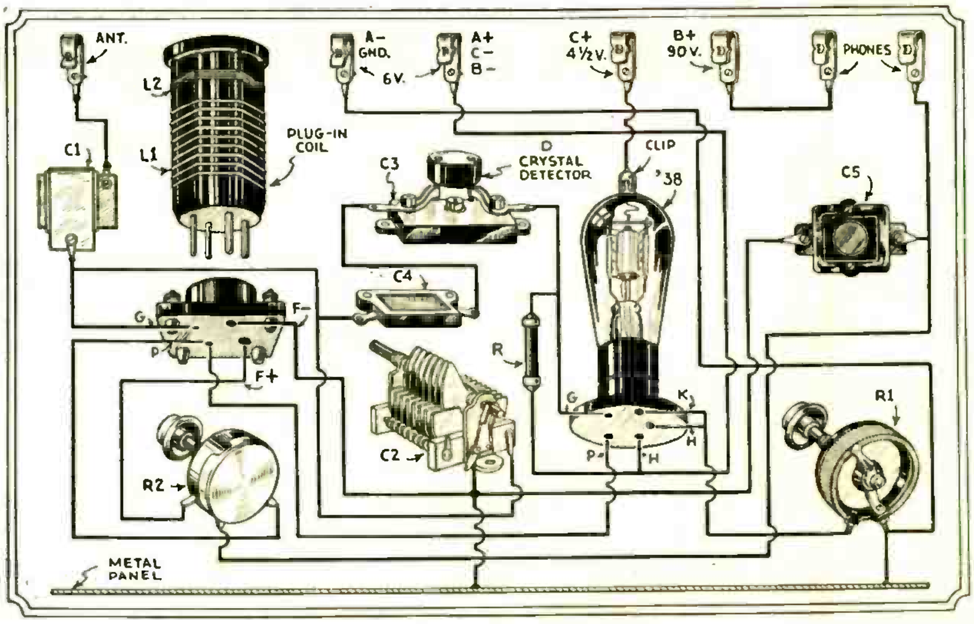


Rear chassis view of the short-wave Megadyne, as perfected by Mr. Gernsback.




**Above—Winding data for Octocoil, or similar shaped form, having sufficient inductance to cover the broadcast band with .00015-mf. condenser.**

**At right—Picture diagram which anyone can easily follow in building the short-wave Megadyne.**




space-charge regenerative detector; that is, the control grid is connected to a plus potential of 6 to 10½ volts with respect to the negative side of the filament or cathode and the screen-grid is then used as a control grid. The plate potential may be 90 volts, although as low as 45 gives satisfactory results. These voltages may vary when other types of tubes are used.

A distinctive feature of this circuit is the use of a fixed crystal detector (D) connected in series with the (screen) grid of the tube, as shown; its use considerably improves the volume of the signals. It acts as a rectifier and therefore feeds a rectified or audio frequency signal to the input of the tube so that the tube serves the dual purpose of functioning as a regenerative R.F. amplifier and an audio amplifier. The method of controlling regeneration and the general method of tuning the circuits may be any of the several standard varieties now employed for short-wave work. With the use of plug-in coils with fixed coupling between plate and grid circuits a variable resistance or capacity regeneration control is essential. The former method is employed in this particular circuit, as it gives a more uniform control.

### Construction of Set

As shown in the photographic illustrations, the set was built in a very simple manner in order to prove the efficiency of the circuit and also allow for making any changes in the wiring, if necessary, for experimental work. A metal panel 8 x 4¼ inches, mounted on a half-inch baseboard 8 x 6 inches, forms the framework of the chassis. The use of a metal panel is recommended, as it eliminates hand capacity.

On the panel are mounted a 10-ohm filament rheostat, R1, which also serves the purpose of opening the filament circuit when in the "off" position; a 400-ohm potentiometer, R2 (mounted at the left) which controls regeneration; and a .00014 mf. midget variable condenser, C2, for tuning the various wave bands. A vernier dial is used on the tuning condenser.

On the baseboard are mounted seven terminals, a home-made antenna series condenser, C1, a four- and five-prong socket, grid condenser, C4, crystal, shunt crystal condenser, C3, and bypass condenser, C5. The location of the various parts is clearly shown in the illustrations. The pig-tail grid leak, R, is mounted directly on the tube socket.

The antenna series condenser comprises a metal plate, 1½ x 1¼ inches, mounted flat on the board and held by the screw that fastens the antenna terminal. The other plate of the condenser is 1 inch wide and 2¼ inches long and is bent around the edge of the baseboard and held in place with a wood screw. Between the two plates is placed a sheet of mica. The upper plate tends to spring out and is held down with a screw, the turning of which varies the capacity.

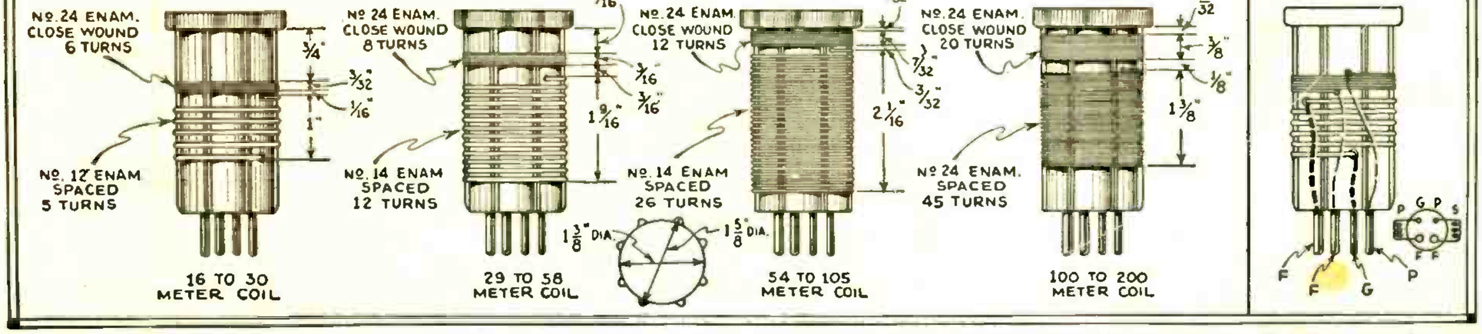
The shunt condenser across the crystal detector was found necessary to act as a by-pass across the crystal and allow the R.F. currents to pass through to the grid of the tube and maintain oscillation. The lower the capacity required to maintain oscillation the better. Since this may vary with different coils in the circuit, an adjustable condenser having a maximum capacity of .001 mf. is employed.

Two metal contact springs from an old vacuum tube socket, mounted on the shunt crystal condenser as illustrated, are used to support and make connection to the crystal detector. This allows the detector to be quickly removed and replaced with a different one, or reversed. It has been found that the polarity of the detector is sometimes important.

The 400-ohm potentiometer that controls regeneration is connected directly across the tickler winding of the plug-in coil. The center connection of this potentiometer is connected to plus "B", and since it is at high potential, the shaft of the potentiometer must be insulated from the contact arm or any of the terminals. Some makes of potentiometers, such as the one used, have insulated shafts and can be mounted on grounded metal panels.

The complete wiring of the set is shown in Fig. 2. The various parts are lettered to correspond with the lettering in the other illustrations and in the list of parts, so that the builder will have

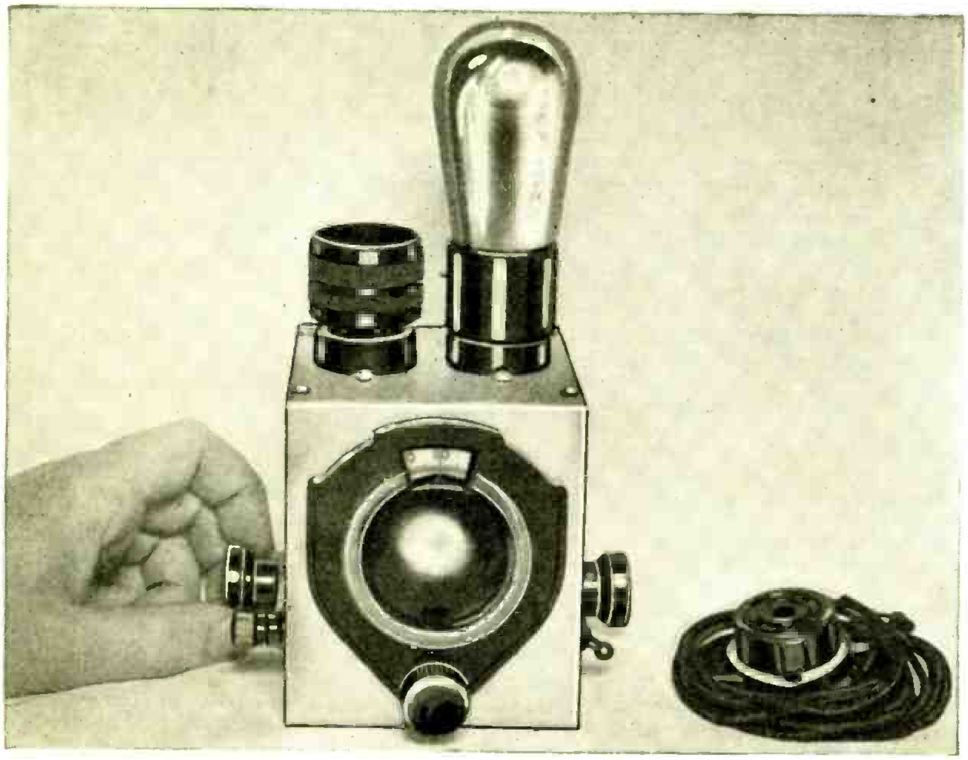
(*Continued on page* 246)



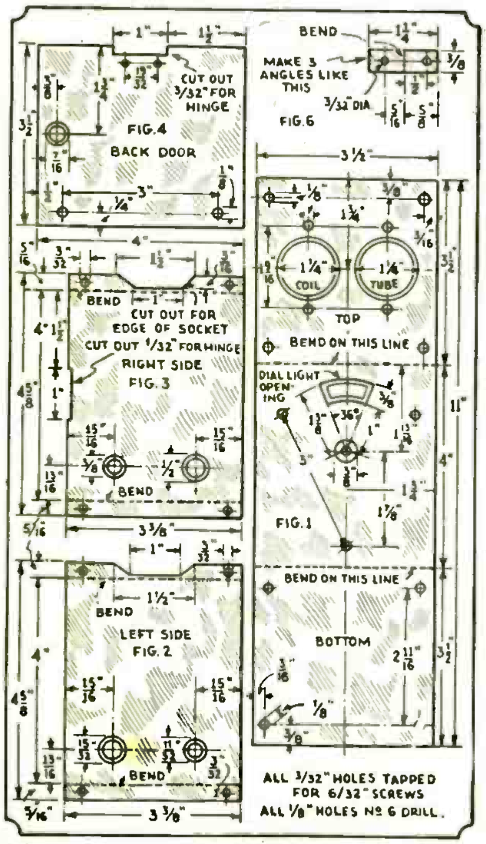

**Coil winding data for the four principal short-wave bands, using Octocoils or similar shaped forms; round tubes can be used without much discrepancy in the wavelength covered.**

# Winners in the First Set Builders' Contest

## FIRST PRIZE—$50.00 Won by LOUIS J. MAIGRET, New York City.



**Above—Mr. Maigret's short-wave converter, which won "first prize" in the May contest.**



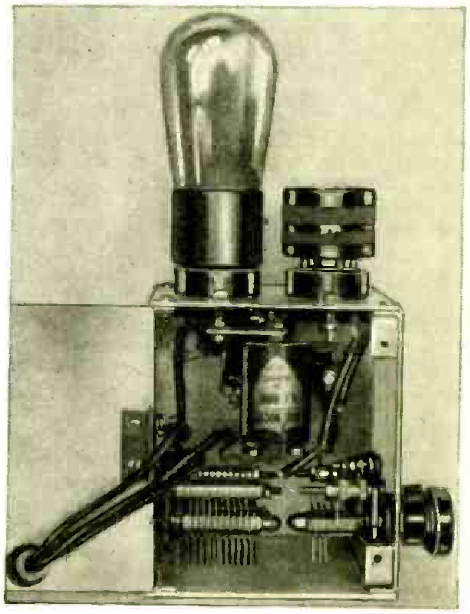

**Left—Details for making aluminum cabinet for Mr. Maigret's short-wave converter.**

• IT IS now generally agreed among sea-going wireless operators that some kind of short-wave set is an every-day necessity on board ship for receiving weather reports, time signals and press, (the Big 3), especially if the vessel is plying between foreign ports where the distance off the coast becomes too great for long wave reception, and more especially when static interference is heavy, as is continually evidenced in tropical waters.

Moreover, many operators do not wish to invest a large sum of money in some elaborate four or five tube receiver; neither have they room for such sets, because some wireless quarters are very "diminutive" and here's one fellow that knows!

Because of these facts, the Pee-Wee Marine S.W. Adapter was designed primarily to meet the needs and requirements of the ship radioman. It embodies portability and top-notch efficiency plus compact sturdiness. The fact that all moving parts are enclosed gives it freedom from exposure, making it practically "weather-proof," a very important feature for ship use. It will readily accomplish the same results as very much larger and more cumbersome short-wave equipment and that's something worth considering whenever moving day comes around.

The Pee-Wee is such a versatile little fellow that it need not only go to sea, but can also be a "landlubber." It will become a valuable piece of apparatus to any short-wave enthusiast "ashore" and many hams will probably be anxious to add it to their ever-increasing collections. Automobile radio owners may also find it a fit and useful adjunct to their present fine receivers. Tests have shown that it operates equally well on D.C. and battery operated sets with but 45 volts plate potential. The author has had no opportunity to try the adapter with an A.C. receiver and would be interested to learn the results of any such attempt.



**Interior view of the Maigret "first prize" short-wave converter, with one of the plug-in coils in place.**

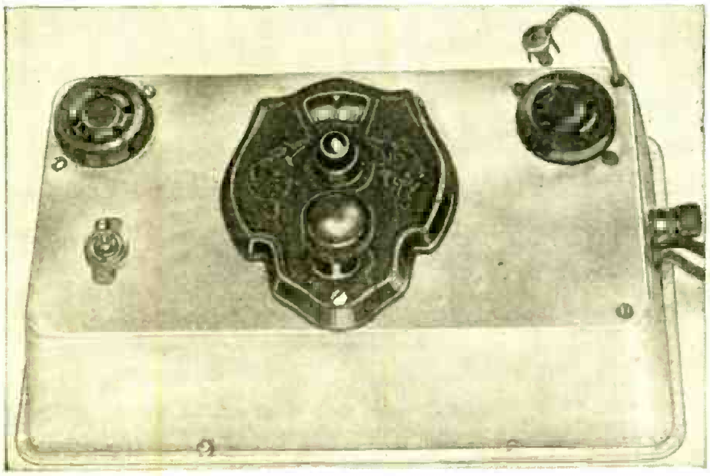
Used in connection with a standard marine two-stage amplifier on shipboard, the Pee-Wee delivers exceedingly loud signals and makes loud-speaker operation possible on many code and broadcasting stations; this with only 45 volts on the plate and three —'01A tubes.

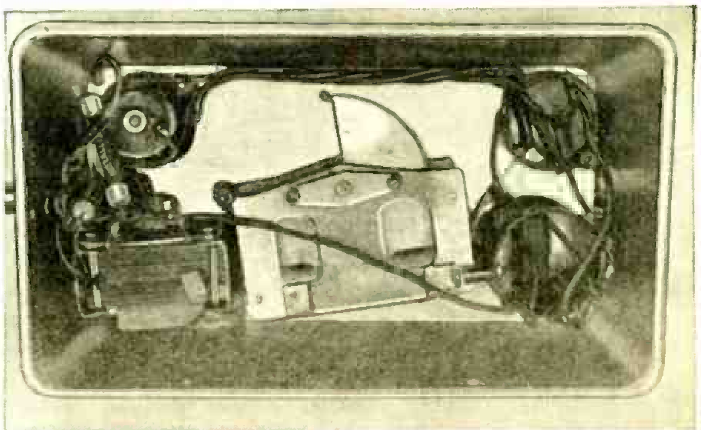
### The Circuit Used

The circuit is at once simple and popular, consisting of a plain regenerative detector with a variable capacity coupled antenna and variable capacity regeneration control. Midget variable condensers

(*Continued on page* 239)

# SECOND PRIZE—$25.00 Won by ARNO WILKINS, Reading, Pa.





The two photos herewith show front and inside view of "second prize" winner—a S.W. converter built in a "baking pan."

• THE short-wave converter here described is about as simple as one may be and still give results. A simpler one, using only one tube as an oscillator, may be built, but will give satisfactory results only on broadcast sets using an untuned first R.F. stage.

This converter uses an untuned first detector or mixing tube. The antenna is connected directly to the grid of the mixing tube, the only other connection to this being a 250,000-ohm resistor to ground for biasing. The customary antenna coupling condenser and grid-leak condenser have been omitted, as they only offer resistance to the incoming signal. The usual choke and condenser output is used, as without this the converter could only be used with broadcast sets having an ungrounded first R.F. coil primary.

The screen-grid tube as mixer is used, as its operation is more certain than a triode. No bias resistor is necessary in the cathode lead. A 25,000-ohm resistor is used for screen-grid voltage, but the customary filter condenser is omitted, as this allows a slight amount of regeneration in the mixer, thus increasing volume. If desired, the screen grid may be tied directly to B+, but volume is somewhat decreased.

(*Continued on page* 242)

# THIRD PRIZE—$12.50 Won by H. A. STAATS, Aliquippa, Pa.

• THIS adapter is very simple to make, requiring only about two hours of work. The parts are put as close together as possible to cut down "floor space." Connect it as shown, reducing the length of the wires as much as possible. The tube (an old one) is inserted, and the 48-to-50 meter coil put in place after the slide resistance (R4) has been adjusted to give 175 to 185 volts on the plate of the '24 tube when 6 or 8 milliamperes are flowing. The resistance R3 (which is much too high as wound) is decreased; soon a happy medium is found and the "Midget Marvel" should do its stuff. This adapter seems to work better with T.R.F. sets, and during the last three or four months has been bringing in the VK's, G's, H's, L's, VE's when some short and long wave combinations couldn't touch them. In this town we have several of these adapters, constructed from my drawings, which have made some very good records and have been sold for about $15.00, giving the constructors $10.00 for two hours work. All the tubes used are old tubes given to us by dealers—another use for old tubes.

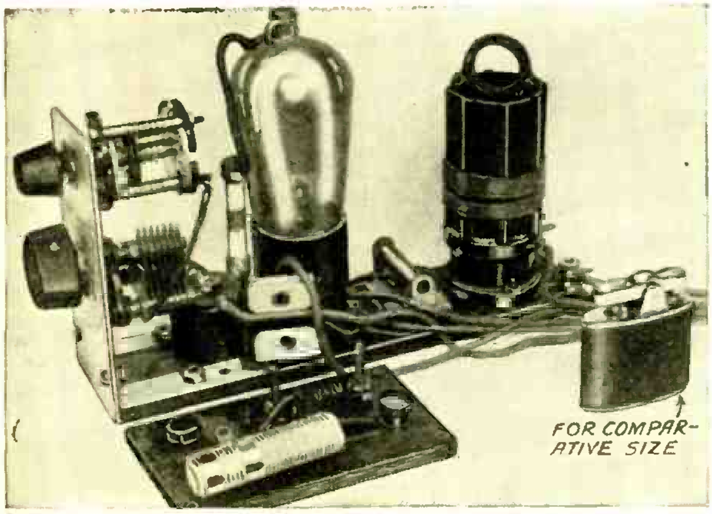
This circuit and the arrangement of parts were developed by the writer and various models for fitting into sets, under and on top of sets have been built during the last five months. This set first started to work December 20, 1931, and has been very successful since then.

We are now ready to wind the coils. They are all wound in the same direction and No. 22 D.C.C. copper wire is used.

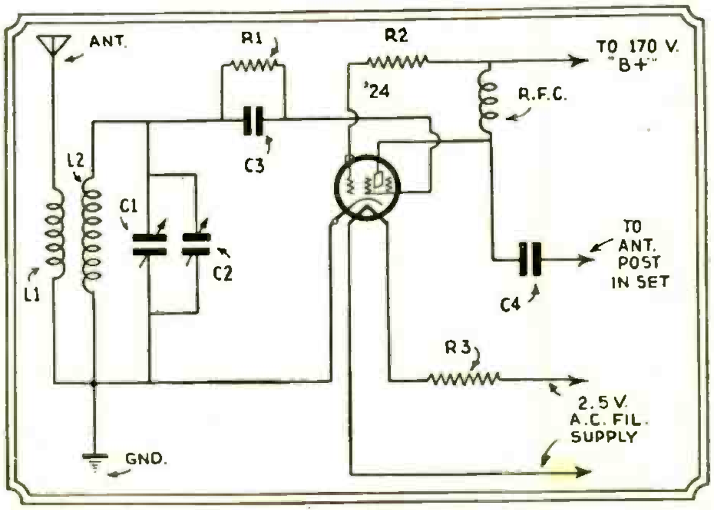
| *Meters* | *L1* | *L2* | *Spacing Between Coils* |
|---|---|---|---|
| 20 | 5 | 5 | ½ |
| 40 | 8 | 8 | ¼ |
| 70 | 12 | 12 | ⅛ |

All wiring is done with push-back wire and flex. wire; all joints soldered.

(*Continued on page* 242)




"Third prize" winner—another short-wave converter.




Wiring diagram for the "third prize" short-wave converter.

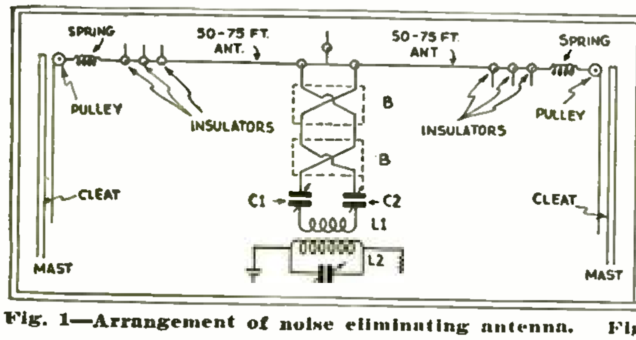



Fig. 1—Arrangement of noise eliminating antenna.

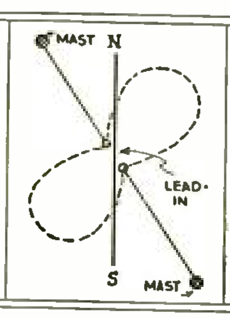



Fig. 1A—Directional effect.

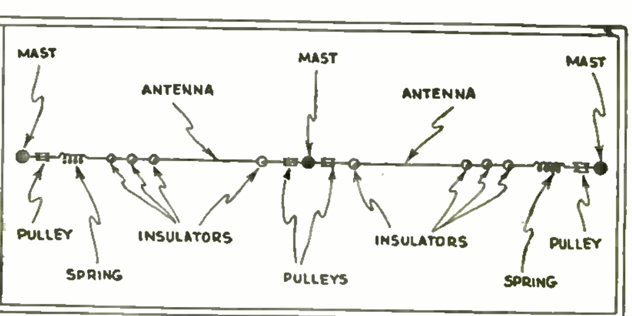



Fig. 1B—Improved short-wave aerial from top.

# Reducing Noise on Short Wave Aerials

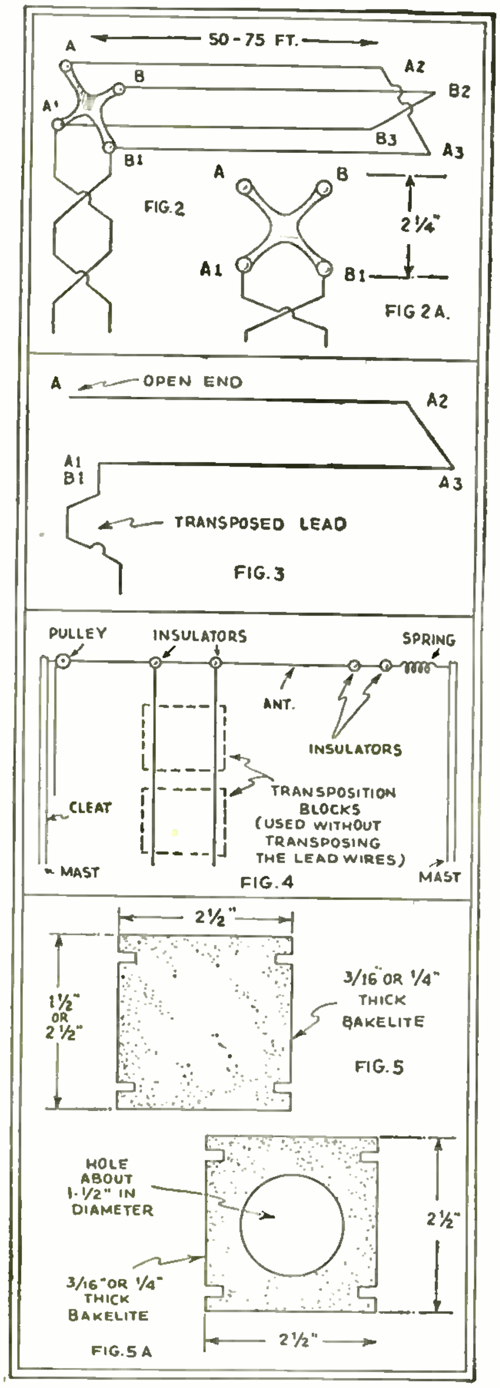
**By ARTHUR H. LYNCH**

● A RECENT investigation which has taken me over a four-thousand mile automobile trip and which has given me a real view of the important subject of background noise elimination is to be recorded briefly. I will give you the views of some of the experts who have been good enough to let me have the benefit of their experience, so that I could communicate it to you. In many cases this interest has been purely academic, but you are also to have the very practical views of such men as the radio buyer of one of the largest chain of department stores in the world. I will try, with the aid of the accompanying diagrams, to give you the essential elements for a suitable system. From this outline, you will be able to have a reasonable understanding of the subject and will be better able to apply the principles to your own needs.

At the outset, may I say that there is a great deal of misinformation being circulated on this important subject. It is generally assumed that any system of noise reduction will operate on all wavelengths, if it operates at all. It is also assumed that most systems of this nature are very much the same. It is impossible to cover the entire subject in a single magazine article, when it is considered that entire volumes have been written around it.

### More or Less in Review

Possibly there has been no more ardent crusader in the cause of noise reduction than Mr. Tobe Deutschman. He has been able to secure the co-operation of many of the radio publications, the manufacturers and even the more progressive electric light companies in his campaign for the elimination of man-made static. He has developed little gadgets which may be attached to all manner of noise producers, such as the ordinary vacuum cleaner, dictating machines, electric flashers and even automatic elevator systems. This method of killing the interference at its source is very helpful, but it is sometimes very difficult to find the source. It is doubtful that you would be able to attach noise eliminators to all your neighbors' oil burners, ice boxes, etc. I do not mean that these devices should not be applied where it is possible to locate the interference—they most certainly should. We all look to the day when manufacturers of electric devices for the home will not sell them without making these simple noise eliminators part of the original equipment.




Various details of improved short-wave "noise elimination" antennas.

The subject of noise reduction has been given attention and some very constructive suggestions have been introduced by Mr. Van Dyck, who now directs the technical affairs of the R. C. A. patent department; Prof. L. A. Hazeltine, the inventor of the Neutrodyne receiver; and George Furness, associated with National Carbon Company, as well as Dr. Alfred N. Goldsmith, vice-president in charge of engineering of the R. C. A. In fact, I had the honor of being a member of the interference elimination committee which was formed a few years ago and which included most of the above gentlemen. The subject of eliminating background racket is by no means new; it is as old as radio. Some of the systems which are being hailed as new and which are all covered over with a lot of pseudo-scientific ballyhoo are as old as radio, but that is another story.

### Where the Two Plans Differ

In nearly every case the attempt to reduce interference has been to kill the effect of the interference at its source. There have been exceptions, but, in general, that statement is quite true. Very little general attention has been given to the subject of reducing interference by means of improved antenna systems. Here, again, there have been outstanding exceptions, such as the antenna systems developed by the R. C. A., Amy, Aceves and King; the General Motors Radio Corporation; Silver-Marshall and the recent vigorous campaign which has been undertaken by the Kolster Radio Corporation. In most of the preliminary work along this line, the antenna systems have been rather complicated and many of them have been designed for use in connection with a group of broadcast receivers, rather than having been designed to meet the needs of the short wave and television experimenter.

In the application of any of the noise reducing antenna systems a few facts which are very helpful and important are often misinterpreted. For instance, it is sometimes thought that the introduction of this or that type of antenna system is all that is necessary to kill all interference. Slight reflection will indicate the error in such a conclusion.

Let us suppose that a rather sensitive

(*Continued on page* 243)

# How to Become a Radio Amateur

By JOHN L. REINARTZ

## Adding the Vacuum Tube to Your Receiver

No. 2 of a Series

● IN the first article we told how to build a receiver that used a crystal detector. This set, while good for local stations up to a distance of 25 miles, is hardly satisfactory for cross country reception. This can only be accomplished with the aid of a vacuum tube as a detector. We designed the receiver so that we can with very little trouble and expense add a vacuum tube to it. This will make the receiver much more sensitive than it could possibly be when we used a crystal detector.

You will remember that when we connected the coil in the receiver to all the switch points and to the tuning condensers, we left one portion of the coil unused, also the three binding posts at the top of the panel. These we will now make use of. We also change one connection to the right-hand condenser looking at the rear of the panel. The condenser we used across the phones will come in handy as a grid condenser. The only things we will have to buy will be a socket, a 6-ohm filament rheostat, four dry cells, a 45-volt "B" battery, a 2-megohm grid leak and holder or mounting and a type '01-A vacuum tube. These things we will connect in the manner shown in Fig. 1. It will be noticed that the condenser we used as a primary tuning condenser in the crystal set is now used as a regeneration control condenser and connects between the aerial wire and switch point number four of the set in the upper right-hand side when looking at the rear of the panel, while the switch lever of that set of switch points now connects with the plate connection on the socket for the tube.

The socket we will mount on the baseboard just back of the coil; all connections to it will then be as short as we can get them. The lever of the left-hand set of switch points, looking at the rear of the panel, now connects to the grid condenser and grid leak instead of to the binding post at the top left corner of the panel, and from the grid condenser and grid leak the connection continues to the grid connection on the socket. Still looking at the rear of the panel, we connect the upper binding post in the left-hand corner to a choke coil made up on a form an inch in diameter and three inches long and having a single layer of No. 28 or 30 double cotton covered magnet wire on it, the other end of this choke coil connecting with the plate connection on the tube socket. The binding post under the one we have just used connects with the top binding post of the two that we have added in the lower left-hand corner of the panel, the bottom binding post of this set conecting with the bottom binding post of the two that we have added in the right-hand corner at the bottom of the panel.

This same connection continues to the bottom binding post in the upper right-hand corner and also to the positive filament connection on the tube socket, the negative connection on the tube and socket connecting to the upper binding post of the two in the lower right-hand corner, having in series with it a 6-ohm rheostat for controlling the current to the filament of the tube. Our connections are now all made and it is only necessary to connect our aerial, ground, phones and "A" and "B" batteries to the front of the panel, which now looks as in Fig. 2. The "A" battery consists of four dry cells connected in series and the "B" battery is a 45-volt battery of any good make. A large size is desirable.

To tune the receiver we use the right-hand condenser, while the left-hand condenser is used to gently bring the regeneration up to a point where the reception is loudest, yet clear. If we use too much regeneration the received signal, be it voice or music, will get "burry," so we reduce the regeneration down to the point where we have the best signal strength and still have good quality. Should we turn the regeneration condenser too far we will get only a musical note, the pitch of the note depending on the difference in frequency between the station signal and the frequency generated by the receiver itself. When in that state of oscillation the receiver is used by amateurs to copy code.

The switch lever in the center of the panel is placed on that switch point which by trial gives the best results as to signal strength and sharpness of tuning. The longer your aerial, the fewer turns you need in the aerial tuning coil. Start off by using the middle switch point and trying first one and then the other on each side of it, retuning with the tuning condenser slightly each time to get the best adjustment. The upper right set of switch points is to make larger wave-length changes, the lowest switch point being for the 100-meter range and the third upper for the longer waves around 500 meters. The upper left set of switch point is for the control of regeneration, being set by trial. If the regeneration condenser has to be turned nearly all the way in, use the lower of the four points. The best setting is where regeneration occurs near the center of the dial. A little experience will enable you to find the best setting.

There are times when we wish to tune to frequencies other than those the coil is built for. To be able to do this we have provided three binding posts at the top of the panel. You will notice that two switch levers have one switch point that connects with one binding post, the one in the center of the panel being to the extreme right and the other being the top switch point. When we wish to use these binding posts we connect to them a coil made up as follows: On a three-inch diameter cardboard tube wind with No. 24 magnet wire, in a jumble fashion, 15 turns, make a loop for a connection, wind 45 turns and finish; call the start of the coil one, the loop two, and the end three; connect from left to right to the binding posts, one, two, three. Place the switch levers on the points that connect with these binding

(*Continued on page* 249)

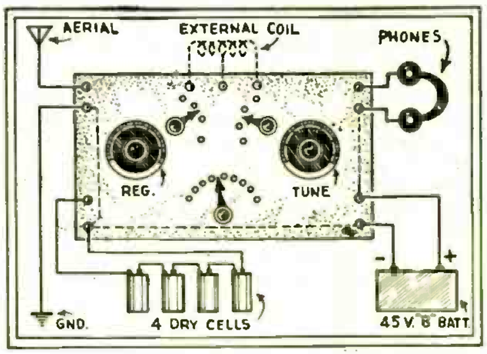



Fig. 2—Front panel view of amateur's short-wave receiver with vacuum tube, batteries and phone hook-up.

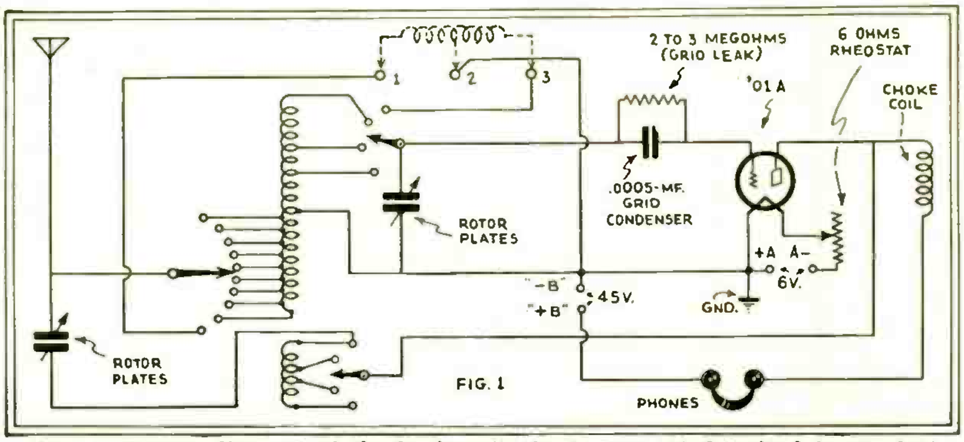
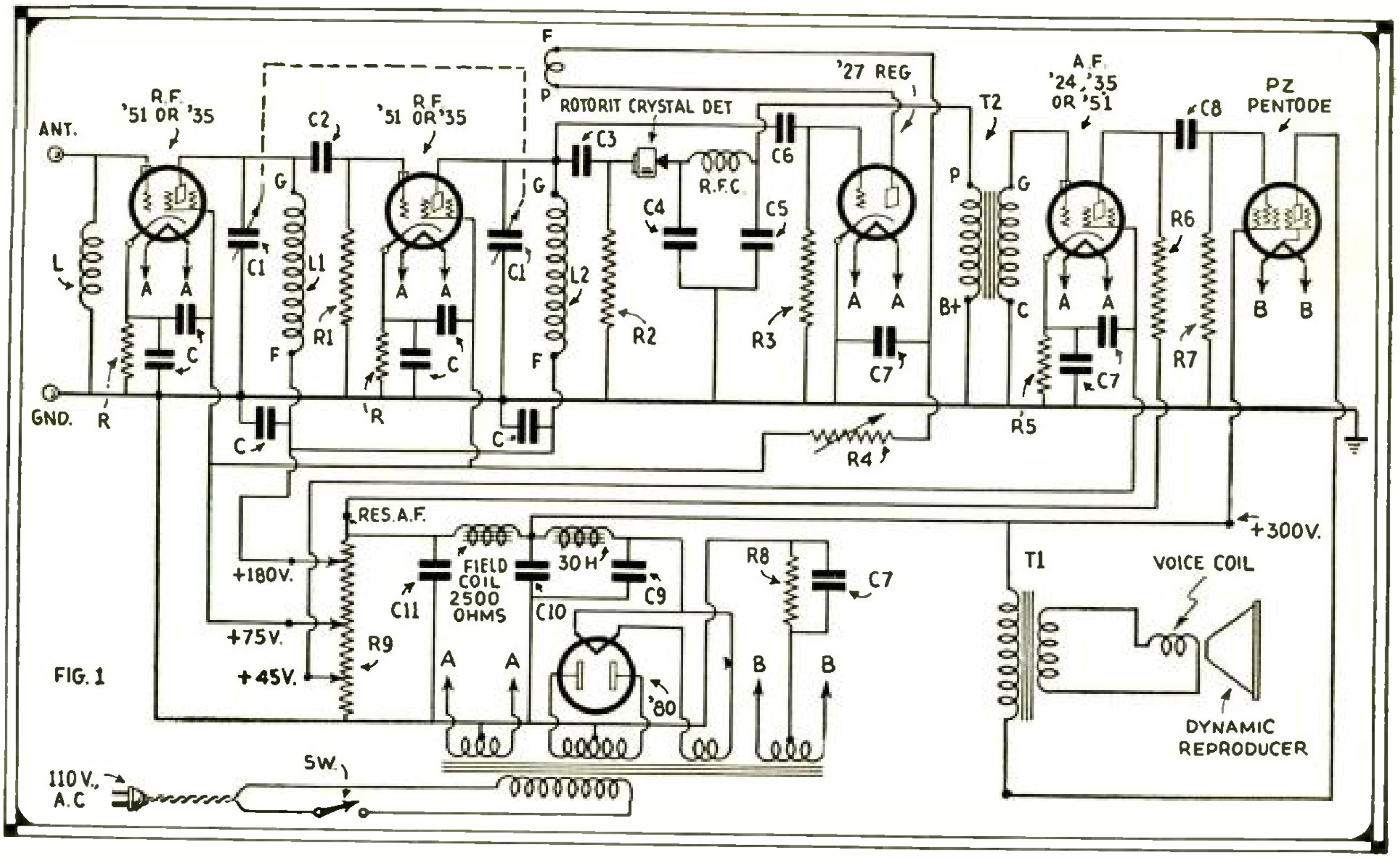



Fig. 1—Wiring diagram of the beginner's short-wave set described in the last issue, here arranged for vacuum tube detector.




The short wave receiver circuit here illustrated involves the use of 2 R.F. stages placed ahead of a crystal detector, with a separate tube to provide controllable regeneration. Two audio stages are also used.

# The Rotorit Crystal Detector Circuit for Short Waves

**By R. WILLIAM TANNER**

The author claims better quality and other features for this novel short wave receiver circuit, in which a crystal detector is used and benefits of regeneration are afforded by a separate regeneration tube. Mr. Tanner states that the selectivity and sensitivity are very satisfactory.

● A NEW crystal detector has made its appearance in this country under the name of *Rotorit*. It is a product of chemical synthesis and an invention of Dr. Hugo Graf, of the German Telefunken Co. The Rotorit is an extremely sensitive device and is highly stable, the crystal having at least 40,000 receptive points. The rectifying unit itself is approximately ⅜ inch in diameter by ¾ inch long, and, when mounted in the *Rotordetector*, is capable of being rotated so that the contact wire can cover any point. The contact wire can be adjusted either up or down by means of a small knob on the top of the unit. The pressure of the contact wire upon the rectifying unit is also adjustable by means of a small lever at the lower end of the detector mounting. These three adjustments make it possible to obtain the best rectifying action at all times while receiving.

The *Rotordetector* is provided with jacks and plugs for easy mounting and the small dimensions, 2 inches high by 1½ inches in diameter, make for compactness.

The writer obtained one of these new crystal detectors in order to work out the design of a sensitive short-wave receiver. The circuit is depicted in Fig. 1. A total of five tubes, plus a '80 rectifier, is employed, a '35 (or '51) untuned R.F. stage, a '35 (or '51) tuned R.F., a '27 regeneration tube, '24 first A.F. and a pentode power stage.

The antenna is coupled to the first R.F. grid through a choke, L. The plate circuit of the first R.F. is tuned and coupled to the second R.F. grid through a very small condenser, C2. The second R.F. plate is also tuned and coupled to the crystal detector through another small condenser, C3.

The plate of the second R.F. is also coupled to the grid of a *separate regeneration* tube, which is controlled by the variable resistor R4. The tickler, L3, in the regeneration tube plate circuit is wound on the same form as the R.F. plate coil L2.

The output of the crystal detector is filtered, allowing the R.F. current to go to ground and the A.F. current to feed into the screen grid A.F. stage through a transformer, T2. The first A.F. tube is resistance-coupled to the grid of the pentode power stage. A dynamic speaker is employed, the 2,500-ohm field being made a part of the filter in the power pack.

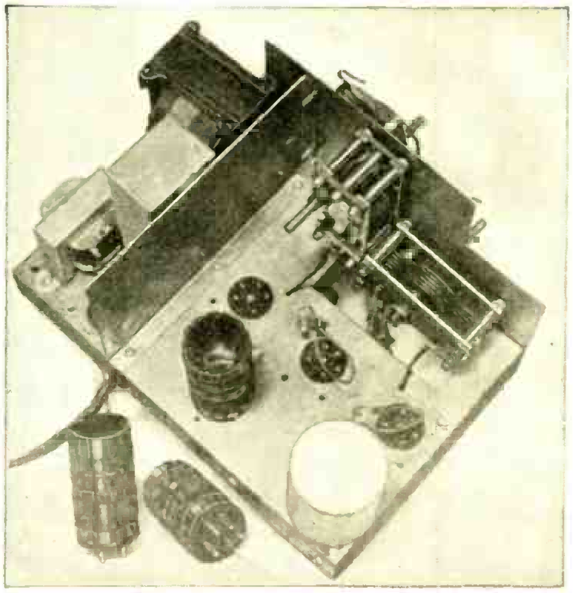
Before going into the constructional details, it would be well to answer a question which would arise in the minds of some readers. That question is: why use a *crystal detector* and a *separate regeneration tube* when this tube could function both for detection and regeneration? When a tube detector is brought up to and beyond the point of oscillation, an *audio howl* is generally the re-

(*Continued on page 247*)

# The "Newark" Short-Wave Converter

This converter uses three tubes including an oscillator plus an '80 rectifier. Plug-in coils are used to change wave bands and a stage of I.F. amplification is included.

**By M. HARVEY GERNSBACK**



Appearance of the short wave converter chassis.

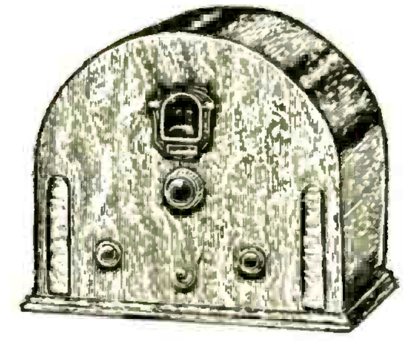
● THE last year has seen the development of the short-wave converter, operating on the super-heterodyne principle, to a high degree of simplicity. In the converter here described the conventional arrangement of using two separate coil forms, one for the modulator tube and one for the oscillator tube, has been simplified by placing the two coils on one form. By using this method it is necessary to change only one coil when tuning to a different wavelength band.

The converter contains, in addition, a stage of I.F. amplification. The chassis utilizes four tubes in all: a modulator, an oscillator, an intermediate frequency amplifier and a rectifier.

The use of the rectifier tube in conjunction with the built-in power unit makes the converter independent of the broadcast receiver supply.

Three plug-in coils are used to cover the short-wave range. Only one coil is changed when shifting from one band to another; there are six contacts on each coil form. Five of the contacts are made through a five-prong UY base on the coil forms, while the sixth contact is made through a special wiping contact on the side of the coil form.

The forms are tubular, with an outside diameter of 1½ inches and a length of 2¾ inches.



The converter is housed in a very neat cabinet.

### Coil Winding Data

| *Coil* | *Turns* | *Type Winding* | *Wire Size* | *Range, meters* |
|---|---|---|---|---|
| 1 | Ant. 10. Mod. 34. Plate 13, Grid 20 | Tight wound | No. 24 | 80-200 |
| 2 | Ant. 9. Mod. 20. Plate 11, Grid 13 | Tight wound | No. 22 | 45-85 |
| 3 | Ant. 8. Mod. 7. Plate 8, Grid 7 | Spacing of 1 wire thickness | No. 22 | 15-49 |

Coupling between the oscillator and the modulator circuits is effected by introducing the oscillator output into the modulator circuit through the screen grid of the modulator tube. The stage of I.F. amplification incorporated in the converter is sharply tuned and has a high gain. It should not be thought of merely as a coupling stage, as it materially adds to the sensitivity and selectivity of the whole system. The resonant frequency of the I.F. stage can be varied between 900 kc. and 1,100 kc. by adjusting the trimmer condenser C1, located at the back of the chassis. This operation is performed by means of a wooden screw driver. For best results, the circuit should be resonated in the vicinity of 1,000 kc., as highest amplification will be obtained from the I.F. amplifier at this frequency. However, if there is a strong broadcast signal operating on this frequency, any other frequency between 900 and 1,100 kc. may be selected by properly adjusting condenser C1.

### Coil Winding Data for I. F. Transformer and R. F. Choke

I.F. Transformer: Form 1⅛" x 3". Primary, 700 turns No. 36 single silk enameled wire. Secondary, 130 turns No. 28 enameled wire.

There is no inductive coupling between primary and secondary; all coupling between these coils is effected by a 10 to 15 mmf. condenser.

R.F. Choke: 300 turn duo-lateral. No. 36 single silk enameled wire.

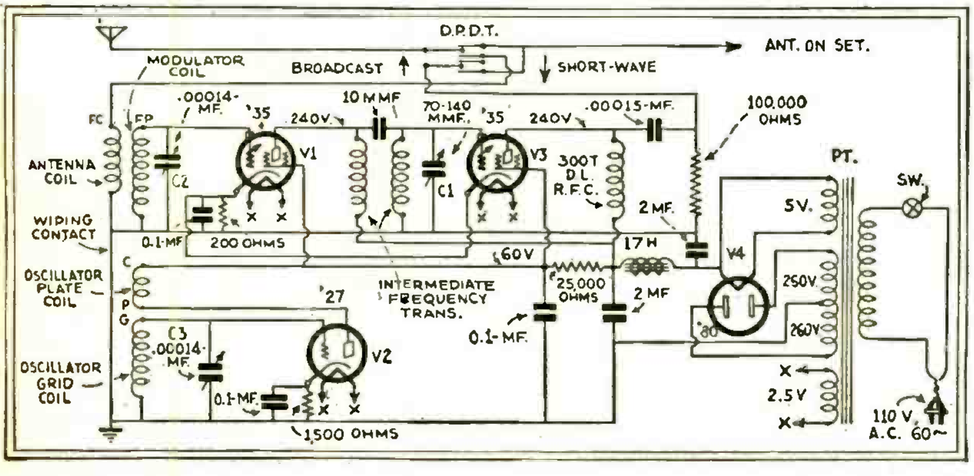



Diagram of the connections used in the Newark Short Wave Converter which includes an I.F. stage.

### Controls

The main tuning control is located at the center of the front panel, at the left is the modulator tuning knob used for vernier adjustments. On the right side is another knob controlling a D.P.D.T. switch. Under the main tuning control is the power supply switch.

The function of the D.P.D.T. switch is to connect the aerial to the converter's input and the converter's output to the broadcast receiver when the switch is at one position, or to connect the aerial directly to the broadcast receiver and to disconnect the converter when the switch is in its alternate position. The use of this switch makes it unnecessary to change the aerial wire from the converter to the broadcast receiver everytime the converter is turned off. The switch performs this operation.

(*Continued on page* 245)

The fair sex can enjoy a short-wave PHONE transmitter. The 10-watt transmitter here described has carried voice and code hundreds of miles.

# 10 Watt C. W. or Phone Transmitter

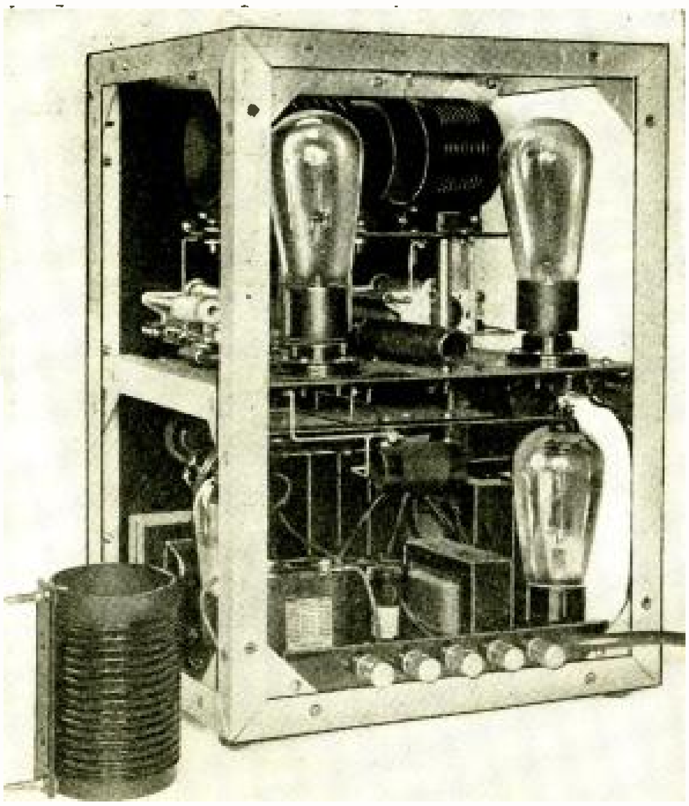
## By G. LEONARD WERNER

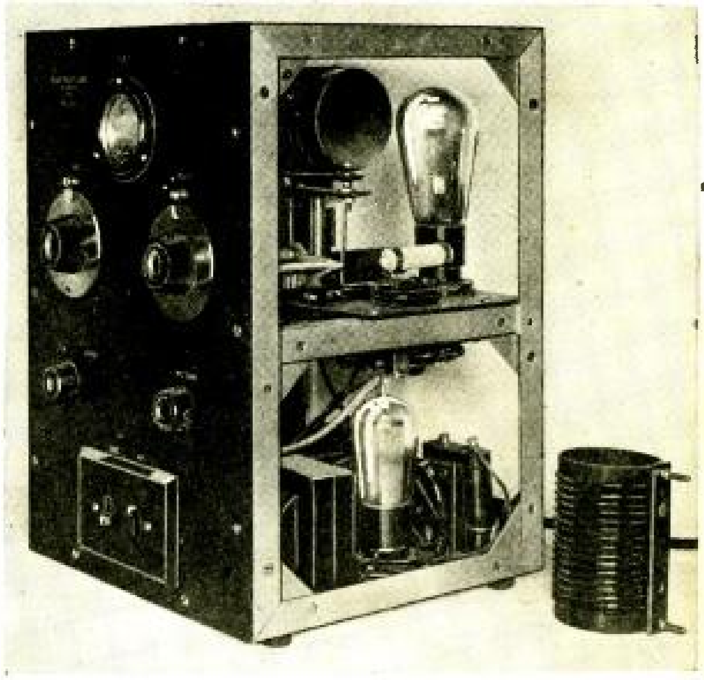
**The Universal Transmitter designed by Messrs. Werner and Blair is exceedingly efficient. The following are a few of the stations worked during the first week the transmitter was on the air: EAR116 (Spain), 40-meter C.W.; W4IU (North Carolina), 160-meter phone; W8ACI (Pennsylvania), 160-meter phone; W7LZ (Oregon), 40-meter C.W.; W2ZZAT, Expedition in Yucatan, kept schedule on 80-meter C.W. Although the output of this transmitter is only 10 watts, it is capable of reaching out to very great distances, not only on C.W. but also on phone. Incidentally, this job is light, compact, and comparatively inexpensive.**

● THE low power universal transmitter described in this article represents the most advanced design for this class of equipment. The circuit employs a '24 speech amplifier, resistance coupled to a pentode modulator which feeds into a pentode oscillator. The rectifier is a full-wave '80 type tube. The output of this transmitter is rated at 10 watts. The power equipment specified has a 75 per cent overload safety factor. The antenna system is of the absorption type. The oscillator is of the well-known Hartley design, with slight modifications, readily noted from the schematic diagram. The Heising or *plate modulation* system is used. An important feature of the design is the fact that one power supply and a single source of bias are used throughout.

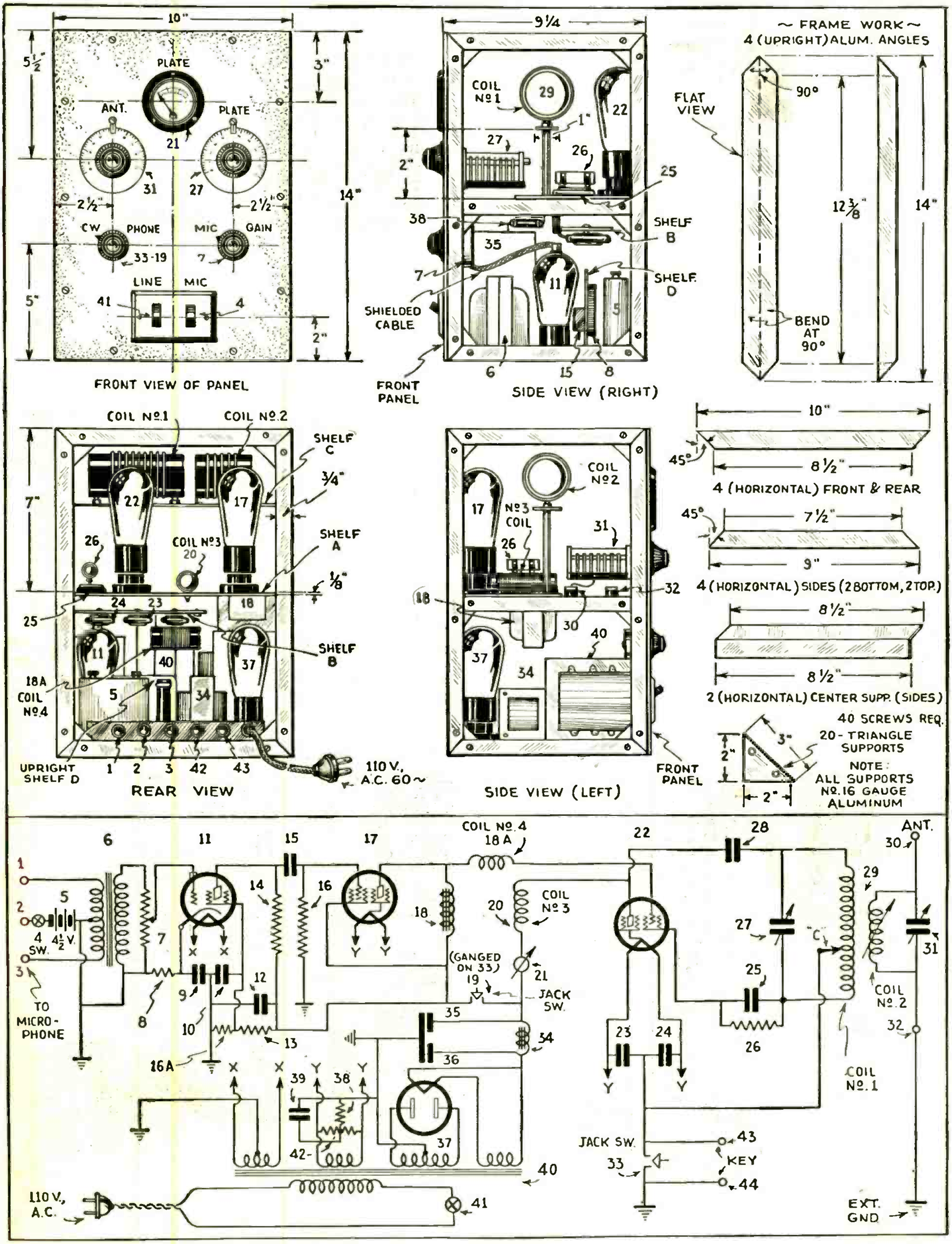
A convenient switch on the front panel permits rapid change from C.W. to phone. The switch, when on "phone," shorts the key and cuts in the modulator. When at the "C.W." position, it cuts out the modulator and speech amplifier, so that only the oscillator is used, with key control. A calibrated listening monitor or a wavemeter should be used to check the wavelength accuracy.

The transmitter is tuned by means of two .000365-mf. condensers, one being used in the tank circuit and the other one in the antenna circuit. Resonance is brought about by increasing or decreasing the capacity of the plate condenser (27). It will be found that when using any band from 20 to 160 meters, tuning to the wavelength desired is attained with the greatest ease and facil-

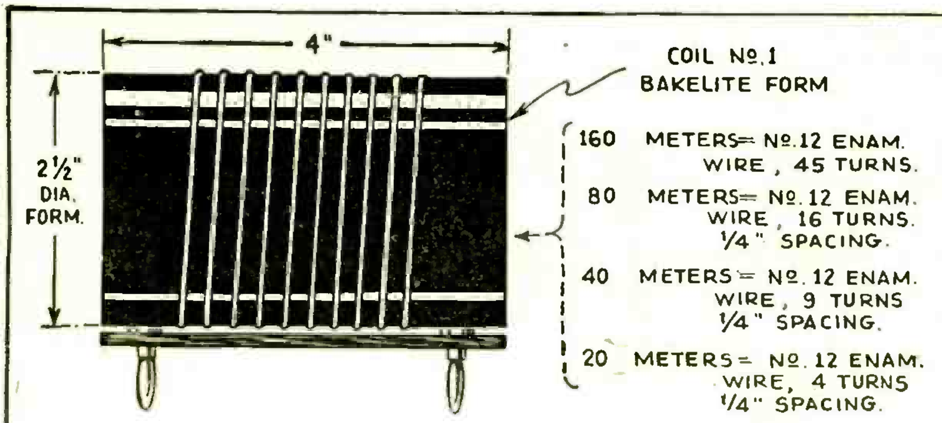


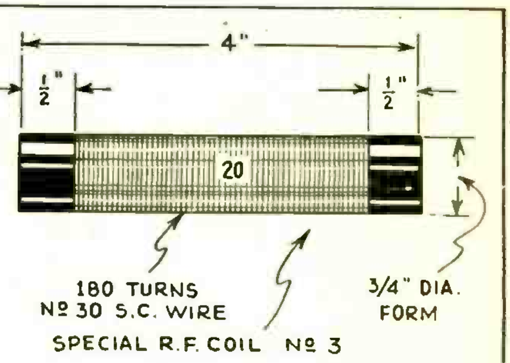


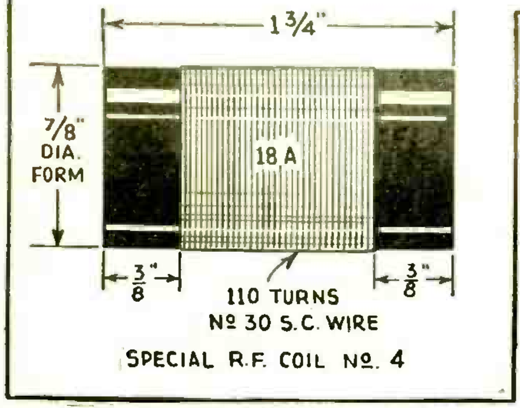
The photos above and at left illustrate the simple, businesslike appearance of the 10-watt universal short-wave transmitter. It is provided with simple switches for changing from C.W. (code) to phone transmission. Ordinary tubes such as those employed in receivers are used, viz.: two PZ pentodes, one '24 screen grid tube and an '80 rectifier.



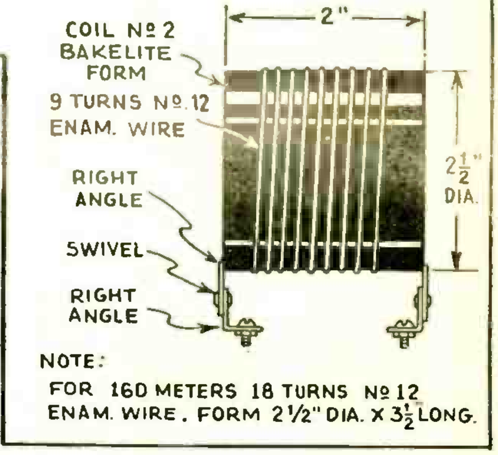

The 10-watt C.W. or phone transmitter is shown in schematic form above, together with details of the supporting frame and assembly.




**The drawing herewith contains the winding data for construction of the various coils used in the 10-watt universal C.W. or phone transmitter here described. Full detailed instructions are given in the drawings accompanying this article, and while this job is not crystal-controlled, for those whose pocketbook permits the luxury of a crystal oscillator for maintaining frequency stability, they may refer to the article by John Brennan, Jr., described in the last issue of SHORT WAVE CRAFT. The cost of the parts for building this transmitter is very small, compared to the efficiency and powerful output of the resulting transmitter.**




ity. It is simply a matter of plugging in the coil for the band desired, attaching the negative return clip "C" to coil No. 1 near the grid end and tuning the condenser to the resonant point. At this time, it will be noted that the milliammeter will show a reading of from 20 to 30 mils. While performing this operation, the antenna should be disconnected from the transmitter. By varying the position of clip "C," either nearer to or further away from the grid end of the coil, it is possible to locate the point of maximum efficiency actually reached when the current drain is between 20 and 30 mils. After this is done, compensation must be made still further, by tuning the plate condenser. If crystal control is desired, this may be added by changing the oscillator circuit as shown in Fig. 4 in the July issue of SHORT WAVE CRAFT, on page 146.

The antenna coil, as described, will operate efficiently for 20, 40 and 80 meters. For 160 meters a larger coil must be substituted, wound according to the directions given in Table No. 1. The variable condensers (27 and 31) can be used to tune all coils from 20 to 160 meters. As mentioned above, the antenna system is of the absorption type. For an efficient means of tuning the antenna circuit to resonance with the plate circuit, the following is suggested: Rotate the antenna coil 2 about three-quarters of the way out of the maximum-coupling field. This coil is arranged on swivels, so that it can be moved through an angle of 90 degrees. When directly opposite coil 1, maximum coupling is attained. Then, starting from minimum capacity, slowly turn the antenna condenser (31) until the milliammeter reading increases slightly. Of course, tuning of the antenna circuit must be done with the antenna connected. Incidentally, this transmitter can be worked on most types of amateur antennas.

Next, for still greater absorption into the antenna itself, place the antenna coil into a position almost even with the tank coil and turn the antenna condenser until a position of maximum current is shown. Then slightly detune the antenna condenser so that there is a decrease of 15 per cent in the current indicated.

The universal 10-watt transmitter is built on a rugged aluminum frame, 10 inches wide by 14 inches high by 9 inches deep. The microphone and the key are connected to binding posts at the back of the transmitter. The frame is grounded, while the antenna is connected to a binding post located alongside of condenser (31). The switch for changing over from phone to C.W. is conveniently located on the front panel. This panel also carries the milliammeter, the microphone gain control, the tuning dials for the variable condensers (27 and 31), and the microphone and line switches.

In constructing the transmitter, the first step is to assemble the framework. The four upright aluminum angles are rigidly bolted to the various horizontal angles, using the triangular aluminum supports at each junction as shown in the illustrations. There are twenty of these triangular supports, each fastened with two small bolts, thus making a total of 40 bolts used in the framework, not counting the ten machine screws used in fastening the panel.

The 10 x 14 x ⅛ inch bakelite panel is next drilled for the meter, the flush toggle switch, the change-over switch and the gain control potentiometer, and these parts are mounted. Holes are also drilled for mounting the two variable condensers and these are also fastened to the back of the panel. The panel is then secured to the aluminum framework.

A bottom baseboard, 9¾ x 8¾ x ¼ inch, is next fitted within the aluminum framework. This is not fastened down, however, until the various parts have been mounted on it. In other words, the parts are mounted on the board first and it is then placed in position inside the framework and fastened securely in place. The illustrations show the location of the power transformer (40), microphone transformer (6), electrolytic condenser (39), sockets (11) and (37), and various other components which go on this baseboard. Note that the upright shelf "D" is supported at the rear of the bottom baseboard by two small right-angle brackets.

Shelf "A" is prepared next. This consists of a piece of bakelite, 5⅝ x 10 x ⅛ inch thick. Sockets (22) and (17) are mounted at the rear of this shelf, as shown. This shelf also carries the grid leak (26), the grid blocking condenser (25), the plate blocking condenser (28), and the R.F. choke 3. Modulation audio choke (18) is fastened to the bottom of shelf "A." The support posts for shelf "C" are fastened to the front part of shelf "A" as indicated in the sketch. These posts consist of pieces of brass tubing, ¼ inch in diameter and 2¾ inches high. Shelf "C" consists of a piece of bakelite 7¾ x 1 x ⅛ inch thick. This shelf is used to carry the tank coil (coil 1) and the antenna coil (coil 2). Pin-jacks are provided for the tank coil, as this is a plug-in coil. As mentioned previously, four different coils are used for 20, 40, 80 and 160 meter bands respectively. The antenna coil is not of the plug-in type but is arranged so that it can be rotated away from the tank coil. This is accomplished in a simple manner by using four small right-angles, two fastened to the shelf and two fastened to the coil. Each pair of angles is linked by a small bolt, so that the coil swivels readily. The various coil constants are given in table No. 1.

Shelf "B" is fastened beneath shelf "A," with all parts mounted on its underside. This shelf is a piece of bakelite 5 x 3 x ⅛ inch. It carries the R.F. choke

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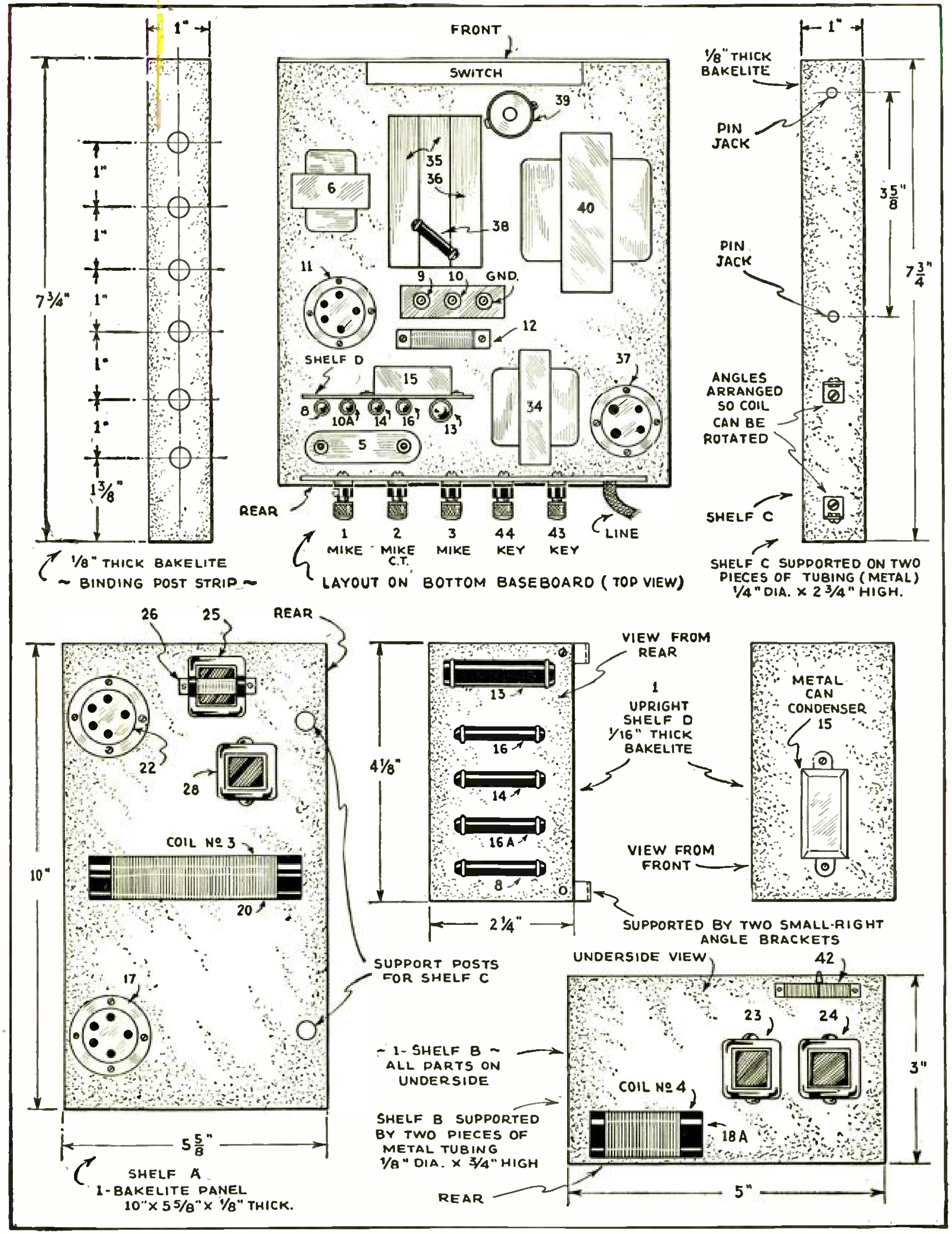



The drawings above show details of terminal strip, apparatus layout on base-board, shelf "A" and other details of the 10-watt transmitter.

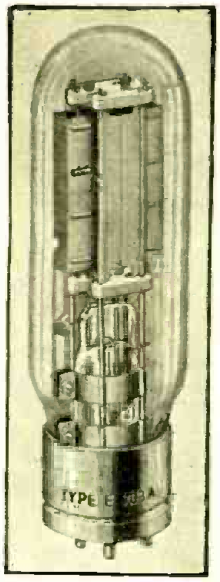


Fig. A. New Arcturus No. E703A transmitting tube.

# New Tubes for the TRANSMITTING AMATEUR

By LOUIS MARTIN

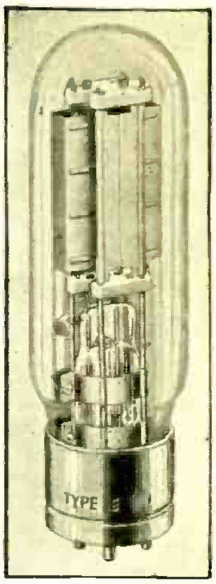


Fig. B. Another new Arcturus transmitting tube.

In the past three months literally dozens of new tubes have made their appearance on the radio market. It takes an expert to tell which tubes are useful, especially for short-wave applications, and the editors feel that they were indeed fortunate to prevail upon Mr. Martin, who has made a special study of all the new tubes, to prepare this special article describing the new transmitting tubes of interest to short-wave fans.

● WITH the deluge of new tubes designed for receiving sets in the broadcast band, the short-wave transmitting amateur seems to have been left out in the cold. However, this is not exactly so; there are some manufacturers who produce tubes that *are* suitable for short-wave transmission purposes.

In the July issue of this publication, there were described several new tubes suitable for short-wave receiving work. In this article, the author pointed out some of the factors which determine the usefulness of a tube for such work. The effects of tube capacity, shielding, etc., were discussed in detail, and while they apply to some extent to transmitting work, there are other considerations which must be faced.

The primary function of a tube that is generating oscillations is to act as a source of high-frequency power that may be radiated into space, the frequency of these oscillations being determined by the product of the inductance and the capacitance of the tank circuit. While the method of coupling the radiating system to the tank circuit may vary (and is even determined by law!), the fundamental function of the tube—that of generating oscillations—remains unchanged.

### Internal Tube Capacitance

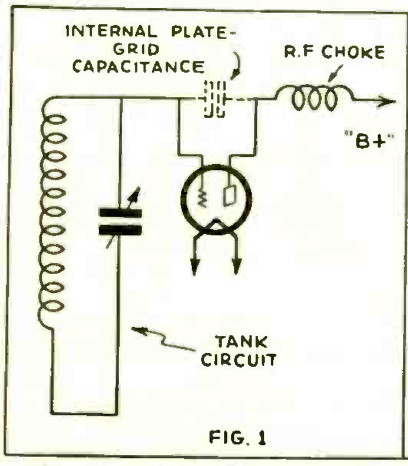
Oscillating circuits may roughly be divided into two classes: (1) those which depend for their action upon tube capacitance; (2) those which do not depend for their action upon tube capacitance. In the first case, an impedance, in the form of a choke, is placed in the plate circuit of a tube, the energy generated being fed back to the grid circuit via the plate-grid capacitance of the tube. A simplified circuit of this idea is shown in Fig. 1. Now it is clear that the greater the tube capacitance the greater will be the energy fed back, and hence the greater the power available. This system has, of late, been discarded because of the deleterious effects of tube capacitance, which will be discussed later.

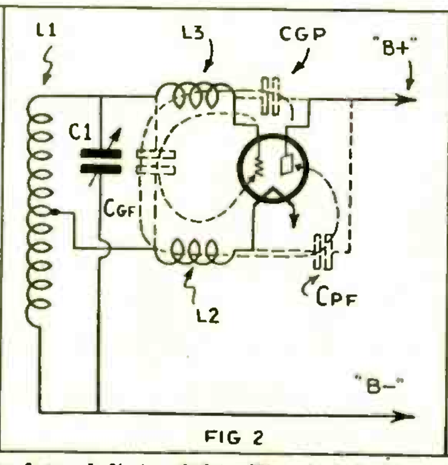
In the second case, energy is fed from the plate to the grid circuit by means independent of tube capacitance; an example is the familiar tickler arrangement used so often. As pointed out in the article referred to above, the input capacitance of a tube depends not only upon the geometric grid-filament capacitance but also upon the amplification factor (mu) of the tube. It was also pointed out that the size of the grid-filament capacitance (in reality the input capacitance) determines the highest freqency that the input (tank) circuit may be tuned to. Thus, it is seen that as the frequency of the oscillator is changed slightly (in order, for instance, to get off an interfering carrier) the input capacitance of the tube changes (increases with increasing frequency) and, at the low tank-condenser settings, actually determines the frequency of transmission. This would not be so important were it not for the effects of *spurious* or *parasitic* oscillations.

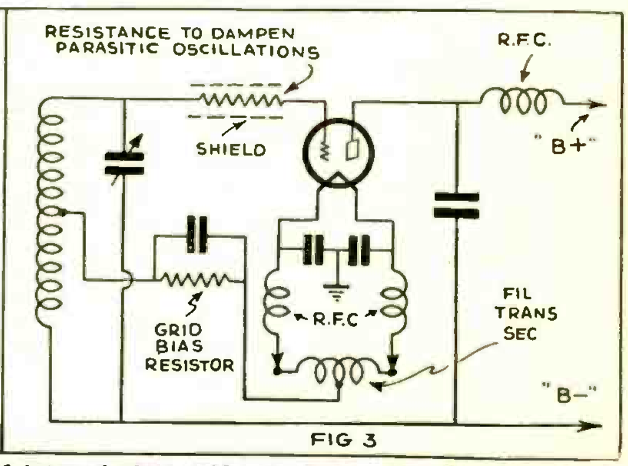
### Parasitic Oscillations

As mentioned above, the frequency of an oscillating circuit is determined by the values of the inductance and capacitance of the oscillating circuit. In any oscillator, at least two oscillating circuits exist: (1) that which is intentionally introduced by the designer, and (2) that which exists by virtue of the distributed capacitance of the circuit, input tube capacitance, inductance of the leads *within* and *without* the tube, etc. This idea is depicted in Fig. 2.

Both L1 and C1 constitute the tank circuit which is intentionally inserted by the designer; L2 and L3 represent the distributed inductance of the tube and associated circuit, and Cgf, Cgp, and Cpf represent the internal tube capacitances. Besides the power generated in the oscillating circuit, oscillating power is also generated about the paths determined by L2, L3 and the associated *parasitic* capacitances Cgp, Cgf, and Cpf. Power *is* generated because of the




Diagrams above show respectively from left to right—Fig. 1, relation of internal plate-grid capacitance; Fig. 2, relations of Cgp, Cgf and Cpf in a tube generating parasitic oscillations. Fig. 3—Use of chokes and by-pass condensers to nullify parasitic oscillations.

inductance and capacitance formed by the parasitic constants. It is clear that this power is entirely wasted as far as useful radiating energy is concerned, because it is radiated at a frequency considerably higher than that determined by the tank circuit.

On the other hand, if the desired radiating frequency is *very* high, then the power generated by the parasitic circuit may approach that generated intentionally, with the result that only a fraction of the total power generated is used to advantage.

Either the parasitic oscillations are generated because of the tube constants or because of external constants. If they are due to the latter, then good design demands that chokes and bypass condensers be inserted at strategic points in the circuit as indicated in Fig. 3. In this figure, only the simple points are bypassed, as the exact location will depend upon circuit conditions. In all cases, however, the oscillating plate current should be kept in the plate circuit, the oscillating grid current in the grid circuit and the tank current in the tank circuit.

If the oscillations are due to the tube, then only the manufacturer is able to reduce the undersired parasitic oscillations.

Figure A shows a typical transmitting tube known as the type E703A. It is rated nominally at 50 watts and has the following characteristics:

Filament voltage, 10 volts; filament current, 3.25 amperes; plate current, 72 milliamperes; plate resistance, 5,000 ohms; transconductance, 5,000 micromhos; mu, 25; plate to grid capacitance, 15 mmf.; input (grid to filament) capacitance, 8 mmf.; plate to filament capacitance, 7 mmf.

When in an operating condition, the following characteristics obtain:

Modulated D.C. plate volts, 1,000 volts; non-modulated plate voltage, 1,250 volts; A.C. plate voltage (R.M.S.), 1,500 volts; D.C. plate current, 175 ma.; maximum plate dissipation, 100 watts.

Let us see what the above characteristics mean, An examination of the tube capacitances reveals that for three-element tubes they are quite low. One reason is that Arcturus separates the leads within the tube so that internal capacitances are a minimum. This is indicated, one way, by the socket connections of Fig. 4. Note that the grid and plate prongs are placed diametrically opposite. A family of plate voltage—plate current curves appear in Fig. 5.

### The E711

Figure B is a photograph of the Arcturus E711, 50 watt transmitting tube. The general characteristics of the tube are the same as for the E703A described above with the following exceptions: The plate resistance is 3,400 ohms; the transconductance (mutual conductance), 3,530 micromhos; and the mu, 12.

In view of the lower plate resistance, the family of plate voltage—plate current curves is shown in Fig. 6.

In this, as well as in the E703A, the grid bias is preferably obtained by an automatic biasing resistor as shown in Fig. 3; this method automatically compensates for variations in plate current. This is recommended especialy when several tubes are operated in parallel, in which case a separate bias resistor for each tube should be used. To prevent parasitic oscillations in this and the type E703A, a small R.F. choke or resistance of about 100 ohms should be inserted in series with the grid lead, as close to the grid terminal as possible. This tube should not be confused with the type E711-E which has a small choke built in the tube itself. This latter tube is for A.F. purposes only.

The type E703A above will oscillate satisfactorily in any self-oscillating circuit. For frequencies above 4,000 kc., a tuned-plate, tuned-grid arrangement is recommended with a limited plate current of 100 ma. Particular care should be taken not to exceed the normal plate dissipation of 75 watts at these higher frequencies.

The type E711 is not designed for frequencies greater than 3,000 kc. and hence will not find as much favor as the E703A described above.

One question that will naturally arise is "why should the E703A work above 4,000 kc. and the E711 only up to 3,000 kc.?" The answer to this query is to be found in the difference in the amplification factors of the two tubes. The mu of the former is 25 while that of the latter is but 12. This means that the ratio of the plate inductance to the grid inductance is greater (step down) with the E703A than with the E711.

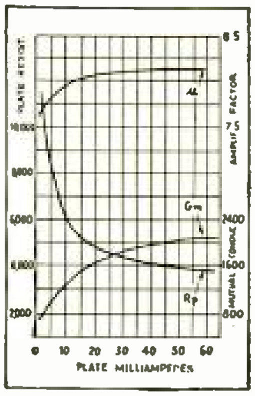
If the grid inductance is lower, the grid losses are lower and more satisfactory high-frequency operation may be secured.

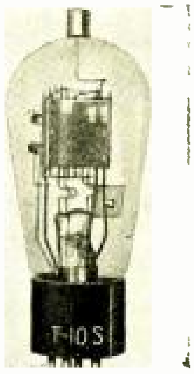
Figure C shows a new type of transmitting tube especially designed for short wave operation; the dynamic characteristics being indicated in Fig. 7. Of particular importance is the fact that the plate lead is connected to the cap at the top of the tube, thus keeping this lead away from all others in the tube.

This feature means that a higher voltage may be applied to the plate of the tube without fear of breakdown; the internal capacitance of the tube is also lowered, which means that the conditions for the generation of parasitic oscillations are more difficult to fulfill. In general, it may be stated that this tube is especially suitable for the lower-powered ultra short-wave transmitter.

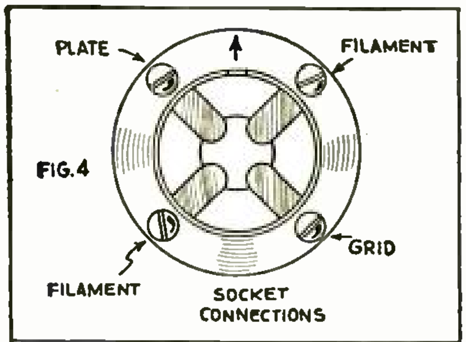
## New World Time Chart

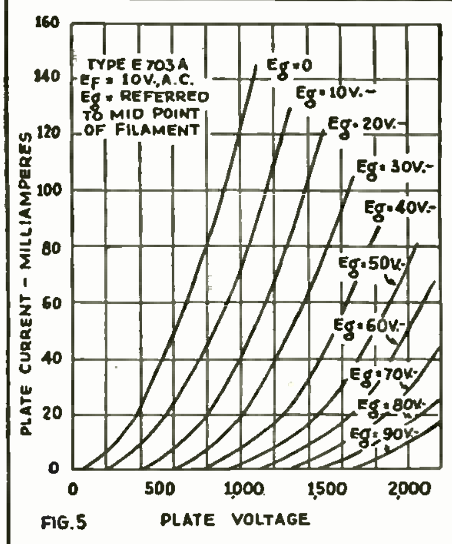
One of the newest rotary slide-rule time charts, by means of which it is possible to determine the equivalent time in any part of the world, has recently been put on the market by the International At-A-Glance Chart Company of New York and London. The time chart is printed in colors on a heavy card-board disc ten inches in diameter, with complete instructions. By setting the movable time disc, pivoted at the center of the mapped chart, and setting any given hour to a given location such as New York City, one can instantly read off the time in any other selected location such as London, Bombay, Melbourne, San Francisco, etc. The time dial is so calibrated and marked that no difficulty will be experienced in determining the time ahead or behind the given hour at the location where the chart is set for. This chart is an excellent help for putting through transoceanic telephone calls, tuning in foreign short wave stations, deciding the best time for sending or receiving cables or radio messages, et cetera.




**Figs. C and 7 above—Appearance and performance curves of new Triad 210 special transmitter tube.**



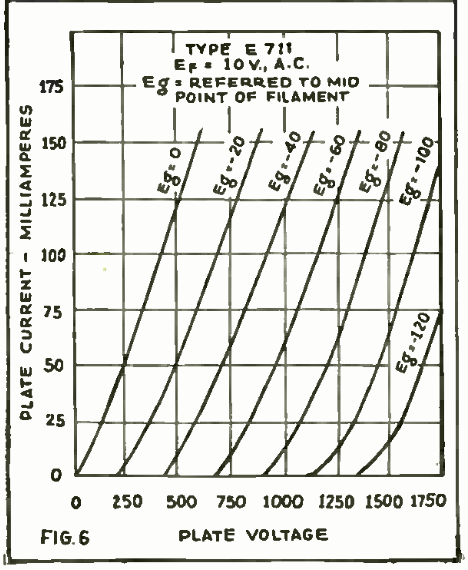



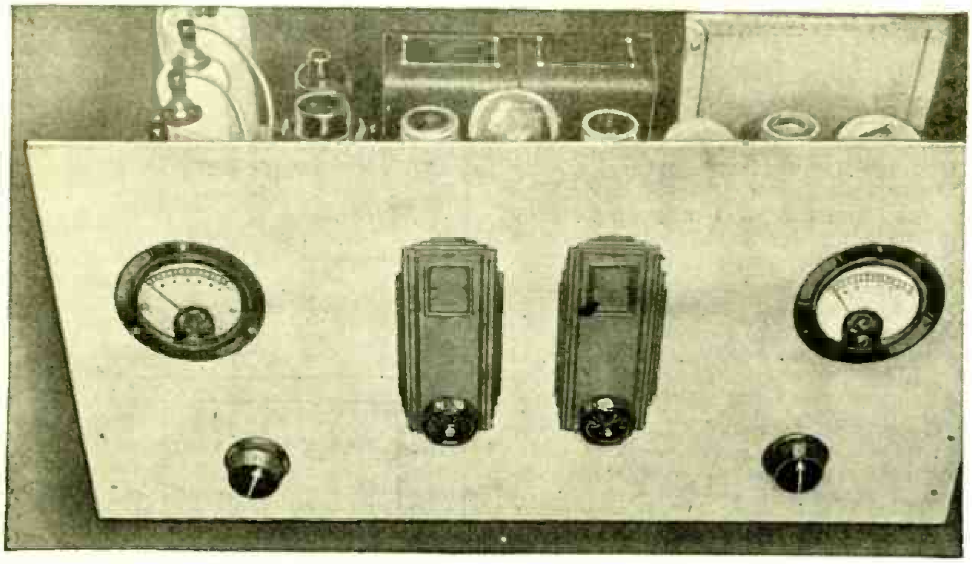

**Fig. 4 shows socket connections for the Arcturus tubes; Fig. 5 (center) shows curves for the E703A tube and lower graphs, Fig. 6, show performance of the E711A.**

An autodyne first detector and oscillator is employed in this interesting short-wave superheterodyne, here described by Mr. Somerset, one of England's outstanding short-wave experts. This set employs two "I.F. stages, a second detector and a power audio stage.

# The Short Wave League Superheterodyne

By E. T. SOMERSET

G2DT, Assoc. Member Institute Radio Engineers



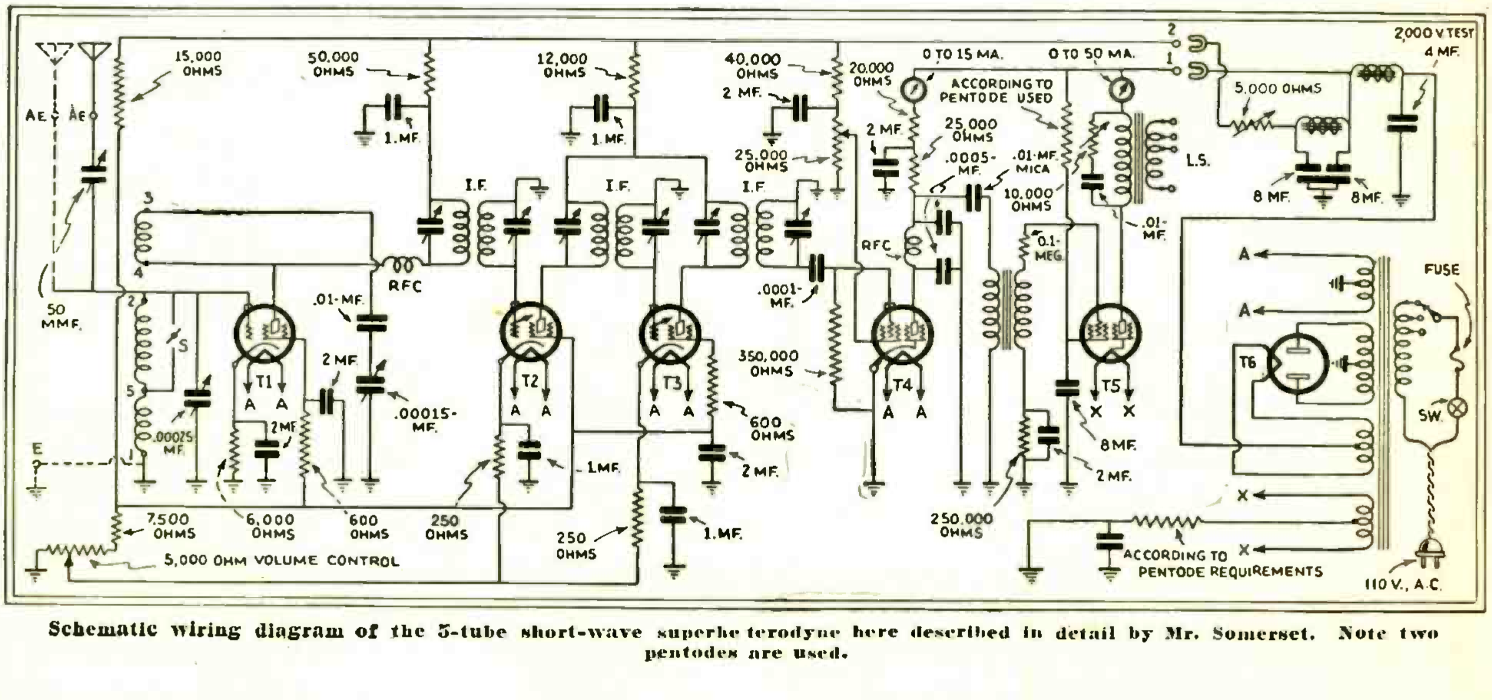
Front panel appearance of the S. W. L. Superheterodyne designed, built and here described by Mr. Somerset, G2DT, famous British short-wave experimenter.

● IN view of the large number of most excellent descriptive articles which have appeared in SHORT WAVE CRAFT dealing with the superheterodyne, it is not considered necessary, in this brief article, to give constructional data as the receiver under review is not for the tyro, but rather for "the hardened sinner." A glance at the circuit will show him that an autodyne plate-bend screen-grid tube is used as *first detector*. Some will, undoubtedly, question the wisdom of this arrangement and my best answer to any criticisms is that it does its job in a most efficient and entirely satisfactory manner.

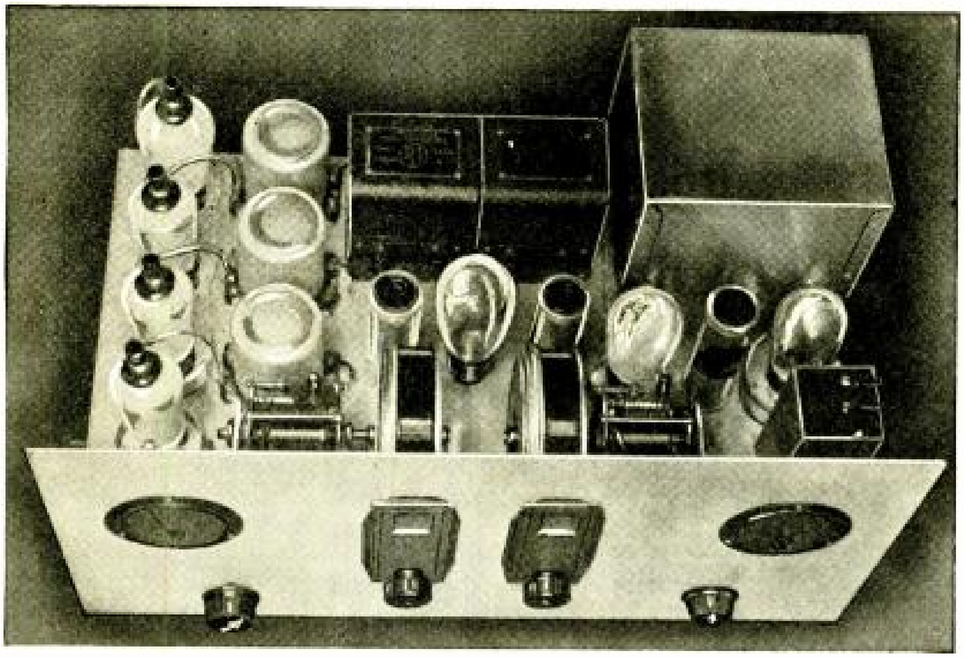
In view of the performance of modern tubes it may reasonably be asked why two intermediate frequency stages are employed. The answer is to be found linked up with the question of *noise level* and the use of a radio-frequency pentode as *second detector*. Obviously, if we use the latter tube in a suitable manner we can look for a large voltage step-up to the audio-amplifier and in consequence of this we can run our two variable mutual-conductance tubes T2-T3 with a large amount of negative bias and by so doing keep down the general noise level of the intermediate amplifier.

With the two intermediate frequency stages there is a good reserve of power which is useful at times. As both primary and secondary of the I.F. transformers (which are peaked at 150 kc.) are tuned at a high level of selectivity, it has not been found necessary to employ an R.F. stage ahead of the first detector.

Turning our attentions to the *second detector*, it will be seen that the R.F. pentode is employed as a *power grid rectifier*. It has been found that when a pentode is suitably loaded and used as a large power-grid detector, it is capable of giving a very large output; in fact, just enough to work a loud speaker. Now, with the two I.F. stages it should be readily possible to fully load the grid of the pentode from any worth-while transmission and by means of a 3-to-1 step-up ratio audio transformer to obtain a peak signal voltage of the order 30, which is just about what is required for the output pentode. This results by em-




Schematic wiring diagram of the 5-tube short-wave superheterodyne here described in detail by Mr. Somerset. Note two pentodes are used.



**Looking down on the S. W. L. superhet designed and built by Mr. Somerset—an extra tube, used for experimental purposes, is shown in the above model. Note the National dials—a tribute to America's radio designers.**

ploying a load resistor of value 25,000 ohms in the plate circuit of T4, and, by virtue of having something like 380 volts at our disposal, we can use a decoupling resistor of 20,000 ohms. If a still flatter frequency characteristic is required, then the load resistor must be reduced to 20,000 ohms and the decoupler increased to 25,000 ohms. This will give a better bass response and greater immunity from the possibility of motor-boating. If motor-boating should be experienced, increase the value of the decoupling by-pass condenser to 4 mf. or more.

It will be appreciated that the writer is alluding to British tubes throughout and for replacement it may oe mentioned that the pentode-detector has an impedance of 80,000 ohms and an amplification factor of 320, giving a mutual conductance of 4,000 ohms. The particular tube used is known as the Cossor MS/PEN-A. The output pentode is a Mullard PM/24C requiring 350/400 plate volts with 28 volts negative bias when the plate current flowing is 30 ma. Just as a matter of interest (at least I trust my readers are as interested in our tubes as I am in yours), there is a larger pentode—the PM/24D—requiring 500 volts and giving an undistorted output of 8,000 milliwatts. Nevertheless, the one under review is quite capable of giving all the volume most folks will be ever likely to require.

The only portion of the receiver that requires to be home-made is the detector grid coil and this is extremely simple. A form 1¼ inches in diameter is used and with the following number of turns will cover 14.5 meters to 60 meters and tuning will not be found to be excessively sharp, in spite of the variable condenser having a value of .00025 mf.: From terminal 3 to terminal 4 there are 7 turns of No. 30 D.S.C.; from terminal 2 to terminal 5 there are also 7 turns but this time of No. 18 enameled, and, still employing this wire, there are 5 turns from terminal 5 to terminal 1. The wave range given is obtained by the use of a small anti-capacity shorting switch, which allows of the winding from 2 to 5 being shorted out.

In practice it will be found that regeneration control by the .00015 mf. variable remains sensibly constant over the two wave-bands, once the correct positions for the series-antenna condenser have been found. This having been done, the receiver becomes a single-dial control for most purposes.

Photograph No. 1 shows the general layout very well. When this photograph was *actually* taken the author was experimenting with an intermediate audio stage (and larger variable condensers) and this will explain the six tubes seen (apart from the rectifier). In the left-hand forefront is the first detector, with the pentode second detector at the rear; the output pentode is dead in the center of the picture, with a filter choke and audio transformer behind, while the A.C. power transformer is completely shielded. In photograph 2 the chassis construction is seen with the two aerial and ground terminals at the side. Note the metallized tubes. On the left of the panel is the volume and on the right the tone control.

# When to Listen in

**By Robert Hertzberg**

## An Interesting Letter

Because its contents are interesting and illuminating, we are printing the following letter received by Mr. K. A. Staats, of Aliquippa, Pa.:

**RADIO CORPORATION OF AMERICA**
**Central Frequency Bureau**
66 BROAD STREET
NEW YORK

MR. K. A. STAATS,
1909 McMinn St.,
Aliquippa, Pa.
DEAR SIR:

This will acknowledge receipt of your card dated March 21, 1932, in which you report the interception at 0243 G.M.T., March 22, 1932, of radiotelephone transmission from station KEJ.

This station is located at Bolinas, Cal., and is operated on its assigned frequency of 9,010 kilocycles. It is a point-to-point communication station, not a broadcasting station, and is one unit of the public service world-wide communications system of R.C.A. Communications, Inc., a subsidiary of the Radio Corporation of America, through which direct radiotelegraph circuits are maintained between the United States and 43 foreign points and by connecting circuits at those points with practically any part of the world. Supplementing its radiotelegraph services the company also operates transoceanic point-to-point radiotelephone services for the transmission of addressed program material between the United States and points abroad.

The program material so transmitted is specifically addressed to the organization abroad which is to make use of it. It is not intended for general public reception and use. Regular schedules are not maintained, transmission is effected when and as the program material is offered by a customer for transmission, and the station or frequency utilized is dependent upon the propagation phenomena of the season, time of day, direction, and distance of the foreign point to be reached. The power varies from one to forty kilowatts according to transmission conditions and usually a directional antenna is employed.

The transmission which you intercepted may have been either addressed program material or point-to-point transmission for observation at a specific foreign terminal. In either case it is classified by international treaty and United States law as point-to-point communication concerning which an obligation of secrecy is imposed, both upon us and upon any chance intercepting listener. Such communication is "correspondence of a private nature" of which "the unauthorized reception," "the unauthorized divulging of the contents or simply of the existence" or "the unauthorized publication or use" is in violation of the secrecy provisions of the International Radio Convention.

With this in mind you will no doubt appreciate that we may not supply any confirmation of material transmitted by our stations.

Yours very truly,

LOYD A. BRIGGS.

## "Which Station Was That"

"World Radio" undertakes a service with the above title, whereby it seeks to help its readers in the matter of the identity of stations heard by them. The service has two forms: A, Free; B, Postal.

According to the terms of "A," the answers will appear in the columns of "World Radio." The conditions of "B" necessitate the enclosure of sixpence for each question asked (6 questions may be sent for 2/6), together with stamped addressed envelope. The answers are sent by post. In each case, whether Postal or Free, a coupon from "World Radio" should be enclosed for every question.

It is essential that as close an estimate of the wavelength as possible should be given. If there is any difficulty in doing this, the dial readings of known stations in the vicinity of the unknown one should be quoted.

## G5SW

The B. B. C. has received so many requests from correspondents abroad for the confirmation of reception of its short-wave experimental station G5SW, and such confirmation involves so much investigation, that it has been decided to apply to them the conditions governing the *World Radio* "Which Station Was That?" service. The particulars set out above should be complied with except that, instead of a stamped envelope, an International Postal coupon for reply should be sent.

(*Continued on page* 254)

# SHORT WAVE LEAGUE

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

## Your League Club Station

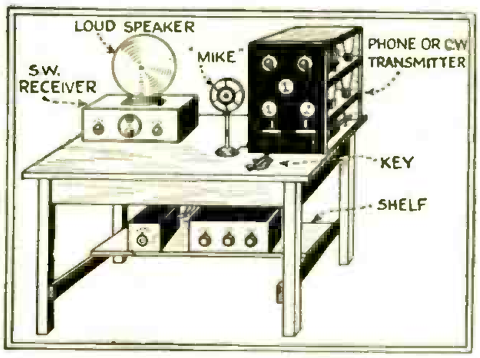
### By ROBERT HERTZBERG, W2DJJ

• THE single factor contributing most greatly to the success and growth of any radio club is undoubtedly a *club station*. No matter how simple the apparatus, it is bound to attract new members and hold the old ones, for it provides a common medium for experimentation, demonstration and study. A club that merely meets every once in a while, does a lot of talking, and then adjourns, will soon find itself falling to pieces.

It is not necessary to spend a lot of money all at once for a complete receiver and transmitter. If the club meets regularly at the same place, it can set up a small table and start off with a receiver which might be assembled out of assorted parts contributed by the members. One man might have a couple of old but serviceable variable condensers, another an audio transformer, another tube sockets or coil forms. It wouldn't be a bad idea for some member to bring a few hand tools down to each meeting and perform some of the actual assembly work right before the members. A demonstration of the proper method of soldering could probably be watched with considerable profit by most set constructors, judging from some of the work we've seen!

A receiver for club purposes should be simple and rugged, as it will be handled by different men. A good arrangement would consist of one stage of T.R.F., regenerative screen-grid detector, and two stages of audio amplification, with plug-in coils or one of the several available coil-switching assemblies. Without A.C. power pack, this should not exceed 18 inches in length. The pack itself is most conveniently placed on a shelf supported between the two rear legs of the table. Such a receiver will readily operate a loud speaker, so the crowding caused by the use of earphones will be avoided.

Of course, it is also very desirable to have a club transmitter. However, this should not be considered unless the club has permanent headquarters in some member's cellar or in a meeting place that can be locked up safely. A medium-power phone or C.W. outfit can easily be built on the right end of the table, so the latter will become a complete unit that can be moved from one place to another, if this becomes necessary. The accompanying drawing shows a good suggested arrangement.



Good layout for your club station.

## Get Your Button!

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

The requirements for joining the League were explained in the May issue; copies of rules 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, 96-98 Park Place, New York.**

We would like to hear from individual radio clubs that have club stations. Photographs of the actual equipment, if good and clear, will gladly be considered for publication.

### Wants Code Rule Changed

*Editor,* SHORT WAVE CRAFT:

I wish to help in the work undertaken to have the code requirements in the ultra-short-wave band limited.

I wish to build a transmitter for experimental purposes or in other words as a hobby.

I commend your attitude toward the amateur and hope your efforts in changing the code ruling will meet with success.

Very truly yours,
J. B. TUPPER,
College of Wooster,
Wooster, Ohio.

(*Thanks for the good wishes.—Editor.*)

### Suggests "No Code" Law Above 3,000 Meters

*Editor,* SHORT WAVE CRAFT:

In SHORT WAVE CRAFT I see that you believe that no one should be required to learn code to transmit below 6 meters. I believe in this very much.

I also have an idea that if one has to learn the code, that a certain wavelength should be set aside above the broadcast and government stations, say, 3,000 meters or less, so that no one will have to have a license to transmit. This would be excellent for code learners. They could get experience and speed better than by practicing in the same room and after getting speed and accuracy, then get a license and go down on good old short waves. We have been practicing quite a while and haven't made any headway for speed. Please put this into consideration with the 6 meter-and-below broadcasts.

Respectfully,
CLAYTON E. FAIER,
WOODROW JOHNSON,
H. WYSONG,
Nezperce, Idaho.

(*We are afraid that this proposal will not receive much consideration, as the longer wavelengths are pretty well filled up with commercial radio telegraph stations. In view of the attitude of most foreign countries toward amateur radio, we think it would be quite a victory to get just the five-meter band opened up to non-telegraphing amateurs.—Editor.*)

### Oh! Oh! What a Kick!

*Editor,* SHORT WAVE CRAFT:

It is noted you are sponsoring the SHORT WAVE LEAGUE for the five-meter phone license without a code test. You will stand a good chance of obtaining more of the phone boys' subscriptions to your magazine if you will advocate and work for licenses on all amateur phone bands without code test.

A majority of the phone boys in this locality have turned against the A. R. R. L. and QST bunch at Hartford for the A. R. R. L. work hand in glove with the Federal Radio Commission. And the phone boys are good and tired of receiving a dirty deal at the hands of A. R. R. L. and want a phone magazine of their own which will sponsor their cause.

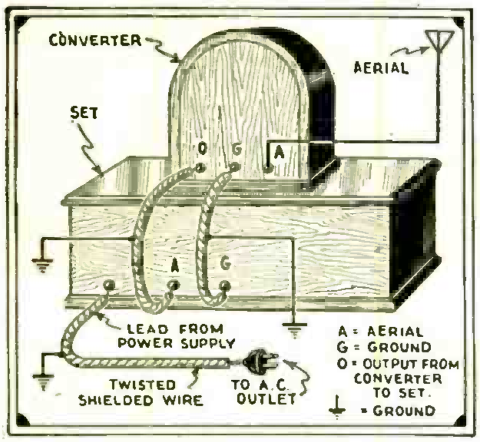
If you are of the opinion that the F. R. C. will hear your plea and grant your request for amateur phone licenses without code test, you are due to be disappointed, for the only thing the F. R. C. understands is political pressure. And in view of the fact that the F. R. C. was created by an act of Congress and receive their power and authority from the same Congress, why it is logical to avoid wasting your time upon the F. R. C. and concentrate your own and the SHORT WAVE LEAGUE'S efforts upon the respective Congressmen and U. S. Senators and thereby cause them to bring the necessary pressure to bear upon the F. R. C.? Then you will get what the phone boys want.

(*Continued on page* 254)

## $5.00 Prize

### Use Shielded Wire for Connecting S-W Converters

● IN connecting a short wave converter to a broadcast set, use shielded wire to make the connections and ground the shield to the set chassis. Also use shielded wire for the leads from the power supply from both set and converter to the light socket, also grounding the shield. This will reduce to a minimum the interference from powerful broadcasting stations if there is a tendency for them to crowd through when the converter is being used. Another feature of this shielding of the power lines is that most of the sets can be used without the use of another ground, as the capacity between the shield and the grounded side of the A.C. line is enough to completely ground the set. I have used this with good results when the interference was worst and recommend it heartily.—*Hector Graham.*



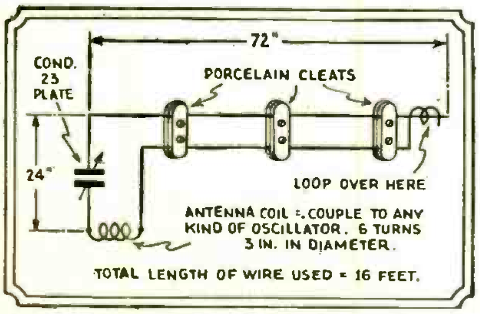

The best way to connect a short-wave converter—using shielded wire.

### "Round the World" with an Indoor Xmitter Antenna

● THIS article is expressly written for the man who is yearning to get into the short wave transmitting game, but is handicapped for room to put up a decent antenna, and for the budding genius who is living on the third floor off the hallway, and has no access to the outdoors *at all.*

This is for 20-meter work only, and while it will work also on the 40-meter band, its pet forte is 20 meters—by all means.

Now the thing is going to look so simple to you after you have read this little talk and looked over the diagram, that you are likely to pass it up, because you have the notion that it can't possibly work—that it's against all radio theory—that the two fields of the antenna will cancel out, etc., etc., but if you have been fussing with radio as long as I have you will have discovered by this time that there are quite a bunch of valuable ideas working fine in amateur radio that the text-books say *will not work.*




A short-wave "transmitting" aerial you can put up indoors—and it works!

## $5 FOR BEST SHORT WAVE KINK

**Beginning with the last issue of SHORT WAVE CRAFT, the editor will award a five dollar prize each month for the best short wave kink submitted by our readers. 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.**

Let it suffice to say that I have worked around the world with this antenna, using one tube, a U.V. 202 five-watt type with an input of 25 watts, on the 20-meter band. In the year of 1928 I was keeping a daily schedule with G2OD of England, using this antenna, so it must be evident that I did not suddenly work somebody with it last night and now want to rush into print with some dubious "discovery."

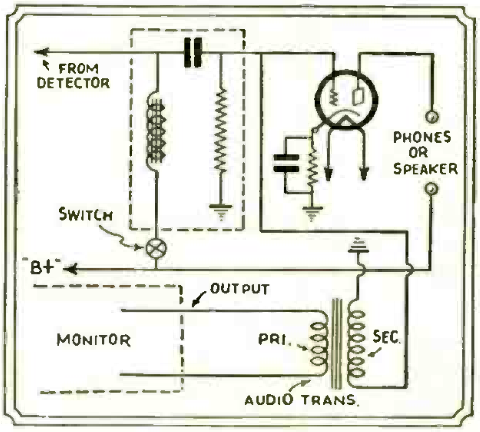
Here is the dope. Use any kind of wire you have handy; lamp cord or rubber covered. That is what I use, and the wire is fastened on the bedroom wall with the usual house wiring porcelain cleats.

Put a condenser in series as shown, and couple to your oscillator in the usual way. When you tune, you may find you get twice the antenna current as you ever did before on other types of antennas but don't let that mean anything. You can get still more current if you take more turns on the ends of the wire as shown, but about two loose turns wrapped round the upper wire is O. K.

Just wrap the end of the lower wire round the upper one as shown in the same way you would do if you wanted the lower wire hung up temporarily out of the way. Keep both wires insulated all the way, and have no electrical connection at the end where the loop is made. That is all there is to it. I have about 2,000 QSL cards from stations worked with that "fool" rig, so go to it, and the best of luck.—*M. J. Caveney,* VE3GG.

### Amplifying the Output of the Monitor

● MOST amateurs prefer a signal with more sock than the one tube of the ordinary monitor can give. Usually a double throw triple pole switch is required to change from the monitor to the receiver amplifier. In the diagram is a circuit in which changing over may be accomplished easily and with a minimum of trouble. An audio transformer is on the output of the monitor. The secondary feeds into the grid of the amplifying tube of the receiver. The switch in positive B lead to the primary of the detector audio transformer is necessary to prevent interference from the transmitter. With this it is possible to continuously monitor the transmitter very easily and with a loud signal.—*Robert Edwards.*

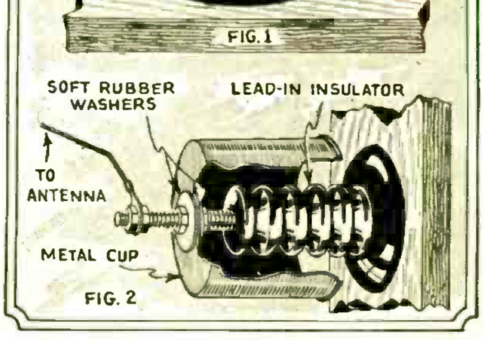



How to amplify the output of a monitor.

### Rain-Drip Cover for Lead-In Insulator

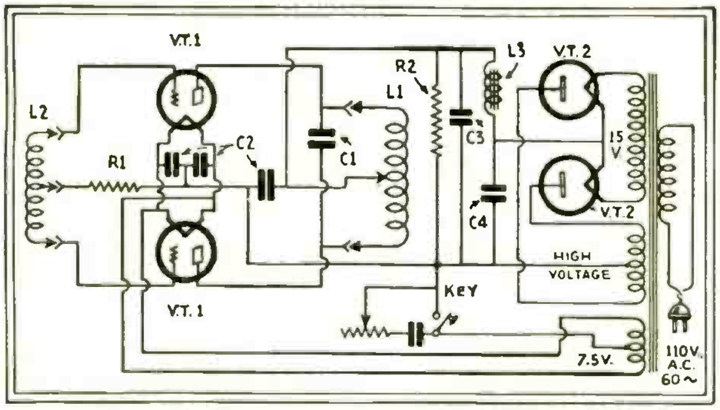
● STATION owners who use a glass or bakelite lead-in insulator, running through the roof or wall of the house, usually find that the range is cut down considerably during rainy weather. This is especially true of the small transmitting station. A simple protective cover can easily be made to remedy this by placing a metal cover over the top of the insulator, as shown in the sketches.

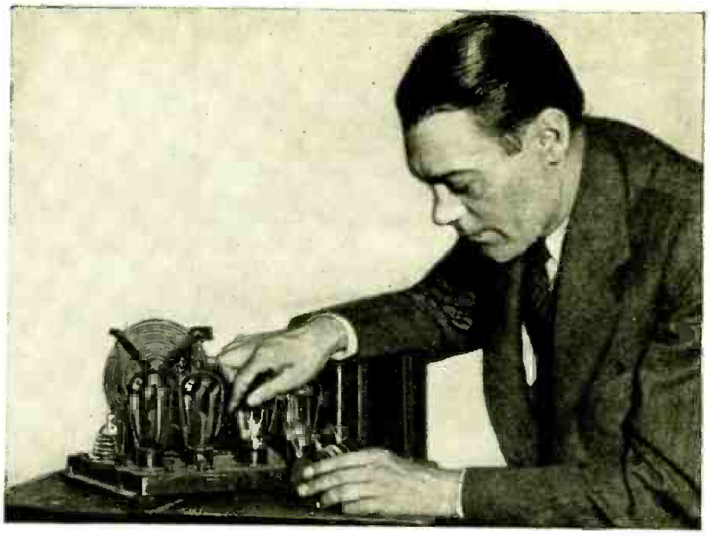
For the upright lead-in insulator, an ordinary aluminum plate or tray will do. (Shown in Fig. 1.) For the horizontal insulator, a metal can of sufficient length to cover about two-thirds of the insulator will do.—*Herman R. Wallin.*




Keeping the rain off that insulator!

Photo at right shows the author adjusting the transmitter which was easily and quickly constructed from a Kolster K-5 power amplifier. Diagram below shows connections of transmitter after the receiver amplifier had been converted.



# A 30-Watt Transmitter Made From a Receiver

## By ROBERT MORRISON LACEY *

● WHEN a 30-watt amateur transmitter can be built from the standard chassis and parts of a power supply designed for a high quality receiver, the cost of such an equipment falls within the financial limits of the most ambitious youngster, not to mention those amateurs who are always looking for a simple and more effective transmitter.

The unit to be described here started with the power supply of a Kolster K-5 broadcast receiver. In its original form this chassis embodied two 281 half-wave rectifiers, a 210 or 250 tube for the output and an 874 ballast tube, together with all filament and plate supplies and taps for other "B" voltages up to 90, and an 11-inch dynamic speaker. These power units have already been adapted by many experimenters for use with an efficient R.F. tuner and detector, the combination forming a complete receiver of great power and fine quality. However, in this article the instructions will be limited to those necessary when the unit is to be converted into a transmitter.

The changes necessary to quickly convert this to a complete transmitter may easily and quickly be carried out by any transmitting amateur or potential amateur. The same idea can be followed for purposes other than transmitting, such as power supply for television equipment, P.A. amplifiers, etc. If desired, the complete unit can be left intact and employed as a power amplifier.

The cost of such a power supply is so extremely low that it will appeal to many amateurs who have multi stage transmitters in which each stage could have its own individual power supply. This is an extremely desirable feature to effect both stability and quality to the admitted signal.

In converting this unit for use as a power supply for a self-excited push-pull transmitter, proceed as follows:

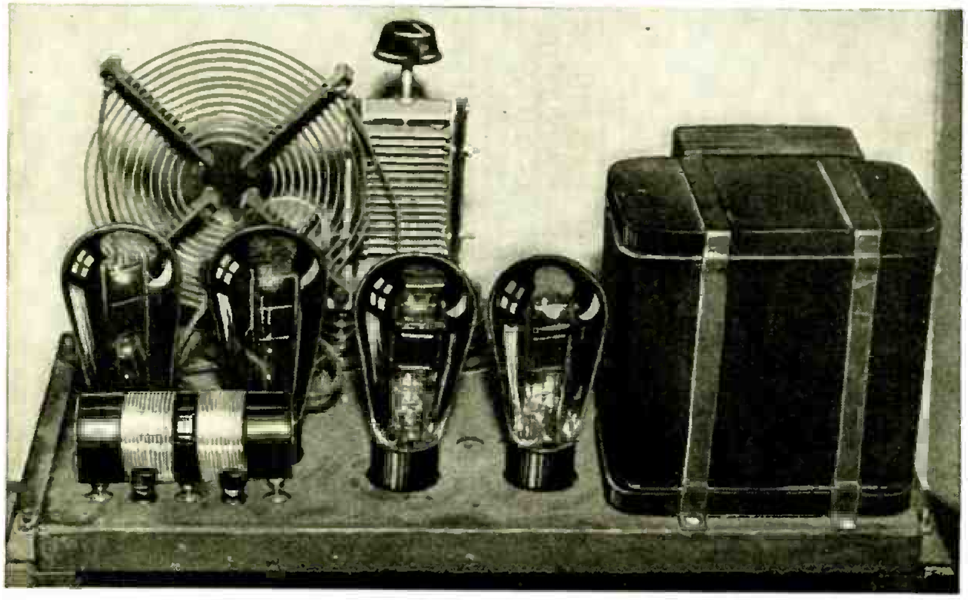
The dynamic speaker, output and input audio transformers are disconnected and removed from the chassis. The field coil of this dynamic speaker was originally in series with the output of the filter.

The voltage divider and "C" bias resistor are in one tapped unit, which is also removed and later employed as a section of the bleeder resistor. The next step is to parallel the filaments of the two sockets on the extreme right hand end, one of which is already connected to the power transformer for 7½ volts' supply. The other socket is the one which was originally employed for a ballast tube.

The connections of this ballast tube are removed and the filament prongs of this socket are jumped to the filament prongs of the 210 socket, which is its neighbor. One side of the 110-volt supply to the primary of the power transformer was originally connected in series with the plate connector of this ballast socket, and the filament contact caticornered from the plate; these leads must of course be connected together in order to complete the 110-volt circuit. There are five binding posts at the rear of this chassis which originally were employed for external "B" supply and the input. The middle one is now removed and also

(Continued on page 238)

* Chief Engineer, American Sales Co.



Above—The completed 30-watt transmitter which was built from the Kolster K-5 power amplifier.

# The New Silver Marshall 728SW

## 13 to 550 Meter Twelve Tube Superheterodyne

By McMURDO SILVER *

The very latest S-M creation—an all-wave superhet with automatic volume control and separate short-wave oscillator.

• FROM the Silver-Marshall laboratories has just come what the writer believes to be the finest all-around radio receiver for sensitivity, selectivity and fidelity he has ever seen. And this opinion applies to its performance on broadcast waves as well as on short waves.

This new set, the 728SW, is illustrated herewith, with its circuit diagram and performance curves. These really tell the whole story—the story of the finest sensitivity and fidelity ever obtained in a practical radio receiver, regardless of cost.

The set is a twelve tube superheterodyne using the new "Q" system developed in the S-M laboratories which for the first time permits of accurate short wave dial calibration at the factory. As a broadcast set it uses ten tubes, and as a short wave set twelve. These two extra tubes are in no sense a conventional converter, for both essentially function as the short wave oscillator and replace the broadcast oscillator entirely on short waves.

The circuit involves a '58 detector and '56 oscillator for the broadcast band, or for the three short wave bands from 1,500 to 22,700 kc., a '58 first detector and '56 oscillator with its '56 harmonic generator tube, which allows one oscillator circuit to cover this wide frequency range without changes. Following this is a two stage 465 kc. i.f. amplifier using two '58 tubes, a '56 A.V.C. tube, '56 second detector, a '45 first audio or driver stage and a "Class A Prime" push-pull '45 output stage, with, of course, an '82 mercury vapor rectifier tube. In changing from one short-wave band to another, only the antenna circuit is changed, the broadcast oscillator being dropped completely out of circuit for the short wave bands.

The audio system is totally new, as it uses only a pair of '45s in the output stage, driven by a third '45, yet turns out over eight watts of undistorted power output, with the ability to handle strong signal peaks of up to twelve and sixteen or more watts—just as much to the ear as will '46 in Class B audio, but without any of the '46s' serious harmonic distortion at home volume levels.

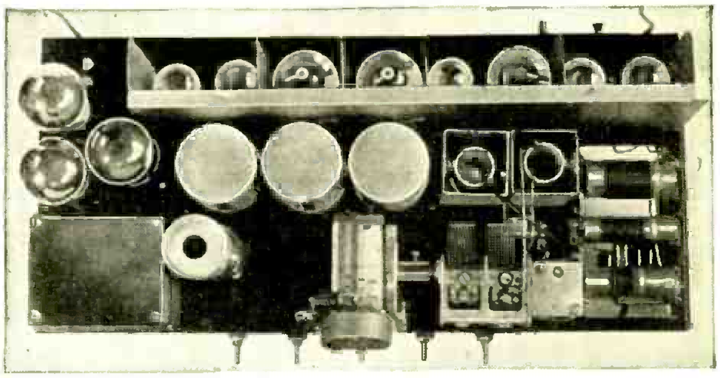
The 728SW has a noise suppressor system adjustable for each and every specific location, so that all noise can be cut out at the throw of a switch for local and medium distance reception. This is accomplished by a switch and a semi-variable resistor (on the rear of the chassis) that allows the first i.f. grid to be biased negative enough to cut sensitivity to a point where only signals stronger than local noise can be heard in the silent position of the noise-suppressor switch.

The radio frequency chokes shown in the plate circuits of the first detector, second intermediate frequency amplifier and second detector, each have a value of 7 millihenries. The coils used in the new 728SW super-het are wound with Litz wire in many cases, and are difficult to wind accurately, let alone trying to calibrate them. However, for the benefit of the short-wave "intelligentsia," the coil winding data is given in the text that follows:

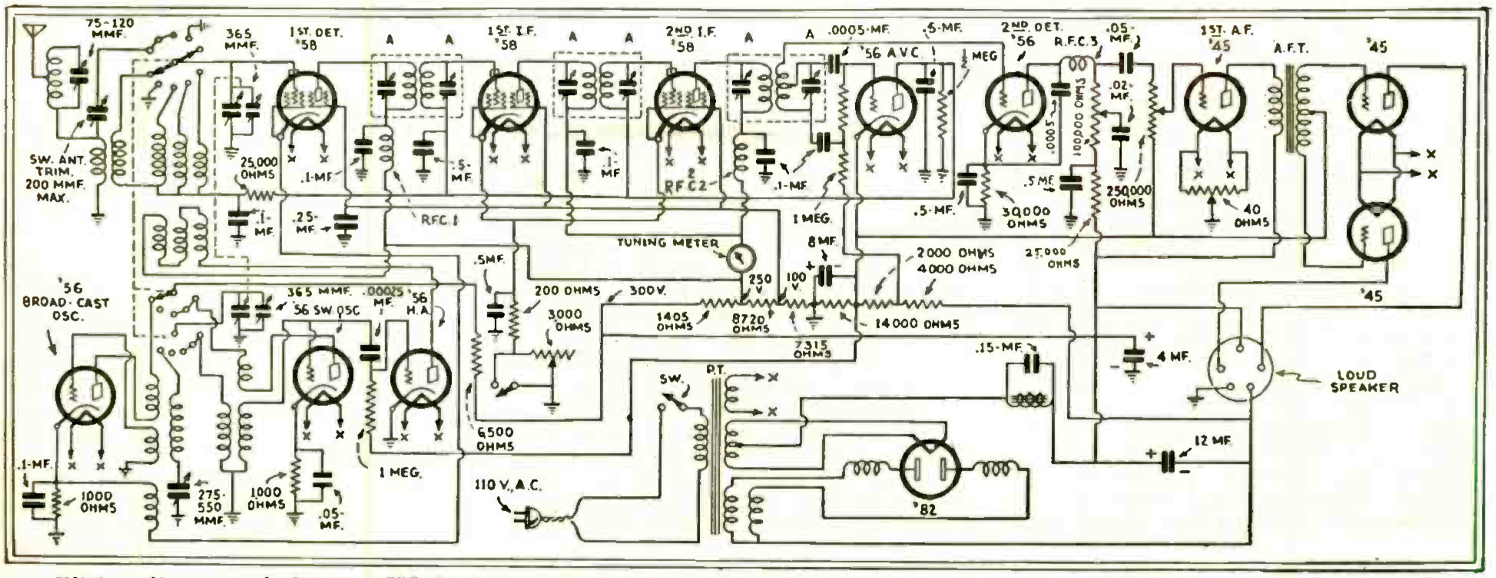
(*Continued on page* 250)

* Pres., Silver Marshall, Inc.

General view of the newest Silver-Marshall creation—the 728 S-W all-wave superheterodyne, fitted with automatic volume control and a separate oscillator for receiving short waves.



Top view of the new 728 S-W all-wave superhet.




Wiring diagram of the new 728 S-W Silver-Marshall, 13 to 550 meter, 12-tube superheterodyne. Capacity A-75-120 mmf., R.F. chokes have a value of 7 millihenries.

# THE SHORT WAVE BEGINNER

By C. W. PALMER

## The Beginner's Short Wave Receiver

No. 2 of a Series

● IN THE first of this series, we considered the fundamentals of electricity and the conduction of current. While this information tells in a general way just what constitutes a current, there are a number of questions that will arise in the minds of those readers not familiar with the science of electricity and its partner—radio.

However, in order to get some practical experience with electrical circuits and actually hear some of the short-wave broadcasts, we must construct and use a set. It is high time, therefore, to build our receiver.

Some of our readers may notice that the circuit of the set shown herewith is the old favorite "three-circuit tuner" so common to radio set builders of the early days of broadcasting. We must not think for this reason that the set is not a particularly good one. In fact, surprising as it may seem, the same circuit with occasional modifications is used by 80 or 90 per cent of present-day short-wave fans and amateurs. One of the attractive things about short-wave radio is that the simplest apparatus suffices for even the greatest distances.

In building our receiver, we will follow a definite plan. First, we will make a simple and economical one-tube set working from batteries. Next, we will construct an amplifier to increase the volume of the programs so that a loud speaker may be used. Then we will make a power unit to do away with the batteries, and thus in gradual steps we will construct a most up-to-date short-wave receiver. At the same time, we will gradually learn more and more about radio reception.

So much for our plans for the future. The problem at hand is to make our short-wave set. To construct any mechanical device, we must have tools, so before continuing further we will collect those required. Figure 1 shows a typical layout of radio tools. It will be noticed that the list includes a hacksaw, a soldering iron (electric preferred), a hand drill and a number of different sized machine drills, a screw-driver, a heavy pair of pliers, a pair of cutters, a pair of long-nose pliers, several files, a knife with heavy blades, a center-punch, a hammer and a pair of tweezers. While all these tools are not essential, it is well to remember that even the best mechanic cannot do good work without correct tools and most of the ones listed above may be found in the household tool box.

A short-wave receiver consists of a number of individual parts, each of which has a distinct use. First, there is a *tuner*. This consists of a coil of wire of a definite size and a condenser. The condenser is a device which stores electricity and it has several uses in radio reception. The use in this case is rather complicated, but for the present we will accept the explanation that a coil and a condenser will permit the signals from one station to be received and all others to be rejected. In other words, if the dimensions of either the coil or the condenser are variable, we can select any station at will. In a subsequent issue, we will learn how the *tuner* can select stations in this way.

The condenser used for tuning consists of a number of flat metal plates in two groups, one arranged to rotate within the other. The two sets of plates are electrically separated (insulated) from each other. This instrument is known as a *variable condenser*. Another type, called a *fixed condenser*, consists of pieces of tin-foil or aluminum foil separated by mica or waxed paper. The latter are used when it is not necessary to vary the size (capacity) of the condenser.

The next part of the radio set is the vacuum tube, which *detects* the signals. Radio signals are electric currents that change their direction of flow extremely fast—even more than 1,000,000 times each second. That is to say, if the current starts to flow in a wire from left to right, it immediately reverses and starts from right to left. This is known as an *alternating current;* when it reverses as fast as mentioned, it is called a *radio-frequency* current.

Now, this radio-frequency current is received in the tuner and is passed on to the detector. Our ears cannot hear the sound caused by anything vibrating faster than about 10,000 to 15,000 times per second and in order to hear the music sent in the form of radio-frequency (high-frequency) currents, we must first reduce the number of reversals of current to low frequencies. This is accomplished by the use of the vacuum tube. Here again, we will accept the explanation without trying to understand how it is accomplished.

The sounds from a radio set are electric currents changed into air vibrations which we hear as music, speech, etc. The device which changes the electric currents into sound is the head phone or loud speaker. When the sounds are not very loud, head phones are employed, and when sufficient sound is available to fill a room, a loud speaker is employed. They operate in very much the same manner, except that the loud speaker is made heavier to carry stronger currents and produce more sound.

In the above explanation of radio reception, we have not tried to learn how each part acts. We are only trying to become familiar with the parts used, so that the task of building our set will be less difficult. At a later date, we will spend some time learning how each part acts and why it is used.

A complete list of the parts needed for the set is given below. The names of the manufacturers of the parts used in the author's set are listed for the convenience of those who wish to copy the receiver exactly. Other makes may be used, if good apparatus of the correct values can be obtained more conveniently. However, as the mounting of the parts and the positions of the connections for wires may be different in other makes, it is advisable to use the specified parts.

1 .0001-mf. variable condenser, National ST100, 180° Equitune (C1).
1 .0001-mf. fixed condenser (with grid leak clips), Polymet (C2).
1 .00025-mf. fixed condenser, Polymet (C3).
1 0.5-mf. by-pass condenser, Polymet (C4).
1 Aerial coupling condenser (made at home) (C5).
1 2-megohm grid leak, Lynch (R1).
1 20-ohm rheostat with switch, Carter (R2).
1 50,000-ohm variable resistor, Clarostat type P10 (R3). (Regeneration control.)
1 4-prong tube socket. Pilot type 216.
1 Vernier dial, Kurz-Kasch.
12 Binding posts, Eby Junior.
¼ Pound No. 22 double silk covered wire, Cornish Wire Co.
1 Box No. 600 Braidtite hook-up wire, Cornish Mfg. Co.
1 Type '30 tube, Triad.
1 45-volt "B" battery, Burgess Battery Co., type 10308.
2 Dry cells, Burgess Battery Co., type 6.
1 Pair of head phones, Trimm.
1 Panel, bakelite or similar material, 5 x 8 inches. Insuline Corp. of America.
1 Strip of bakelite 4 x 1 inch, Insuline Corp. of America.
8 inches of bakelite tubing. 2-inch diameter, Insuline Corp. of America.
1 Wooden baseboard 8 x 8 x ¼ inch thick.
6 Brass angles with 1-inch arms.
1 Strip of stiff bus-bar.
Miscellaneous screws, soldering lugs, etc.

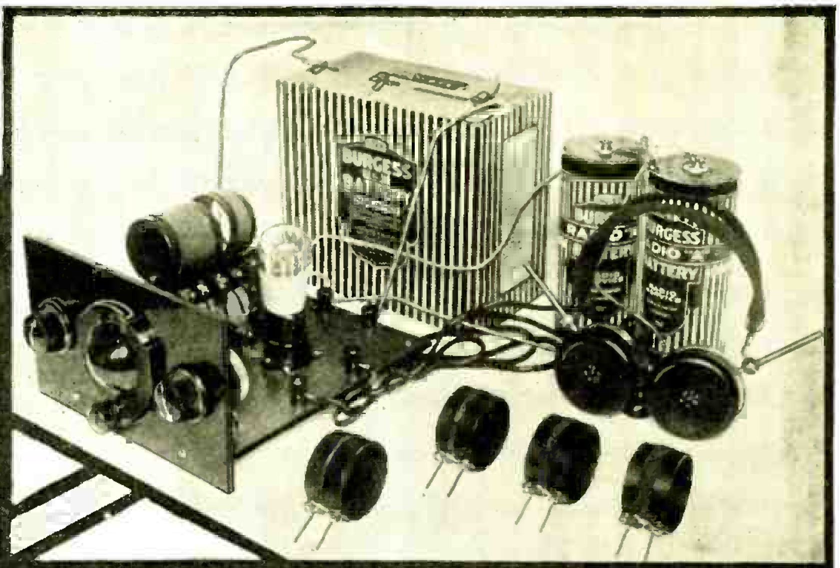
When all the parts are obtained, the panel may be drilled to hold the tuning condenser C1, the rheostat R2, and the regeneration control R3. The positions of the mounting holes, as well as the two holes for the brass angles that secure the panel to the baseboard, are shown in Fig. 2. In drilling the panel, care should be taken to press lightly with the drill so that the panel will not be cracked. The size of each hole is indicated in the illustration.

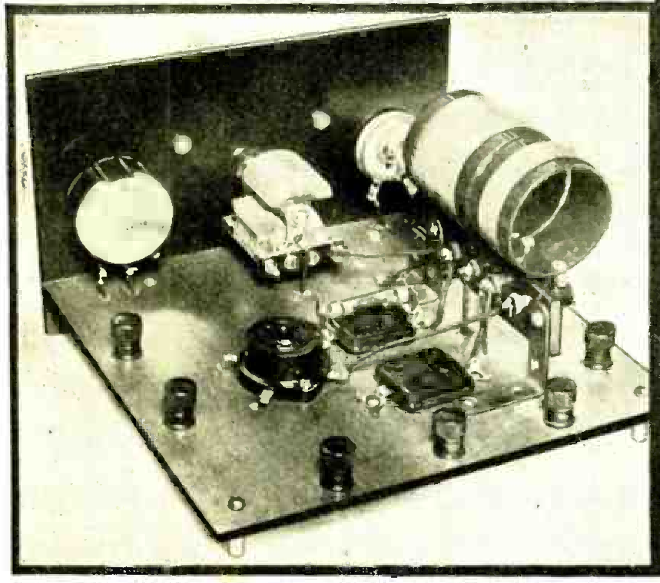
When we have mounted the three controls on the panel, we can drill the baseboard. Fig. 3 shows the positions of the holes. As a wooden board is employed, we do not have to drill holes for mounting the apparatus. Round head wood screws will suffice for this purpose.

In order to cover all the short-wave bands a number of different coils are needed. As these coils must be interchanged from time to time, they are made in such a way that the changes can be made easily. A bakelite strip 4 inches long and 1 inch wide is equipped with four binding posts and mounted on the baseboard with brass angles. Stiff pieces of wire (bus-bar) are fastened on the coils and these wires are secured in the four binding posts. The mounting strip is shown in Fig. 4. In drilling this strip, be very careful not to crack the bakelite.

(*Continued on page* 251)

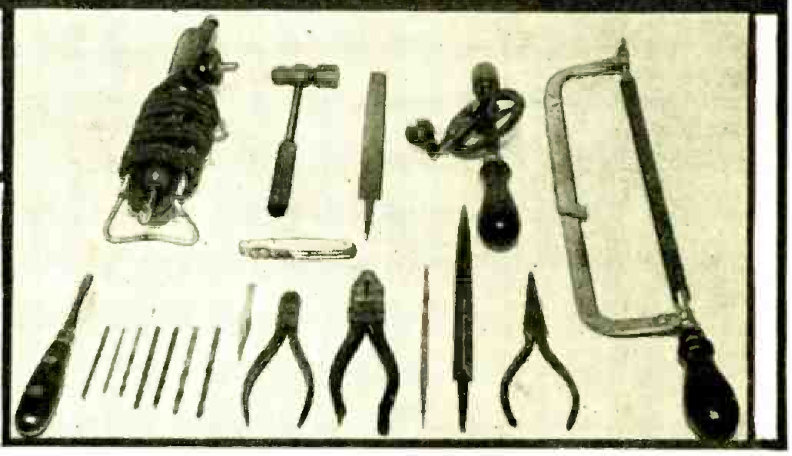
**Photo at right shows general appearance of the complete "beginners" short-wave receiver as designed by Mr. Palmer. The coils are home-made, and with a good pair of phones and a fair aerial, together with a good location, there is no reason why you cannot "step out" with this set and bring in short-wave stations from all over the world.**

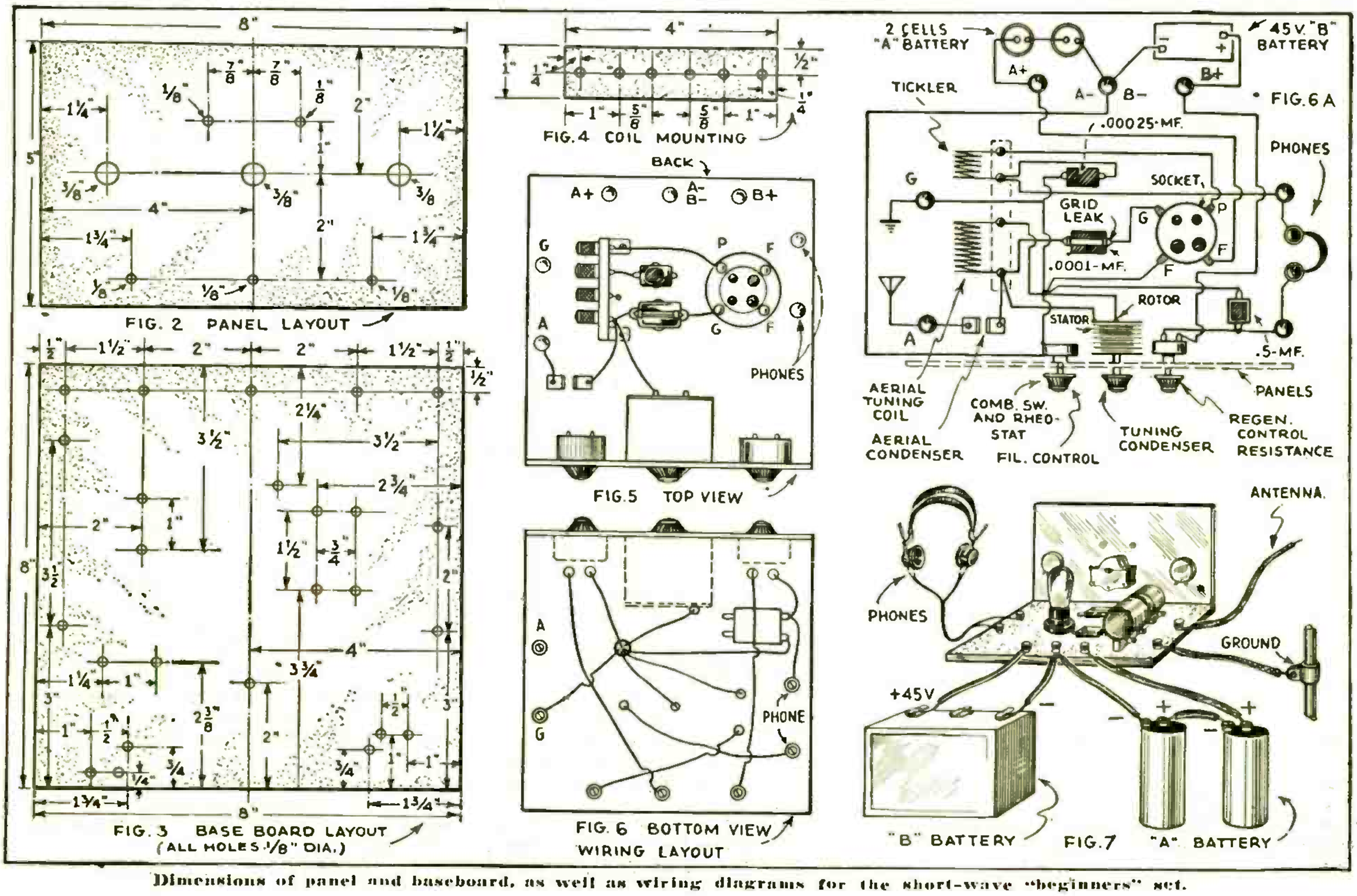


**Above—Close-up view from the rear of Mr. Palmer's idea of a short-wave "beginners" set. The layout of the apparatus is very neat and the parts well spaced so as to avoid undue loss by induction or capacity.**

**The tools recommended in building a short-wave set such as the one pictured, are illustrated in the photo at the right.**






**Dimensions of panel and baseboard, as well as wiring diagrams for the short-wave "beginners" set.**

# The 2-Tube "Reliable"

This compact A.C. operated, 2-tube receiver, described by a veteran short wave "DX-er," embodies quiet operation with good signal strength in the phones; also a novel method of controlling the regeneration.

By EDWARD G. INGRAM

● MOST moderate priced short-wave receivers of the two-tube type now in use are designed for battery operation, '01A and '22 tubes being used, or in some instances the new low voltage dry cell tubes. In view of the fact that much better results can be obtained with A.C. tubes and that maximum efficiency is highly important when a minimum number of tubes are to be used, this is rather surprising.

There is no difficulty in building a low-priced two-tube set with A.C. tubes. Moreover, the choice of full socket power supply, full battery supply, or A.C. for the heaters and D.C. for the plates and screen grid, can be had with only slight alterations in design.

### Uses '24 Detector and '27 A.F.

The circuit here described is provided with a type '24 detector tube and a type '27 audio stage tube. The high sensitivity of the type '24 screen grid tube when used as a regenerative detector is becoming well known. Signals which would be inaudible with an '01A detector come in clearly with the '24 tube. While the '22 screen grid battery tube is more sensitive than the '01A, it is not the equal of the '24 and has the objectionable feature of being very microphonic. The '24 A.C. tube is, therefore, the ideal detector. The '27 tube is a better audio frequency tube than the '01A or even the '12A, and being of the heater type it is desirable where residual hum must be reduced to a negligible quantity.

A tuned impedance in preference to a radio-frequency transformer is used in the circuit, this being deemed more suitable for a small receiver because high gain and the ability to tune to very high frequencies (low wavelengths) are more important than maximum selectivity. Also, simplicity is a desirable characteristic of the coil, which is advantageous when the experimenter does his own winding.

### Regeneration Control

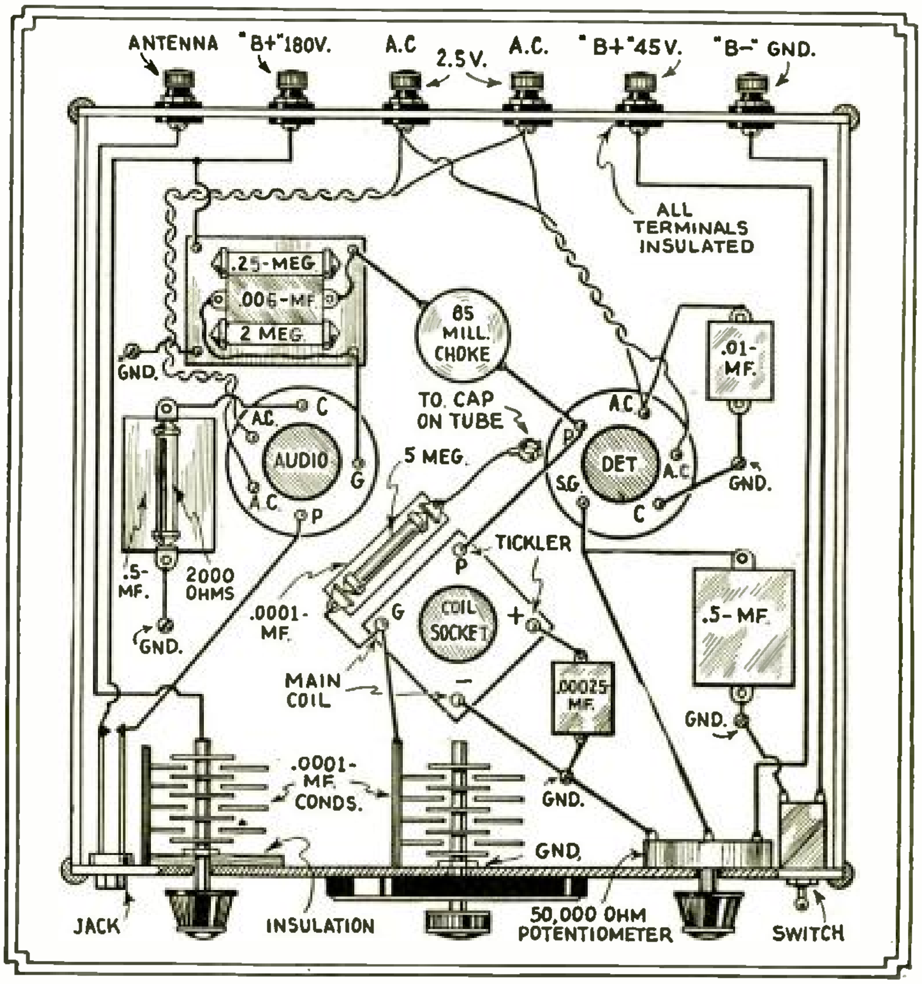
Regeneration is controlled by varying the voltage applied to the screen grid of the detector with a 50,000-ohm potentiometer, rather than by using a variable capacity or resistance in series with the plate circuit. While this method of control has not been used generally in small sets, it has proved its worth in a standard five-tube short wave receiver.

Screen grid tubes differ in their ability to oscillate under varying conditions of plate voltage, and this method of control is particularly effective in overcoming this trouble.

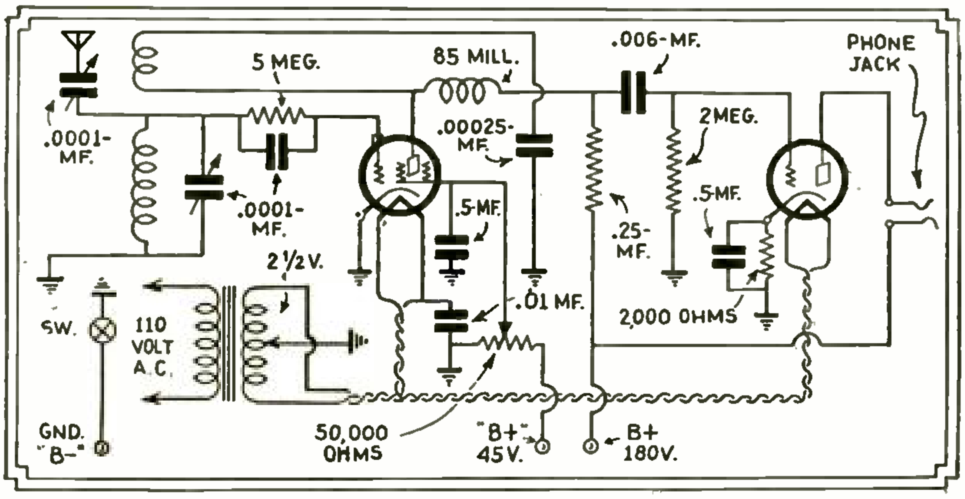
### Tuning Condenser of Low Capacity Best

Many short-wave receivers are provided with tuning condensers of too high capacity. This causes sharp tuning and makes it difficult to avoid passing right by faint signals from distant stations. A condenser of .0001 mf. capacity is much more desirable from this standpoint. Condensers with single bearings are more silent in operation than those

(Continued on page 250)




Top view of Mr. Ingram's 2-tube, A.C. operated, short wave receiver which represents a very compact and efficiently laid out job. Twelve-thousand-mile reception can and has been accomplished with a well-built receiver of this type.




Schematic hook-up of Mr. Ingram's 2-tube A.C. short wave receiver, which provides smooth regeneration control and a good solid wallop in the phones. Mr. Ingram is an engineer who has made short-wave reception his hobby, and he "counts that day lost" when he does not hear Australia.

# $500.00 Short Wave Builder's Prize Contest

## $100 In Monthly Prizes For Best Models

In the May number of SHORT WAVE CRAFT, we announced, in considerable detail, this new contest and the rules for those desiring to enter sets in the contest. For the benefit of those who did not read the original announcement in the May number, we mention here some of the more important points that you should bear in mind.

The closing date for the July contest is given below. The keynote of this contest is expressed by the single word—SIMPLEST.

Short wave set builders may submit any one of the following apparatus:

SHORT WAVE SET
SHORT WAVE ADAPTER
SHORT WAVE CONVERTER

You will please note that the set must be BUILT BY YOU and furthermore THE SETS THEMSELVES must be sent, PREPAID, preferably by express, to the editorial offices of SHORT WAVE CRAFT. Remember that WORKMANSHIP will be one of the strong factors that the judges will have in mind in awarding prizes. Sets may be sent with or without phones or loud-speaker. Data is given below on the length of descriptive article, diagrams and other information required by the judges. Have your article typewritten, if at all possible: diagrams need not be finished mechanical drawings, as our draughtsmen will re-draw diagrams for publication, but make neat sketches in ink. All coil and condenser data must be given; also all resistor and speaker (or phones) ohmic or impedance values.

| | |
|---|---|
| FIRST PRIZE . . . . | $50.00 |
| SECOND PRIZE . . . | 25.00 |
| THIRD PRIZE . . . . | 12.50 |
| FOURTH PRIZE . . . | 7.50 |
| FIFTH PRIZE . . . . | 5.00 |

## RULES FOR $500.00 SHORT WAVE BUILDER'S CONTEST

During the contest period, SHORT WAVE CRAFT will award a total of $500.00 in prizes in an important new contest. You are asked to build a home-made short wave set which should fill one or more of the following requirements: 1, Simplicity; 2, Compactness; 3, Ingenuity; 4, Novelty of Circuit Used; 5, Portability; 6, Workmanship.

Read carefully the text of the adjoining article, and observe the following simple rules:

1.—Short wave sets submitted may be in either of the following classes:
"Straight" S-W Receiving Set (battery operated or A.C. operated).
Short Wave Converter.
Short Wave Adapter.

2.—Sets must be home-made and built by contestants themselves. Manufactured sets are absolutely excluded from this contest.

3.—Sets submitted may be for ONE, TWO, THREE and NOT MORE THAN FIVE TUBES. Any type of tube as selected by the builder can be used. Crystal operation or crystal-tube combinations allowable, at the option of builder. Sets may be of any size or shape, at the option of the builder.

4.—In order to win a prize, it is necessary that the set itself be submitted to the editors. The five best models submitted each month will be awarded the prizes as scheduled here.

5.—All sets submitted to SHORT WAVE CRAFT Magazine will be returned to their owners after they have been judged and described for the benefit of SHORT WAVE CRAFT readers in the magazine.

6.—This is a monthly contest, which began May 1st, 1932, and will last for five months. Each monthly contest closes on the 1st of the following month. Thus the contest for July closes Midnight August 1st, 1932, at which time all entries for this month must be in the editorial offices of SHORT WAVE CRAFT. The second prize-winning announcements will be made in the September, 1932, issue of SHORT WAVE CRAFT.

7.—Every set must be accompanied by an article written by the builder, and contain not more than 2,000 words, giving minute instructions with wiring (schematic) diagram, list of parts with values of all resistors, condensers, coil data, including number of turns, etc., how the set was built, its operating characteristics, what stations have been received with it, and other information considered important by the builder. Such article should be typewritten or written in ink, and should be sent separately by mail, and should not be included with the set itself!

8.—All sets must be shipped in strong wooden boxes, NEVER in cardboard boxes. All sets must be sent "prepaid"! Sets sent "charges collect" will be refused. SHORT WAVE CRAFT Magazine cannot be held responsible for breakage in transit due to improper packing of sets. Before packing the set, be sure to affix tag with string giving your name and address to the set itself. IN ADDITION, PUT YOUR NAME AND ADDRESS ON THE OUTSIDE OF THE WRAPPER OF THE PACKAGE.

9.—Employes and their families of SHORT WAVE CRAFT are excluded.

10.—The judges will be the Editors of SHORT WAVE CRAFT Magazine, and the following short wave experts: Robert Hertzberg, Clifford E. Denton. Their findings will be final.

11.—Address all letters, packages, etc., to Editor, SHORT WAVE BUILDER'S CONTEST, care SHORT WAVE CRAFT Magazine, 96-98 Park Place, New York.

# The Short Waves Are Saying—

**Schenectady Closer to India than England!**

The waywardness of radio waves of the higher frequencies is recorded by F. De Swart, a radio fan living in Izmir, Turkey-in-Asia. He reports that on November 7 of last year while tuned to W2XAF, one of WGY's short wave stations at Schenectady, he heard Sir Oliver Lodge in London, talking on "Science and Civilization." He knew that Chelmsford, England, was also broadcasting the program and endeavored to tune to the nearer station. "Chelmsford," he writes, "failed even to emit a whisper." Mr. De Swart's reception is all the more remarkable since W2XAF uses an antenna directional on South America.

**WGY Heard in Belgian Congo**

From the Belgian Congo, WGY has received congratulations on its tenth anniversary, celebrated February 20th last. Dr. George W. Westcott, medical missionary at Tremont Hospital, Tondo, Belgian Congo, writes that he and others at the mission frequently enjoy programs from WGY. Their radio sets are built to receive European programs also, but there is so much interference and static on the longer waves that he is almost wholly dependent on the "short waves" for radio entertainment. The programs from the Metropolitan Opera House are particularly fine, he reports, and the signal has been so strong on occasions that his next door neighbors, 100 feet away, have been awakened by the music.

Dr. Westcott writes that he has a great affection for WGY, because he made his debut at the Schenectady station in the summer of 1923, when he played a couple of musical "saw" solos. He is located sixty miles south of Equatorville, which is on the equator.

**Pilot-less Plane Directed by Radio**

A radio-controlled airplane visited Cape Girardeau, Mo., on a test flight, early in April, according to the officials of the International Aircraft-Radio-Electric Exposition, of St. Louis. The pilot-less plane starts its own motor, and wings its way through the sky, while its skilled and daring pilot soars nearby in the "Control" plane. By sending various groups of dots and dashes, the pilot is able to maneuver the ship just as if seated at its manual controls.

Its first public exhibition was given last summer in Houston, Texas, after which it was taken on an exhibition tour of a number of midwestern cities. Government officials and aviation engineers who have witnessed its uncanny performance, proclaim it as the most advanced step in aviation "since Lindbergh went to Paris." The radio-control mechanism used is the invention of Robert E. Autrey, of Los Angeles. Miss Gloria Hall, popular and widely-known stunt flyer, has been engaged to operate the mysterious pilot-less airplane.

**Long and Short Wave Airplane Radio**

New airplane radio equipment for carrying on two-way radio telephone conversation and also for the reception of beacon signals and weather reports is being installed on twenty-seven new airplanes of the Pilgrim type, being manufactured by the American Airplane and Engine Corporation, at Farmingdale, Long Island. One of the interesting features of this airplane radio equipment is that the planes will leave the factory completely fitted with Western Electric two-way radiophone apparatus, tuning to waves from 50 to 200 meters, and which will be used for communication with the American Airways radio telephone stations all along its routes. The planes will also be fitted with Western Electric radio receivers for the reception of radio range beacon signals and weather reports, which are regularly broadcast from stations of the U. S. Department of Commerce, the latter receivers tuning from 1304 to 600 meters. It is interesting to note that two-way radio telephone conversations have been carried on between planes of the Pilgrim model 100-A and ground radio stations for distances up to 400 to 500 miles. The phone transmitter in each of these airplane installations is of the 50 watt, crystal frequency control type. The power for the transmitter and both receivers in each plane is obtained from two dynamotors which, with the 12 volt airplane battery and control equipment, are located in a specially designed compartment towards the front of the airplane. The antenna system consists of a six foot stream-lined duralumin mast, located towards the tail of the plane, which supports three wires; two of the wires extend forward where they are attached to stub masts in the wing and the rear wire is attached to the vertical fin. All metal parts of the airplane are bonded or connected electrically and form the counterpoise or ground of the antenna system.

# SHORT WAVE STATIONS OF THE WORLD

ALL SCHEDULES EASTERN STANDARD TIME: ADD 5 HOURS FOR GREENWICH MEAN TIME

| Wavelength (Meters) | Frequency (Kilocycles) | Call Letters | Address and Schedule |
|---|---|---|---|
| 19.56 | 15,330 | W2XAD | General Electric Co., Schenectady, N. Y. Broadcasts 3-6 p.m. daily; 1-6 p.m. Sat. and Sunday. |
| 19.68 | 15,240 | | Pontoise (Paris), France. 9:30-12:30 a.m. Service de la Radiodiffusion, 103 Rue de Grenelle, Paris. |
| 19.72 | 15,210 | W6XK | Westinghouse Electric & Mfg. Co., Saxonburg, Pa. Tues., Thurs., Sat., Sun., 8 a.m. to noon. |
| | | DJB | For address, see listing for DJA. Mondays, 10-11 p.m. |
| 19.83 | 15,120 | HVJ | Vatican City (Rome, Italy) Daily, 5:00 to 5:15 a.m. |
| | | JIAA | Tokio, Japan. Irregular. |
| 19.99 | 15,000 | CM6XJ | Central Tuinucu, Cuba. Irregular. |
| 20.50 | 14,620 | XDA | Trens-News Agency, Mexico City. 2:30-3 p.m. |
| 20.95 | 14,310 | G2NM | Gerald Marcuse, Sonning-on-Thames, England. Sundays, 1:30 p.m. |
| 21.50 | 13,910 | ...... | University of Bucharest, Bucharest, Roumania, 2-5 p.m., Wed., Sat. |
| 23.35 | 12,850 | W2XO | General Electric Co., Schenectady, N. Y. Antipodal program 9 p.m. Mon. to 3 a.m. Tues. Noon to 5 p.m. on Tues. Thurs. and Sat. |
| | | W2XCU | Ampere, N. J. |
| | | W9XL | Anoka, Minn., and other experimental relay broadcasters. |
| 23.38 | 12,820 | ...... | Director General, Telegraph and Telephone Stations, Rabat, Morocco. Sun., 7:30-9 a.m. Daily 5-7 a.m. Telephony. |
| 25.16 | 11,920 | FYA | Pontoise, France. 1-3 p.m. daily. |
| 25.24 | 11,880 | W8XK | Westinghouse Electric & Mfg. Co., Saxonburg, Pa. Tues., Thurs., Sat., Sun., 11 a.m.-4 p.m. |
| | | W9XF | National Broadcasting Co., Downers Grove (Chicago), Ill. 9-10 p.m. daily. |
| 25.26 | 11,870 | VUC | Calcutta, India. 9:45-10:45 p.m.; 8-9 a.m. |
| 25.34 | 11,840 | W2XE | Columbia Broadcasting System, 485 Madison Ave., N. Y., Jamaica, New York. 7:30 a.m. through to 2 a.m. Sundays 8 a.m. to midnight. |
| | | W9XAA | Chicago Federation of Labor, Chicago, Ill. 7-8 a.m., 1-2, 4-5:30, 6-7:30 p.m. |
| 25.42 | 11,800 | VE9GW | W. A. Shane, Chief Engineer, Bowmanville, Canada. Daily, 1 p.m.-10 p.m. |
| 25.47 | 11,780 | VE9DR | Drummondville, Quebec, Canada. Irregular. |
| 25.50 | 11,760 | XDA | Trens-News Agency, Mexico City. 3-4 p.m. |
| 25.53 | 11,750 | G5SW | British Broadcasting Corporation, Chelmsford, England. Mon. to Sat., 1:45-7 p.m. |
| | | VE9JR | Winnipeg, Canada. Weekdays, 5:30-7:30 p.m. |
| 29.30 | 10,250 | TI4 | Amondo Cespedes Marin, Heredia, Costa Rica. Mon. and Wed., 7:30 to 8:30 p.m.; Thurs. and Sat., 9:00 to 10 p.m. |
| 30.3 | 9,890 | EAQ | Transradio Espanola, Alcala, 43-Madrid, P.O. Box 951, Spain. Daily for America, 0030-0200 G.M.T.; for Europe and Canaries, on Saturdays only, 1800-2000 G.M.T. |
| 31.10 | 9,640 | HSP2 | Broadcasting Service, Post and Telegraph Department, Bangkok, Siam. 9-11 a.m. daily. |
| 31.28 | 9,590 | VK2ME | Amalgamated Wireless, Ltd., 47 York St., Sydney, Australia. Sun., 1-3 a.m. 5-9 a.m., 9:30-11:30 a.m. |
| 31.30 | 9,580 | W3XAU | Byberry, Pa., relays WCAU daily. |
| 31.33 | 9,570 | W1XAZ | Westinghouse Electric & Mfg. Co., Springfield, Mass. 6 a.m.-10 p.m. daily. |
| | | SRI | Poznan, Poland. Tues. 1:45-4:45 p.m., Thurs. 1:30-8 p.m. |
| 31.38 | 9,560 | DJA | Reichspostzentralamt, 11-15 Schoenberge Strasse (Berlin). Konigswusterhausen, Germany. Daily, 8 a.m.-7:30 p.m. |
| 31.48 | 9,530 | W2XAF | General Electric Co., Schenectady, N. Y., 5-11 p.m. |
| 31.49 | 9,520 | OXY | Skamleboek, Denmark. 2-7 p.m. daily. |
| 31.55 | 9,510 | VK3ME | Amalgamated Wireless, Ltd., 47 York St., Melbourne, Australia. Wed. and Sat., 5-6:30 a.m. |
| 31.70 | 9,460 | ...... | Radio Club of Buenos Aires, Argentina. |
| 32.00 | 9,375 | EH9OC | Berne, Switzerland. 3-5:30 p.m. |
| 32.26 | 9,290 | ..... | Rabat, Morocco, 3-5 p.m. Sunday, and irregularly weekdays. |
| 35.00 | 8,570 | RV15 | Far East Radio Station, Khabarovsk, Siberia. 5-7:30 a.m. |
| 38.6 | 7,790 | HBP | League of Nations, Geneva, Switzerland. 3 - 8 p.m., irregular. |
| 39.80 | 7,530 | ...... | "El Prado," Riobamba, Ecuador. Thurs., 9-11 p.m. |
| 40.00 | 7,500 | ...... | "Radio-Touraine," France. |
| 40.20 | 7,460 | YR | Lyons, France. Daily except Sun., 10:30 to 1:30 a.m. |
| 40.50 | 7,410 | ...... | Eberswalde, Germany. Mon., Thurs., 1-2 p.m. |
| 40.70 | 7,370 | X26A | Nuevo Laredo, Mexico. 9-10 a.m.; 11 a.m.-noon; 1-2; 4-5; 7-8 p.m. Tests after midnight. I.S.W.C. programs 11 p.m. Wed. A.P. 31. |
| 40.90 | 7,320 | ZTJ | Johannesburg, So. Africa. 9:30 a.m.-2:30 p.m. |
| 41.46 | 7,230 | DOA | Doeberitz, Germany. |
| 41.50 | 7,220 | HB9D | Zurich, Switzerland. 1st and 3rd Sundays at 7 a.m., 2 p.m. |
| | | ...... | Budapest, Hungary 2:30-3:10 a.m., Tu., Thurs., Sat. Budapest Technical School, M.R.C., Budappest, Muegyetern. |
| 41.67 | 7,195 | VS1AB | Singapore, S. S. Mon., Wed. and Fri., 9:30-11 a.m. |
| 42.00 | 7,140 | HKX | Bogota, Colombia. |
| 42.70 | 7,020 | EAR125 | Madrid, Spain. 6-7 p.m. |
| 42.90 | 6,990 | CT1AA | Lisbon, Portugal. Fridays, 5-7 p.m. |
| 43.00 | 6,980 | EAR110 | Madrid, Spain. Tues. and Sat., 5:30 to 7 p. m.; Fri., 7 to 8 p.m. |

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

| Wavelength (Meters) | Frequency (Kilocycles) | Call Letters | Address and Schedule |
|---|---|---|---|
| 43.60 | 6,875 | F8MC | Casablanca, Morocco. Sun., Tues., Wed., Sat. |
| 46.40 | 6,480 | TGW | Guatamala City, Guat. 8-10 p.m. |
| 46.70 | 6,425 | W9XL | Anoka, Minn. |
| 46.70 | 6,425 | W3XL | National Broadcasting Co. Bound Brook, N. J. Relays WJZ. Irregular. |
| 46.72 | 6,420 | RV62 | Minsk, U.S.S.R. Irregular. |
| 47.00 | 6,380 | HC1DR | Quito, Ecuador. 8-11 p.m. |
| 47.35 | 6,335 | VE9AP | Drummondville, Canada. |
| | | CN8MC | Casablanca, Morocco. Mon. 3-4 p.m., Tues. 7-8 a.m., 3-4 p.m. Relays Rabat. |
| 47.81 | 6,270 | HKC | Bogota, Colombia. 8:30-11:30 p.m. |
| 48.00 | 6,250 | HKA | Barranquilla, Colombia. 8-10 p.m. ex. Mo., Wed., Fri. |
| 48.62 | 6,170 | HRB | Tegucigalpa, Honduras. Monday, Wednesday, Friday, Saturday 5-6 p.m. and 9-12 p.m. |
| 48.83 | 6,140 | W8XK | Westinghouse Electric and Mfg. Co., Saxonburg, Pa. Tues., Thurs., Sat., Sun., 5 p.m. to midnight. |
| 48.99 | 6,120 | ...... | Motala, Sweden, "Rundradio." 6:30-7 a.m.; 11-4:30 p.m. Holidays, 5 a.m. to 5 p.m. |
| 48.99 | 6,120 | F3ICD | 106 Boulevard Charner, Chi-Hoa (S a i g o n), Indo-China. 6:30-10:30 a.m. |
| 48.99 | 6,120 | W2XE | Columbia Broadcasting System, 485 Madison Avenue, New York, N. Y. 7:00-a.m. to midnight. |
| | | FL | Eiffel Tower, Paris. 5:30-5:45 a.m., 5:45-12:30. 4:15-4:45 p. m. |
| | | ...... | Toulouse, France. Sunday, 2:30-4 p. m. |
| 49.10 | 6,110 | VE9CG | Calgary, Alta., Canada. |
| 49.15 | 6,100 | W3XAL | National Broadcasting Company, Bound Brook, N.J., Irregular. |
| | | VE9CF | Halifax, N. S., Canada. 6-10 p.m., Tu., Thu., Fri. |
| 49.17 | 6,095 | VE9GW | Bowmanville, Ontario, Canada. Irregular. |
| 49.31 | 6,080 | W9XAA | Chicago Federation of Labor, Chicago, Ill. 6-7 a. m., 7-8 p.m., 9:30-10:15. 11-12 p.m. Int. S.-W. Club programs. From 10 p.m. Saturday to 6 a.m. Sunday. |
| 49.40 | 6,070 | VE9CS | Vancouver, B. C., Canada. Fridays before 1:30 a.m. Sundays, 2 and 10:30 p.m. |
| | | ...... | Johannesburg, South Africa, 10:30 a.m.-3:30 p.m. |
| 49.46 | 6,065 | SAJ | Motala, Sweden. 6:30-7 a. m., 11 a.m. to 4:30 p.m. |
| 49.50 | 6,060 | W8XAL | Crosley Radio Corp., Cincinnati, O. Relays 6:30-10 a.m., 1-3 p.m., 6 p.m. to 2 a.m. daily. Sunday after 1 p.m. |
| 49.50 | 6,060 | VQ7LO | Imperial and International Communications, L t d ., Nairobi, Kenya, Africa. Monday, Wednesday, Friday, 11 a.m.-2:30 p.m.; Tuesday, Thursday, 11:30 a.m.-2:30 p.m.; Saturday, 11:30 a.m.-3:30 p.m.; Sunday, 11 a.m. - 1:30 p.m.; Tuesday, 3 a.m.-4 a.m.; Thursday, 8 a.m.-9 a.m. |
| | | W3XAU | Byberry, Pa. Relays WCAU. |
| 49.59 | 6,050 | VE9CF | Halifax, N. S., Canada. 11 a.m.-noon, 5-6 p.m. On Wed., 8-9; Sun., 6:30-8:15 p.m. |
| | | HKD | Barranquilla, Columbia. |
| 49.67 | 6,010 | PK3AN | Sourabaya, Java. 6-9 a.m. |
| | | W4XB | Lawrence E. Dutton, care Isle of Dreams Broadcasting Corp., Miami Beach, Fla. |
| 49.75 | 6,030 | VE9CA | Calgary, Alta., Canada. |
| 49.80 | 6,020 | W9XF | National Broadcasting Co., Downers Grove (Chicago), Ill. |
| 49.96 | 6,005 | VE9DR | Canadian Marconi Co., Drummondville, Quebec. |
| 49.97 | 6,000 | YV2BC | Caracas, Venezuela. 7:45-11 p.m. daily ex. Mon. |
| | | ...... | Eiffel Tower, Paris, France. Testing, 6:30 to 6:45 a.m.; 1:15 to 1:30, 5:15 to 5:45 p.m., around this wave. |
| | | VE9CU | Calgary, Canada. |
| 49.97 | 6,000 | ...... | Administration des P. T. T., Tananarive, Madagascar. Tues., Wed., Thurs., Fri., 9:30 - 11:30 a.m. Sat. and Sun., 1-3 p.m. |
| 50.26 | 5,970 | HVJ | Vatican City (Rome). 2-2:15 p.m., daily. Sun., 5-5:30 a.m. |
| 50.80 | 5,900 | HKO | Medellin, Colombia. 8-11 p.m., except Sunday. |
| 51.40 | 5,835 | HKD | Barranquilla, Colombia. 7:45-10:30 p.m. Mon., Wed. 8-10:30 p.m.; Sunday 7:45-8:30 p.m. Elias J. Pellet. |
| 52.50 | 5,710 | VE9CL | Winnipeg, Canada. |
| 54.02 | 5,550 | W8XJ | Columbus, Ohio. |
| 58.00 | 5,170 | OKIMPT | Prague, Czechoslovakia. 1-3:30 p.m., Tues. and Fri. |
| | | PMY | Bandoeng, Java. |
| | | PMB | Sourabaya, Java. |
| 60.30 | 4,975 | W2XV | Radio Engineering Laboratories, Inc., Long Island City, N. Y. Irregular. |
| 62.56 | 4,795 | W9XAM | Elgin, Ill. (Time signals.) |
| | | W3XZ | Washington, D. C. |
| | | W9XL | Chicago, Ill. |
| 67.65 | 4,430 | DOA | Doeberitz, Germany. 6-7 p.m., 2-3 p.m., Mon., Wed., Fri. |
| 70.00 | 4,280 | OHK2 | Vienna, Austria. Sun., first 15 minutes of hour from 1 to 7 p.m. |
| 70.20 | 4,273 | RV15 | Far East Radio Station, Khabarovsk, Siberia. Daily. 3-9 a.m. |

*(Continued on opposite page)*

# SHORT WAVE STATIONS OF THE WORLD

*(Continued from opposite page)*

## Short Wave Broadcasting Stations

| | | | |
|---|---|---|---|
| 80.00 | 3,750 | F8KR | Constantine, Tunis, Africa. Mon. and Fri. |
| | | I3RO | Prato Smeraldo, Rome, Italy. Daily, 3-5 p.m. |
| 82.90 | 3,620 | DOA | Doeberitz, Germany. |
| 84.24 | 3,560 | OZ7RL | Copenhagen, Denmark. Tues. and Fri. after 6 p.m. |
| 128.09 | 2,342 | W7XAW | Fisher's Blend, Inc., Fourth Ave. and University St., Seattle, Washington. |

## Experimental and Commercial Radio-Telephone Stations

| Wavelength (Meters) | Frequency (Kilocycles) | Call Letters | Address and Schedule |
|---|---|---|---|
| 5.83 | 51,400 | W2XBC | New Brunswick, N. J. |
| 7.05 | 42,530 | ...... | Berlin, Germany. Tues. and Thurs., 11:30-1:30 p.m. Telefunken Co. |
| 8.67 | 34,600 | W2XBC | New Brunswick, N. J. |
| 9.68 | 31,000 | W8XI | Pittsburgh, Pa. |
| 10.79 | 27,800 | W6XD | Palo Alto, Calif. M. R. T. Co. |
| 11.55 | 25,960 | G5SW | Chelmsford, England. Experimental. |
| 11.67 | 25,700 | W2XBC | New Brunswick, N. J. |
| 12.48 | 24,000 | W6XQ | San Mateo, Calif. (Several experimental stations are authorized to operate on non-exclusive waves of a series, both above this and down to 4 meters.) |
| | | | Vienna, Austria, Mon., Wed., Sat. |
| 13.92 | 21,540 | W8XK | Saxonburg, Pa. |
| 14.00 | 21,420 | W2XDJ | Deal, N. J. And other experimental stations. |
| 14.01 | 21,400 | WLO | American Telephone & Telegraph Co., Lawrence, N. J., transatlantic phone. |
| 14.15 | 21,130 | LSM | Monte Grande, Argentina. |
| 14.27 | 21,020 | LSN | (Hurlingham), Buenos Aires, Argentina. |
| 14.28 | 21,000 | OKI | Podebrady, Czechoslovakia. |
| 14.47 | 20,710 | LSY | Monte Grande, Argentina. Telephony. |
| 14.50 | 20,680 | LSN | Monte Grande, Argentina. after 10:30 p.m. Telephony with Europe. |
| | | LSX | Buenos Aires. Telephony with U. S. |
| | | FSR | Paris-Saigon phone. |
| 14.54 | 20,620 | PMB | Bandoeng, Java. After 4 a.m. |
| 14.62 | 20,500 | W9XF | Chicago, Ill. |
| 14.89 | 20,140 | DWG | Nauen, Germany. Tests 10 a.m.-3 p.m. |
| 15.03 | 19,950 | LSG | Monte Grande, Argentina. From 7 a.m. to 1 p.m. Telephony to Paris and Nauen (Berlin). |
| | | DIH | Nauen, Germany. |
| 15.07 | 19,906 | LSG | Monte Grande, Argentina. 8-10 a.m. |
| 15.10 | 19,850 | WMI | Deal, N. J. |
| 15.12 | 19,830 | FTD | St. Assise, France. |
| 15.45 | 19,400 | FRO, FRE | St. Assise, France. |
| 15.50 | 19,350 | ...... | Nancy, France. 4 to 5 p.m. |
| 15.55 | 19,300 | FTM | St. Assise, France. 10 a.m. to noon. |
| 15.58 | 19,240 | DFA | Nauen, Germany. |
| 15.60 | 19,220 | WNC | Deal, N. J. |
| 15.91 | 18,820 | PLE | Bandoeng, Java. 8:40-10:40 a.m. Phone service to Holland. |
| 16.10 | 18,620 | GBJ | Bodmin, England. Telephony with Montreal. |
| 16.11 | 18,620 | GBU | Rugby, England. |
| 16.33 | 18,370 | PMC | Bandoeng, Java. |
| 16.35 | 18,350 | WND | Deal Beach, N. J. Transatlantic telephony. |
| 16.38 | 18,310 | GBS | Rugby, England. Telephony with New York. General Postoffice, London. |
| | | FZS | Saigon, Indo-China. 1 to 3 p.m. Sundays. |
| 16.44 | 18,240 | FRO, FRE | Ste. Assise, France. |
| 16 50 | 18,170 | CGA | Drummondville, Quebec, Canada. Telephony to England. |
| 16.57 | 18,100 | GBK | Bodmin, England. |
| | | W9XAA | Chicago, Ill. Testing, mornings. |
| 16.61 | 18,050 | KQJ | Bolinas, Calif. |
| 16.80 | 17,850 | PLF | Bandoeng, Java ("Radio Malabar"). |
| | | W2XAD | New Brunswick, N. J. |
| 16.82 | 17,830 | PCV | Kootwijk, Holland. 9:40 a.m. Sat. |
| 16.87 | 17,780 | W8XK | Westinghouse Eleteric and Mfg. Co., Saxonburg, Pa. |
| 17.00 | 17,640 | | Ship, Phones to Shore: WSBN, "Leviathan"; GFWV, "Majestic"; GLSQ, "Olympic"; GDLJ, "Homeric"; GMJQ, "Belgenland"; work on this and higher channels. |
| 17.25 | 17,380 | JIAA | Tokio, Japan. |
| 17.34 | 17,300 | W2XK | Schenectady, N. Y. Tues., Thurs., Sat. 12 to 5 p.m. General Electric Co. |
| | | W8XL | Dayton, Ohio. |
| | | W6XAJ | Oakland, Calif. |
| | | W2XCU | Ampere, N. J. |
| | | W9XL | Anoka, Minn., and other experimental stations. |
| 17.52 | 17,110 | WOO | Deal, N. J. Transatlantic phone. |
| | | W2XDO | Ocean Gate, N. J. A. T. & T. Co. |
| 17.55 | 17,080 | GBC | Rugby, England. |
| 18.40 | 16,300 | PCL | Kootwijk, Holland. Works with Bandoeng from 7 a.m. |
| | | WLO | Lawrence, N. J. |
| 18.50 | 16,200 | FZR | Saigon, Indo-China. |
| 18.56 | 16,150 | GBX | Rugby, England. |
| 18.68 | 16,060 | NAA | U. S. Navy, Arlington, Va. Time signals, 11:57 to noon. |
| 18.80 | 15,950 | PLG | Bandoeng, Java. Afternoons. |
| 18.90 | 15,860 | FTK | St. Assise, France. Telephony. |
| 18.93 | 15,760 | JIAA | Tokio, Japan. Up to 10 a.m. Beam transmitter. |
| 19.60 | 15,300 | OXY | Lyngby, Denmark. Experimental. |
| | | W6XAL | Westminster, Calif. |
| 20.65 | 14,530 | LSA | Buenos Aires, Argentina. |
| 20.70 | 11,480 | W8XK | Saxonburg, Pa. |
| | | GBW | Radio Section, General Post Office, London, E. C. 1, Rugby, England. |
| | | WNC | Deal, N. J. |
| 20.80 | 14,420 | VPD | Suva, Fiji Islands. |
| 21.17 | 14,150 | KKZ | Bolinas, Calif. |
| 22.38 | 13,400 | WND | Deal Beach, N. J. Transatlantic telephony. |
| 23.46 | 12,780 | GBC | Rugby, England. |
| 24.41 | 12,290 | GBU | Rugby, England. |
| 24.46 | 12,250 | FTN | Ste. Assise (Paris), France. Works Buenos Aires, Indo-China and Java. On 9 a.m. to 1 p.m. and other hours. |
| | | GBS | Rugby, England. |
| | | PLM | Bandoeng, Java. 7:45 a.m. |
| 24.68 | 12,150 | GBS | Rugby, England. Transatlantic phone to deal, N. J. (New York). |
| | | FQO, FQE | Ste. Assise, France. |
| 24.80 | 12,090 | ...... | Tokio, Japan. 5-8 a.m. |
| 24.89 | 12,015 | NAA | Arlington, Va. Time signals, 11:57 to noon. |
| | | NSS | Annapolis, Md. Time signals, 9:57-10 p.m. |
| 24.98 | 12,000 | FZG | Saigon, Indo-China. Time signals, 2-2:05 p.m. |
| 25.10 | 11,945 | KKQ | Bolinas, Calif. |
| 25.65 | 11,680 | YVQ | Maracay, Venezuela. (Also broadcasts occasionally.) |
| 25.68 | 11,670 | KIO | Kahuku, Hawaii. |
| 26.00 | 11,530 | CGA | Drummondville, Canada. |
| 26.10 | 11,490 | GBK | Bodmin, England. |
| 26.15 | 11,470 | IBDK | S.S. "Elettra," Marconi's yacht. |
| 26.22 | 11,435 | DHC | Nauen, Germany. |
| 26.44 | 11,340 | DAN | Nordeich, Germany. Time signals, 7 a.m., 7 p.m. Deutsche Seewarte, Hamburg. |
| 27.30 | 10,980 | ZLW | Wellington, N. Z. Tests 3-8 a.m. |
| 28.20 | 10,630 | PLR | Bandoeng, Java. Works with Holland and France weekdays from 7 a.m.; sometimes after 9:30. |
| 28.44 | 10,540 | WLO | Lawrence, N. J. |
| | | VLK | Sydney, Australia. 1-7 a.m. |
| 28.80 | 10,410 | PDK | Kootwijk, Holland. |
| | | KEZ | Bolinas, Calif. |
| | | LSY | Buenos Aires, Argentina. |
| 28.86 | 10,390 | GBX | Rugby, England. |
| 29.54 | 10,150 | DIS | Nauen, Germany. Press (code) daily; 6 p.m., Spanish; 7 p.m., English; 7:50 p.m., German; 2:30 p.m., English; 5 p.m., German. Sundays: 6 p.m., Spanish; 7:50 p.m., German; 9:30 p.m., Spanish. |
| 30.15 | 9,950 | GBU | Rugby, England. |
| 30.30 | 9,890 | LSN | Buenos Aires, phone to Europe. |
| | | LSA | Buenos Aires. |
| 30.64 | 9,790 | GBW | Rugby, England. |
| 30.75 | 9,750 | ...... | Agen, France. Tues. and Fri., 3 to 4:15 p.m. |
| | | WNC | Deal, N. J. |
| 30.90 | 9,700 | WMI | Deal, N. J. |
| 30.93 | 9,600 | LQA | Buenos Aires. |
| 31.23 | 9,600 | LGN | Bergen, Norway. |
| 32.13 | 9,330 | CGA | Drummondville, Canada. |
| 32.21 | 9,310 | GBC | Rugby, England. Sundays 2:30-5 p.m. |
| 32.40 | 9,250 | GBK | Bodmin, England. |
| 32.50 | 9,230 | FL | Paris, France (Eiffel Tower). Time signals 4:56 a.m. and 4:56 p.m. |
| 32.59 | 9,200 | GBS | Rugby, England. Transatlantic phone. |
| 33.26 | 9,010 | GBS | Rugby, England. |
| 33.81 | 8,872 | NPO | Cavite (Manila), Philippine Islands. Time signals 9:55-10 p.m. |
| | | NAA | Arlington, Va. Time signals 9:57-10 p.m., 2:57-3 p.m. |
| 33.98 | 8,810 | WSBN | S.S. "Leviathan." |
| 34.50 | 8,690 | W2XAC | Schenectady, New York. |
| 34.68 | 8,650 | W2XCU | Ampere, N. J. |
| | | W9XL | Chicago. |
| 34.68 | 8,650 | W3XE | Baltimore, Md. 12:15-1:15 p.m., 10:15-11:15 p.m. |
| | | W2XV | Radio Engineering Lab., Long Island City, N. Y. |
| | | W8XAG | Dayton, Ohio. |
| | | W4XG | Miami, Fla. |
| | | W3XX | Washington, D. C. And other experimental stations. |
| 34.74 | 8,630 | WOO | Deal, N. J. |
| | | W2XDO | Ocean Gate, N. J. |
| 35.02 | 8,550 | WOO | Ocean Gate, N. J. |
| 35.50 | 8,450 | PRAG | Porto Alegre, Brazil. 8:30-9:00 a.m. |
| 36.92 | 8,120 | PLW | Bandoeng, Java. |
| 37.02 | 8,100 | EATH | Vienna, Austria. Mon. and Thurs., 5:30 to 7 p.m. |
| | | JIAA | Tokyo, Japan. Tests 5-8 a.m. |
| 37.80 | 7,930 | DOA | Doeberitz, Germany. 1 to 3 p.m. Reichpostzentralamt, Berlin. |

*(Continued on next page)*

## "STAR" SHORT WAVE BROADCASTING STATIONS

The fallowing stations are reported regularly by many listeners, and are known to be on the air during the hougs stated. Conditions permitting, you should be able to hear them on your own short-wave receiver. All times E.S.T.

G5SW, Chelmsford, England. 25.53 meters. Monday to Saturday 1:45 p.m. to 7 p.m. Signs off with the midnight chimes of Big Ben in London.

HVJ, Vatican City. Daily 5 to 5:15 a.m on 19.83 meters; 2 to 2:15 p.m. on 50.26 meters; Sunday 5 to 5:30 a.m. on 50.26 meters.

VK2ME, Sydney, Australia. 31.28 meters. Sunday morning from 1 to 3 a.m.; 5 to 9 a.m.; and 9:30 to 11:30 a.m.

VK3ME, Melbourne, Australia. 31.55 meters. Wednesday and Saturday, 5 to 6:30 a.m.

Pointoise, France. On 19.68 meters, 9:30 a.m. to 12:30 p.m.; on 25.16 meters, from 1 to 3 p.m.; and on 25.63 meters from 4 to 6 p.m.

Konigs-Wusterhausen, Germany. On 31.38 meters daily from 8 a.m. to 7:30 p.m.

HKD, Barranquilla, Colombia. On 51.4 meters, Monday, Wednesday and Friday, 8 to 10:30 p.m.; Sunday, 7:45 to 8:30 p.m.

VE9GW, Bowmanville, Ontario, Canada. 25.42 meters. from 1 to 10 p.m.

HRB, Tegucigalpa, Honduras. 48.62 meters. Monday, Wednesday, Friday and Saturday, 5 to 8 and 9 to 12 p.m.

T14, Heredia, Costa Rica, Central America. 29.3 meters. Monday and Wednesday, 7:30 to 8:30 p.m.; Thursday and Saturday, 9 to 10 p.m.

XDA, Mexico City. 25.5 meters. Daily, 3 to 4 p.m.

F3ICD, Chi-Hoa, French Indo-China. 49.1 meters. Daily from 6:30 to 10:30 a.m.

RV15, Khavarovsk, Siberia. 70.2 meters. Daily from 3 to 9 a.m.

# SHORT WAVE STATIONS OF THE WORLD

(Continued from preceding page)

## Experimental and Commercial Radio-Telephone Stations

| Wavelength (Meters) | Frequency (Kilocycles) | Call Letters | Address and Schedule |
|---|---|---|---|
| 38.00 | 7,890 | VPD | Suva, Fiji Islands. |
| | | JIAA | Tokio, Japan (Testing). |
| 38.30 | 7,830 | PDV | Kootwijk, Holland, after 9 a.m. |
| 38.60 | 7,770 | FTF | Ste. Assise, France. |
| | | PCK | Kootwijk, Holland. 9 a.m. to 7 p.m. |
| 39.15 | 7,660 | FTL | Ste. Assise. |
| 39.40 | 7,610 | HKF | Bogota, Colombia. 8-10 p.m. p.m. |
| 39.74 | 7,520 | CGE | Calgary, Canada. Testing, Tues., Thurs. |
| 43.70 | 6,860 | KEL | Bolinas, Calif. |
| | | Radio Vitus | Paris, France. 4-11 a.m., 3 p.m. |
| 43.80 | 6,840 | CFA | Drummondville, Canada. |
| 44.40 | 6,753 | WND | Deal, N. J. |
| 44.99 | 6,660 | F8KR | Constantine, Algeria. Mon., Fri., 5 p.m. |
| | | HKM | Bogota, Colombia. 9-11 p.m. |
| 45.50 | 6,560 | RFN | Moscow, U.S.S.R. (Russia) 2 a.m.-4 p.m. |
| 46.05 | 6,515 | WOO | Deal, N. J. |
| 62.80 | 4,770 | ZL2XX | Wellington, New Zealand. |
| 63.00 | 4,760 | Radio LL | Paris, France. |
| 63.13 | 4,750 | WOO | Ocean Gate, N. J. |
| 63.79 | 4,700 | W1XAB | Portland, Me. |
| 72.87 | 4,116 | WOO | Deal, N. J. |
| 74.72 | 4,105 | NAA | Arlington, Va. Time signals. 9:57-10 pm., 11:57 a.m. to noon. |
| 92.50 | 3,256 | W9XL | Chicago, Ill. |
| 95.00 | 3,156 | PK2AG | Samarang, Java. |
| 96.03 | 3,124 | WOO | Deal, N. J. |
| 97.53 | 3,076 | W9XL | Chicago, Ill. |
| | | | Motala, Sweden. 11:30 a.m.-noon, 4-10 p.m. |

## Airport Stations

| Wavelength (Meters) | Frequency (Kilocycles) | Call Letters | Address and Schedule |
|---|---|---|---|
| 98.95 | 3,030 | VE9AR | Saskatoon, Sask., Canada. |
| 53.25 | 5,630 ) | WQDP | Atlanta, Ga. |
| 86.00 | 3,490 ( | WSDE | Tuscaloosa, Ala. |
| | | WSDB | Jackson, Miss. |
| | | KGUK | Shreveport, La. |
| | | KGUF | Dallas, Tex. |
| | | KGUC | Fort Worth, Tex. |
| | | KGUL | Abilene, Tex. |
| | | KGUG | Big Springs, Tex. |
| | | KGUA | El Paso, Tex. (Southern Air Transport Lines.) |
| 53.53 | 5,600 ) | WQDU | Aurora, Ill. |
| 94.52 | 3,170 ( | KQQ | Iowa City, Iowa. |
| | | KQM | Des Moines, Iowa. |
| | | KMP | Omaha, Neb. |
| | | KRF | Lincoln, Neb. |
| | | KMR | North Platte, Neb. |
| | | KQE | Cheyenne, Wyo. |
| | | KQC | Rock Springs, Wyo. |
| | | KQD | Salt Lake City, Utah. |
| | | KKO | Elko, Nevada. |
| | | KJE | Reno, Nevada. |
| | | KFO | Oakland, Calif. |
| | | KRA | Boise, Idaho. |
| | | KDD | Pasco, Wash. (Boeing Air Lines). |
| 54.00 | 5,560 ) | WAEF | Newark, N. J. |
| 96.77 | 3,100 ( | WAEE | Camden, N. J. |
| | | WAED | Harrisburg, Pa. |
| | | WAEC | Pittsburgh, Pa. |
| | | WAEB | Columbus, Ohio. |
| | | WAEA | Indianapolis, Ind. |
| | | KGTR | St. Louis, Mo. |
| | | KSY | Tulsa, Okla. |
| | | KSW | Amarilla, Tex. |
| | | KSX | Albuquerque, N. M. |
| | | KGPL | Kingman, Ariz. |
| | | KGTJ | Las Vegas, Nev. |
| | | KSI | Los Angeles, Calif. |
| | | KGTD | Wichita, Kan. |
| | | KST | Kansas City, Mo. (Transcontinental Air Transport). |

## Television Stations

| Wavelength (Meters) | Frequency (Kilocycles) | Call Letters | Address and Schedule |
|---|---|---|---|
| 3.75 to 5 meters—60 to 80 megacycles. | | | |
| 5.96 to 6.18 meters—48.5 to 50.3 megacycles. | | | |
| 6.52 to 7.14 meters—42 to 46 megacycles. | | | |
| | | W8XF | The Goodwill Station, Pontiac, Mich. |
| | | W8XL | WGAR Broadcasting Co., Cleveland Ohio. |
| 6.89 | 43,500 | W9XD | Milwaukee Journal, Milwaukee, Wis. |
| | | W3XAD | Camden, N. J. (Other experimental television permits: 48,500 to 50,300 k.c., 43,000-46,000 k.c.). |
| 101.7 to 105.3 meters—2,850 to 2,950 kc. | | | |
| | | W1XAV | Short Wave & Television Corp., Boston, Mass. 1-2, 7:30 to 10:30 p.m. daily ex. Sun. Works with W1XAU 10-11 p.m. |
| | | W2XR | Radio Pictures, Inc., Long Island City, N. Y. 4 to 10 p.m. exc. Sundays. Silent 7-7:30 Sat. |
| 105.9 | 2,833 | W6XAN | Los Angeles, Calif. |
| | | W7XAB | Spokane, Wash. |
| 105.3 to 109.1 meters—2,750 to 2,850 kc. | | | |
| | | W2XAB | Columbia Broadcasting System, 485 Madison Ave., N. Y. 8:00-10:00 p.m. |
| | | W2XBO | Long Island City, N. Y. |
| | | W9XAA | Chicago, Ill. |
| | | W9XG | Lafayette, Ind. 60 holes, 1,200 r.p.m. Tuesdays and Thursdays, 2:00 p.m., 7:00 p.m., 10:00 p.m. |
| 108.8 | 2,758 | VE9CI | London, Ont., Canada. |
| 136.4 to 142.9 meters—2,100 to 2,200 kc. | | | |
| | | W2XBS | National Broadcasting Co., New York, N. Y., 1,200 R.P.M., 60 lines deep, 72 wide. 2-5 p.m., 7-10 p.m. ex. Sundays. |
| | | W2XR | Radio Pictures, Inc., Long Island City, N. Y. 48 and 60 line. 5-7 p.m. |
| | | W3XAD | R. C. A.-Victor Co., Inc., Camden, N. J. |
| | | W2XCW | Schenectady, N. Y. |
| | | W8XAV | Pittsburgh, Pa. 1,200 R.P.M., 60 holes. 1:30-2:30 p.m., Mon., Wed., Fri. |
| | | W9XAP | Chicago, Ill. |
| | | —— | Kansas State Agricultural College, Manhattan, Kans. |
| 142.9 to 150 meters—2,000 to 2,100 kc. | | | |
| | | W2XAP | Jersey City, N. J. |
| | | W2XCR | Jersey City, N. J. 3-5, 6-9 p.m. ex. Sun. |
| | | W3XK | Wheaton, Maryland. 10:30 p.m.-midnight exc. Sun. Works with W3XJ. |
| | | W2XCD | Passaic, N. J. 2-3 p.m. Tues., Thurs., Sat. |
| | | W8XF | The Goodwill Station, Pontiac, Mich. |
| 142.9 to 150 meters—2,000 to 2,100 kc. | | | |
| | | W9XAO | Chicago, Ill. |
| | | W9XAA | Chicago, Ill. |

## Police Radio Stations

| Wave-length (Meters) | Frequency (Kilo-cycles) | Call Letters | Location |
|---|---|---|---|
| 121.5 | 2,470 | KGOZ | Cedar Rapids, Ia. |
| | | KGPN | Davenport, Ia. |
| | | WPDZ | Fort Wayne, Ind. |
| | | WPDT | Kokomo, Ind. |
| | | WPEC | Memphis, Tenn. |
| | | KGPI | Omaha, Neb. |
| | | WPDP | Philadelphia, Pa. |
| | | KGPD | San Francisco, Cal. |
| | | KGPM | San Jose, Cal. |
| | | WRDQ | Toledo, Ohio |
| 122.0 | 2,458 | WPDO | Akron, Ohio |
| | | WPDN | Auburn, N. Y. |
| | | WPDV | Charlotte, N. C. |
| | | WRDH | Cleveland, Ohio |
| | | WPDR | Rochester, N. Y. |
| | | WPEA | Syracuse, N. Y. |
| 122.4 | 2,450 | WPDK | Milwaukee, Wis. |
| | | WPEE | New York, N. Y. |
| | | WPEF | New York, N. Y. |
| | | WPEG | New York, N. Y. |
| | | KGPH | Okla. City, Okla. |
| | | KGPO | Tulsa, Okla. |
| | | KGPZ | Wichita, Kans. |
| 122.8 | 2,442 | KGPX | Denver, Col. |
| | | WPDF | Flint, Mich. |
| | | WPEB | Gr'd Rapids, Mich. |
| | | WMDZ | Indianapolis, Ind. |
| | | WPDL | Lansing, Mich. |
| | | WPDE | Louisville, Ky. |
| | | KGPP | Portland, Ore. |
| | | WPDH | Richmond, Ind. |
| 123.4 | 2,430 | WPDI | Columbus, Ohio |
| 123.8 | 2,422 | KSW | Berkeley, Cal. |
| | | WMJ | Buffalo, N. Y. |
| | | KGPE | Kansas City, Mo. |
| | | KGPG | Vallejo, Cal. |
| | | WPDW | Washington, D. C. |
| 124.1 | 2,416 | KGPB | Minneap'lis, Minn. |
| | | WPDS | St. Paul, Minn. |
| 124.2 | 2,414 | WPDY | Atlanta, Ga. |
| | | KGPS | Bakersfield, Cal. |
| | | WCK | Belle Island, Mich. |
| | | WPDX | Detroit, Mich. |
| | | WRDR | Grosse Point Village, Mich. |
| 124.2 | 2,414 | WMO | Highland Park, Mich. |
| | | KGPA | Seattle, Wash. |
| | | WPDA | Tulare, Cal. |
| 175.15 | 1,712 | KGPJ | Beaumont, Tex. |
| | | WPDB | Chicago, Ill. |
| | | WPDC | Chicago, Ill. |
| | | WPDD | Chicago, Ill. |
| | | WKDU | Cincinnati, Ohio |
| | | KVP | Dallas, Tex. |
| | | KGPL | Los Angeles, Cal. |
| | | KGJX | Pasadena, Cal. |
| | | WPDU | Pittsburgh, Pa. |
| | | KGPC | St. Louis, Mo. |
| 189.5 | 1,574 | WRDS | E. Lansing, Mich. |
| | | WMP | Fram'gham, Mass. |
| | | KGPY | Shreveport, La. |
| 1123 | 257 | WBR | Butler, Pa. |
| | | WJL | Greensburg, Pa. |
| | | WBA | Harrisburg, Pa. |
| | | WMB | W. Reading, Pa. |
| | | WDX | Wyoming, Pa. |

## Marine Fire Stations

| | | | |
|---|---|---|---|
| 187.81 | 1,596 | WRDU | Brooklyn, N. Y. |
| | | WKDT | Detroit, Mich. |
| | | WCF | New York, N. Y. |
| 192.4 | 1,558 | WEY | Boston, Mass. |
| | | KGPD | San Francisco, Cal. |

# LETTERS FROM S-W FANS

## TUBE OR NOT TO BE

*Editor,* SHORT WAVE CRAFT:

Having noticed your article on the Western Electric 216A transmitting tubes, I wish to give you some of my personal experience with these tubes.

Recently I acquired two of them and started using them in a single tube Hartley Hi-C transmitting circuit, and they seemed to "get out" better than the 210, I was previously using. (I was only using them one at a time.) On the first one I put 9 volts on the filament and 400 on the plate and the tube lasted for 4 months, and the only reason that it burnt out was that I had too much filament voltage on it. Then I put the other tube in my transmitter and the set seemed to jump into new life. Of course I ran the filament down, but no lower than 7.5 volts. I increased power by getting a Thordarson 250 watt power transformer and so I put 600 volts on the 216A and 7½ on the filament. I then used the tube for 8 months, but one day I was doing some repair work on my xmitter and accidentally broke the tube. At the time of the calamity, or rather, previously, the tube showed no sign of "going west," and was working OK.

I have been on the air for a little over a year and the only tubes I have ever used are 210 and 216A, and the 216A most of the time. I like it very much, and honestly believe that it will take more punching than the 210. The last tube mentioned was drawing 96 mills and would get *slightly red* when the key would stay down for a long time. (The latter 216A, not the 210.) I am now using a VT2 Navy type tube and it will not stand my voltage without "blushing like a beet."

I would be very pleased if you could find a few of these tubes, and would appreciate it if you would let me know who has some spare ones. I would like to have some of them in my transmitter. By the fall I hope to have a couple of Type 52 tubes perking in a crystal-controlled rig, with a 216A Xtal oscillator, feeding a couple of un-neutralized 210 tubes, with these 210s feeding two 852 tubes in push-pull (neutralized final amplifiers).

That's enough about that now, and I wish to say "More Power to You and Your Magazine." It has a world of good information in it, and that dope on the directional antenna system is "sure the berries." Transmitter designs and also those of receivers are the "cat's pajamas" also.

Well, good luck and keep the good work up, and 73 es C U L.

JUNIOR CRUMLEY, W4AAO,
607 Fifth St.,
Bristol, Tenn.

"Sigs From A Gud Place to Live."

*(You ask us a difficult one Junior, but we believe that Blan, the Radio Man, 89 Cortlandt Street, New York City, may be able to fix you up. Few of these tubes are in use. Blan may have them.—Editor.)*

## A SWELL KICK

*Editor,* SHORT WAVE CRAFT:

I get your publication regularly and think it is getting worse right along. I think that it is the best I have gotten hold of yet but here's a suggestion—let's have some more dope on the construction and operation of short wave receivers and transmitters. I noticed in your January issue there are five or six articles on factory-made receivers.

These belong in some service man's magazine and not in a "ham" publication. I am not a "ham" myself, but expect to go on the air soon. I would like to see something on the calibration of wave meters.

Yours truly,
Forrest Bigelow,
Roanoke, Indiana.

*(Thanks, Forrest, for the brick-bat and we certainly do like to get them once in a while, because editors are liable to get swelled heads if they receive laudable letters all the time. In self-defense, however, let us hasten to explain that the short wave art is progressing so rapidly that unless we show you readers exactly what the manufacturers are doing, we earnestly believe that we are falling down on the job. You will notice that unlike other radio publications, we insist that the manufacturer give you readers 100 per cent dope on the inside of the set, including coil specifications, etc.*

*Referring to the calibration of wave meters, we hope to have an article on this soon.—Editor.)*

## NOT SO GREEN!

**Editor, SHORT WAVE CRAFT:**

**Well, here is the first letter I ever wrote to any magazine. I want to tell you about the first radio receiver I ever built. Yep, I mean the DOERLE Receiver; I had to get started some time. I couldn't understand the radio symbols very well, but it turned out "not so bad," I must say. I had a lot of trouble to control the oscillation, but by looking over the old issues of SHORT WAVE CRAFT I found what I needed and applied it, and oh boy! did it work! Oh say! No kiddin'—IT'S A WOW!**

**I have listened to the following stations (the first four are heard daily): W2XAF, W1XAZ, W3XAL, W8XK, W9XF, KEF, VE9JR, WOF, RV15, VK2ME, W2XBJ, VE9DR, W9XAA. I have received station F31CD at Saigon every morning for the past three weeks; not bad, I think. I'll say 73, wishing SHORT WAVE CRAFT a long and prosperous life.**

**Yours truly,**
**A. P. VENTURA,**
**637 Porter St., Vallejo, Calif.**

*(Congrats, "A. P.," and welcome to the ranks of the short wave wrecking crew. Not so bad at all, we assure you, for a greenhorn in short waves. As a matter of fact, some of the old hands may find that they can learn something from you. Keep up the good work and here's hoping you go broke in buying short wave parts.—Editor.)*

## OH! OH!

*Editor,* SHORT WAVE CRAFT:

Would you be interested in helping an enthusiastic beginner? You will do so if you will be so kind as to publish this letter in a future issue of SHORT WAVE CRAFT. I would like some "ham" (or "hams") to write me describing a 4, 5 or 6 tube short wave receiver (A.C.) which they have built and operated with good results. I built a two-tube battery set which "percolated," but I could only get WOO, Deal, New Jersey. Well, anyway, I feel I'm progressing. By the way, the circuit I used was Mr. Doerle's. I will appreciate it very much if you will publish this.

Very truly yours,
Allison Staples,
17 Cushing Ave.,
Nashua, N. H.

*(Not so hot, Allison, and it seems time that someone took you in hand and showed you how to fix up your set so that it will percolate properly. There must be something wrong with the "carburetor." But seriously, we hope that some of your neighbors will read this and get your set to work.—Editor.)*

## THIS MAKES US BLUSH

*Editor,* SHORT WAVE CRAFT:

I am sure getting the mail from the fans that read SHORT WAVE CRAFT magazine, after they have read my letter in the Aug.-Sept. of of 1931 in "Among the Hams" department. But I hereby like to say that I will be very glad if some of the foreign readers of "S. W. C." will write me.

I should have stated that before as your magazine is no place for such letters as I am writing. But anyway I am writing you because I know that I will get the results that I wish to get for "S. W. C." has good readers that know their business. Most of the letters I receive from the "Swappers" of "S. W. C." are very interesting and have lots of good information. I am a subscriber to the following magazines: *Radio Craft*, SHORT WAVE CRAFT and *Television News*, besides a few of the Gernsback books. All these are valuable to me as besides graduating from a very good radio school (which is the R. C. A. Institute, Inc.) I get the rest of my radio dope out of these Gernsback publications, as these publishers know their business. There are quite a few radio magazines in circulation. They all claim that they are best but the best and the leader of all are the magazines that are published by Hugo Gernsback and his associates, as they give *real radio dope* and no bunk as others do; that is why I don't like other magazines as they publish that which Gernsback publishers have published months ago.

Gernsback publishers are always first to give the latest findings in radio and so I wish them success and also like to see them keep up their very good work. In conclusion please let me say that I predict that the SHORT WAVE CRAFT is going to be a monthly publication as the subscribing list is going upward very rapidly. Now let me suggest that those that write me or other fellow "Swappers" put their addresses very plainly as I received quite a few letters and can't answer them as I am confused about their addresses. Some of them might be disappointed by not receiving an answer but that is not my fault. But any way I thank them all that have written me, and do hope to hear from some foreign readers of "S. W. C." I also wish the president of the International Swappers Radio Club success in his drive for members of this club; incidentally, his name is Eugene C. Miller, 15½ N. Main St., Three Rivers, Michigan. So I request those who have not joined this club yet, to please do so at once as pretty soon the club's album will be passed around to each member of this International Swappers Radio Club, for inspection and for putting their own photographs of their radio stations as well as their own pictures of themselves. If you do write please state what clubs you belong to and also what radio magazines you are a subscriber of. Foreign readers of SHORT WAVE CRAFT are desired for this club. So let Eugene C. Miller of 15½ N. Main Street, Three Rivers, Michigan, hear from you. Mr. Editor, if not asking you too much please have this printed in your worthy magazine, SHORT WAVE CRAFT, as I know of no better "Short Wave" magazine than this SHORT WAVE CRAFT.

Thanking you in advance, I beg to remain,

A steady reader of "S. W. C."
STANLEY JOHN YUREK,
72 East 21st St., Bayonne, N. J.

*(Now listen Stanley, please don't write any more letters such as these because if you do, you will be reading about an editorial explosion because our swelled head may pop off! How about a good-sized brickbat for a change—but thanks for your kind wishes.—Editor.)*

# A Tried and Proven S-W Adapter

**By ROD PERRY**

Radio Operator, S.S. "S. M. Spalding"

● PRACTICALLY all marine radio operators, like myself, carry their own "short wave" receivers; these vary from simple one-tube affairs to multi-tube supers. I have tried many types and find the adapter described very satisfactory and meeting the requirements of the sea-going operator.

Several factors had to be taken under consideration; the adapter must be compact so as to take up a minimum amount of space and be easily packed in a traveling bag. It must be sturdily built to withstand the conditions aboard ship; it must be enclosed to protect the set from the damp air and salt spray, and it must cover a wave band at least from 15 to 50 meters.

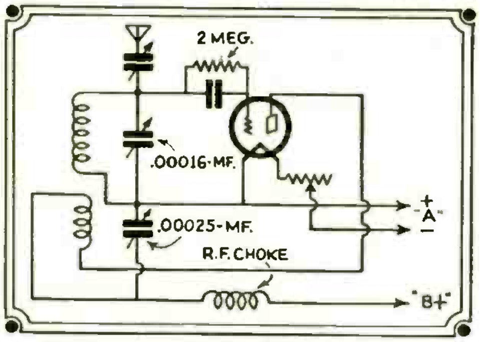
A 5" x 9" x 6" aluminum box was chosen for the cabinet; this is of standard size and easily obtained. Plenty of room is available to allow sufficient spacing between the parts; if the cabinet is too small there will be a tendency for feed-back to take place between the various circuits.

Four controls are on the face of the set; a 30 ohm rheostat, a .00016 mf. tuning condenser, a .00025 mf. plate condenser and a midget condenser in series with the antenna. The variable condensers are of great importance and should be of some reliable make and of the S. L. F. type.

The tube socket projects through a hole cut in the top of the cabinet and a socket to receive the plug-in coils projects through the back in a similar manner. The tube socket is fastened to the front panel with two brass angles, leaving the cover free to allow easy access to the set for inspection. The coil socket is bolted to the rear of the cabinet.

The circuit is of the conventional regenerative type found in most one tube adapters. Some trouble was experienced in controlling regeneration; the set had a tendency to go into oscillation with a "plop", and made it very difficult to tune in broadcasting stations. This was overcome by trying different grid-leaks and by varying the number of turns on the plate coil. It was found that a two megohm grid-leak worked best. If the adapter still persists in going into oscillation in an abrupt manner, place an external variable resistor of 50,000 ohms in series with the 45 volt detector lead of the long wave receiver. Even if the adapter seems to work satisfactory without the variable resistor, it is advisable to use one to compensate for any drop in battery voltage.

Any "plug-in" coils can be used that will match the plate and tuning condensers, but a "one-tap coil" will cover the required band of 15 to 50 meters. For the grid coil wind 8 turns of number 18 enameled wire on a 2½ inch form and take off a tap at 3½ turns. The plate coil has 4 turns of number 22 cotton




Circuit of the successful short wave adapter here described by Mr. Perry.

covered wire, spaced about ⅛ of an inch from the grid coil.

A plug fits into the detector socket of the long wave receiver to obtain the filament and plate supply and to couple the adapter to the receiver's audio amplifier. Flexible leads are attached to the plate, filament positive and filament negative prongs of a tube base that is used for the plug. A great many battery receivers have the old style UV sockets, and the tube base comes flush with the top of the socket, making it difficult to turn the base in the socket. It is advisable to make a cap for the plug in the following manner: Remove the brass fittings from an ordinary hard rubber electrical appliance plug, file the sides until it fits snugly into the tube base and glue it in place; this makes a neat finished looking job.

This adapter can be used with any battery receiver by plugging into the detector socket. No detailed list of parts is given as the constructor will probably wish to use parts already on hand, or favor some certain manufacturer's products.

●

## Stand-Off Insulators

● HERE is a new wrinkle I am using at the present time. I needed an insulator to keep my transmitting aerial away from the house. Not having the ready money to buy one, I made one that is just as good and will stand the "gaff."

Take a piece of hard rubber or bakelite, 1.5"x12"x¼". Drill three holes in it, as per drawing. Now a piece of the same material 1.5"x14"x7"; drill only 2 holes in this piece. (See drawing.) Now, if you have two small right-angle irons, attach one at point "*a*" on one piece and at point "*b*" on the other piece. This may be done with machine-screws. Make sure that these screws are nickel-plated or brass; iron will rust. Now attach the smaller piece to the larger one with another machine-screw. We are now ready to attach the stand-off insulator to the wall. We will need two round-head wood-screws. Fasten the main insulator first; then brace it with the other piece. It works very well and has a long leakage path.

If an insulator is needed for the receiving aerial, use a strip of hard rubber or bakelite, 1.5"x6"x¼", as a good substitute. These insulators cannot be used where there is heavy strain on them.—*Raymond Stephens, W9GPL.*

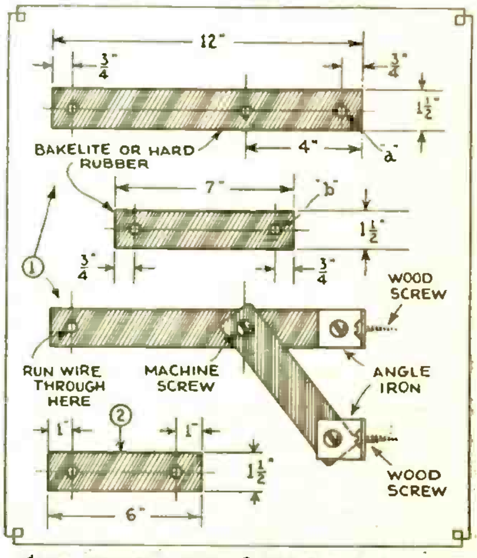
●

## How to Photograph Your Set

● UNFORUNATELY many people are under the impression that taking photographs indoors is a difficult and expensive job. Such is not the case, for some very fine "shots" may be taken with an ordinary camera, a 200-watt electric light bulb, and a simple home-made reflector. The latter may be made in a few seconds by cutting a 2-ft. cone out of a piece of white cardboard and fastening the edges together with paper clips. A hole should be left in the center of the cone to allow for the 200-watt lamp.

Now for taking the actual pictures. First mount the camera on something steady and focus it on the subject. Do not get closer than 6-ft., with an ordinary camera. All light should be excluded from the room except that from the lamp mentioned above. The shutter should be set for time-exposure and the lens stopped to about *f*.16. Now open the shutter and taking the reflector in your hand keep moving it about slowly so that the light from it falls on the subject from different angles. This procedure should be continued throughout the exposure. Avoid letting the light fall directly on the lens, by keeping the reflector always well behind the camera.

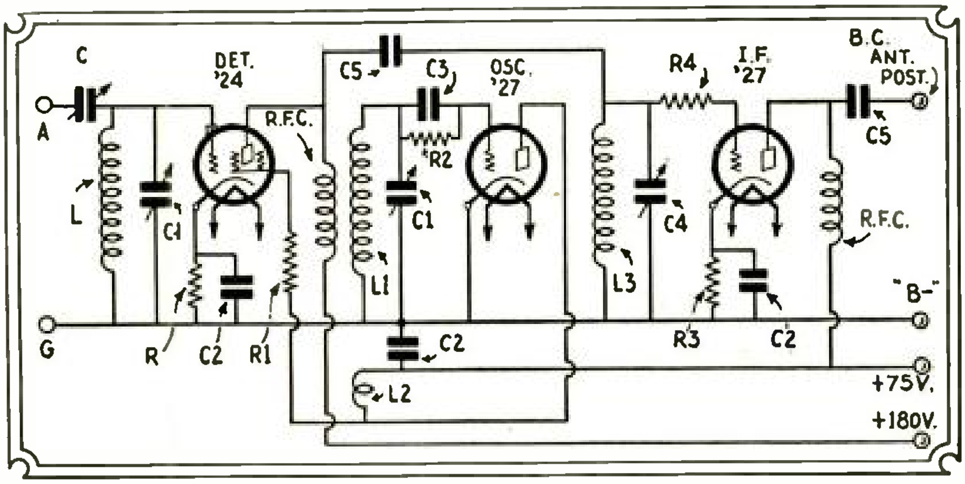
The film should be exposed for about three-and-a-half or four minutes if the subject is fairly light-colored as a whole. If medium-colored the time will be longer, say four or five minutes, or five or six minutes if it is dark. It is well to try several different times of exposure, noting which one is best. Have the films developed by a commercial photographer if possible.—L. G. MORRIS.




Very effective "stand-off" insulators can be made from bakelite or hard-rubber strips, arranged as shown.

# SHORT WAVE QUESTION BOX

**Edited by R. WILLIAM TANNER**




**A short wave converter suitable for use with a Philco 11-tube superhet is shown in diagram above.**

## S-W CONVERTER

Raymond Banks, Belleville, N. J., asks:

Q. For a converter circuit suitable for use with a Philco 11-tube Super-heterodyne.

A. The circuit is given in these columns. A '27 I.F. amplifier is incorporated in order to properly couple the converter to the low impedance input circuit of the Philco. This converter can be used with nearly all makes and models of broadcast receivers. The plug-in coils L, L1 and L2 may be any good make. The I.F. coil L3 should be a regular type of broadcast R.F. transformer with primary removed. The I.F. tuning condenser C4 is a Pilot .0005 mf. semi-variable. Oscillation in the I.F. stage is prevented by the 1000 ohm resistor R4. The detector screen-grid resistor R1 is not always needed. If the oscillator and detector components are not shielded, then R1 should be used to reduce oscillator-detector coupling.

## VALUE OF CHOKE

Kenneth Maper, Binghamton, N. Y., wants to know:

Q. If the filter choke in the circuit of the power supply, page 314, Feb.-March issue, is 30 henries or 36 henries as the description states?

A. The value of 30 henries is correct.

## RESONANCE INDICATOR

Eric Johnson, Cudahy, Wis., asks:

Q. What is a reliable resonance indicator to use with a 201A Hartley transmitter? The plate voltage is 90 volts.

A. An 0 to 25 ma. milliammeter in the "B" positive lead is the best indicator for such low power. Tune the oscillator to the required wave and note the plate current. Then tune antenna circuit until current is highest. It is advisable, for the sake of stability, to reduce the antenna coupling so that the plate current is actually about 85 per cent of its maximum value.

## COIL WINDING QUERIES

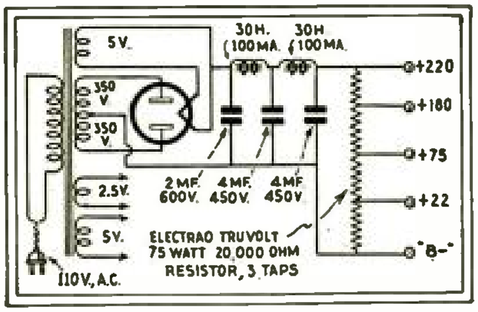
Steve Setar, Cleveland, Ohio, wants to know:

Q. In regard to the receiver circuit shown on page 393, April issue, are the *ticklers* wound on the same form as the secondaries, or on another form placed within the secondaries?

A. They are wound on the same form, with spacing of about ⅛ inch.

Q. Are the turns spaced on the 17-25 meter coil?

A. As spacing was not mentioned in the article, it would be assumed that all coils are close-wound.




**Power supply circuit suitable for use with short wave receiver.**

## POWER SUPPLY HOOK-UP

Thomas Burr, Media, Pa., writes:

Q. Can you give me the circuit of a power supply to use with the receiver on page 304, Dec., 1930-Jan., 1931, issue?

A. The circuit appears in these columns.

## SPACING BETWEEN GRID AND TICKLER COILS

Harold Gruber, Cincinnati, Ohio, writes as follows:

Q. When winding coils, what spacing should be used between tickler and secondary or grid coil?

A. The spacing will depend upon the detector plate voltage, the value of the grid-leak and condenser, the number of tickler turns and the tube. Approximately 1/16 to ⅛ inch will generally be sufficient. The spacing and number of tickler turns should be proportioned so that the tube will just oscillate at the high end of the tuning scale, with the regeneration control set at maximum. When this is done, regeneration will be very smooth with a minimum of fringe howl and other noises.

## '22 AS A DETECTOR

L. P. Ryan, Mingo Jct., Ohio, asks:

Q. Can you publish a circuit using a '22 screen grid tube as a detector?

A. A '22 tube is not suitable for use as a detector, due to its microphonic behavior.

## BROAD-TUNING AND SUPER-REGENERATORS

C. C. Morris, Aubundale, Fla., wants to know:

Q. If it is possible to cure the extremely broad tuning of the super-regenerative circuit described in the Oct.-Nov. issue?

A. Broad tuning is a characteristic of super-regenerative circuits. This is one of the reasons they are used on the very short waves, where ordinary short wave sets are too critical for operating convenience.

Q. Could a stage of R.F. be added to increase selectivity?

A. An R.F. stage can easily be added, but even this does not increase *selectivity* to any great extent.

## "MOPA" TRANSMITTER DIAGRAM

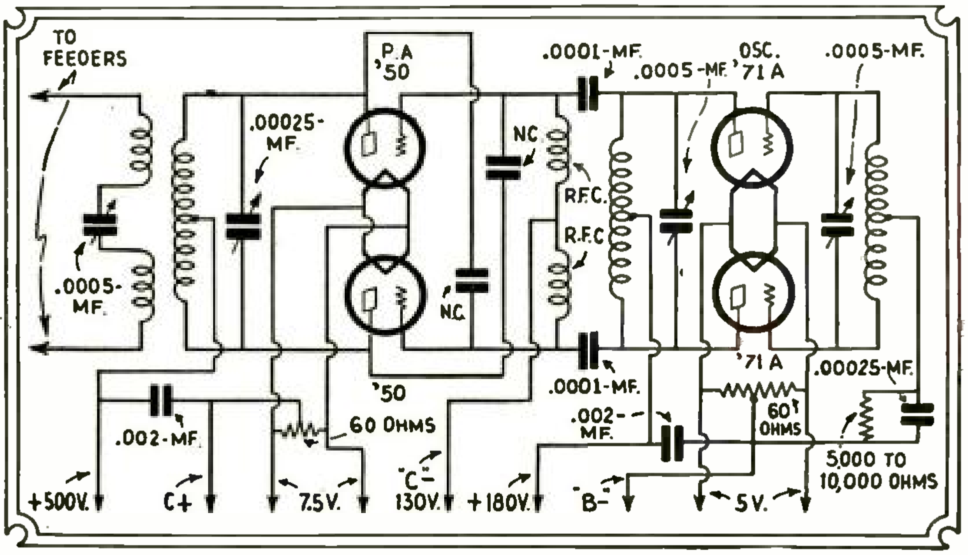
Douglas Wood, Nixon, Ontario, writes this department:

Q. Will you publish an MOPA (master oscillator-power amplifier) transmitter circuit, using '50 tubes in the power amplifier and '71A's in the oscillator, both of which are P-P?

A. The circuit is given on these pages.

Q. Can loop modulation be used for phone work with this circuit?

A. It could, but is not advisable, since such modulation causes distortion and "wobulation" or frequency modulation.




**Master oscillator-power amplifier transmitter circuit using '71A and '50 tubes.**

# Amateurs who made good

## G. LEONARD WERNER

● G. LEONARD WERNER, design engineer of Blair Radio Laboratories. Specialist on transmitters. In 1918, Werner built his first amateur transmitter. He was one of the early experimenters in Brooklyn, N. Y., way back when radio was called "wireless," and he and his "gang" kept the air waves cluttered with dots and dashes.

G. Leonard Werner, well - known New York radio engineer, who has specialized in the design of short-wave transmitters. Mr. Werner first operated an amateur short-wave station in Bethlehem, Pa., under the call 3HC.

In 1922, under the call of 3HC. Werner operated an amateur station in Bethlehem, Pa. He was one of the first amateurs from this section of the country to communicate with the West Coast on extreme low power. After considerable experimentation with a simple Colpitt's circuit, employing a 201 tube (with 90 volts of "B" battery), he established intermittent communication with Oakland, Calif.

About five years ago, Werner became associated with H. C. Blair, who was then quite well known as the manufacturer of the high-quality, resistance-coupled Blair receiver. Werner and Blair decided to manufacture custom-built amplifiers and transmitters for every type of work.

Werner has concentrated his efforts on the design of amateur and commercial transmitters. He is the designer of the Universal Phone-C.W. Transmitter described in the present issue of SHORT WAVE CRAFT. At the present time he is doing advanced research work on ultra-short waves in conjunction with light waves, and he is also doing special experimental work in connection with the physics department of Columbia University. Mr. Werner is a graduate of New York University, class of 1924. His amateur call letters are W2PN.

## JEROME GROSS

● JEROME GROSS, better known as "Jerry" to hundreds of amateurs and experimenters not only in America but even in foreign climes, has built up an excellent custom-made radio business in New York City. Jerry's first short-wave transmitter was tackled in 1908 and was used for demonstrating "wireless" telegraphy to a science class in a school. This set was entirely home-constructed, including the ½-inch spark coil.

In the course of the next few years dozens of transmitters were constructed up to the use of the vacuum tube.

At this period GJ was used as the call, a license being unnecessary at that time.

Jerry has been actually engaged in the design and construction of short-wave equipment for the last ten years, having marketed some of the first equipment of its kind in the country. To date the score-card shows the construction and design of over several thousand transmitters, including everything from '99's to 5 K.W. tubes.

Jerry's amateur call is now W2AAE; he's at present conducting the Gross Radio Co., devoted exclusively to catering to those interested in short waves. Besides the store and mail order business, he conducts a laboratory, which has placed within the reach of the average amateur short wave apparatus commercial in appearance and operation.

"Jerry" Gross, popular short-wave expert, well-known to all New York City amateurs. His present station call is W2AAE.

# A 30 Watt Transmitter

## By ROBERT M. LACEY

(*Continued from page* 226)

the two outside ones. Tip jacks may now be inserted in place of these binding posts for use as a plug-in connection for the center-tapped grid coil of the oscillatory circuit.

The remaining posts are connected to the "B" negative of the filter and to the center tap of the 7½ volts oscillator filament winding.

The above mentioned posts are now completely wired to accommodate a transmitting key.

A 10,000 ohm transmitting grid leak is now connected between the center tap for the oscillator grid coil and "B—." The grid prongs of the two sockets now intended for the oscillator tubes are connected direct to the two outside binding posts or tip jacks.

Originally, directly in front of the two sockets we have now connected as oscillators, there was a grid leak mounting, the spring receptacles of which are removed and binding posts installed in their place. These two binding posts are now in turn connected to the plate prongs of the two oscillator tube sockets and these will form the connections to the plate circuit inductance of the oscillator. The center point of this coil is connected to the "B" plus lead that we at first taped up together with the two leads that originally fed the field of the dynamic speaker.

A by-pass condenser should also be inserted between this center tap of the plate inductance and B negative. A Sangamo 2,500 volt .002 mf. fixed condenser will serve this purpose. There also should be connected in series and across the oscillator filament two more such condensers and their center connection also connected to "B" negative.

The conversion has now been accomplished and the outfit is ready for the tubes. Two 281 tubes for the rectifier and two 210 or 510 as oscillators are employed and the plate tank circuit coupled to an antenna system.

The only additional equipment necessary for this outfit is a tuning condenser for the tank circuit, which is connected directly across the oscillator plate inductance. Such a condenser may be secured for an investment of less than $2.

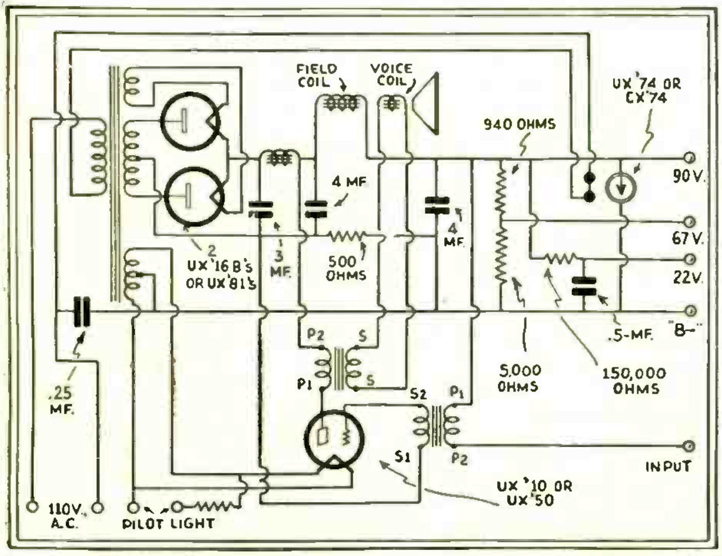
As will be seen in one of the photographs, the center-tapped grid coil may be wound on a one-inch piece of Bakelite tubing long enough to fit phone tips for the three phone tip jacks previously installed where the binding posts were originally installed on the chassis. The turns on this coil depend, of course, upon which amateur band the transmitter is intended to work in. The same applies to the tank circuit inductance.

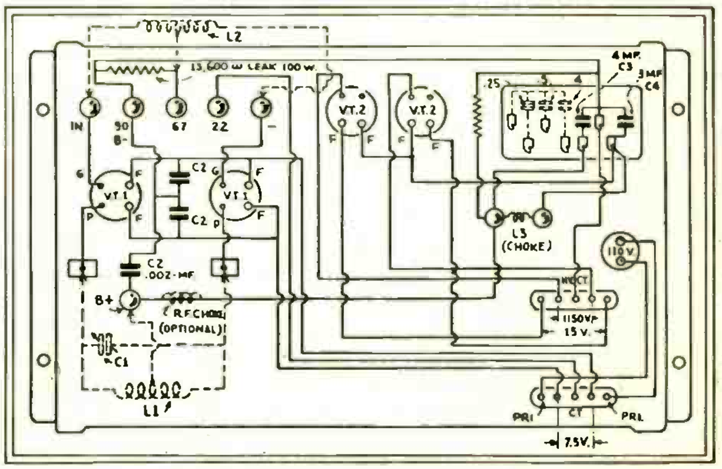
The grid coils for the various amateur bands, all wound on bakelite tubing with an outside diameter of one inch, should have the following specifications:

Seventy-two turns (of No. 32 S.S.C. magnet wire) center-tapped for the 3,500 kc. band, 40 turns of No. 28 D.C.C. magnet wire for the 7,000 kc. band and 16 turns of No. 28 D.C.C. center-tapped for the 1,400 kc. band.

When using the regular coil-form for the plate tank inductances, the following specification may be followed, using ⅜-inch copper tubin formed on a round form such as pipe or wooden dowel; the diameter as follows.

(*Continued on page* 252)




**Above—Bottom view of Kolster power amplifier with conversion connections made for transmitter.**

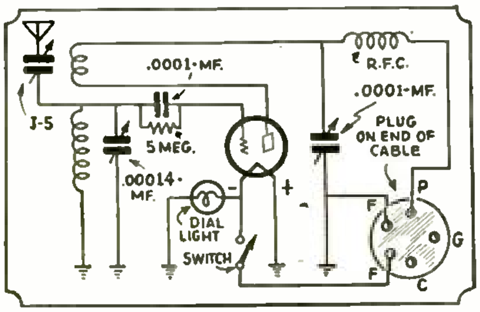
**Left—Original circuit of Kolster power amplifier and loud speaker.**

## First Prize Winners

**First Prize Winner—Louis P. Maigret.**

(*Continued from page* 210)

are used throughout the converter: a Hammarlund MC-140-M for tuning purposes, a Pilot J-23 for controlling oscillation, and a Pilot J-5 for coupling to the antenna. Incidentally, it might be added here that the J-5 midget condenser must be slightly altered to reduce its capacity when the converter is used with a large antenna as found on ships. This alteration is done by simply removing the 9/16" spacers holding the stator plates in place and replacing them with 3/8" spacers. Both stator plates are put together as one and the condenser reassembled. That is all. The rotor is left as before, with its three plates. In this way, the condenser is not damaged, and, while now having the desired small capacity, can be quickly restored to its original construction. If this change is not made, the setting of the condenser will be critical with a large antenna and it will have to be left open in order to obtain oscillation at every point on the tuning dial. After the change, oscillation is smooth and the antenna-coupler acts more like a vernier adjustment, its intended function. The required 3/8" spacing was obtained by using two small knurled round 6/32 nuts end to end of the type found on the midget condenser screw-ends. The same five plate midget must be insulated from the chassis with fiber bushing washers both inside and out. The remaining two condensers are mounted directly to their respective panels.




**Wiring diagram of Mr. Maigret's S.W. Converter.**

An 85-millihenry radio-frequency choke coil is inserted in the plate lead to keep R.F. currents where they belong. Three tube-base plug-in coils are used to cover the three most useful and popular high frequency bands, giving the converter a range of from 14 to 100 meters, approximately.

### Connecting the Adapter

Using the chassis as the "A" plus side of the filament supply eliminates much of the wiring and also automatically grounds the converter. If it is found necessary to use an additional ground connection, it can easily be made by running a wire from the most convenient screw on the chassis to the ground binding post of the receiver. Excluding the cable, just about one foot of wire was used to make all connections. The cable consists of three wires, two of which provide the converter with filament voltage. The third goes to the plate end (not "B" plus) of the first audio transformer primary for the plate voltage. This may be accomplished in two ways: first, by removing the detector tube from the receiver and plugging the cable in its socket. This method, while being the simpler of the two, soon becomes irksome and not so good for the socket. So a compromise was effected and the following method (Fig. 7) decided upon: a separate five-prong socket to accommodate the five-prong cable plug was mounted in a convenient spot not far from the receiver's detector. Three wires were attached to this socket; the two leads from F and F were connected to the ship's *General Electric* AA-1400 detector-amplifier, which has five handy terminals on each end. The remaining lead from P on the socket was attached to any point on the tickler reversing switch, or either of the two tickler binding posts on the panel. In this manner, the detector tube is never removed to use the converter, but simply turned off with its rheostat. The advantage of this system lies in the fact that either long or short waves (or both together) may be received by simply switching either tube on or off. This feature is fully appreciated every night by the author when receiving weather reports from NAA on 2653 meters and press from KUP on 47 meters, because both are transmitted simultaneously at 10 P. M. E. S. T.

It will be wise to install a 100,000-ohm resistor across the secondary of the first audio transformer to eliminate "fringe howl" which occurs at the "spilling over" point of oscillation. This is easily done on the G-E AA-1400 amplifier because clips are provided for that very purpose behind the center tube. The resistor already in place there usually is too high, being of 2 megohm value.

A five-prong adapter plug is supplied with the Pee-Wee converter to make possible the use of either four- or five-prong tubes, such as the '01-A, the '30 and the '37 types. The adapter plug may also be used on the five-prong plug on the end of the cable when the converter is being plugged into a four-prong socket. Incidentally, a type '37 automobile tube was found to be a very good performer with the converter, being a better oscillator than the types '01-A and '30, and also being much less microphonic. A dial light is included in the circuit of the converter and is, of course, optional.

Mounting the tube on the outside of the adapter was justified mainly by the resulting compactness; but other reasons make this feature desirable and it will be appreciated if it ever becomes necessary to replace a defective tube while copying code. It means just the difference between missing two or three words and missing a whole sentence or even more, with the tube inside the cabinet.

## How Metal Box Was Made

The Pee-Wee measures 4 inches high by 3½ inches wide by 3¼ inches deep and is constructed entirely of 1/16-gauge silver dip finish sheet aluminum purchased from Bian-the-Radio-Man, New York City. It is made up of four sections. The largest piece forms the top, front and bottom of the "cabinet" and is 11 inches long by 3½ wide. It is bent at right angles 3½ inches from both ends as shown in Fig. 1. The two side pieces are of the same size and each measures 4⅝ inches long by 3⅜ inches wide. The "back door" or "inspection hatch" of the converter is a piece of aluminum 4 inches long by 3½ inches wide and is attached to the right side by a small brass hinge (1 inch long by 13/16-inch wide) obtained in the ten cent store. This arrangement greatly facilitates getting at the "works" of the set.

It was found easier to drill all the necessary holes first in the 11 by 3½ inch section before bending it. The two side pieces must be cut out according to Figs. 2 and 3 to allow room for the edges of the coil and tube sockets, and should be bent before drilling the small tapped holes. These are drilled only after the sides have been fitted and centered with the holes in the top and bottom. All the holes on the bent edges of the two side-pieces were made with a No. 4 drill and then tapped with a 6/32 tap drill and wrench also purchased in the dime store. This last operation is very easy as the aluminum is soft. The four holes for mounting the brass hinge were also bored with a No. 4 drill and tapped for 6/32 screws. All the other small holes are ⅛ inch in diameter and made with No. 6 drill.

All the large holes including the two on top for the sockets were made first by drawing two concentric circles of about 3/16 inch different diameter with a pair of dividers, and then drilling small holes all around on the inside circle. After this, the pieces were punched out and the holes smoothed off with a half round and rat-tail file. The dial light opening was made in the same manner. This procedure is rather tedious but it does the trick. A large drill or a washer cutter obviously would be the correct tool to use, but the converter described here was built on board ship and facilities were quite limited.

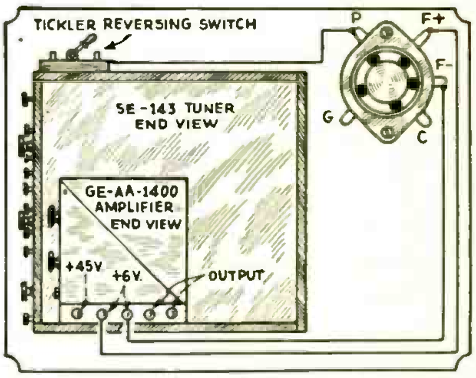
The bending was easily done in a vise. Two thin strips of copper or brass should be used in the jaws of the vise when bending the aluminum to avoid scratching or scarring it.

The back door of the adapter is held shut by two 6/32 screws which fit into two small aluminum or brass angles mounted on the adjoining screws that project from the top and bottom. The dial light was mounted in the following manner: take a Pilot pilot-light bracket and remove the socket. Screw the socket into one side of another small angle-piece. The other hole in the angle-piece attaches to the right-hand mounting screw on the Kurz-Kasch dial.

The choke coil was mounted by fastening it to one end of a small metal piece 1¼ inch long by ½ inch wide, the other end of which attaches to the rear tube socket screw. The tuning condenser is mounted upside down; the two other condensers also. The threaded section of the tuning condenser shaft should be kept from projecting beyond the face of the panel with three 1/16-inch thick washers. This is necessary to obtain a perfect fitting dial. A template supplied with the dial gives correct position of the holes.

## Wiring Details

In order to shorten connections, the tube socket was mounted on the right side of converter with filament lugs on the outside. The coil socket was placed on the left side with the grid lug inside. The result of this arrangement simplifies wiring. The P lug of the tube socket is soldered directly to the G lug of coil socket. The F plus lug of tube socket is grounded to rear mounting screw. The F plus lug of the coil socket is grounded to the front mounting screw. The midget grid-leak and .0001-mf. grid condenser are soldered directly to the tuning condenser stator and G of tube socket. That leaves just two connections by wire from the




Hooking up converter to power amplifier.

coil socket. One goes from lug C to choke coil and stator of the 23-plate midget. The other goes from lug F— to the tuning condenser stator and also to the stator of the 5-plate midget. Lug P of coil socket is not used.

The rotor of the 5-plate midget connects to the antenna binding post. This post should be well insulated from the chassis. The remaining connection from the tube socket goes from F— straight down to the switch. And that completes the wiring. I beg your pardon; a short piece of wire goes from F— to the lug on the pilot-light socket. Now the job is done.

Connecting the cable comes next. One wire goes to the open side of the choke coil; another goes to the remaining side of the switch and the last is fastened to the most convenient screw on the chassis. The cable was made with three wires run through a three-foot length of green rubber tubing, ¼ inch in diameter, also obtained in the dime store. A five-prong speaker plug attaches to the other end of the cable.

The five-prong adapter plug was constructed by sawing off half of the top of a four-prong tube base and mounting thereon a Pilot No. 215 five-prong socket. A wire is soldered to the C and adjoining F contact of the socket and run through the F-prong of the tube base. The other three socket lugs connect to their corresponding tube base prongs, that is, P to P, G to G, and F to F plus.

## Coil Data

The coils are wound on five-prong tube bases and No. 24 D.S.C. wire is used throughout, the grid winding being on top and the tickler winding on the bottom. A spacing of 1/8 inch is allowed between both windings. The top of the grid winding goes to prong F—, the one nearest to prong C. The bottom of grid winding goes to prong F plus, nearest prong P. The top of the tickler winding connects to prong C and the bottom goes to prong G.

The following is a table of the coil data:

| COIL. | GRID WINDING. | TICKLER WINDING. |
|---|---|---|
| 20-meter coil | 4½ turns | 4¾ turns No. 24 |
| 40-meter coil | 10¼ turns | 7 turns D.S.C. |
| 80-meter coil | 24 turns | 10 turns wire for all. |

A final constructional detail that was overlooked pertains to the hinge. It is fastened by 6/32 screws, which should be cut flush with the panel if too long. Screw-heads go inside. A rubber bushing is fitted in the hole through which the cable runs in order to avoid troublesome chafing of the cable on the metal. "Spaghetti" insulating tubing is used over bare stranded wire for wiring the converter. Collodion may be used as a binder for the coils. The adapter plug is held firmly together by a small screw and nut running through center.

### How Converter Is Used

The Pee-Wee is used by plugging it into the receiver's detector socket, or into the five-prong socket which connects to the receiver, as described previously. A wire is connected from antenna binding post on converter to receiver's antenna post. A coil is plugged in and the switch turned on. Proper manipulation of the regeneration condenser then enables the operator to tune in the desired signals. If the adapter should fail to oscillate, the tickler connections should be reversed.

To use the Pee-Wee with a direct-current receiver, remove the detector tube and plug in the converter. Connect antenna and proceed as before.

It is unnecessary to stress the extreme usefulness of this type of apparatus on shipboard because most operators already realize that. But to those who are without short-wave sets, here is an opportunity to acquire a handy, foolproof converter that will fit nicely in one corner of your suitcase and that will many times repay for itself in gratifying results.

### What the "Pee-Wee" Can Do!

The following table gives an example of what the Pee-Wee can do:

| Call | E.S.T. | Wave | Dial | Coil | Service |
|---|---|---|---|---|---|
| HJY | P.M. | 15.4 | 18. | 1 | Brdcst. |
| NAA | 10:00 | 18.6 | 35. | 1 | Weather |
| W2XAD | P.M. | 19.5 | 49. | 1 | Brdcast. |
| "HAMS" | A.M.-P.M. | 20.+ | 50.± | 1 | Code |
| NAA | 12:00 | 23.7 | 76. | 1 | Time Sigs. |
| W8XK | P.M. | 25.2 | 78.5 | 1 | Brdcast. |
| VE9GW | P.M. | 25.4 | 79. | 1 | Brdcast. |
| G5SW | P.M. | 25.5 | 79.5 | 1 | Brdcast. |
| FYA | P.M. | 25.6 | 80.5 | 1 | Brdcast. |
| W1ID | 13:00 | 26.6 | 84. | 1 | Press |
| WFD | 08:30 | 28.6 | 82. | 1 | Press |
| WFD | 11:30 | 28.6 | 92. | 1 | Wea., Stks. |
| W1XAZ | A.M.-P.M. | 31.3 | 23. | 2 | Brdcast. |
| W2XAF | P.M. | 31.4 | 24. | 2 | Brdcast. |
| LSD | 18:45 | 33.9 | 36. | 2 | Time Sigs. |
| KTK | 20:00 | 34.7 | 38. | 2 | Press |
| WPN | 19:00 | 34.7 | 38.5 | 2 | Press |
| NPG | 14:55 | 34.9 | 39. | 2 | Time Sigs. |
| NAA | 21:55 | 35.6 | 41. | 2 | Time Sigs. |
| NAA | 22:00 | 35.6 | 41. | 2 | Weather |
| "HAMS" | A.M.-P.M. | 40.± | 55.± | 2 | Code |
| KTK | 20:00 | 46 | 73. | 2 | Press |
| WPN | 19:00 | 46 | 73.5 | 2 | Press |
| W8XK | P.M. | 48.8 | 77. | 2 | Brdcast. |
| W3XAL | P.M. | 49.1 | 79. | 2 | Brdcast. |
| W8XAL | P.M. | 49.5 | 80. | 2 | Brdcast. |
| "HAMS" | A.M.-P.M. | 80.± | 55.± | 3 | Ph'ne.C'de |
| KUP | 22:00 | 46.5 | 72.5 | 2 | Press |

### List of Parts Required

4 Pieces 1/16 gauge aluminum, one 11"x3½", one 4"x3½", two 3⅜"x4⅝".
1 Hammarlund Midget .00014 mfd. variable condenser, MC-140-M.
1 Pilot Midget 23 plate variable condenser, J-23.
1 Pilot Midget 5 plate variable condenser, J-5.
1 Hart-Hegeman switch.
1 Kurz-Kasch 3-inch vernier dial, Walnut.

2 Pilot No. 217 Sub-Panel sockets.
1 Pilot No. 216 Sub-Panel socket.
1 Pilot-light bracket No. 40.
1 25c spool of No. 24 D.S.C. wire.
3 5-prong tube bases.
1 5-prong speaker plug for cable.
1 Pilot Neutrocap R.F. Choke coil.
2 Pilot 1-inch walnut knobs.
1 Eby "Antenna" binding post.
1 6-volt flashlight bulb.
1 '01-A tube.
1 Small brass hinge, 1"x13/16".
1 .0001 midget fixed grid condenser.
1 5-megohm midget Durham grid leak.
3 Feet ¼" rubber tubing.
2 Feet spaghetti.
2 Dozen 6/32 flat-head screws, ¼" long.
20 Feet stranded hook-up wire.
4 Small metal strips, 1¼"x⅜"x1/16".
1 Rubber bushing, 5/16" inside diameter.
2 Fiber bushing washers, ⅜" inside diameter.
1 4-prong tube base, for adapter plug.
1 Pilot 5-prong No. 215 socket, for adapter plug.

## Second Prize Winner—Arno Wilkins

(*Continued from page* 211)

Tuned grid, untuned plate circuit is used. A two-position tap switch is used for changing wavelength range. Cathode coupling to the mixer is used. Note the method used to increase the amount of coupling on the low-wave position. The coupling coil is simply a continuation of the grid coil, instead of a separate one. A large .00035 mf. tuning condenser is employed to give a large range without a large tap switch. If fine tuning is required, the broadcast receiver dial will be the vernier. As will be noted, no biasing means are used on the oscillator, as no one cares about the efficiency of the oscillator as long as it oscillates. Total plate current of both tubes is less than 10 ma. at 100 volts. The set will give satisfactory results with any plate voltage from 45 to 180.

The filament transformer is home-made, using the iron core from a Philco "B" eliminator choke. The primary is 1,150 turns of No. 30 enameled magnet wire, layers spaced with waxed paper. The 2½-volt secondary consists of 27 turns of No. 18 enameled magnet wire. The R. F. choke is an old thread spool wound with about 1,000 turns of No. 46 D.S.C. wire; its inductance is 84.2 mh. The oscillator coil consists of 1¾-inch bakelite tubing wound as below with No. 26 enameled wire; ⅛-inch spacing between secondary and tickler. The cabinet is a 4 x 8 inch aluminum bread-pan. The top is reinforced with No. 14 aluminum to prevent sagging, and a bottom of No. 20 gauge is used. While this model has the bottom screwed on, duplicates may be made with soldered bottoms to prevent tampering.

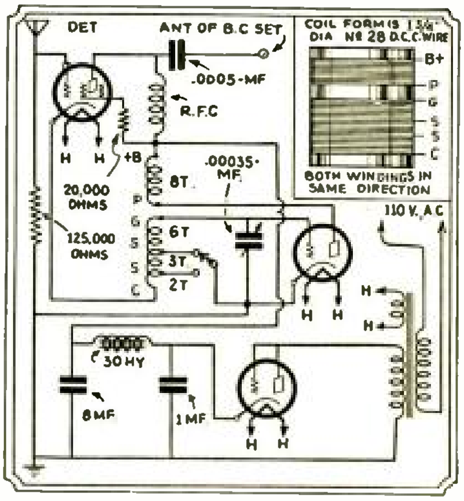



**Diagram of Wilkin's S.W. Converter**

## Third Prize Winner—H. A. Staats

### Operation of the Midget Marvel

The tube (an old one will do) is plugged into the tube socket; with the 40-meter coil in place we are ready to tune in. Turn the regular set to 1,000 kc. and with the volume on full, after a few minutes the set should start to work. If no sounds are heard the voltage on the plate may be too high, the voltage on the plate (150-180), the voltage on the cap (35-45), when the set is working the voltage should kick as the set starts to work. The writer uses several quick-heating tubes and reduces the time necessary to receive on short waves. Some sets have a low 2.5-volt A.C. supply; in this case it is necessary to use a separate transformer or use a higher voltage and reduce it to a workable voltage. If the set oscillates too much, it can be reduced by increasing the value of the resistance (R-3).

The writer would be glad to hear from any readers of SHORT WAVE CRAFT their records or failures, for this little set is bringing them in from the four corners of the world.

### Parts Required

C1—.00005 mf. midget variable tuning condenser.
C2—.00005 mf. with all but one fixed and one movable plate removed (variable) condenser.
C3—.0001 mf. with grid leak attachment condenser.
C4—.0001 mf. fixed coupling condenser.
R1—25,000-ohm to 1 megohm grid-leak (use the leak that works with the tube best).
R2—20,000-ohm, 5-watt fixed resistor.
R3—An adjustable resistance, about 5 ohms, to regulate heater current.
R4—A 25,000-ohm, 25-watt sliding contact to cut the "B" voltage to about 175 volts.
RFC—Any short-wave choke (Silver-Marshall choke used).

### Log of VK2ME, Sydney, Australia, May 1, 1932 (31.28 Meters)

7 a.m. Eastern Daylight Saving Time. Weather unsettled. Some static.
7:01—Orchestral selection.
7:05—VK2ME, announced 5 past 9, Sun. eve.
7:05½—Band selection, "Entry of the Gladiators."
7:07½—Organ selection by Dr. Stanley.
7:12 a.m.—Kookaburra bird laughs. VK2ME.
7:13—Gave a long talk about the Kookaburra bird or "Laughing Jackass," its habits: says it's an Australian bird, one that is well known; the laughing type has brown back, wings and breast; the howling type is marked with blue on breast and wings. Some of these birds are robbers, not catching their own game. Gave the sound film, "Laugh of the Australian Kookaburra."
7:20½—Announced time, 20½ past 9 p.m. Sun.
7:21—Piano forte, solo, "Teasing the Classics."
7:25—VK2ME, Mr. J. C. Thomas will now sing "Rose Marie."
7:29—VK2ME, orchestra selection, "Sylvia."
7:32—Nat Band playing "El Vedor."
7:35—Gave the weather report—minimum temperature for May 1, 56° F.; maximum, 63° F. Temperature today, 59.5° F.; barometer, 30.2.
7:37—'Cello solo, "Spanish Dance," Opr. 54, No. 5.
7:42—Baritone solo.
7:45½-14½ minutes to 10. VK2ME.
7:45½—Organ solo by Leslie James.
7:49—Orchestra selections.
7:53—VK2ME stopped and changed selections.
7:57½—VK2ME, 31.28 meters, 9.590, 1 a.m. to 3 a.m. E. S. T. they broadcast. 5 a.m. to 9:30 a.m., 10 a.m.-11:30, Amalgamated Wireless, 47 Queen St.
8 a.m.—Please stand by, VK2ME, "The Voice of Australia."
8:01—The laugh of the Australian Kookaburra bird.
8:02—Spoke in foreign.

8:03—(a) Band selection, (b) Band selection (8:05½).
8:09½—VK2ME. Tenor solo.
8:13½—Announced time, 13½ past 10 p.m.
8:14—Orchestra selection, "(?) Fair."
8:16—VK2ME, Organ and contralto.
8:19—19 past 10, Sunday evening.
8:20—Orchestra.
8:26½—New Mayfair Orchestra, selections from a musical comedy.
8:27—Soprano solo.
8:32½—VK2ME, 32½ past 10.
8:33—Organ solo, Dr. Stanley.
8:37—Orchestra, "Grass Hopper Dance."
8:41—Minimum temperature, 56; maximum, 63. Today, 59.5; barometer, 30.2.
8:42—Tenor solo.
8:46½—VK2ME, Sydney. Kookaburra bird laughs.
8:47—Talks about the Kookaburra bird, same as at 7:13 a.m.
8:55—Orchestral selection.
8:59½—VK2ME, Sydney. (Local Interference.)
9 a.m. Eastern Daylight Saving Time.
9:03—Musical selection.
9:05—Soprano solo. (Faint, local interference.)
9:09½—VK2ME, 9½ past 11 p.m. Sunday.
9:10½—Hear VK2ME carrier wave but no music or speech.
9:15 a.m.—Orchestral selection. (Signal strength much better.)
7:17 a.m.—VK2ME. (Faded out, back at 9:20.)
9:23½—VK2ME. The laugh of the Australian Kookaburra bird.
9:25—Organ solo.
9:30 a.m.—VK2ME. faded out.

Midget Marvel dial setting 27, vernier on 1st point. Broadcast 925 kc.

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED
Broadcasting Department
"Wireless House," 167/9 Queen St., Melbourne
B. C. 647 — Box 1272 L. G. P. O.
9th February, 1932.

Mr. K. A. Staats,
1909 McMinn Street,
Aliquippa, Pa.
Dear Mr. Staats:

Many thanks for your letter of the 26th December, in which you give us a report of reception from our Experimental Station, VK2ME, at Melbourne.

We are very pleased indeed to know that you can tune us in so well, and we have pleasure in confirming your reception, an examination of our Station records showing that the items you enumerate were actually transmitted on the date and at the times you specify.

We regret very much that our organization prevents our complying with the request contained in the last paragraph of your letter. Our Experimental Station is operated under very rigid Governmental Regulations, and it is very difficult to arrange for anything outside our usual transmissions. We regret this very much, but hope we shall at some future date be able to comply with your request.

Yours faithfully,
Amalgamated Wireless (A/Asia) Ltd.
H. Johnston, Engineer.

HJ/VM.
ENC.



## Reducing Noise

By ARTHUR H. LYNCH

(*Continued from page* 212)

broadcast receiver is to be used in a neighborhood where the interference level is rather high, such as we are likely to find in a city apartment, where there are all kinds of electrical devices, ranging from fans to X-ray machines and electric elevator control equipment. Interference from these sources may reach the receiver in several ways; it may be picked up on the antenna; it may be fed into the receiver through the electric light line which supplies the current for operating the receiver; or it may be picked up by the coils of the receiver itself, if it is not sufficiently shielded.

In order to get any kind of signal from the desired broadcast stations, with the most convenient type of antenna—usually a very small piece of wire under the carpet or around the picture moulding—engineers have given us receivers which are extremely sensitive. Most purchasers of such receivers have thought that sensitivity was all that would be required to enable them to bring in the distant stations. They have not understood the interference problem. The plain and disagreeable fact remains that the limit of the distance the receiver will cover is limited by the very simple matter of the strength of the desired station—in that particular location—as compared to the strength of the interference from the local interference producers. If the wavelength and the intensity of the electric wave set up by the ice box or the elevator mechanism happens to be equal to the strength of the desired signal, we are not likely to receive either understandable or pleasant programs. The interference will vary with the wavelength, but for all practical purposes, we will find that it is not possible to use the full sensitivity of a modern receiver, in such localities, with any degree of noise-free results. We will also find that the noise-to-signal ratio becomes greater as we proceed to the shorter waves. This results from the fact that most of the noise producers are emitting waves of comparatively short lengths.

Where it is only possible to use an antenna of the indoor variety, in a territory where the interference is high, we are absolutely limited to comparatively local reception, if we want noise-free results. No known antenna system will alter this situation, although a great many purchasers of combination short and long wave receivers have been disappointed with the results they have been able to secure, because they have not understood the conditions and have expected too much. Certain sales folk, either intentionally or unintentionally, have contributed to this misunderstanding by the use of misleading and ambiguous advertising.

The radio buyer of a large chain of department stores, whom I visited in Pittsburgh, told me that he had sold more than two thousand combination short and long wave receivers in just one of his stores, as the direct result of advertising done by the manufacturer of the particular type of receiver sold. The purchaser was led to believe that all he had to do to listen to stations all over the world was to hook the receiver to the light socket and use an antenna just a few feet long. There were more than 2,500 complaints. It must be remembered that there are exceptions to this rule, like most others. There are locations where, with a short wire, remarkable results are obtained. By the application of suitable, simple means it is now possible to reduce interference very materially. The principal difficulty lies in getting the antenna out of the field of interference and then providing a lead-in to the receiver which will not pick up the local interference. In ninety-nine cases out of a hundred the results more than justify the trouble of first making a study of your antenna problem and then making a suitable installation, as suggested in the accompanying diagrams.

## Real Information

It is very unlikely that there are any people more interested in the application of these ideas than those who have given me the benefit of their experience, so that it might be passed along for the general good of the art. Mr. James Millen, General Manager of the National Company, of Malden, Mass., who, with S. Kruse, the former Technical Editor of Q S T, has just released instructive manuals on short wave and ultra-wave reception, spent several hours going over this subject with me. Mr. E. H. Scott, President of the Scott Transformer Company, of Chicago, and his Chief Engineer, Mr. Pfaff, showed me the work they have been doing along this line and told me that it is one of the most important contributions to the general satisfaction which the owners of their receivers are enjoying. "Bob" Arnold, formerly Chief Engineer of Grigsby-Grunow and now in charge of engineering for The United Air Cleaner Company, Chicago, told me that he thought the application of intelligence to receiver design and to antenna systems was one of the most gratifying engineering advances, at the recent trade show, at Chicago. McMurdo Silver expressed himself in much the same way and both Commander Brigham and L. E. Clement, who have been responsible for the very revolutionary Kolster line of receivers, have contributed much valuable information.

Don C. Wallace, of Los Angeles, who won the Hoover Cup for the best amateur radio station in the country a few years ago, has been devoting himself diligently to this study and I am more than grateful to him for the very helpful information he gave me, both personally and through his very informative article on this subject, which appeared in the April issue of *Radio*.

It is hoped that the digest given here will serve the purpose of concentrating some intelligent thought on this important subject and that the results obtained by our readers will be satisfactory.

The practical application of antenna systems of this nature, as used in the regular handling of commercial messages, where the elimination of interference is even more important than it is for the providing of pleasure, was given to me by Fred Meinholtz, who is in charge of the radio department of the New York *Times*; Mr. Baker, in charge of the Press Wireless Station, at Hicksville, L. I., and Mr. H. O. Peterson, Engineer-in-charge, the R. C. A. receiving station, Riverhead, L. I.

Nearly every one of the experts agreed that the ideal antenna for short waves should be made in the fashion shown in Fig. 1.

Some short-wave receivers and short-wave converters, such as those made by the National Company, have a resistance in the antenna circuit. A new winding, such as described for L1, may be wound on the same form which carries the tuned grid circuit. In receivers where plug-in coils are provided, a new winding may be added to each antenna coil form.

L2 is the tuned grid circuit in the receiver itself, one end going to the input grid and the other to the ground. There is no connection to ground on L1.

There are three insulators at the far end of both antenna wires, which, for best results, are spread directly opposite each other, and, looking from the top, appear as one of the diagrams shows.

An antenna of this sort is very directional. For best reception from European and Australian stations it should be installed in a position approximately northwest and southeast for all sections of the U. S.

The dotted line shows the approximate directional effect of such an antenna system.

All the above is based upon an antenna installation in a position free from surrounding objects such as trees, light wires, telephone wires, etc. It is the ideal situation. Most of us will be forced, by our locations, to make compromises.

If moving one leg of the system slightly off the direct line of the opposite leg will avoid any obstruction, move it.

It is good to remember that the purpose is *to get the antenna as high and as free from other objects as possible*. The length of the transposed lead-in may be anything up to a hundred feet, or more. The antenna does all the work and the lead just *pipes* the received signal to the receiver.

## Use of Transposed Lead-in

In ordinary systems, used for broadcast reception alone, twisted lamp cord, telephone twisted pairs and even twisted BX has been used with satisfaction. None of these lead-ins are as good as the transposed transmission line lead-in for short-wave use. In the opinion of the experts interviewed, the gain in the transposed line is from 15 to 30 per cent greater than is possible with the other forms of lead-in wires.

The engineers at Press Wireless say that very much the same effect is produced when the condensers C1 and C2 are replaced by 400-ohm fixed resistors, in suitable, low-resistance

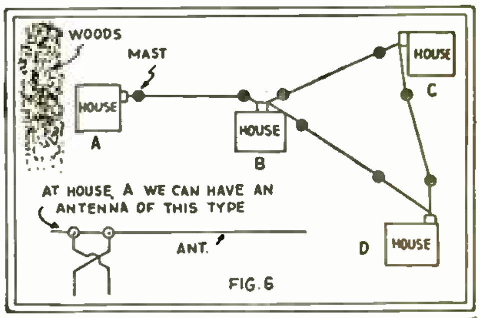



**Fig. 6 shows how to lay out short-wave antennas with a woods at one side. At house A we can have an antenna of the type shown in the lower left-hand corner of the diagram above. At house B we can have our choice of any variation of the ideal short-wave antenna, with the flat portions going to house A, C, or D, depending upon the direction which is free from obstructions. At house C we may have a choice of a flat top going to B or D, with a transposed lead or a variation of the ideal extending to B and D, with the transposed lead-in at C. At house D very much the same choice is to be had and at A, B, C, and D, we can always have an antenna of the variety shown in Fig. 2.**

mountings. They say the resistor arrangement may be employed in any of the systems described, in place of the condensers.

The action of the ideal antenna system, without the marked directional features and without requiring the same unobstructed area, is accomplished, according to the Press Wireless engineers, in the manner shown in Fig. 2.

In Fig. 2 the antenna section is made in the form of a square, with the ends A and B open and forming one portion of the antenna system. For instance, the entire half of the antenna system which makes the "A" portion is shown in Fig. 3.

The "B" section is of the same character and the entire system may be separated, if there is a tendency for the wires to come together, by small wooden blocks, such as shown in Fig. 2A, spaced about 5 feet apart, on the flat-top portion of the antenna. The lead-in should be made in the manner shown in Fig. 1.

Suitable antenna transposition blocks may be made from bakelite or hard, kiln-dried wood soaked in paraffine. The best results are obtained when the transposition blocks are of the best possible insulating material, for it must be remembered that the results obtained on short waves differ greatly from those obtained on the broadcast waves and anything which reduces loss is highly desirable.

In some instances, where the ideal system cannot be employed, other systems of various kinds have been suggested. The special difference seems to be in the lead-in system, rather than in the antenna proper. Some engineers prefer the system shown in Fig. 4, or the slight variation from it, which comes from the substitution of 400-ohm resistors for the variable condensers.

It will be observed that the lead-in wires run parallel and are not transposed. However, the regular transposition blocks, now being offered for sale by several manufacturers, make suitable and convenient spreaders for the lead-in wires, whether transposed or run parallel.

Where regular transposition blocks are not available, they may be cut out of 3/16 inch or ¼ inch bakelite, as shown in the sketches in Figs. 5 and 5A.

In most suburban communities the benefits of suitable antennas are most noticeable, and these antennas are most easily erected. They are most noticeable because the normal interference level is usually higher, due to faulty electric transmission lines and not the best wiring systems. The benefits can be most easily secured by neighborhood cooperation. A single mast on one dwelling can be made to support several antennas, as shown in Fig. 6.

At house A we can have an antenna of this type. At house B we can have our choice of any variation of the ideal extending to B and D, with the transposed lead-in at C.

At house D, very much the same choice is to be had, and at A, B, C, and D, we can always have an antenna of the variety shown in Fig. 2.

The results obtained from Fig. 1 are best, if erected in an unobstructed area. If one side passes over a house, tree or other obstruction, it is better to move the antenna to a "free" position, using the antenna shown in Fig. 2.

In every case one simple rule will guide us: "The antenna should be as high and as free of surrounding objects as possible—the length of the transposed lead makes no practical difference."

The lead-in should be as far as possible from any absorbing material, such as green trees, metal-framed buildings or any other objects.

Antenna systems of this type are highly desirable in every locality and the reduction of the interference is very noticeable in the suburbs as well as in the large apartment houses in the most congested city areas.

## The 'Newark' Converter

By M. HARVEY GERNSBACK

(*Continued from page* 215)

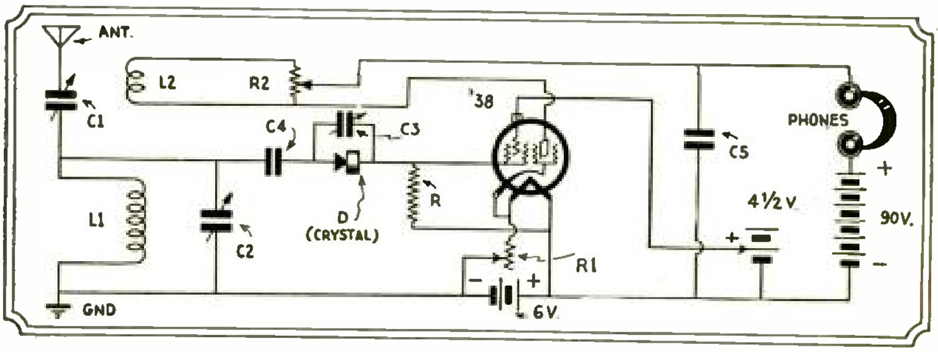
### Installation and Operation

When the converter is installed it is necessary to remove the aerial wire from the broadcast receiver and connect it to the "aerial" post on the converter. The output terminal of the converter should be connected to the "aerial" terminal of the broadcast receiver. A wire should be run from the "ground" terminal of the converter to that of the broadcast set. Connection may then be made to a 110-120 volt 60 cycle A.C. line. The converter will then be ready for operation. Both the converter and the broadcast receiver power supply switches should be turned on and the knob on the right hand side of the converter turned clockwise. This connects the converter to the broadcast set. Tune the receiver to 1,000 kc. and turn the volume control all the way on. Insert one of the plug-in coils in the converter and turn the main tuning dial of the converter until a signal is heard. Use the left hand knob on the converter to bring the signal to best strength. The volume control on the broadcast set may be used to control the volume of the short-wave signals. If the listener wishes to use the broadcast receiver he may do so by turning off the converter and turning the D.P.D.T. switch control on the right side of the converter in a counter-clockwise direction.

# The Short Wave Megadyne

By HUGO GERNSBACK

(*Continued from page* 209)




**Schematic diagram of short wave megadyne.**

little difficulty in assembling and wiring the set.

## The Coils

While any good set of standard plug-in coils may be employed, it is recommended that the builder wind his own either on tube-base forms or on regular plug-in forms. In winding your own coils the data given on page 395 of the April, 1932, issue of SHORT WAVE CRAFT may be closely adhered to. The socket connections, as shown in Fig. 2, are correct for these plug-in coils.

## Operation

In operating the set, a coil covering any desired waveband should be inserted in the socket and the filament rheostat, R1, turned all the way on. After about 30 seconds the tube will warm up and the set will be ready for operation. With the regeneration control, R2, turned to one side the set should not oscillate. By turning this potentiometer slowly, the set should start to oscillate and then the tuning condenser, C2, can be turned until the heterodyne squeal of a station is heard. It may then be well to try reversing the crystal detector and leave it in the position that gives loudest response. For code reception the set should remain in this oscillating condition. For phone reception potentiometer, R2, should be turned until the set just stops oscillating and the station is heard loud and clear.

When using the small coils it will be found that the antenna condenser, C1, should be adjusted so as to have very little capacity; with the largest coils this condenser can be adjusted to maximum capacity. This adjustment may vary with different types of aerials and no set rules can be given.

The batteries used for operating this set depend upon the type of tube employed. Using a type '38, four 1½-volt dry cells connected in series furnish the filament current and two 45-volt units furnish the plate potential. A 4½-volt "C" battery is used for the space charge grid. The ingenious builder of course can make it for A.C. or D.C. operation if he desires, although the current consumption of the single tube is so low that we believe battery operation is more practical and less troublesome.

Those who operate this set will be amazed at the ease of control and lack of dead-spots in the tuning spectrum. The circuit goes gradually into oscillation, allowing for maximum regeneration, as contrasted with other short-wave receivers that flop into or out of oscillation with little control of regeneration.

In actual tests, stations all over the country could be picked up on any of the short-wave bands. This includes police signals from all over the United States, television signals, amateur phone and code; transatlantic phone conversations and, under favorable conditions, foreign broadcast stations. Canadian and U. S. A. short-wave broadcast stations came in with surprising volume—some of them loud enough to operate a loud speaker with fair volume.

## List of Parts

1 set short-wave plug-in coils (Octocoils).
1 .00014 mf. Hammarlund midget condenser, C2.
1 .001 X-L-Radio adjustable condenser, C3.
1 .00025 mf. fixed condenser (Polymet), C4.
1 Home-made antenna condenser, C1.
1 .001 fixed condenser (Pilot), C5.
1 BMS fixed crystal detector (Brooklyn Metal Stamping Co.), D.
1 1-megohm grid-leak (Durham), R.
1 10-ohm filament rheostat (Carter), R1.
1 400-ohm Clarostat potentiometer with shaft insulated from terminals, R2.
1 Four-prong socket (Benjamin).
1 Five-prong socket (Benjamin).
7 Fahnestock binding posts.
1 Vernier dial, 0-100 (Kurz-Kasch).
1 baseboard, 6 x 8 x ⅝ inch plywood.
1 panel, aluminum, 4¼ x 8 inches.
1 '38 pentode, 6.3-volt type.

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### Examinations for Unlimited Amateur Phone Operators' License by Mail Discontinued

Effective April 15, 1932, examinations for unlimited amateur phone privileges by mail will be discontinued. Applicants desiring examination for this privilege must appear personally before one of the examining officers of the Radio Division at one of the examining points, which may be either the district headquarters, a suboffice, or any city visited by an examining officer.

### Renewals of Temporary Amateur Operators' Licenses Discontinued

After one year from April 15, 1932, renewals of temporary amateur class operators' licenses will not be issued. Holders of this class of license will be expected to pass the regular amateur examination during the 1-year term of such license, and failing to pass this examination, the temporary amateur license held will be canceled.

### Regulations Governing the Issuance of Renewal Amateur Operators' Licenses

An applicant should appear at an examining office for a code test in order that the division may be apprised of his ability to copy and transmit code in accordance with the regulations; or, in lieu thereof; submit an affidavit stating that his or her station has been in operation within the last three months prior to the expiration of license and naming three licensed amateurs with whom the applicant has been in communication by Continental Code, such amateurs corroborating this statement and affixing their signatures to the said affidavit.

Service at an amateur phone station exclusively will not be considered for renewal of an amateur class license unless the applicant successfully passes a code test as set forth in the regulations.

### Amateur Stations to be Operated Only by Operators Holding Amateur Operators' Licenses

Effective July 1, 1932, amateur stations will be operated only by operators holding amateur operators' licenses. Amateur stations now being operated by the holders of any commercial class of license will be required to pass the regular amateur examination and obtain an amateur first-class license which will authorize the operation of an amateur station.

## The Rotorit Crystal

By R. W. TANNER

(*Continued from page* 214)

sult, this sometimes being a low growl. It can be cured by connecting in parallel with the secondary of the first A.F. transformer a rather low value of resistance, frequently as low as 50,000 ohms. This, of course, reduces the A.F. gain. On the other hand, if we regenerate with a separate tube, the plate circuit of which is not feeding into the A.F. amplifier, the "fringe howl" is entirely absent. An adjustment of the regeneration control, with a separate regeneration tube, causes less reaction upon the tuning control than with a regenerative detector. There are other advantages but these will not be mentioned, as the reasons given were sufficient to make the combination worth while in this circuit.

Generally, the first job of the "ham" set-builder when constructing a new set is the tuning inductances. Plug-in coils were employed in this layout in preference to a series of coils with tap switches, in order to save space and eliminate, so far as possible, that "horror" of ham-built short-wave receivers—*radio frequency feed-back.* Silver-Marshall type 130P midget form, 1½ inches long by 1½ inches in diameter, were used with UY sockets as mounting bases. The coils L1 and L2 were all wound with No. 24 D.C.C. wire, turns not spaced. The feed-back coils L3 are wound in the slots with No. 30 D.C.C. wire. Great care must be taken when winding the feed-back coils to make sure that the direction of winding is the same as L2; otherwise the regenerative feature will be absent. The start of the feed-back coil should go to the P prong, the finish to one of the F prongs. The start of L2, near the slot, goes to the remaining F prong and the finish to G. The mounting sockets should be connected into the circuit according to Fig. 1. When the coils are completed, it would be well to "dope" the windings with some good insulating varnish—but not shellac! Details of the coils are given in the accompanying table.

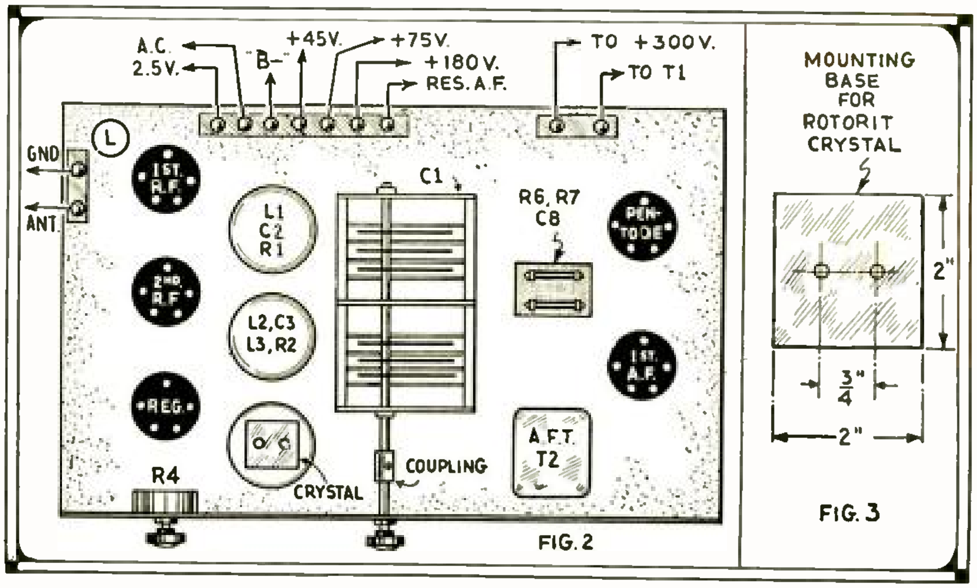
In the first experiments with this circuit, a small trimmer condenser was connected in parallel with each section of the .00014 mf. gang tuning condenser. This was found quite satisfactory and once the trimmers were set on the 20 meter band, they did not require readjustment on the higher waves. This was made possible by winding L1 and L2 exactly alike and using plate-to-coil leads in both tuned circuits of the same length.

A much better method is to mount Hammarlund 35 mmf. compensating condensers in the top of each coil form and to connect them across the windings L1 and L2. It is then possible to set these for maximum sensitivity on each band and leave them alone. This trimmer scheme has been used in many plug-in coil receivers built by the writer and has always proven better than a trimmer condenser in parallel with each tuning section.

The tuning condenser C1 may be a two-gang .00014 mf. (.000125 to .00016 mf. can be used with only a slight difference in frequency coverage) if one can be obtained. Those having a two-gang .00035 mf. broadcast unit may remove plates from the rotor and stators to obtain the proper value. The exact number of plates to remove will depend upon the size and the spacing, but probably 6 or 7 plates in each section will be correct.

A rather high ratio vernier dial will be needed for the tuning condenser, at least 20 to 1, since the tuning is quite sharp even in the 85-meter phone band. The noticeable sharpness of tuning represents actual selectivity.

The antenna coupling coil L may well be a coil tapped in four places, one tap for each band. By properly proportioning the taps, it is possible to realize considerably greater gain from the first R. F. stage. It is not possible to give exact specifications for this coil, as the number of turns depends upon the capacity of the aerial and ground system. It is an easy problem to figure out. When the set is completed, wind 15 turns on a one-inch form (No. 30 wire is OK) and plug in the 20-meter coils. Remove turns until maximum sensitivity is obtained with the dial at full scale. Then




**Layout of sub-base of Crystal detector S-W receiver.**

add 20 more turns, plug in the 40-meter coils and prune the coil again. Continue adding and removing turns for the two higher bands.

A peculiar condition exists in the output circuit of the crystal detector. If the R.F. filter is insufficient in capacity and inductance, feed-back into the R.F. amplifier will occur as well as distortion in the A.F. stages. This is due to the fact that no crystal is a perfect rectifier. The usual type of short wave R.F. choke will generally not do, a value of at least 85 mh. being necessary. A choke having an inductance of 250 mh., taken out of an old 50-kc. superhet, was employed in the model. The larger value of choke will permit lower values of by-pass capacity, which results in a minimum of "cut-off" at the higher audio frequencies.

The R.F., crystal and A.F. stages were mounted on an aluminum sub-panel, the power-pack being a separate manufactured unit. The sub-panel was 10 inches wide by 18 inches long by ⅛ inch thick and had three brackets fastened to the bottom for support and to allow the resistors, by-pass condensers, etc., to be mounted underneath. The layout is shown in Fig. 2. A panel cutter was used to cut holes for the five tube sockets, care being taken not to place too much pressure on the brace or turning it too fast. The sockets are mounted underneath the sub-panel with two 6/32 bolts. Tube shields are fitted to the two R.F. and regeneration tube sockets.

The shield cans for the two tuning coils and crystal detector were of copper, size 3 inches in diameter by 3 inches high. The bases are bolted to the sub-panel. The cans were of the type that are easily removed by turning slightly to the left and lifting off, facilitating the changing of the plug-in coils. Some of these shield cans now on the market have different diameters from 2½ inches to 3½ inches. Even the smaller size will be quite suitable, there being sufficient space for the UY sockets.

It will be necessary to provide a short length of ¼ inch shaft and a coupling bushing for the tuning condenser, the length depending upon the type of condenser used.

The filament circuits should be wired with No. 10 stranded insulated wire so that the voltage drop will not be excessive. This is a point given little or no consideration by most set builders. A great many failures in A.C. sets are due to the use of small wire in the filament supply circuits.

The by-pass condensers, the bias resistors and the detector filter are located underneath the sub-panel. The low potential wires should be run to one side and bunched together with string.

The crystal detector requires a mounting base. This is a small piece of bakelite or hard rubber 2 inches square with holes drilled for the jacks, as shown in Fig. 3. The base is mounted in the detector shield can ½ inch above the bottom.

When completely assembled and wired, the set may be tested. Connect the proper speaker and adjust the voltages to the values specified, assuming that a power-pack having adjustable taps is used or one similar to that shown in Fig. 1. Plug in the 20-meter coils and adjust the trimmer condensers, either those in parallel with the main sections of the gang condenser or those mounted in each coil form, as the case may be, to maximum volume on a weak signal. This operation should be done with the dial at or near minimum. Bringing up regeneration will increase both sensitivity and selectivity exactly the same as in any regenerative set, but with practically no effect upon tuning. The 40-meter coils should then be plugged in and the trimmers on the coil forms (if this method is used) again adjusted to maximum volume. Continue this procedure until all coils are "peaked" correctly.

It will be found that the selectivity of this receiver is somewhat better than the usual type of tuned R.F. tuner and has extremely satisfactory sensitivity. Tone quality on music or speech far surpasses that obtained when a tube detector is employed. The volume leaves nothing to be desired, due to a screen grid first and a pentode power audio stage.

The crystal detector employed is one of the most sensitive and stable crystals ever used by the writer and is one of the reasons for the satisfactory operation of this interesting circuit.

### PARTS LIST

L—Antenna coupling coil.
R—1,000-ohm bias resistor, R.F.
R1—2-megohm R.F. grid resistor.
R2—2-megohm resistor.
R3—2 to 5-megohm regeneration tube grid leak.
R4—50,000-ohm regeneration control.
R5—1,000-ohm A.F. bias resistor.
R6—100,000-ohm plate resistor.
R7—250,000-ohm grid resistor.
R8—400-ohm pentode bias resistor.
R9—25,000-ohm Electrad Truvolt resistor (75 watt). Three taps.
C—.1 mf. by-pass condensers.
C1—Two-gang .00014 mf. tuning condenser.
C2 & C3—35 mmf. coupling condensers.
C4—.0001 mf. by-pass condensers.
C5—.001 mf. by-pass condenser.
C6—.0001 mf. regeneration tube grid condenser.
C7—1 mf. by-pass condensers.
C8—.1 mf. A.F. coupling condenser.
C9—2 mf. 600-volt filter condenser.
C10—4 mf. 600-volt filter condenser.
C11—450-volt, 4 mf. filter condenser.
T—Power transformer.
T1—Output transformer.
T2—2 to 1 ratio audio transformer.
RFC—85 to 250 mh. R.F. choke.
Rotorit crystal detector.

### COIL DATA

| *Band* | L1 | L2 | L3 |
|---|---|---|---|
| 20 | 4 | 4 | 3 |
| 40 | 7 | 7 | 5 |
| 80 | 19 | 19 | 9 |
| Television | 45 | 45 | 15 |

# Short Waves Indicate Altitude

By DR. IRVING J. SAXL

(*Continued from page* 205)

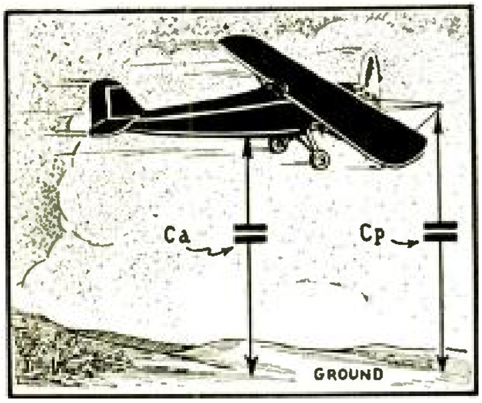



**Fig. 1 illustrates how the electrical capacity between the plane, its antenna, and the ground act like condensers.**

result in a different pitch but not in a different intensity, as the beat note oscillator delivers a fairly constant output. What is wanted are actual changes in the total delivered energy.

Picture 5 shows the actual apparatus. It is important to protect the radio tubes against the microphonic influences which occur in a vibrating airplane. They are therefore covered with felt.

The different parts of the oscillator and of the amplifying equipment are shielded separately in the usual metal boxes. This is important for the functioning of the sensitive apparatus, as stray fields and distributed capacities outside of the antenna naturally influence the coupling between the oscillating systems

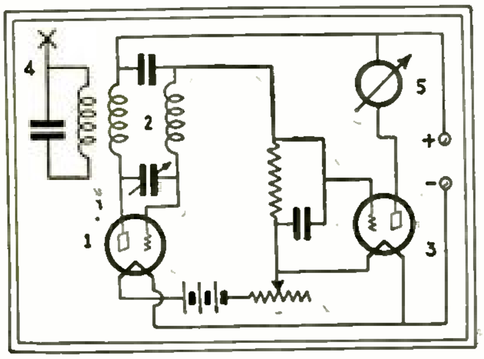



**Fig. 2—Wiring diagram of the new Theremin "radio altimeter."**

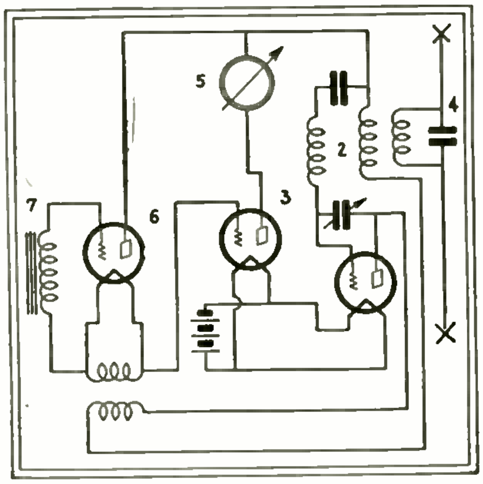



**Fig. 3 shows another method of measuring the electrical capacity (and also the altitude) of a plane above the ground.**

out, the grid of a tube 3 is controlled by the latter. Finally, changes in the plate current occur which can be read on the milliammeter 5. The amount of this plate current change is dependent upon the distance of the antenna system 4 above the ground.

There are many other circuits in which the plate current is proportional to changes in the capacity of a system. All, however, relate practically to the same phenomenon of detuning an oscillating system in such a way that the energy output of an associated system is varied. It is not sufficient to simply detune one side of a beat note oscillator. This would and therefore disturb the functioning of the radio altimeter. Picture 6 shows the inventor, Professor Leon Ssergejewitsch Theremin, in the cockpit of an airplane before taking off on a test flight with his instruments. These instruments are simple and light in weight—factors which are of special importance in apparatus for aircraft service. They are not difficult to construct and employ commonly used parts practically throughout. In consideration of all these facts, the radio altimeter may soon become a standard instrument in all airplanes and dirigibles.

# How to Become a Radio Amateur

By JOHN L. REINARTZ

(*Continued from page* 213)

posts and tune the receiver just as you did before. You should be able to hear practically the same stations that you could with the coil mounted in the receiver, as we have about the same number of turns. This will illustrate to you how you can build other coils for use on other frequencies for connection to the three binding posts.

In general, have three times the number of turns on the second half of the coils as on the first half; remember, we had 15 for the first half and 45 for the second half in the coil we just made. To listen to the radio compass stations we need a coil that has 30 and 90 turns; to listen to short-wave broadcasts below 100 meters we need a coil of 5 and 15 turns. The receiver truly becomes a universal receiver through the extra coils.

When we first turn the tube on, we adjust it so that when we turn the regeneration control dial we hear a click in the receivers as we go into and out of regentration. Do not burn the tube filament brighter than is necessary; after you have been successful in tuning to a station and getting it to your satisfaction, turn the filament rheostat down to where the signal strength drops markedly; then turn it up slightly and leave it there. In the next article we will first tell you something about tubes and how they function in your receiver.

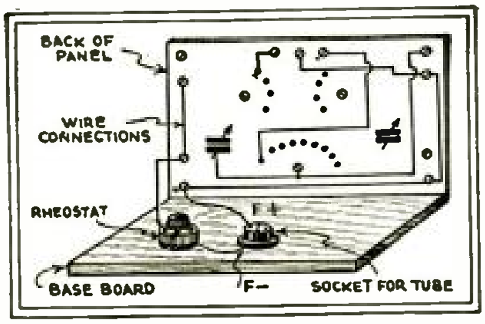



**Fig. 3—Rear view of amateur short-wave receiver described by Mr. Reinartz.**

# "HAM" ADS

Advertisements in this section are inserted at 4c per word to strictly amateurs, or 8c a word (8 words to the line) to manufacturers or dealers for each insertion. Name, initial and address each count as one word. Cash should accompany all "Ham" advertisements. No less than 10 words are accepted. Advertising for the September issue should reach us not later than July 20.



# The 2-Tube "Reliable"

By EDWARD G. INGRAM

(*Continued from page* 230)

having a yoke-shaped frame and two bearings, unless the bearings are insulated from the frame. Since the capacity named falls within the range of the usual midget condensers with a single bearing, this type is used for both the tuning and antenna condensers.

Thus by the use of a midget condenser for tuning and a potentiometer for controlling regeneration, better performance is obtained than where two large condensers are used for these purposes, and with a considerable saving in cost.

## Don't Wind Coils on Cardboard Tubes

Coils for high-frequency work never should be wound on low-grade forms, such as those made from cardboard. Fortunately, bakelite forms of suitable size with ribs to keep the wire away from the dielectric can be obtained at a low price.

While heavy wire is theoretically desirable for high-frequency coils, practically any size from No. 20 to No. 30 may be used to good advantage. No. 30 enameled wire is moisture-proof and very good for the purpose. The number of turns used should be approximately as follows:

Eighty-meter band, plate coil 20 turns, tickler 10 turns; 40-meter band, plate coil 10 turns, tickler 8 turns; 20-meter band, plate coil 5 turns, tickler 6 turns.

A space of one-quarter inch should be left between the plate and tickler-windings. If trouble is experienced in making the tube oscillate, turns may be added to the tickler coil one at a time until best results are obtained. If there is a complete refusal to oscillate the tickler leads may require reversing or the tube may be defective.

## Good R.F. Choke Desirable

While fair results possibly may be obtained with no radio frequency choke coil in the plate circuit, the use of one is strongly recommended. *It must be of good design and construction to prove effective.*

Current for the screen grid and plates of the tubes can be taken from a suitable "B" substitute or from dry batteries. If the power-pack is not provided with a winding for supplying current to the tube heaters, or if "B" batteries are used, a filament transformer can be procured for a small sum. The transformer available probably will be designed for furnishing current to more than two tubes, but this will make no difference. If no center tap is provided, a center-tapped resistor should be placed across the secondary of the transformer and the tap grounded directly to the ground lead-in wire.

To avoid magnetic coupling, the transformer should be placed about three feet from the receiver, and to prevent a serious voltage drop due to resistance of the leads, heavy wire of about No. 10 gauge should be used.

The heaters of the tubes can be operated from a 6-volt, 100 ampere-hour storage battery, if desired, but a change in the wiring will be necessary. Since the tubes are in parallel and each consumes 1¾ amperes at 2½ volts, the total current consumption will be 3½ amperes at 2½ volts, which is too high for the ordinary storage battery. By wiring the heaters in series the current consumption can be reduced to 1¾ amperes at 5 volts. A rheostat should be provided in this case and adjusted to maintain the proper voltage.

To avoid trouble from hand capacity when tuning, it is necessary to use complete shielding for entire satisfaction. It is suggested that an aluminum box about 12 x 12 x 6 inches, of the type having grooved corner pieces and removable sides, be obtained for the purpose.

Both the coil socket, which is an ordinary four-prong tube socket, and the five-prong tube sockets should have the terminals placed as shown. The aerial condenser is mounted on a small piece of rubber panel and care should be taken to see that the shaft does not come in contact with the metal shielding.

The switch for cutting off the ground and B-minus connection is not essential with a "B" substitute. It is necessary when "B" batteries are used, to prevent the continuous leakage of current through the potentiometer.

The lid of the aluminum box may be attached with small hinges to facilitate the changing of the plug-in coils.

Parts suggested are:

Two .0001 mf. Pilot No. J-23 midget tuning condensers.
50,000-ohm Frost "roller type" potentiometer.
85-mh. Hammarlund R.F. choke.
One four-prong bakelite tube socket.
Two five-prong bakelite tube sockets.
Pilot No. 501 double resistor mount.
¼-meg., 2-meg., and 2,000-ohm Lynch resistors.
5-meg. Lynch grid-leak.
One .0001 mf. Lynch No. 1460 grid condenser.
One .01, one .00025, one .006 and two .5 mf. fixed condensers (Pilot, Aerovox or Sangamo).
Set of coil forms (Pilot, Silver-Marshall or Octocoil).
National type "B" vernier dial.
Six Eby binding posts.
One switch.
One two-prong jack.
Aluminum box about 12 x 12 x 6 inches.

# The New Silver-Marshall 728 S-W

(*Continued from page* 227)

INTERMEDIATE TRANS.
1st and 2nd—
Pri.—211 turns No. 41 S.S.E. Litz wire
Sec.—211 turns No. 41 S.S.E. Litz wire
Wound on ¾" form—spaced 1⅟₁₆" with loss ring between coils
3rd—
Pri.—211 turns No. 41 S.S.E. Litz wire
Sec.—211 turns No. 41 S.S.E. Litz wire—tapped at 150 turns.
Wound on ¾" form—spaced ⅟₁₆"

BROADCAST OSC. COIL:
Tank—95 turns No. 27 P.E. wire—space wound 60 T.P.I. on 1¼" dia. form.
Grid—35 turns No. 36 P.E.—close wound
Plate—45 turns No. 36 P.E.—close wond
Pickup—13 turns No. 36 P.E. space wound
Grid, plate, pickup wound on ⅞" dia. form.

SHORT WAVE OSC. COIL:
Tank—29 turns No. 20 P.E.—space wound—winding length 1⅛" wound on 1¼" dia. form.
Plate—26 turns No. 36 S.E.—space wound—winding length 1⅛" wound on ⅞" dia. form.
Grid—9 turns No. 36 S.E.—wound in spacing of tank

ANTENNA COIL—BROADCAST:
Secondary—Approx. 121 turns No. 30 P.E. wire—space wound—83 T.P.I.
Primary—450 turns No. 34 D.C.C. wire—random wound.

SHORT WAVE COILS

1st COIL.
Secondary—34 turns No. 27 P.E. wire—space wound
Pickup—20 turns No. 36 S.E. wire—close wound spaced ⅛" from sec.
Wound on 1¼" dia. form

2nd COIL:
Secondary—19½ turns No. 21 P.E. wire—space wound
Pickup—20 turns No. 36 S.E. wire—close wound spaced ⅛" from sec.
Wound on ⅞" dia. form.

3rd COIL:
Secondary—6½ turns No. 19 P.E. wire—space wound—length, ⅞"
Pickup—20 turns No. 36 S.E. wire—close wound spaced ⅛" from sec.
Wound on ⅞" dia. form.

## Short Wave Beginner

By C. W. PALMER

(*Continued from page* 228)

The remainder of the parts may now be screwed into place on the baseboard as shown in the layout, Fig. 5. Finally, the panel is fastened to the baseboard with the two wood screws and the set is ready for wiring.

The binding post at the front of the coil mounting strip, marked 1, is at the "grid" end of the tuning coil. It is connected to the stationary (fixed) plates of the tuning condenser C1 by a piece of hook-up wire. One end of the grid condenser C2 is also connected to the binding post 1. A wire is soldered to the soldering lug on the condenser and the other end is soldered to the binding post. A third connection is made from this same binding post to the aerial terminal through condenser C5. This condenser is formed of two brass angles mounted on the baseboard, facing each other, but not touching. There should be a space of about 1/16 inch between them. The exact size of the angles and the spacing between them is not critical, so we may use approximate dimensions.

A number of the wires of the set are connected together and grounded to the "Ground" binding post. To facilitate making these connections, a machine screw is passed through the baseboard, below binding post 2 of the coil mounting. A connection is made to a soldering lug under the head of the screw to this post. By referring to the picture layout of the under side of the set, Fig. 6, the wires connecting to this screw may be readily seen. One side connects from tthe rotary plates of the tuning condenser C1; another from one of the terminals of the rheostats R2; a third runs from the bypass condenser C4, which is fastened to the under side of the baseboard; still another wire connects to one side of the condenser C3; another connects to one of the F binding posts on the tube socket and the last wire runs from the screw to the "Ground" binding post of the set.

The remaining wires are as follows: The third binding post from the front on the coil mounting is wired to the remaining soldering lug on condenser C3 and through the baseboard to the back phone terminal. The fourth post on the coil mounting connects to the P terminal on the tube socket. The lug on the other side of the grid condenser C2 is connected to the terminal G on the tube socket which is adjacent to it. A wire is soldered to the other angle of the condenser C5 and connects to the aerial binding post. The front phone terminal connects to one of the soldering lugs on condenser C4 which is also connected to resistor R3 with a wire through a hole in the baseboard. The resistor R3 is equipped with three terminals. The center one and one of the outer terminals are used and the third one is left open. The second terminal on this resistor is soldered to a wire which connects to the right hand binding post at the rear of the set.

The center binding post of the three at the back of the receiver is connected to one side of the rheostat R2 and the left hand binding post is connected to the other F terminal of the tube socket. This completes the wiring of the receiver. It is advisable to check the wiring to be sure that all the wires have been connected. This can be done most readily by marking off the wires on the diagram with a colored pencil as the wires are checked off.

The coil forms are made of short lengths of two-inch tubing cut from the eight-inch piece obtained. They are all 1¼ inches long, except the largest, which is two inches long. To cut the tubing, measure off the 1¼-inch length with a ruler and wrap a strip of paper several times around the coil at the desired point. Then with a pencil, a straight line may be marked around the tube.

The lengths can then be cut off with a hacksaw and the edges smoothed off with a file. Two holes are then drilled near the edges, directly opposite each other, to permit the insertion of small screws for holding the ends of the wire and the mounting "legs." The legs are simply pieces of stiff wire (bus-bar) bent around the screws and spaced to fit in the mounting strip binding posts.

The coils are all wound with No. 22 double silk covered wire. All the coils are wound in the same direction, and each coil should be centered on its form. There are six coils numbered in the following table according to the number of turns.

| | |
|---|---|
| Coil No. 1 | 45 turns |
| " " 2 | 18 " |
| " " 3 | 12 " |
| " " 4 | 8 " |
| " " 5 | 6 " |
| " " 6 | 4 " |

The grid or "tuning" coil is inserted in binding posts No. 1 and 2 of the coil mounting. The plate or regeneration coil is inserted in binding posts No. 3 and 4. The coils can be used as either grid or plate coils, but the following combinations are ordinarily employed:

| | | |
|---|---|---|
| 190-100 meters. | Grid coil No. 1. | Plate coil No. 3 |
| 100- 60 meters. | Grid coil No. 2. | Plate coil No. 4 |
| 70- 45 meters. | Grid coil No. 3. | Plate coil No. 4 |
| 50- 28 meters. | Grid coil No. 4. | Plate coil No. 5 |
| 28- 18 meters. | Grid coil No. 6. | Plate coil No. 5 |

The next point in the installation of the set is the construction of the aerial and ground. The aerial consists of a wire about 50 to 100 feet in length suspended on the roof or in any other convenient way. The ends of the wire must be insulated by placing glass or porcelain insulators between the wire and the support. The wire brought down from the aerial to the set must be insulated as carefully as the aerial itself, if good results are to be obtained.

The ground consists of a wire wrapped tightly around the water pipe or steam pipe. The pipe should be sandpapered so that a good contact can be made.

Our set is now ready for operation. Turn the rheostat about half way up and rotate the regeneration control knob until the set goes into oscillation. This is a phenomenon easy to recognize by the click and hissing sound after a certain point is passed in turning the knob. The point where oscillation begins is the most sensitive operating point for the receiver. Now, if we turn the tuning dial slowly, readjusting the regeneration control to keep the set at the point of oscillation, we will find the locations on the dial for various stations.

(*Don't miss Part III in next issue.*)

# 10 Watt C. W. or Phone Transmitter

**By G. LEONARD WERNER**

(*Continued from page* 218)

(18) for preventing R.F. feed-back, the two fixed mica condensers (23) and (24) and the wire-wound center-tap resistor (42). This shelf is held to the upper one by two pieces of brass tubing ⅛ inch in diameter and ¾ inch high.

### Complete List of Parts Required for the Universal 10-Watt Transmitter

2 Cardwell .000365 mf. Midway Featherweight Variable Condensers, type 407-B (27, 31).
1 75-watt Trutest Power Transformer—Secondary Voltage 375 volts each side of center-tap; 2 2½-volt Filament windings; 1 5-volt Filament winding (40).
1 Electrad Truvolt 50-ohm Center-Tap Resistor (42).
1 Electrad Truvolt 200-ohm Wire-Wound Resistor, type B-2 (38)
1 Electrad Truvolt 10,000-ohm Wire-Wound Resistor, type B-100 (26)
1 Electrad 500,000 ohm Gain Control, type RI-203 (7)
1 Blair Microphone Transformer (6)
1 2,000-ohm Trutest Audio Modulator Choke (18)
1 30 henry, 100 mil Trutest Filter Choke (34).
1 .0001 mf. Aerovox Mica Transmitting Condenser, type 1450 (25).
2 .004 mf. Aerovox Transmitting Mica Condensers, ttype 1450 (23, 24).
1 .003 mf. Aerovox Transmitting Mica Condenser, type 1450 (28).
1 Double Section Aerovox Metal Case Condenser, type 46-01, 0.1 mf. each section (9, 10).
1 .1 mf. Aerovox Metal Case Condenser, type 460 (15).
1 1 mf. Aerovox Condenser, type 407 (12).
1 25 mf. (25 volt) Aerovox Dry Electrolytic Condenser, type E-25-25 (39).
7 Eby Binding Posts (1, 2, 3, 30, 32, 43, 44).
3 5-Prong Eby Sockets (11, 17, 22).
1 4-Prong Eby Socket (37).
1 124 Arcturus Screen Grid Tube used as Speech Amplifier (11).
1 PZ Arcturus Pentode Tube used as Modulator (17).
1 PZ Arcturus Pentode Tube used as Oscillator (22).
1 180 Arcturus Full Wave Rectifier Tube (37).
1 Duplex Toggle Switch, flush-type (Microphone Switch) (4). (Power Switch) (41).
1 Set Short Wave Coils (See Coil Winding Data-table No. 1) (29).
1 Special R.F. Choke—Coil No. 3 (20). (See Coil Details.)
1 Special R.F. Choke—Coil No. 4 (18A). (See Coil Details.)
1 Special Jack Switch—"Phone" to "CW" (19, 33).
2 I.R.C. (Durham) 3,000-ohm, 1 watt Metallized Resistors, type M.F.4 (8) (16A).
1 I.R.C. (Durham) 30,000-ohm, 2 watt Metallized Resistor, type M.R.4 (13).
1 I.R.C. (Durham) 100,000-ohm, 1 watt Metallized Resistor, type M.F.4. (14).
1 I.R.C. (Durham) 1 megohm, 1 watt Metallized Resistor, type M.F.4 (16).
1 4 mf. Aerovox Filter Condenser, type 602 (36).
2 2 mf. Aerovox Filter Condensers, type 602 (Connected in parallel) (35).
1 4½-volt Burgess "C" Battery, No. 5360 (5).
1 Weston D.C. Milliammeter, 0-150 mils, No. 301 panel type (21).
1 Bakelite Panel, 10 x 14 x ⅛ inch.
2 General Radio Dials (27, 31).
2 Knobs (19, 33) (7).
1 Piece of Bakelite—Shelf "A"—10 x 5⅝ x ⅛ inch.
1 Piece of Bakelite—Shelf "B"—5 x 3 x ⅛ inch.
1 Piece of Bakelite—Shelf "C"—7¾ x 1 x ⅛ inch.
1 Piece of Bakelite—Shelf "D"—4⅛ x 2¼ x ⅛ inch.
1 Binding Post Strip—7¾ x 1 x ⅛ inch.
1 Bottom Board, 9¾ x 8¾ x ¼ inch.
4 Rubber Feet.
1 Universal Double-Button "Handi-Mike" Microphone.
1 Transmitting Key.
All Aluminum Frame Angles—16 Gauge.

Note:—Numbers in parenthtses refer to corresponding numbers used to mark parts on diagrams.

### Coil Winding Data

*Table No. 1*
COIL No. 1
Form 4 inches long by 2½-inch diameter. Bakelite Form

| 20 Meters | 40 Meters | 80 Meters | 160 Meters |
|---|---|---|---|
| 4 Turns No. 12 Enameled Wire Spaced ¼" apart | 9 Turns No. 12 Enameled Wire Spaced ¼" apart | 16 Turns No. 12 Enameled Wire Spaced ¼" apart | 45 Turns No. 12 Enameled Wire |

COIL No. 2
2 inches long by 2½-inch diameter. Bakelite Form

| | | | |
|---|---|---|---|
| 9 Turns No. 12 Enameled Wire | 9 Turns No. 12 Enameled Wire | 9 Turns No. 12 Enameled Wire | 18 Turns No. 12 Enameled Wire |

# A 30 Watt Transmitter

(*Continued from page* 238)

For the 3,500 kc. band 13 turns formed on 2¼-inch. For the 7,000 kc. band 9 turns formed on 1½-inch. For the 14,000 kc. band 5 turns formed also on a 1½-inch form.

The windings of the two smaller coils may be so spaced that the ends will fit to the same dimensions that the largest coil does. Make certain that no portion of the turns touch the next turn and keep the spacing as uniform as possible. An extra inch should be allowed on each end turn which may be flattened and drilled for the purpose of mounting on some form of standoff insulator, fitted with vertical bolts and wing nuts.

A bleeder resistor is highly recommended, as it protects tubes and condensers from high voltage surges while "keying" and also greatly improves the note. A 10-watt resistor of 50,000 ohms will be satisfactory.

In the schematic it will be noted that there is a condenser and a variable resistor shunted around the key; this is strongly recommended in order to surpress key clicks. A condenser of .5 mf. is satisfactory but must be able to withstand the plate voltage. The variable resistor may be in the form of any rheostat or potentiometer variable from zero to 1,000 ohms.

Such a transmitter was converted from the power-pack referred to and actually placed in operation for a period of eight hours, delivering 30 watts to a dummy antenna, without causing the original transformer choke, etc., to heat up above normal. The cased transformer is equipped with ports to allow air circulation.

With reference to the grid-leak, it is advisable to use a 100 watt size, as while adjustments are being made to determine the exact amount of grid turns, or in tuning, the circuit at times becomes considerably out of resonance, resulting in very heavy grid currents, which are apt to burn out a low-wattage resistor or seriously damage it, so as to cause a *noisy carrier later on*. This damage very often is not apparent when the resistor is out of service and under test, but develops shortly after it has been put back in service when it heats up, even though the heating is not apparent by physical contact.

*Any inquiries addressed to the writer, in care of the Editor, will be cheerfully answered.*

## Denton 8-Tube Super

(*Continued from page 207*)

turns to the inch with a winding length of 1 inch.

28 TO 60 METERS—*Detector*

Primary...... 4 turns No. 30 D.S.C.
Secondary.... 14 turns No. 20 Enam.
Regeneration.. 6 turns No. 30 D.S.C.

*Oscillator*

Plate........ 4 turns No. 30 D.S.C.
Secondary.... 12 turns No. 20 Enam.
Coupling...... 2 turns No. 20 Enam.

Detector secondary is space wound 12 turns to the inch with a winding length of 1⅛ inches scant.

The oscillator secondary is space wound 12 turns to the inch with a winding length of 1 inch.

55 TO 125 METERS—*Detector*

Primary...... 5 turns No. 30 D.S.C.
Secondary.... 33 turns No. 20 Enam.
Regeneration.. 16 turns No. 30 D.S.C.

*Oscillator*

Plate........ 5 turns No. 30 D.S.C.
Secondary.... 24 turns No. 20 Enam.
Coupling...... 3 turns No. 20 Enam.

The detector secondary is space wound 24 turns to the inch with a winding length of 1⅜ inches.

The oscillator secondary is space wound 24 turns to the inch; length of 1 inch.

120 TO 300 METERS—*Detector*

Primary...... 6 turns No. 30 D.S.C.
Secondary.... 78 turns No. 30 D.S.C.
Regeneration.. 30 turns No. 30 D.S.C.

*Oscillator*

Plate........ 14 turns No. 30 D.S.C.
Secondary.... 44 turns No. 28 D.S.C.
Coupling...... 5 turns No. 30 D.S.C.

The detector secondary is space wound 56 turns to the inch with a winding length of 1⅜ inches.

The oscillator secondary is space wound 56 turns to the inch; length of over ¾ inch.

240 TO 550 METERS—*Detector*

Primary...... 10 turns No. 30 D.S.C.
Secondary....114 turns No. 30 D.S.C.
Regeneration.. 48 turns No. 30 D.S.C.

*Oscillator*

Plate........ 30 turns No. 30 D.S.C.
Secondary.... 70 turns No. 28 D.S.C.
Coupling...... 8 turns No. 30 D.S.C.

PARTS LIST

1, 2—Alden antenna-ground assembly.
3, 12—Hammarlund S6 Isolantite sockets.
4, 13—National 150-mmf. tuning condensers ST-150.
2 National type "B" dials VB-D.
5—International resistor, 1 meg., 1 watt.
6, 14—Illini mica condenser, .000125-mf.
7, 16, 20, 24, 32, 35—4-prong Eby sockets.
8, 10, 19, 23, 31, 39—Acratest by-pass condensers No. 2817, capacity .02-mf.
9—Frost 250,000-ohm potentiometer No. 6189.
11—Micamold resistor, 30,000 ohms, 1 watt.
15—International resistor, .1 meg., .5 watt.
17, 21, 29—Acratest 465 kc. transformers.
18, 22, 30—Acratest resistors, 50,000 ohms, .5 watt.
25—Acratest resistor, 15,000 ohms, .5 watt.
26—Frost potentiometer, 100,000 ohms, No. 6188.
27—Acratest resistor, 30,000 ohms, .5 watt.
28—Acratest resistor, 60,000 ohms, .5 watt.
33—Micamold condenser, .001-mf.
34—Acratest I.F. choke No. 2871.
35—Acratest resistor, 150,000 ohms, 1 watt.
36—Acratest coupling condenser, .075-mf.
37—Frost potentiometer, 500,000 ohms.
40—Acratest push-pull input transformer No. 5834.
41, 42—Eby 5-prong sockets.
43, 44, 45, 46, 47, 48—Pins of Eby 6-prong socket.
49—Power switch mounted on (37).
Special drilled and folded panel and chassis, Blan, the Radio Man.
3 Hammarlund tube shields, type TS.

(Concluded in next issue.)

# When to Listen In

By ROBERT "BOB" HERTZBERG

### From Canada and Cuba

● OLIVER AMLIE, our indefatigable correspondent of Philadelphia, Pa., has sent this department several cards and letters of acknowledgment that he received from various short-wave stations. A card from the Canadian Marconi Company gives the following "dope" on VE9DR:

"VE9DR was designed and built by the Canadian Marconi Company, and operates on a frequency of 6,005 kilocycles or 49.96 meters, with a power output of four kilowatts. The present schedule is 7:00 p. m. to 11:00 or midnight, E. S. T., every evening."

The office of the Canadian Marconi Company is at Montreal, but the actual radio transmitter is at Drummondville, Quebec.

From Havana Cuba:

"This card will verify that you heard station **CMCI** on 49.5 meters of the International Broadcasting Company of Havana, Cuba, broadcasting a musical program on last April 7th, 1932. We also broadcast daily on our long-wave station, CMDC on 675 kc., from 7:00 a. m. till 8:00 p. m. and from 8:00 p. m. till 11:00 p. m. on CMCI."

### Daylight Saving Time in Foreign Countries

For the current year this time is in effect as follows: France, advanced 1 hour, April 2 at 23:00 o'clock, until October 1 at 24:00 o'clock; Great Britain, advanced 1 hour, April 17 at 2 o'clock a. m., until October 2 at 2 a. m.; Irish Free State, advanced 1 hour, April 17 at 2 a. m.; Holland, advanced 1 hour during the night of May 2-22; Portugal, advanced 1 hour, April 2 at 23:00 o'clock; Belgium, advanced 1 hour, April 3 at 2 a. m.

### New Home for W8XK

Radio station W8XK, the little brother of station KDKA, is being moved to a new home.

The change in location is being made in the interest of centralization and with the completion of the transfer the short waves will go on the air from the ultra-modern plant at Saxonburg, Pa., approximately 30 miles from Pittsburgh. The standard wave broadcasting of KDKA has been done from Saxonburg since the plant was first opened, August 31, 1930.

New transmitting sets are being installed at the Saxonburg plant for the frequencies of 15,210 kilocycles and 21,540 kilocycles, their respective wavelengths being approximately 19 meters and 13 meters. Other frequencies being moved are those of 6,140 kc., or 48 meters, and 11,870 kc., or 25 meters.

Walter C. Evans, manager of radio operations for the Westinghouse Electric and Manufacturing Co., is supervising the installation of the short wave equipment at the Saxonburg station.

The achievements of W8XK are known throughout the world. It has carried the National Broadcasting Company programs originating in the KDKA studios to the far corners of the earth. Not only have these short-wave programs of W8XK been received direct on short-wave sets, but millions have tuned in on them after the waves had been picked up and re-broadcast.

### Your League Club Station

(*Continued from page* 224)

And that is amateur phone licenses for all of the amateur phone bands *without code tests*. Also we want one-half of all the amateur frequencies for phone work.

The phone boys at the present time are required to know two times as much as the code boys in order to be licensed to operate twenty- and eighty-meter phones and are in turn penalized by the F. R. C. by permission to use but a very small amount of the amateur frequencies. This is the handiwork of the CW—A. R. R. L. pirates at Hartford.

73's

N. E. BREWER, Radio Station W9DKK,
418 W. 5th St., Abilene, Kansas.

*(You seem to have gotten a very twisted slant on the phone-C. W. problem, OM, and I will try to straighten you out. First of all, you must understand that one phone transmitter takes up as much room on the air as fifty C.W. transmitters. If the ham bands were opened to unrestricted phone work the bedlam would be unbearable. It's bad as it is now, what with many inconsiderate amateurs using wobbling oscillators and down-in-the-cellar modulation. CW experience is very valuable to the phone experimenter, because a phone transmitter must first be a stable C.W. outfit before it can be modulated properly.*

*Your remarks about the A. R. R. L. are altogether unwarranted. If it were not for this organization there probably would be no such thing as amateur radio today. You must remember that amateur radio is no longer a local proposition, but has assumed international aspects. Uncle Sam has certainly treated the "ham" more kindly than any other government, and has stood up for him when most of the other countries wanted to "wipe him off the map" completely and grab off all the short-wave channels for commercial and military purposes.—Editor.)*

## Short Wave Events of the month

**May 19—Chicago Tribute to Germany, 11:30 to 12 noon, E. D. S. T., National Broadcasting System. (W2XAD, 15,340 kc., WGY.)**

May 19—Pan-American Program, 11:30 to 12 midnight. E. D. S. T., National Broadcasting Company. (W2XAF, 9,530 kc., WGY.)

May 20—Hudson Festival, 3 to 4 p.m., E.D.S.T., National Broadcasting Company. (W2XAD, 15,330 kc., WGY.)

May 25—The song of an English nightingale, picked up by microphones concealed in the Pangbourne Woods, Berkshire, England, was heard here over the Columbia Broadcasting System. The program was sent by short waves.

May 26—Transatlantic rebroadcast from London, England, over Columbia Broadcasting System network—"The Great Unlicked," stories of college life, given by Carleton K. Allen, warden of Rhodes College, Oxford, England.

May 26—Rebroadcast to American audience over the C. B. S. chain of stations of the charity concert from Albert Hall, London, England.

May 28—Rebroadcast to America by C. B. S. of Bonn University students chorus from Bonn, Germany.

May 29—Amelia Earhart spoke to American broadcast audience via C. B. S. over short-wave link across the Atlantic from London, England.

May 31—Ambassador Mellon, C. B. S. short-wave broadcast to America from London, England.

June 3—C. B. S. international exchange feature—"Broadway," sent from WABC studio to London and the whole continent via Rocky Point, Long Island, short-wave station.

June 3—Sangerfiest Program, 2 to 2:30 p.m., E. D. S. T., N. B. C. (W2XAD, 15,330 kc., WGY.)

June 5—Monte Grappa Rock, 10 to 11 a.m., E. D. S. T., N. B. C. (W2XAD, 15,330 kc., WGY.)

June 11—C. B. S. short-wave broadcast from London, England, to American audience, of the Aldershot tattoo.

June 11—Washington College, 12 noon to 1 p.m., E. D. S. T., N. B. C. (W2XAD, 15,330 kc., WGY.)

June 17—Pan-American Program, 11:15 to 12 midnight, E. D. S. T., N. B. C. (W2XAF, 9,530 kc., WGY.)

## SWAPPERS

SWAPPERS are swappers of correspondence. During the past few years we have noted that Short-Wave enthusiasts love to get acquainted with each other by mail in order to swap experiences.

Use a postcard only. Never write a letter. Address postcard as follows:

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c/o SHORT WAVE CRAFT
96-98 PARK PLACE
NEW YORK, N. Y.

On the blank side of the postal PRINT clearly your name, address, city and State. Don't write anything else on card. We will then understand that this is your request to publish your name and address and that you wish to enter into correspondence with other short-wave readers. There is no charge for this service.

—EDITOR.

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# WHAT ARE YOU DOING IN RADIO

## IN THESE DAYS OF KEEN COMPETITION AND SCARCITY OF JOBS AND POSITIONS?

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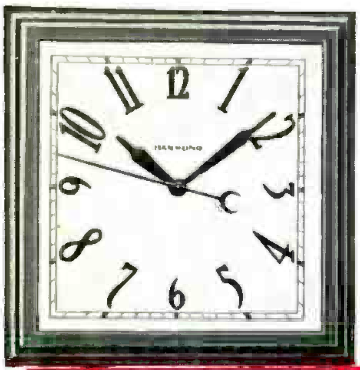

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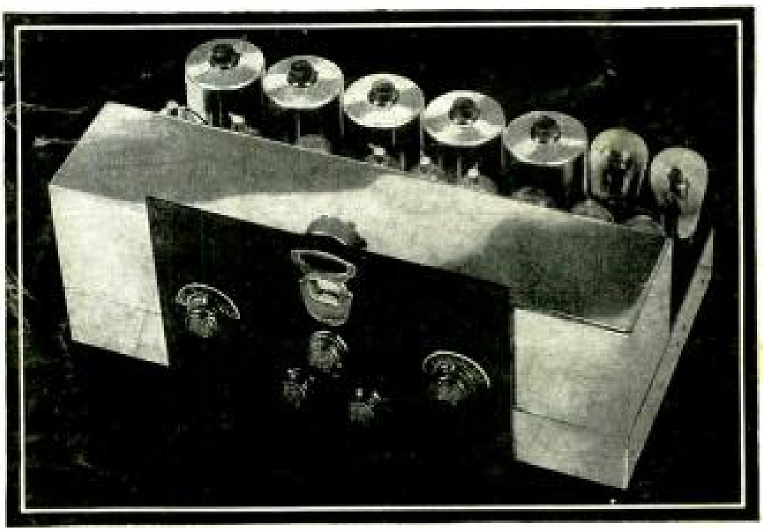

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