THE RADIO EXPERIMENTER'S MAGAZINE

SHORT WAVE CRAFT

Edited by
HUGO GERNSBACK

IN THIS ISSUE

SMOOTHING UP THE REGENERATION CONTROL

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A SUPER-REGENERATOR WITH PENTODES

W9ZG SAVES A LIFE!—SHORT WAVE FICTION BY A. D. MIDDLETON, W8UC

A 20-METER TRANSMITTER

S-W "THRILLS" ON 2-TUBES M. H. GERNSBACK

HOW SUN AFFECTS S-W RECEPTION BY DR. F. NOACK

NOW 25¢ IN CANADA 30¢

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December 32

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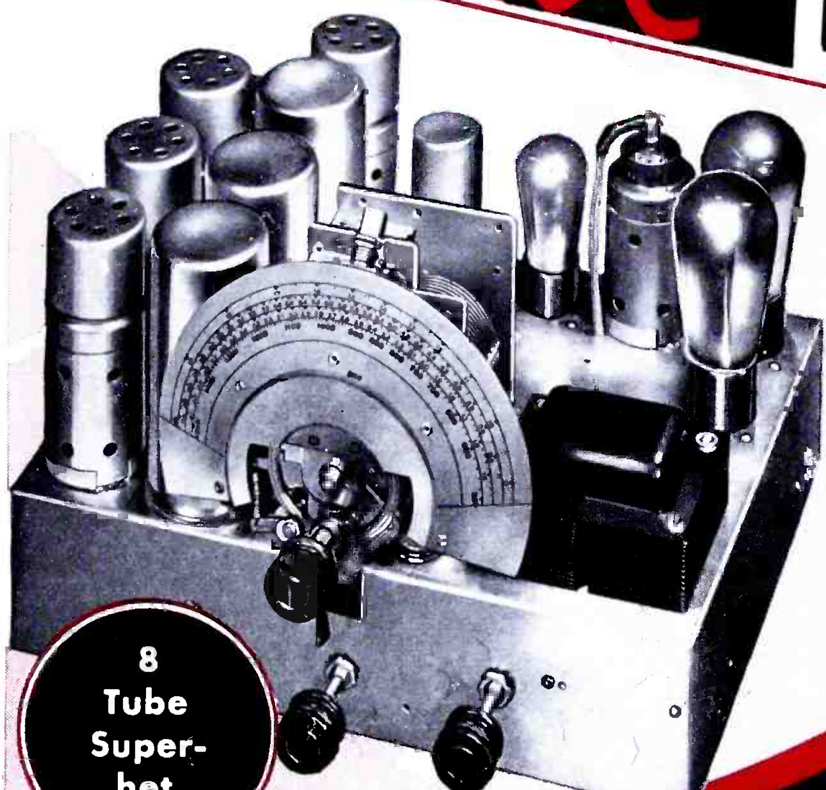
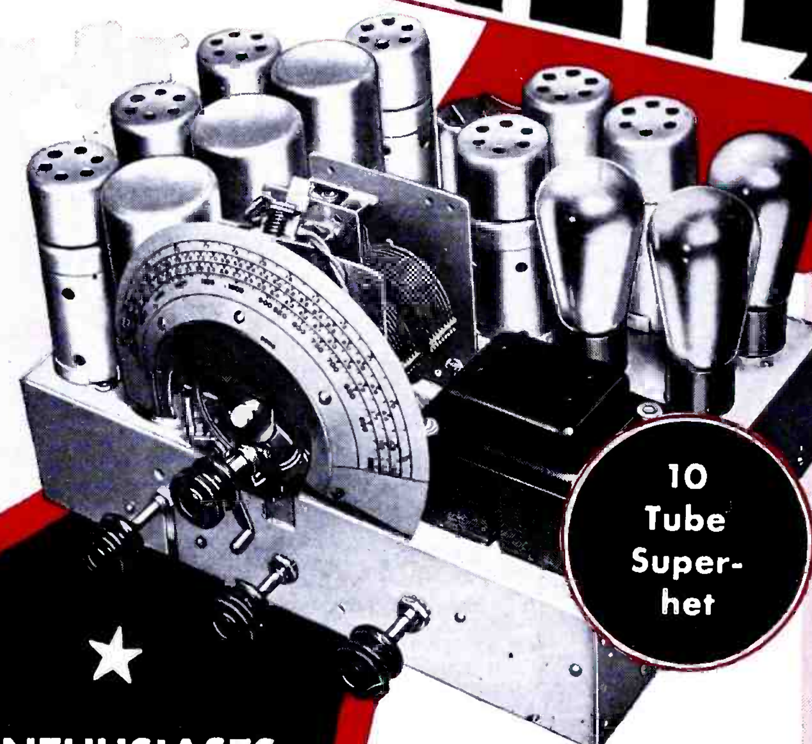


8 Tube Super-het



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★

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IN THIS ISSUE: PROMINENT SHORT-WAVE AUTHORS
Noack • Rohde • Tanner • Reinartz • Denton • Binneweg • Palmer

SHORT WAVE CRAFT

HUGO GERNSBACK
Editor

H. WINFIELD SECOR
Managing Editor

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Crystal Oscillators and Crystal Control, by A. Binneweg, Jr.
A Long-Wave Receiver, by C. E. Lindberg, W8CIL, range up to 300 meters.
Pentodes in Low-Power Transmitters, by Dr. W. Möller.
Radio Signals from the Stratosphere, by Hanns Mendelsohn, Berlin.
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The "3-In-1 Monotube" Super-Regenerator Receiver is described in full detail by R. William Tanner, popular short-wave authority and writer on page ... 464

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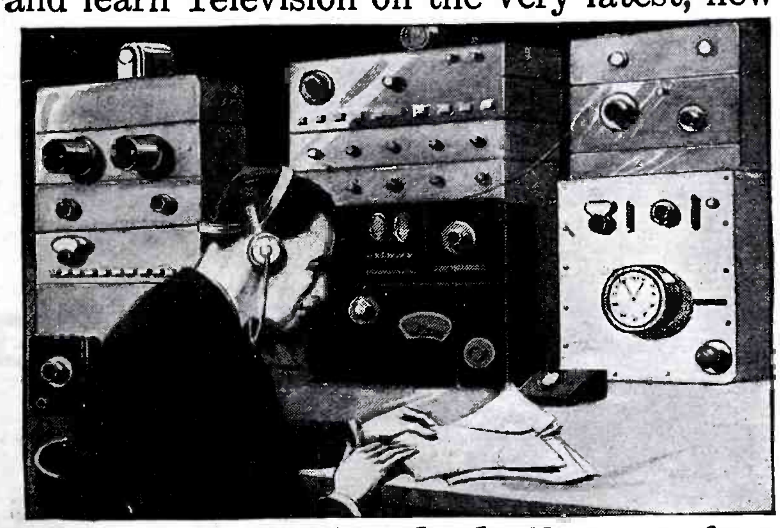

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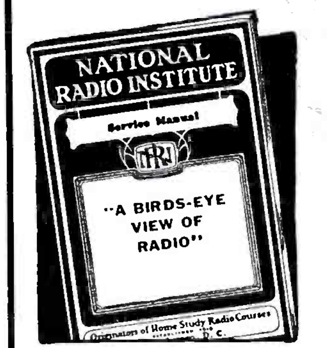

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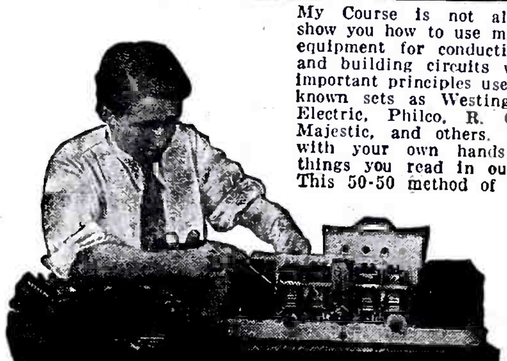

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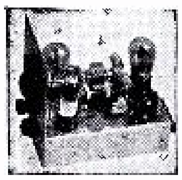

Accepted and enthusiastically endorsed by many prominent experimenters, following its introduction last month. Setting as it does new standards of excellent performance and low price. Completely described in our July adv. It's cheaper to buy this AIR TESTED 3 tube receiver than it is to assemble a kit that may not function properly. Using 2 type 37—one type 38 tube. Unconditionally guaranteed at (less tubes)........... **$12.45**

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Size (Turns)	Price Each
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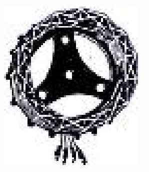
35	.30
50	.45
50	.45
75	.50
100	.55
150	.60
200	.60
250	.70
300	.70
400	.75
500	.85
600	.95
750	1.00
1000	1.10
1250	1.25
1500	1.35

TRANSCONTINENTAL T.R.F. COILS



These are the same make of Diamond-weave T.R.F. coils which made the Freshman name famous. Designed for use in tuned radio frequency receivers with .00035 condensers. Excellent for replacements in Freshman Masterpiece receivers or in construction work. Sold only in sets of three—attractively boxed. FREE PLANS for constructing a complete T.R.F. receiver furnished with each set. Each coil is provided with a convenient fiber mounting for attaching directly to tuning condenser. Shipping weight, 1 lb. Overall size, ¾x3x3". SET OF 3 COILS........ **25c**

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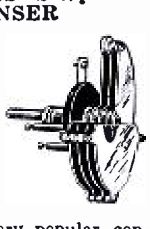

7 Plate Variable Condenser for use in short wave receivers. Heavy aluminum plates withwith SFL rotors. Excellent for DX work. Sturdily constructed for indefinite use. Rotors will not short to stator when "wide open." A very popular condenser with amateurs. Shipping weight, 1 lb......... **25c**

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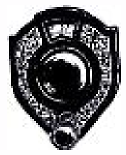

Attaches to shaft of tuning condenser by means of famous Kurz-Kasch split-bushing method. Heavy spring compensates for wear. Vernier ratio 14 to 1. Excellent for short wave tuning. Translucent dial permits lighting from the rear. Ship. weight 8 oz. **45c**

3" Dial ....

4" Dial **55c**

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Two 8 mf. sections	1.00
Three 8 mf. esctions	1.60

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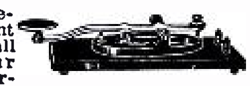

A three-adjustment key for all amateur and experimental uses. Arm is of nickel-plated steel, base of cast metal. Coin silver contacts, will not arc. Key is mounted on black enameled wooden base and is provided with 2 convenient terminals. Equipped with 4 rubber feet to prevent scratching. Shipping weight, 1½ lbs. **55c**

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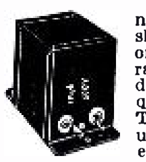
A..00035 mf. (per section) condenser of the "bath-tub" type. Each section is equipped with a trimmer condenser in order to perfectly align the entire unit. Impossible to get out of alignment. Measures 8¾" long less ¼" shaft x 3¾" wide x 2¼" deep. Ship. wt., 6 lbs..... **95c**

1 MF. 600 VOLT FILTER CONDENSER



Just the thing for noise filters—for shunting light lines or electrical apparatus. One such condenser will eliminate quite a bit of noise. Three or four such units will eliminate every trace of line noise. Complete elimination is assured by a series-parallel arrangement of six condensers with center taps grounded. Excellent for filter replacement and constructional work. Measures 2¼" high x 2⅛" wide x 2" deep. Shipping weight, 1 lb....... **45c**

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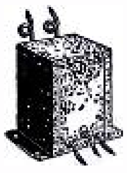
Made of high-grade porcelain composition, black enamel coated. Recommended for low power transmission work and S.W. reception. Particularly suited to the mounting of extremely high frequency (quasi-optical) R.F. coils. Used universally for 5 meter work. Shipping weight, 4 ounces. Each **10c**

THORDARSON 30 HENRY CHOKE—Type 3653T

A neat, compact 30 Henry Choke which will easily pass 75 mils without heating. Recommended for constructional, repair and experimental work. Put up in neat, completely shielded metal can with suitable mounting flanges. Convenient soldering lugs protrude through the bottom for concealed, sub-panel wiring. Shipping weight, 3 lbs. **69c**

LEEDS 2½ VOLT FILAMENT TRANSFORMER



Here is an ideal transformer to have around the laboratory or repair shop. Practically every commercial A.C. set uses 2½ volt filament tubes. This transformer has one center tapped 2½ volt winding, capable of supplying 10 amperes without heating. For use on 110-20 volts, 60 cycles, A.C. Completely shielded in attractive metal case with mounting flanges. Heavy insulation between windings — will stand test of 1,000 volts. Shipping weight, 5 lbs... **$1.15**

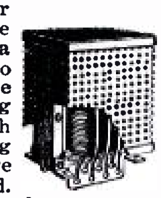
Headquarters for Short Wave Transmitting and Receiving Apparatus.
When in town, visit our store.

DeFOREST TUBES

Look at these prices—all perfect

400-A	$2.00	428	$1.38
401-A	.38	439	1.38
412-A	.75	445	.55
422	1.50	446	.75
424-A	.80	447	.88
426	.40	451	.80
427	.50	456	.63
430	.80	457	.80
431	.80	458	.80
432	1.15	471-A	.45
433	1.38	480	.50
435	.80	482	.53
436	1.38	566 ½. rec.	3.95
437	.88	510 15w.	3.95
410-50-81	1.95	503-A-11-45	14.45

GREBE POWER TRANSFORMER



Just the power transformer for constructing a high-grade P. A. amplifier, using a screen grid A.F. amplifier to boost the output of a mike or phono-pickup; following this with 2 stages of push pull amplification consisting of 2—'27's in the first stage and 2—'45's in the second. Sold complete with perforated metal case to assure cool operation under heavy loads. Equipped with electro-static shield to prevent transformer noises. Supplied with 2 insulated terminal strips arranged for concealed sub-panel wiring. Case measurements: 5½" high x 4" deep x 3½" wide. Diagram included. Ship. wt., 14 lbs **$2.25**

KENYON REPLACEMENT POWER TRANSFORMERS

Provided with universal mounting brackets and convenient soldering lugs, properly identified. 3 types available:

Type KR-1. High voltage, 700 volts ct, 125 MA; 5 volts, 2 amp; 2½ volts ct, 3 amp; 2½ volts, ct, 10½ amp..... **$2.95**

Type KR-2. High voltage, 580 volts ct, 85 MA; 5 volts, 2 amp.; 1½ volts, 4.2 amp.; 2.5 ct, 1.75 amp; 5 volts, ct, 1.5 amp. **$1.95**

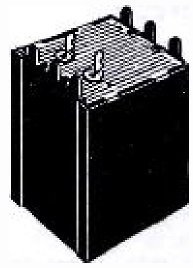
Type KR-3. High voltage, 650 volts, ct, 60 MA; 5 volts, 2 amp.; 2.5 volts, ct, 1.5 amp.; 2.5 volts, ct, 8.5 amp...... **$1.95**

THORDARSON PLATE TRANSFORMER

Type B.H.

This transformer may be used as a replacement in receivers where the high voltage winding has become shorted or burnt-up. Merely leave the old transformer there, mount the new one, and you're all set to operate once more. Comprises center tapped high-voltage winding of 285 volts either side of CT, and tapped primary to accommodate line voltages from 95 to 115 volts. Excellent replacement transformer for Majestic Super B and other B Eliminators using Ratheon tube. Semi-shielded with heavy iron brackets and provided with suitable mounting flanges. Ideal for low power transmitters as well as for experimental and constructional work. Electrostatically shielded to prevent extraneous noises. Ship. wt., 4 lbs List Price, $8.00............... **$1.25**

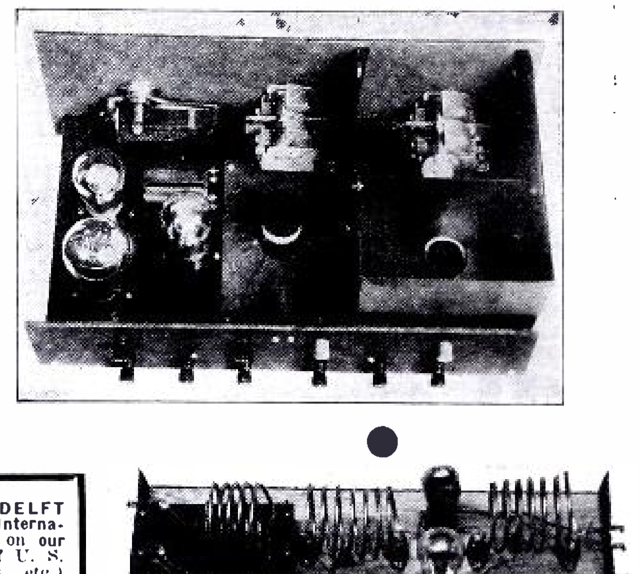
R.C.A. 30 HENRY CHOKE



Genuine RCA 30 Henry Choke, capable of passing 125 mils without heating. D.C. resistance 200 ohms. Provided with convenient soldering lugs for concealed sub-panel wiring. For replacements in all RCA-Victor receivers as well as for constructional and experimental work. May be used in all types of filter circuits, for P.A. systems, amplifiers, radio receivers, etc. Measures 3½" high x 3" wide x 2¾" deep. Sold in original factory containers. Ship. wt., 4 lbs.... **79c**

THIS PAGE IS DEVOTED ENTIRELY TO SHORT WAVES AND ULTRA SHORT WAVES

Here is an inexpensive **POWERFUL MODERN RECEIVER**, a set that gives **VOLUME ON DISTANCE** and four times the **DISTANCE** of any type of short-wave adapter or convertor. **SUPER-SENSITIVE!! FOUR MODERN TUBES, TUNED PENTODE INPUT AND PENTODE OUTPUT!!** Economical in operation. If other sets get distance, this set gets **MORE DISTANCE** and **GREATER VOLUME . . . .** No hand capacity; full dial-spread; easy tuning. Uses latest six-prong coil forms and sockets. Photo shows cover removed from heavily shielded R.F. compartment. A new design throughout with all modern features, and special neat, colored metal chassis.



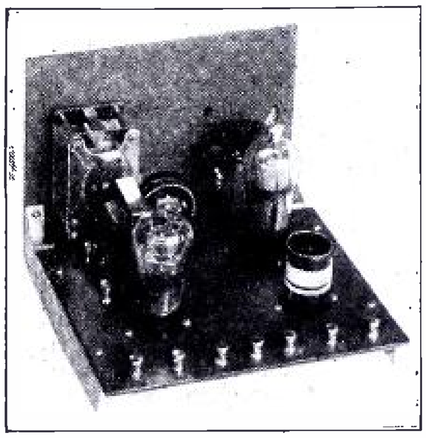
A powerful set at a reasonable price! Available in AC and DC Models. Tunes from 14 to 550 meters ("all wave"). **Full broadcast band coverage with but one coil.** . . . We manufacture them. Note special two-gang condensers! Remember! This set has **TUNED RADIO-FREQUENCY AMPLIFICATION!!** Inferior sets may boast of an R.F. stage, but only **TUNED** R.F. amplification is of any use at short waves! . . . Kits come complete with all coils for the 14 to 200-Meter range as shown in photo and need only to be wired to complete them. Broadcast coils (200 to 550 meters) 85c extra.

DELFT INTERNATIONAL FOUR-TUBE DC KIT, $23.00. Complete Simplified Wiring Instructions furnished. Uses any desired style of DC tubes, including two-volt tubes. 50% Discount on Standard tubes **if ordered with the Kit.**

DELFT INTERNATIONAL FOUR-TUBE AC KIT, $27.00. Includes filament transformer and all instructions. **Tubes, $2.50 extra, saving you at least 50%.**

These sets are **much more sensitive** than ordinary superheterodynes! Use ordinary loudspeakers. **Magnovox Dynamic Speakers, $4.00 extra.** AC Kit uses any standard power pack having a variable detector voltage, or your own B-eliminator. Several pages of instructions furnished, so that anyone with little or no experience can build and tune one of these fine sets! Tubes can be sent safely, and will save you plenty! You can't buy the **parts** for the price of these Kits!

The price of a set ready to operate is the Kit price plus the Wiring and Testing charge **($8.00).** On special order (you can even make these yourself), we can furnish coils that will allow this set to tune to wavelengths higher than 600 meters. **A real all-wave set!**



SPECIAL HOLIDAY PRICE REDUCTIONS!! POPULAR DELFT DX RECEIVERS!! We are conservative, yet **we guarantee International Reception!!** Here's what **users** receive with headphones on **our** sets (and many of these Stations on the **loudspeaker!**) **Packs** of U. S. Stations (Music, Police Stations, Airplane Stations, Amateurs, etc.) Canada, **Indo-China, Siberia, Java, Australia, Mexico, Madrid, Spain, Argentina etc. ONE TUBE SET COMPLETE (DC), $7.95.** Can be used as is, as a one-tube separate S.W. set, **or as a converter for either an AC or DC broadcast receiver.** Build a simple oscillator to it, and make it a superheterodyne convertor of the latest design. **Kit of Parts, $6.45. One-Tube AC Kit, $7.45.**

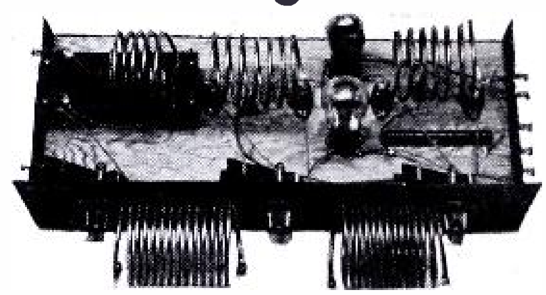
COMPLETE MODERN PENTODE TWO-TUBE SET, $12.00. High-gain Detector and stage of High-gain audio. Set of tested tubes, $2.00. Pentode tubes give more distance than screen-grid tubes! Set uses the much-talked-of **Type '34 Pentode Tube** also the **'33 Pentode Tube.** Nothing more Modern! **Kit of Parts with Instructions, $9.95.**

COMPLETE MODERN PENTODE THREE-TUBE SET, $14.00. Sensitive Detector, high-gain audio, plus a **powerful pentode output tube.** Gives results **equal to any 3-tube set.** Set of tested tubes, $2.50. This set gives somewhat more volume on distance than a set having one R. F. stage, detector and one audio! **Kit of Parts with Instructions, $12.95.** Don't fail to order tubes with your set, you save about 50%! Set of good, dry batteries for complete operation of any DELFT set, $4.75.

All of our sets use the latest circuits and tubes. They get anything on short waves as well as ordinary broadcast reception (users report **more distance** on these sets than on standard sets, even in the broadcast band!). Modern tubes! Don't fail to read every word of this ad, there's a set for **your** purse! Our completed sets are not furnished with cabinets because these are troublesome anyway when changing coils. Extremely high ratio vernier dials are unnecessary with our sets because they tune so easily.

INEXPENSIVE MODERN KITS! (See also bottom of this page.) **TWO-TUBE KIT (Pentode In Audio), DC, $7.95. AC, $8.45. THREE-TUBE KIT (Pentode in Audio): DC, $9.95. AC, $10.45.** AC Sets or Kits need a $3.45 filament transformer, also a B-eliminator or power pack to complete them. AC Sets can be operated temporarily on B Batteries; buy the power pack later. The DC sets are **very economical with 2-volt tubes** which use only two dry cells and two B-battery blocks, which are very cheap now. Ordinary headphones, loudspeakers, B-eliminators, aerial and ground connections can be used. We believe in showing you what you need. Our prices are as low as good merchandise will allow. All Kits are complete to the last washer, and come complete with a set of plug-in coils. Also a good set of Instructions: show where to put each wire. Simple! Sets Easy to build! Of course, **they are as good as any and better than most!** State kind of tubes to be used, or current supply when ordering. Better order tubes with your Kit or Set; **will save you 50% or more! Can be sent safely!**

SEND FEW STAMPS FOR OUR WHOLESALE CATALOG!!



DELFT TRANSMITTERS.
We know how to build Transmitters!! Here's the Dope: Our Transmitter Kits furnish **all necessary parts and hardware** to build them. **Full instructions** are furnished with each and every Kit or Set. Assembling one of these sets, and reading the instructions which explain the operation of each part, will greatly help in passing the "EX", if you haven't done so already!! Will operate on AC or DC! Will use **any ordinary tubes,** operating from batteries or ordinary B-eliminators, **even from the power now used with your receiver.** Any power from zero to 50 watts depending upon the tube you use! All parts will stand up on high power. Range at low power 500 to 1000 miles. With a pair of '45's or 210's, range is 10,000 miles or more. **Copper tubbing coils** furnished for any one band at prices quoted. All sets will operate at 160 meters as well as in **all other bands.**

MODEL A TRANSMITTER: Hartley Circuit. Easy to adjust and operate. **Price Complete $14.00. Kit, $8.95.**

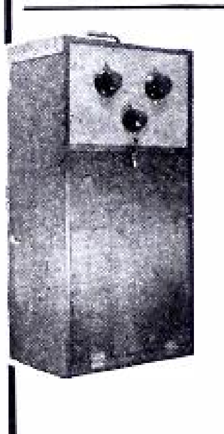
MODEL B TRANSMITTER: TP-TG circuit. **Complete, $15.00. Kit, $9.45.**

MODEL C TRANSMITTER: A High-grade push-pull set. Can be used at any wavelength at high power if desired. Great stability. **High efficiency. Complete, $16.00. Kit, $10.95.** Extra high grade push-pull set, supplied with wall-insulator mountings for coils, extra long panel, and all antenna equipment. **$18.00, Kit, $12.95.**

TRANSMITTING CRYSTALS: For 80 or 160-meter bands, **$3.95.** For 40-Meter Band, **$4.95.** Crystal Holder, **$1.00.**

ULTRA-SHORT WAVE SETS. Developed by A. Binneweg. Super-regenerative 4 to 7 meter Receiver Kit. **$12.00.** Push-Pull Five-Meter Transmitter Kit. **$13.00.**

HERE'S YOUR PORTABLE SET

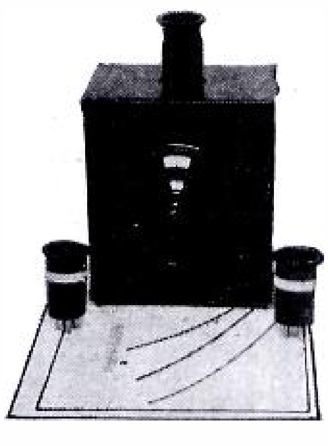


Takes up minimum space and easy to move around. All complete as shown. **GIVES FINE LOUD HEADSET VOLUME ON ANY SHORT WAVELENGTH!** Will also get ordinary broadcast reception. Light in weight; very popular for airplane, auto and yacht use. 1000 miles on small aerial. Extras slip inside case. Uses two, two-volt tubes, with a PENTODE tube (works like a three-tube set!)

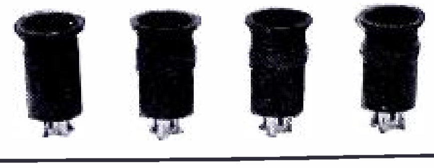
Size: 9"x18"x7" deep. The small set at top of the case is completely enclosed by itself, and can be slipped out like a drawer for **separate table use with any kind of tubes and batteries. Complete Kit, including assembled case and tubes, with coils covering 15 to 200 meters, $19.90. Full instructions furnished. Completely assembled and tested Set with all coils, tubes, and a set of set-up Instructions, $26.00.**

DELFT WAVEMETERS

A WAVEMETER will check the ranges of coils, condensers, Transmitters, and the operation of **any regenerative short-wave receiver!!** If you do any set building or experimenting, you can't afford to be without an **accurate Wavemeter.** Will also locate those elusive foreign stations on the dials of your short-wave receiver! W.R.C. of Cincinnati says: **"Your Wavemeter is just what Short-Wave Fans need to locate distant stations."** Hundreds of other uses. **Will** also serve as a Wavetrap to eliminate interference on **any short wavelength.** Nothing else necessary to use with it. Tunes from 14 to 250 meters, thus covering **all short-wave and broadcast** stations. Each instrument is **individually calibrated** and supplied with an **accurate chart.** Shielded. Works with any Short-Wave Regenerative Receiving Set; also checks Transmitters. Works with AC or DC receivers. **Complete Wavemeter with three accurate coils, large, accurate calibration chart and Full Operating Instructions, Your Special Holiday Price, $8.95.** (Regular $15.00 value.) (We manufacture a special Wavemeter for Superheterodynes and Superhet. Converters. Ask for descriptive leaflet.) **HAM BAND WAVEMETER.** Looks like above meter. ¼ of 1% accuracy. Supplied with accurate, spacewound, low-loss coils wound on heavy, genuine bakelite coil forms as in photo. Supplied with calibrated coil for any one Ham Band at $7.95. For each extra Ham Band desired add $2.00 for calibrated Coil. Calibration chart and Instructions furnished.



DELFT High Grade plug-in Coils. Set of four, for 15 to 200 meters, wound on high-grade forms. For .0001, .00014 or .00015 tuning condensers. For four-prong plug-in. **Your Special Holiday Price, $2.50 per set of four.** Supplied for either Detector or Tuned Radio-Frequency Amplifier Use, at same price. (**Retail Price $4.50!**)



SLIGHTLY USED PARTS SAVE YOU MONEY!! All parts to build a **two-tube short-wave receiving set,** including panel, tuning condensers, set of plug-in coils, hookup, etc., **$3.75.** All parts for a **three-tube set, $4.75.** Good used parts are better than cheap new ones!! No taxes on used parts! Parts for a **four-tube set, $8.75.** For Hartley Transmitter, **$4.75.** For TP-TG Transmitter, **$5.95.** All in good shape.

NEW PARTS AND ACCESSORIES. Special! Plug-in coils for 15 to 125 meter range, for four-prong plug-in, Set of 3, for Detector Use, **$1.20 postpaid** with hookup diagrams. Extra Coil for 100 to 200 meter range, 69c. For R. F. Amplifier Use, 15 to 125 Meters, Set of 3, match above Detector Coils, **$1.15 Postpaid.** Extra R. F. Coil for 100 to 200 meter range, **59c.** (These coils all for .00014 or .00015 condensers.) .00014 or .00015 short-wave tuning condensers, **$1.35.** Regeneration Condenser, **$1.10.** .00015 ganged condensers, with individual trimmers, two-gang, **$2.25.** Three-gang, **$3.00.** Four-gang, **$4.00.** Fine quality. Four-Position Coil-Changing switch, **$2.60.** Complete Short-wave Superhet. Coil Assembly (includes above switch), **$5.50.** 50,000-ohm regeneration controls, **$1.00.** 25, 35 and 50 mmfd., midget variable condensers, **80c each.** 100 mmfd. size, **90c. Include sufficient postage on small orders.**

Sufficient information is given in this ad so that you can order intelligently. **Transportation charges are really very low;** to send an average size package costs less today than it did a year ago!

SEND A FEW STAMPS FOR OUR WHOLESALE CATALOG (DEVOTED ENTIRELY TO SHORT WAVES AND ULTRA SHORT WAVES. ANSWERS YOUR QUESTIONS. INSTRUCTIVE!) The prices will surprise you! There are Receivers and Kits, Transmitters and Kits, Fine Coils, and Coil-Winding Sets, Wavemeters, Radio-Frequency Amplifiers and Kits, Code Practice Sets and Complete lines of inexpensive Sets, Parts and Set-Building Instructions. **TERMS:** 2% off for cash in Full. Send Money in Bills, Stamps, or Money Order. Register letter if much cash enclosed. If C. O. D., send about 15% deposit pay r at to postman when delivered.

• D E L F T •

Phone: Higate 0748 **Delft Radio Mfg. Co., 524 W. Fairbanks Avenue, Oakland, California**

HUGO GERNSBACK, EDITOR   H. WINFIELD SECOR, MANAGING EDITOR

INSULATION IN SHORT WAVES

An Editorial by HUGO GERNSBACK

● THE average short-wave experimenter frequently fails to grasp the tremendous importance of *insulation* in short-wave operation. A good sized book could be written on the subject. The following few paragraphs give only the high lights of this important subject.

It should be understood at once that, particularly on the short waves, due to the high frequency of the current, effective insulation is of the highest importance as the frequency increases (wavelength decreases). Such currents exhibit altogether different characteristics than the lower frequencies used in broadcast sets.

Some insulators which serve efficiently in broadcast sets are no longer insulators at all at the higher frequencies. In fact, what is a good insulator for broadcast work frequently becomes almost a *short-circuit* in short-wave sets.

What Tesla Coil Demonstrated

Anyone who has worked with Tesla high frequency currents and has looked at one of these coils in the dark has seen how glow discharges emanate from all sharp points on every piece of metal. On the ultra short waves, it would seem advisable, because of this effect, to change the design of our present-day tuning condensers, so that they do not exhibit any sharp points or edges. Transmitting condensers have been made this way for years; why not receiving condensers? Sharp corners should be avoided in the building of all short wave sets; all such corners should be kept rounded.

I mentioned in another editorial the importance of insulation of *lead-ins*, where a great deal of energy is usually dissipated. Only the best insulation, with the lead-ins kept at least a foot away from all obstructions, is advised.

A short wave constructor who builds a set should never use wood if any of the metal parts or wires carrying high frequency currents touch it. If wood is used as a baseboard, for instance, all current-carrying parts, including wires, should be insulated from the wood with such good insulators as Pyrex Glass, Isolantite, or Bakelite.

Kind of Insulation on Wire Important

For this reason, coil forms and sockets for first class sets are made nowadays of Isolantite or similar high-grade insulation. When it comes to wires, it would seem that silk-covered "Litz" is the best for coils except on the extremely high frequencies. For connecting the various instruments together, either bar wire on insulators or rubber-covered wire of a good grade should be used; also avoid sharp bends. The use of cotton covered wire, unless paraffined, should always be discouraged, because cotton is not a good insulator and it absorbs moisture, and if two wires touch, a tremendous loss of energy may result.

For best results, of course, only a high grade of the newer porcelain sockets should be used. The usual type of composition socket is not suitable for ultra high frequencies and should never be used.

I now come to a subject which would seem to be of the utmost importance, but about which, so far, little can be done. I speak of the vacuum tube, the "heart" of every radio set.

Losses in Glass Bulbs Considerable

From commercial considerations, vacuum tubes, that is, the bulb part, nowadays are made of lime glass. The stem, which carries the wire, is usually made from potash-lead glass. Both these types of glass are exceedingly poor insulators at the higher frequencies, as a simple experiment will readily show.

Take an old vacuum tube, and by means of a Carborundum drill, or other tool, bore a hole in the top. Fill the tube about three-quarters full with salt water. Paste a one-inch strip of tin-foil around the middle section of the tube. You now have a crude Leyden jar, with the tin-foil acting as one section of the condenser and the inside metal as the other section. One connection is made to one or all of the prongs and another connection to the tin-foil.

Simple Test Shows Loss in Glass

If you own a static machine or other equivalent electrical apparatus, try and charge this Leyden jar. You will find that it is impossible to build up a charge in this "jar" in order to draw a spark from the two terminals, say five seconds after the static machine has been disconnected. In other words, the high frequency currents leak right through the plates, making it impossible to build up a charge. A good type of radio condenser will hold such a charge, as is well known, and will give you a good shock and actually produce a good sized spark within ten seconds after you disconnect it from the high frequency source.

Why can we not build up such a charge on our vacuum tube type Leyden jar? The reason is that the lime glass is porous and is a fairly good conductor of electrical currents. The same is true of potash-lead glass, which also becomes a good conductor. If this is true of this simple experiment, what will happen when you use a vacuum tube on the high frequencies? The answer is that you lose a lot of energy! If the insulator were perfect, you would not lose it.

If vacuum tubes were made of pure potash glass, or Pyrex glass, this trouble would not be experienced, and our vacuum tubes, particularly those used for ultra high frequencies, would work much more efficiently.

The matter of the vacuum tube base is another sore spot with the serious experimenter. Usually, such bases are made of a Bakelite composition, and while this material is a vastly better insulator than the lime and lead glass, it is not the ideal insulator for high frequency currents. Some of the newer special porcelain or Isolantite bases should be adapted by all vacuum tube manufacturers. It may be some time before these changes are made, but once the tube manufacturers come to realize the importance of these points, the changes will without a doubt come about.

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

This is the December, 1932, Issue - Vol. III, No. 8. The Next Issue Comes Out December 15th

Editorial and Advertising Offices - 96-98 Park Place, New York City

MOST Powerful Ultra Short-Wave Station

To energize an antenna at the low wavelength of seven meters, or 43,000 kilocycles, with a power of 15 kilowatts, was no mean goal; yet, this has been accomplished by the Telefunken engineers. This high output at such a short wavelength was made possible by new water-cooled tubes, operated at a direct plate potential of 6,000 volts.

● THE new ultra short-wave station which is about to be put into service for the first regular ultra short-wave broadcasts in Germany has just been finished at the Telefunken plant. This station represents for the technical world of radio a great advancement in transmitter technique. With the extraordinarily high frequency of the transmitter (43,000 kilocycles, equal to a wave length of 7 meters) it was formerly impossible to attain a greater antenna output than 3 kilowatts. The largest ultra short-wave transmitter hitherto used in Germany had the quite considerable output of 1½ kw.

These outputs formerly attained are, as practice has shown, amply sufficient for pure radio purposes, i.e., the transmission of speech and music, within the limits of a city, since one can of course extensively sharpen tuning of receivers by regeneration. Matters are totally different if it is intended to use such a station, as in the present case, for *television* as well. While, as we well know, for radio broadcasts the highest modulation frequency is about 10,000 cycles, in the case of this new Telefunken ultra short-wave transmitter, consideration has already been given to the future development of television, which anticipates a considerable increase in the number of pictorial elements, so that modulation frequencies up to 300,000 cycles become necessary! Now, if it is desired to take in this extremely great breadth of band at the receiving end, regeneration can be used only very slightly, since otherwise the resonance curve of the receiver becomes too sharp and the high modulation frequencies are lost. For this reason, therefore, perfect television reception requires a far greater transmitter output than does ordinary radio reception of speech and music.

15 K.W. of Ultra High Frequency Energy

The surprisingly high output of 15 kilowatts in the antenna, now attained in the test stage by the new Telefunken transmitter, was only made possible through completely new style construction of every single part, commencing with the tube. The Telefunken newly developed ultra short-wave transmitter tubes, of which the output stage contains two alike, are special water-cooled tubes, each having an electron emission of 10 amperes. They are operated with a direct plate potential of 6,000 volts. In spite of the relatively large dimensions of these tubes, it has been possible through the use of the diffusion capacities and by meticulous avoidance of all in any way needless conductor lengths to lower the wavelength to 6 meters.

The transmitter itself does not represent merely a conglomeration fit for a laboratory, but is constructively to the last detail as thoroughly worked out as any ordinary long or short wave transmitter. Also, in its external form, it represents a unified construction.

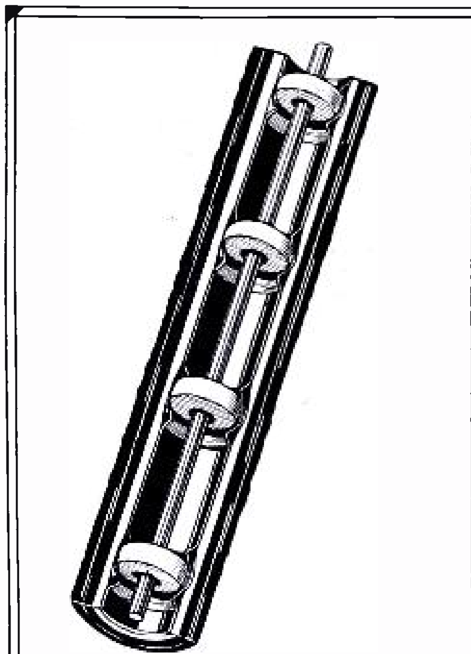
Elaborate Crystal Control

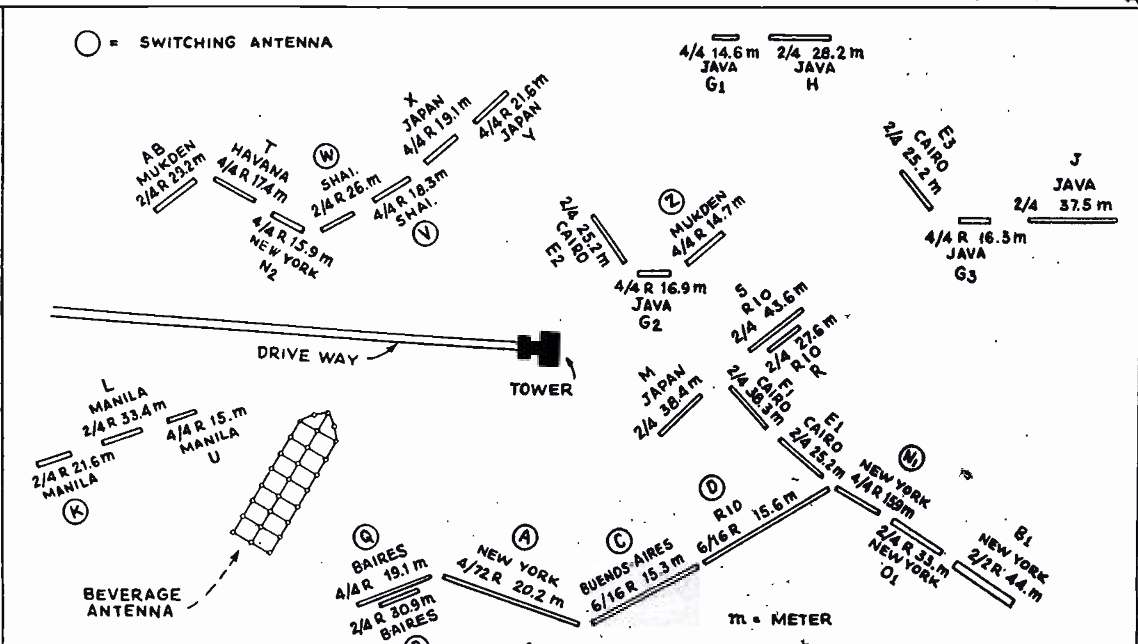
The transmitter has seven stages and is equipped with crystal control for the attainment of the necessary constancy of frequency. The wave length of the crystal is 56 meters and this value is brought through three stages of doubling and amplification to the seven meter wave, i.e., the frequency is multiplied by eight. The first four transmitter stages are provided with special screen-grid tubes, with especially small control power and small internal capacity. The individual stages have the following outputs:

1—The crystal stage	56 m.	about .1	watt
2—1st doubling stage	28 m.	about .8	watt
3—2nd doubling stage	14 m.	about 4	watts
4—4th transmitting stage	14 m.	about 70	watts
5—5th transmitting stage (3rd doubling stage)	7 m.	about 150	watts
6—6th transmitting stage	7 m.	about 1.5	kilowatts
7—Final stage	7 m.	about 15	kilowatts

The modulation of the transmitter takes place in the next to the last stage through the influencing of the grid bias of the tubes, there being provided as modulator a resistance-coupled amplifier having for the radio field a frequency range of 30 to 10,000 cycles. For attaining great freedom from distortion other special means are of course included. For *television* purposes the modulator is also operated on the grid side in resistance amplification connection and it is then suitable for frequencies up to 300,000 cycles.

There are also built into the transmitter a modulation meter and a monitoring device, *(Continued on page 506)*



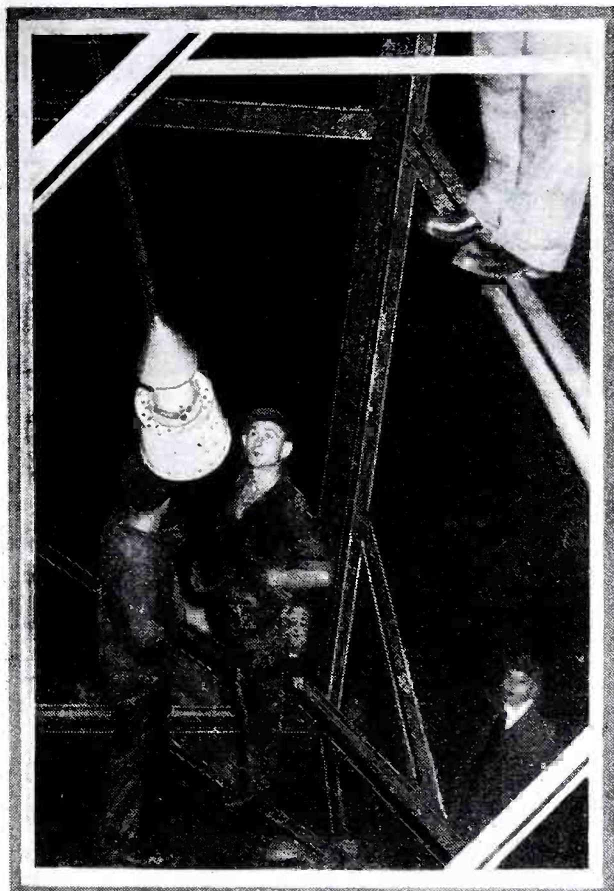


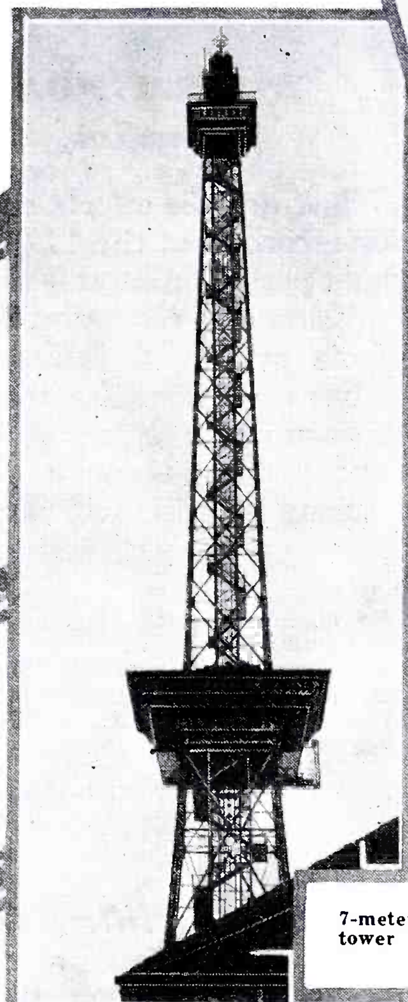
Left—Cross sectional view of the new high-frequency "energy cable" devised by the Telefunken Company, and used for connecting the antenna with the transmitter or receiver in short-wave stations. Plan view at right shows directional antennas and also position of ultra short-wave antenna tower.

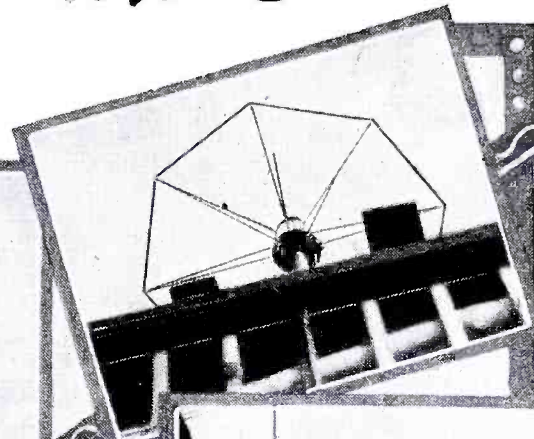
New Energy Cable

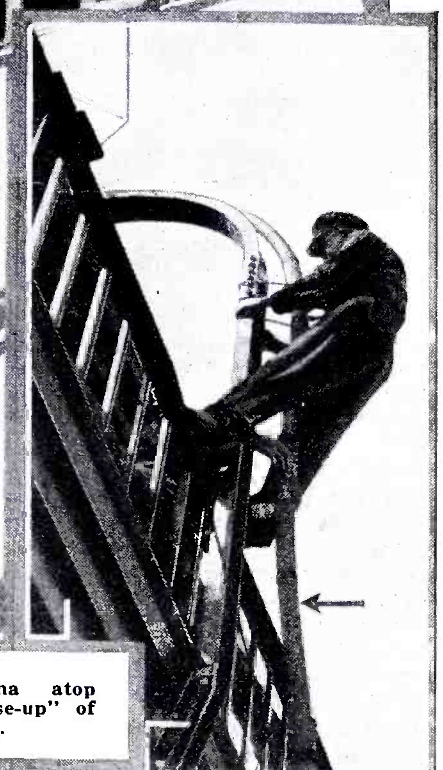
Devised by Telefunken Engineers helps solve problem of perfecting powerful ultra short-wave station described on opposite page.

Below—Interesting view of a section of the high-frequency "energy cable," which joins the antenna proper, and the ultra-short-wave high-powered transmitter.



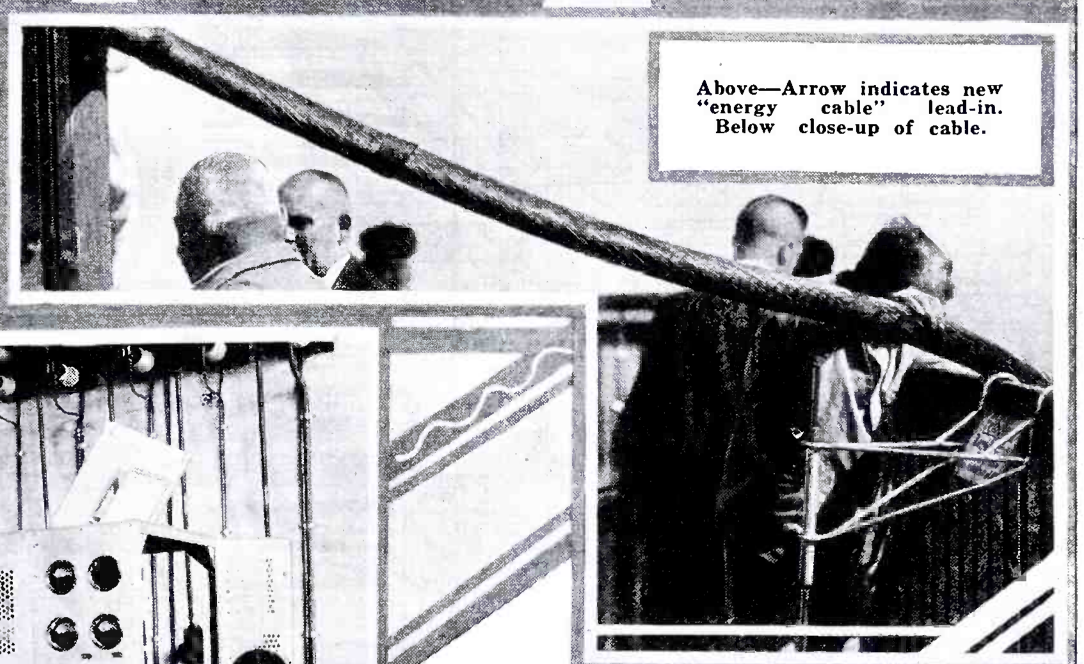




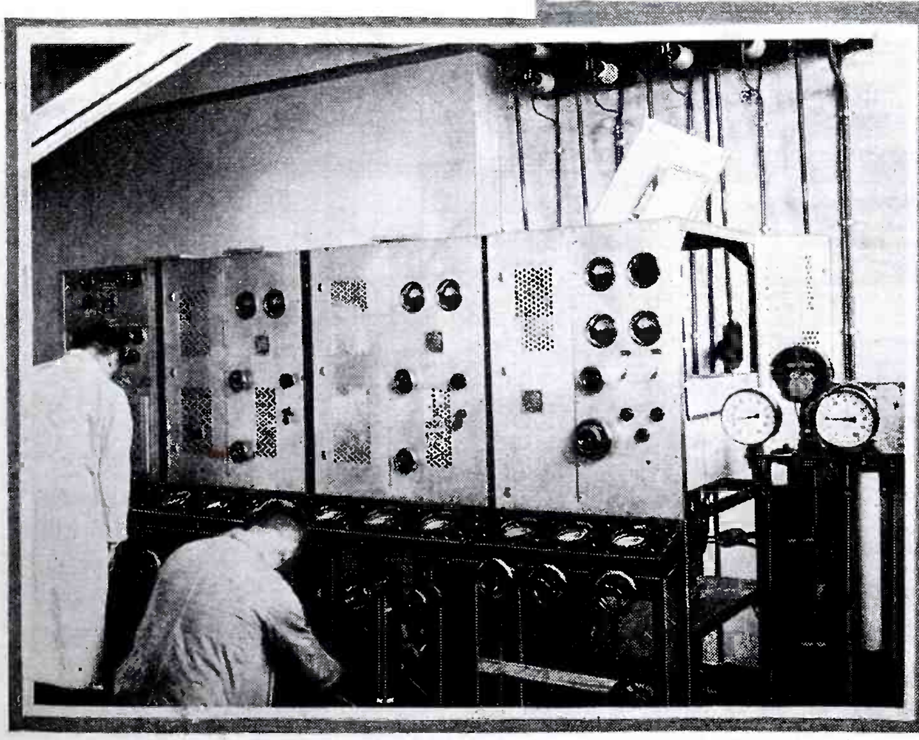


7-meter antenna atop tower and "close-up" of antenna.

Above—Arrow indicates new "energy cable" lead-in. Below close-up of cable.



Below: The new Telefunken transmitter which develops the astonishing power of 15 kilowatts at seven meters, or 43,000 cycles, thanks to the new Telefunken water-cooled, specially designed tubes, operating with a direct plate potential of 6,000 volts. This remarkable transmitter, the most powerful of its kind in the world, is connected to the antenna, atop the tower, by the new "energy cable" shown at right.



Photos at left and above show the newest Telefunken ultra-short-wave development, a seven-meter transmitter developing the surprising power of 15,000 watts. This transmitter comprises seven stages, and is equipped with crystal control to maintain a constant frequency. The wavelength of the crystal is 56 meters and this value is brought through 3 stages of doubling and amplification to the 7 meter wave; i. e., the frequency is multipled by eight. One of the newest Telefunken developments is the new high frequency "energy cable" which takes the place of the older "lead-ins" made of copper pipes or parallel wire conductors. These new "energy cables" join the receiving instruments, as well as the transmitters, to the antennas.

How Sun Affects S-W Reception

By DR. F. NOACK

(BERLIN)

What are the effects noticeable or recorded of the 11 year sun-spot period on short-wave transmission and reception? The effects of the variations in the sun's radiations on short-wave transmission have been recorded and a chart showing these effects is presented herewith.

● SHORT WAVE reception is not merely a plaything for the amateur. The radio communication between North America and Europe is in part maintained on the short waves. And then there is also short wave commercial wireless telephony.

Last year it appeared that in Europe the American short wave stations were in general not capable of good reception. In the opposite direction matters were more favorable. One suspected a powerful influence of the solar activity on the reception. We are at present in the eleven-year sun-spot period. The sun-spots evidently emit disturbing radiations which very noticeably affect commercial wireless telephony.

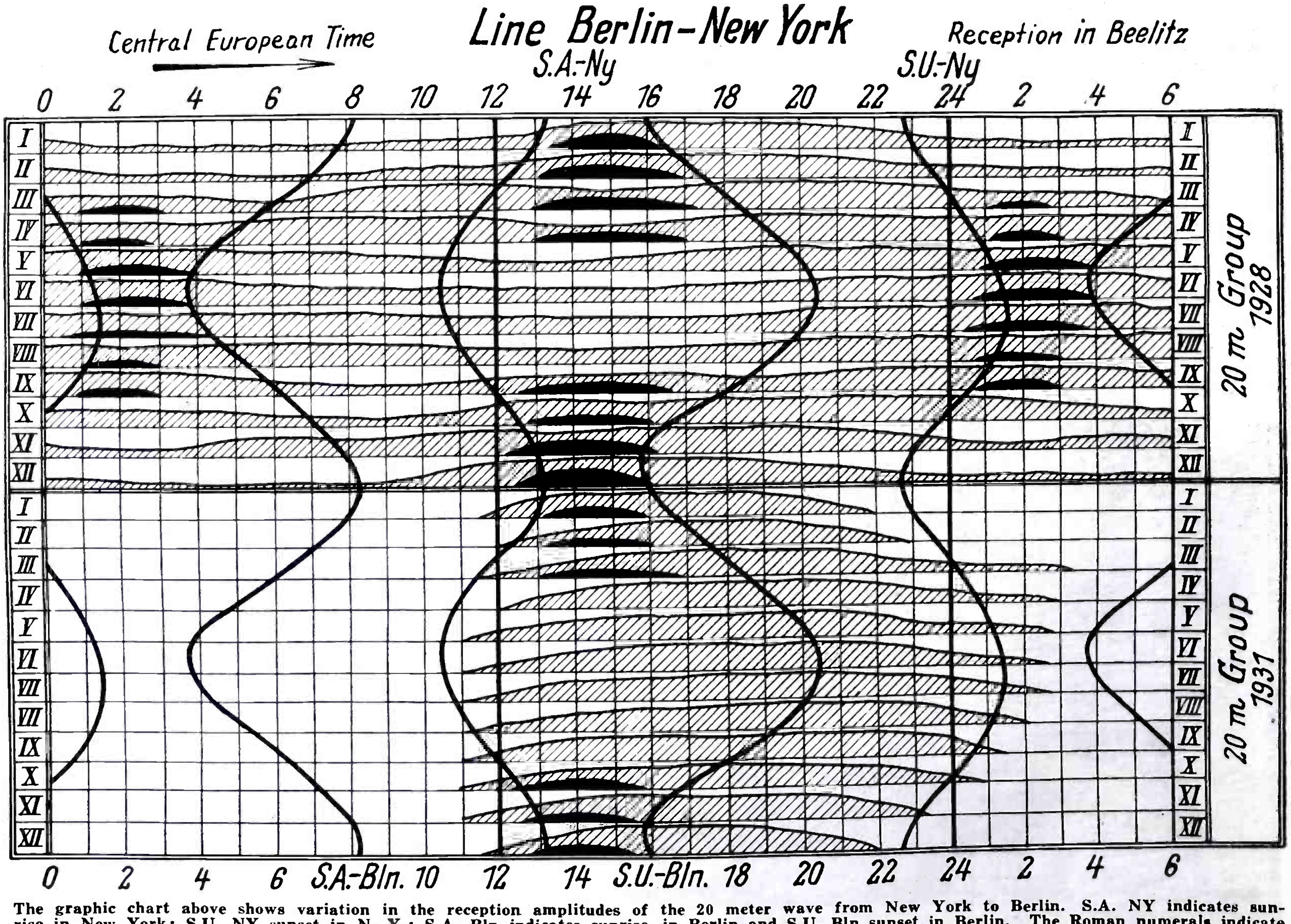
Effect of Sun-Spots

While in normal times definite wavelengths could be used for day communication and definite ones for the night, recently this too has changed. It has in fact appeared that the most favorable waves for the various times of year and times of day have shifted to lower frequencies. These conditions were first explained by Plendl last year; Plendl prophesied that in the sun spot minimum, which we are approaching, the most favorable waves would perhaps be displaced about 25 per cent upward. Now we have some extremely interesting results of the *Transradio Company* on the connection between sun-spot activity and short wave reception. I should like to give a brief summary of these results, which were reported lately by Mögel.

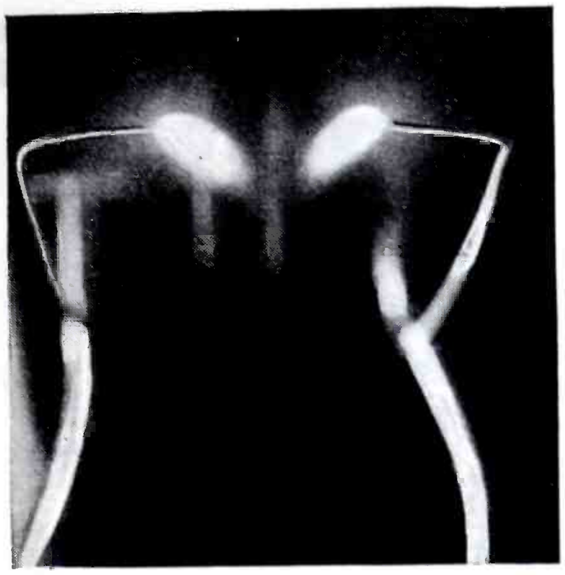
Two Kinds of Disturbing Rays

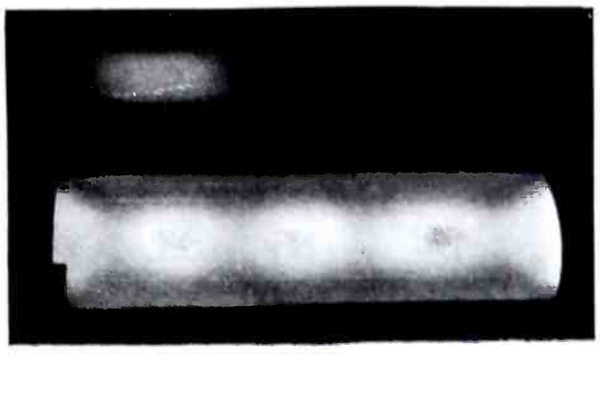
Transradio has carried out extensive measurements on the influence of the sun-spot activity on short wave reception. Two kinds of disturbing rays are distinguished, the *penetrating rays* and the *deflectable radiation.* There are in addition *magnetic disturbances* and disturbances through the *Aurora Borealis.* All disturbances decrease toward the minimum of the sun-spot period. There actually is no sense in speaking of a *sun-spot frequency* but only of *solar activity*, in general terms. It seems not merely as though the disturbances and explosions on the sun decrease, as the minimum is approached, but also the total radiation. To be sure, according to the short wave observations of *Transradio* scientists, the entire radiation does not seem to lessen in intensity but only the deflectable, the *electron radiation.* Likewise, that the regular radiation of the sun is connected with the *eleven year period* of solar activity, is clear from *long wave* observations at great distances, concerning which there is much material at hand. The average reception field strength of long waves is much less at the minimum of the solar activity period than at its maximum, because the additional radiation from the Heaviside layer becomes smaller at the sun-spot minimum, on account of the small reflection ability.

(Continued on page 507)



The graphic chart above shows variation in the reception amplitudes of the 20 meter wave from New York to Berlin. S.A. NY indicates sunrise in New York; S.U. NY sunset in N. Y.; S.A. Bln indicates sunrise in Berlin and S.U. Bln sunset in Berlin. The Roman numerals indicate the months, the Arabic numerals the hours of the day; the black areas mark the region of great fading.





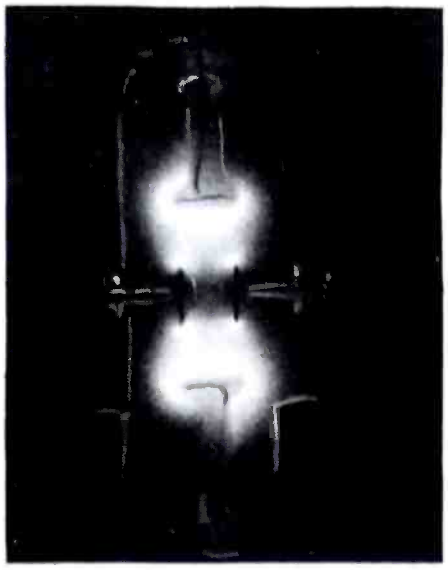


Fig. 1, left—Discharge on the ends of two wires at 75,000 kc. and 5000 volts! Fig. 2, above, shows discharge in a 1-inch dia. Neon tube under a tension of 300 volts. Fig. 3, Electrons oscillating in gas discharge between end electrodes, with darkness between the center electrodes. The effect may be reversed when desired.

High Frequency and Gases

DR. L. ROHDE, Jena

● THE passage of electricity from one conductor to another through the air normally takes place only by means of sparks. Since air consists of a mixture of oxygen and nitrogen, it is ordinarily a non-conductor of electricity. However, at high voltages this gas mixture can become conductive; a spark results, which is accompanied by heat and light, representing the energy lost in the passage of the current through the gas.

The spark only occurs, however, when there is normal air pressure. At lower pressures one does not speak of sparks but of *gas discharge*. The special characteristics of a gas discharge are that it occurs in more or less evacuated vessels and that one needs much less potential to produce them than in the case of a spark of the same length. The gas discharge or *glow discharge* we all know from the many glass tubes, mostly with red or blue light, which are used for advertising purposes. These gas discharges are obtained with alternating current. Now, if instead of ordinary alternating current of low frequency, we use a high frequency current, very interesting and novel phenomena arise.

Each gas consists of a great number of atoms. In a space of 1 cc. (cubic centimeter) there are about 10^{20} atoms, i.e., 100,000,000,000,000,000,000 of them; how great this number is can be imagined if one considers that such a number of dollar bills, laid one upon the other, would reach clear to a distant star (Alpha Centauri), from which it takes the light four years to reach the earth!

Very interesting and valuable new phenomena concerning high frequency discharges in gases are here described by Dr. Rohde. Discharges here shown were taken at a frequency of 75,000 kilocycles, or a wavelength of four meters.

Sparks and Glow Discharges

At normal air pressure, one calls the beginning of the conduction of electricity *sparks*. In rarefied gases it is called a *glow discharge*. The current conduction by a gas is always accompanied by the emission of light and heat. The heat evolution can become very great, so that the electrodes become hot. Then the electrodes themselves give off electrons (as the cathode in a tube); there begins an arc discharge; the current is mainly carried by electrons.

In direct current the electrons, which are negative, move toward and are attracted by the positive pole, from the cathode (negative) to the anode (positive). In the case of *high frequency*, the conditions are more complicated. The electrodes in the course of time very quickly change their polarity. Cathode and anode are no longer exactly defined. If the alternating current is of low frequency, there arises in one period two normal discharges in different directions. The electrons need a certain time to run from one pole to the other. If the potential applied is of very high frequency (100,000 kilocycles), the case can occur that the potential changes its polarity before the electron has run to the next electrode. But now because the electron is already attracted by the other pole, it does not continue on its way but turns around and runs back. The same happens in the next half period.

Thus it happens that electrons begin to oscillate (swing back and forth in pendulum motion). The oscillating electron therefore does not reach the electrodes and therefore is not neutral-

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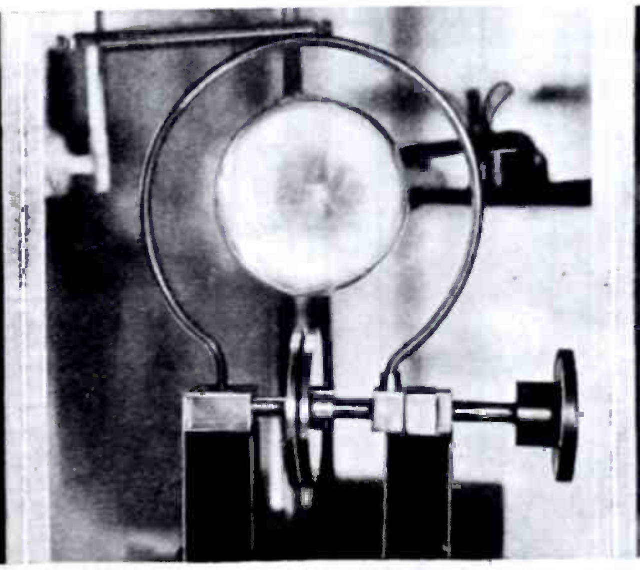


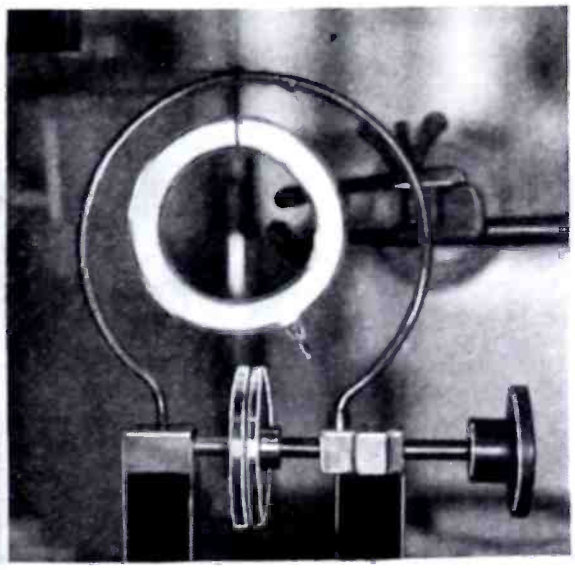


Fig. 5, left—Interesting electrode-less ring discharge in mercury, at a wavelength of 4 meters; the bulb being placed inside the circuit and the magnetic field causing the discharge to take the form shown. Center—Fig. 4—Discharge in a gas-filled sphere due to oscillating electrons, with hydrogen gas at a pressure of 0.5 mm. Fig. 6, right—Electrode-less discharge in a neon-filled glass ring, suspended in the circuit; current 30 amperes.

Short Wave THRILLS GALORE on 2 Tubes

By M. HARVEY GERNSBACK

Here is an "easy-to-build" short-wave receiver of very nominal cost and which is capable of excellent results. This receiver employs a regenerative screen-grid detector, improved regeneration control, and impedance coupled audio amplifier stage.

Mr. Herman Young enjoying a short-wave program picked up on the 2-tube receiver here described by Mr. Gernsback.

Short Wave Fun on 2 Tubes

● THE editors are continually receiving requests to publish constructional articles on simple S-W receivers. With the idea of satisfying the readers of SHORT WAVE CRAFT the receiver described in this article was constructed.

It is a straightforward circuit containing nothing tricky and requiring no special aptitude to construct. It is easy to operate and will give good results if carefully built. Reference to the schematic circuit diagram discloses that the set employs a screen-grid detector, utilizing regeneration in the usual manner. Regeneration control is effected by varying the screen potential of the detector through potentiometer R1. Two-volt battery tubes of the '30 type were used in this particular set, but there is no reason why the experienced constructor cannot substitute tubes of the automotive series (6.3 volt) or even A. C. tubes. The set was built for use with batteries but "A" & "B" eliminators may be used, provided that adequate filtration is secured to eliminate all trace of hum.

Construction

A sheet of aluminum, 8½x6x1/16 inches, is required for the front panel. The location of the holes is judged from the photo but the sizes of the holes are not specified, as they will vary with parts of different manufacture. A baseboard of wood 7¾x6½x¼ inches also should be secured.

The parts that are mounted on the baseboard should be wired first. After this has been done the front panel may be screwed in position and then the variable condenser, the potentiometer and the combination phone jack and "on-off" switch may be wired in.

Coil Data

The coils used are the standard detector coils made for the Pilot Super-Wasp receiver. The coil forms have 5 prong UY type bases. They have an outside diameter of 1½ inches and a length of 2½ inches. Four coils are required.

	Grid winding (L1)	Tickler (L2)
14.5-28 meters,	3¼ turns	5 turns
27.5-53 meters,	7½ turns	6 turns
52-100 meters,	16½ turns	7 turns
99-200 meters,	46½ turns	15 turns

All tickler windings are ⅛ inch below the grid windings. No. 24 double silk covered wire is used for all the coils. A difference of half a turn or so on the grid windings of the coils will make an appreciable difference in the tuning range of any one coil, so a little experimentation here to secure proper overlapping for the coils is permissible.

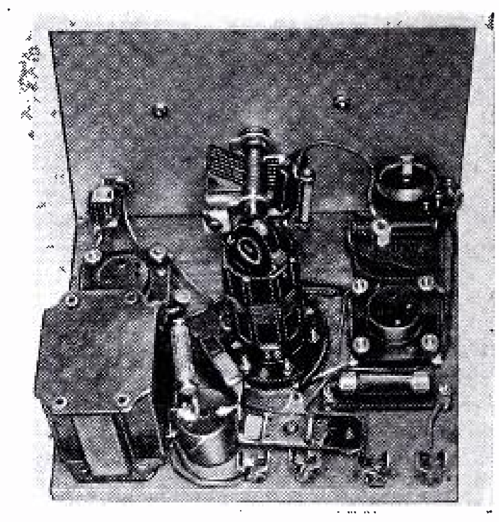
Equipment

The necessary accessories are: 1 type '30 tube; 1 type '32 tube; A 2 volt source of "A" or filament supply and 135 volts of "B" battery; a pair of headphones and a phone plug.

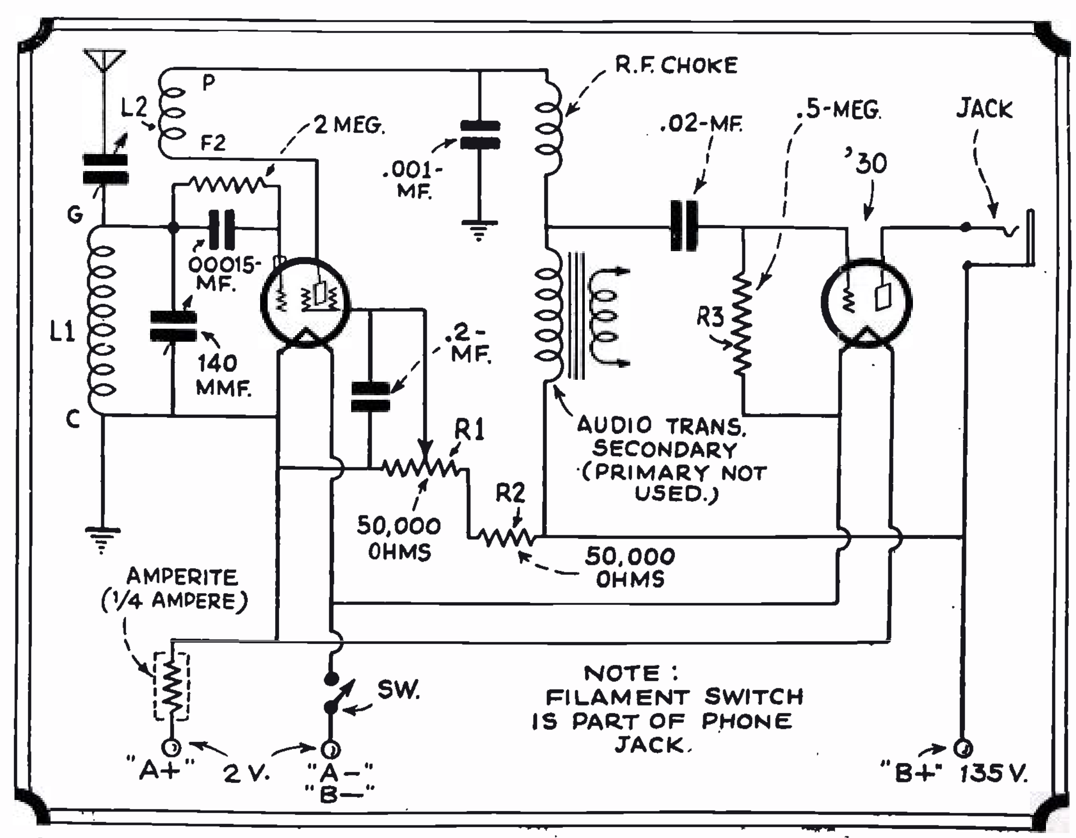
Operation

The set is placed in operation by inserting the phone plug in the (fila-

(Continued on page 499)



Rear view of the 2-tube "short-wave thriller."



Schematic diagram of the 2-tube receiver here described... It's really so easy to build that you need not have had any previous experience in constructing sets.

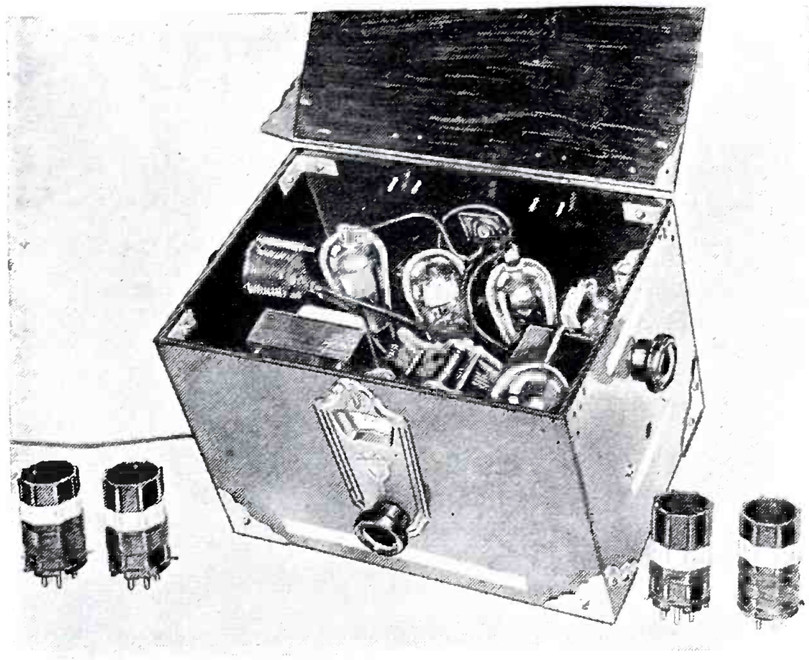
An A. C. Operated Short-Wave CONVERTER

By R. B. KINGSBURY

Wilmington, N. C.

Winner 5th Prize, $5.00, in August Contest

To hear S.W. stations on your broadcast receiver, you need a "tip-top", well-designed, S.W. converter. Here it is—a "prize winner"—110 volt, A. C. operated—has its own plate supply—also R. F. amplifier and coupling tube.



Five tubes, including the rectifier, provide this S.W. converter with a real "wallop." It enables you to hear S.W. stations on your "broadcast receiver."

● THE average "fan," after dabbling in the mystic realm of short waves for a considerable time, cannot tolerate sets and converters which produce only mediocre results. The writer, having graduated into this class, set about to build a converter which could be termed really efficient and yet be moderate in cost.

Single dial tuning, compactness and a tuned intermediate stage, permitting the transfer of the signal to the broadcast set with very little loss in transmission, are but a few of the features incorporated in the converter illustrated. The word simplicity has therefore been superseded by the more desirable one—*efficiency!*

Despite its seemingly complicated design, the average set constructor should experience no trouble at all in assembling the converter here shown.

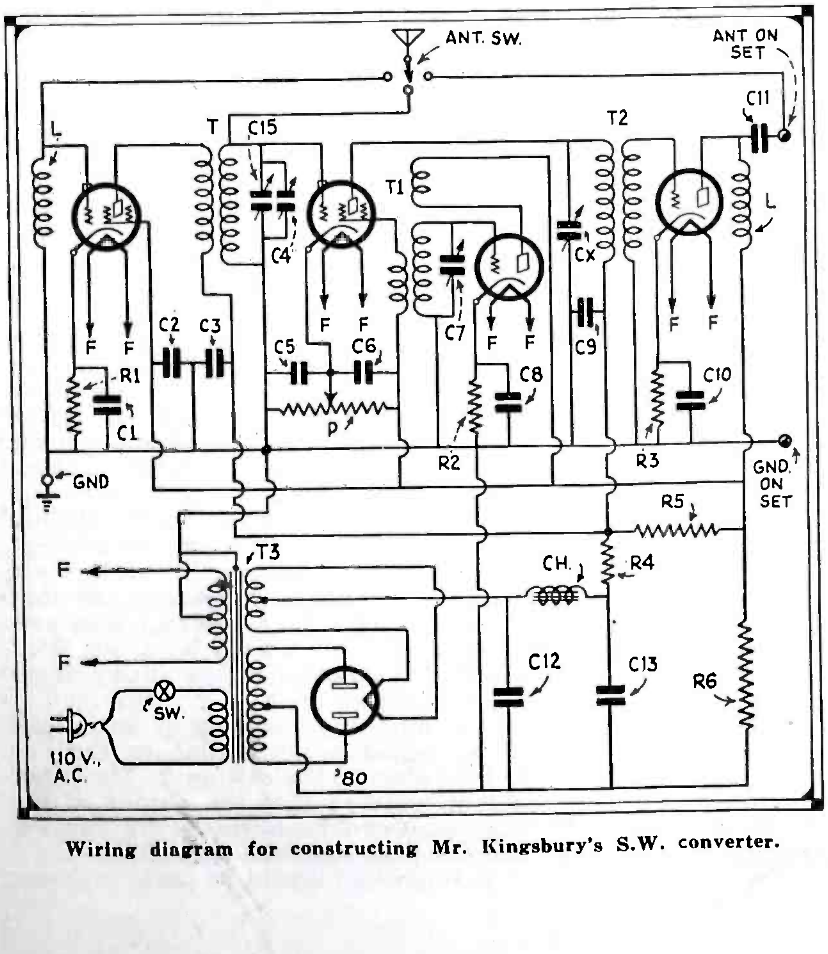
Exclusive of the cabinet, the total cost should not exceed $10 or $12 and this moderate figure can be brought down even lower by substituting parts which are usually found in your "odd-parts" box.

Tested on Many Receivers

This set has been tried out with a dozen different broadcast receivers and one has yet to be found with which it will not "percolate" (meaning *work*).

Five tubes, including the rectifier, are used in this layout and as it supplies its own power, the problem of low filament voltage and incorrect "B" supply is entirely eliminated.

A switch is used to "cut out" the R. F. stage below 30 meters, as it has been found that this stage is only a *losser*, when tuning in stations covered by the 20 meter coil. The energy gathered by the antenna is transferred to the grid of the modulator tube. No direct connection is made, however, as the exact amount must be determined by experiment. To determine this take two pieces of enamelled wire about No. 18 or 20 gauge. Solder one to the switch in the antenna circuit and the other to the grid circuit of the modulator. As this stage tunes very broadly, this condenser can also be used as an auxiliary *volume control*. This condenser may be eliminated, however, if the builder desires to use two dials for tuning.



Wiring diagram for constructing Mr. Kingsbury's S.W. converter.

The method of modulation is that the oscillation is introduced into the modulator tube by way of the screen. Grid bias detection is used.

The plate circuit of the modulator contains a circuit tuned to the intermediate frequency. This insures a high impedance load on the modulator at the intermediate frequency.

Intermediate Frequency

It is best to use an intermediate frequency at which the broadcast receiver is the most sensitive. If it is equally sensitive throughout the entire tuning range, then set the frequency either below 550 kc. or above 1500 kc. Therefore, no specific instructions are given as to the number of turns on T. This is left up to the constructor to determine, as he will know at which frequency the broadcast set he will use in conjunction with the converter is the most sensitive. The ratio of this transformer is 1 to 1 and the primary is tuned by a midget or balancing condenser.

This converter has a volume control of its own, as the signal intensity range will be very large and two controls are desirable. The control is the potentiometer P, which is connected between the screen return and ground, with the cathode of the modulator connected to the slider. When the slider is moved to the left, that is, toward the ground, the bias on the tube is lowered and at the same time the screen voltage is increased. The best place is a short distance to the right of the ground end, at which point the maximum sensitivity will be found.

Power Transformer Details

The filament and plate voltage are supplied by a power transformer T3 and a '80 rectifier. This transformer has one 2.5 volt winding which supplies the four tubes in the converter and one 5 volt winding for the rectifier filament. The high voltage winding gives approximately 325 volts after the choke

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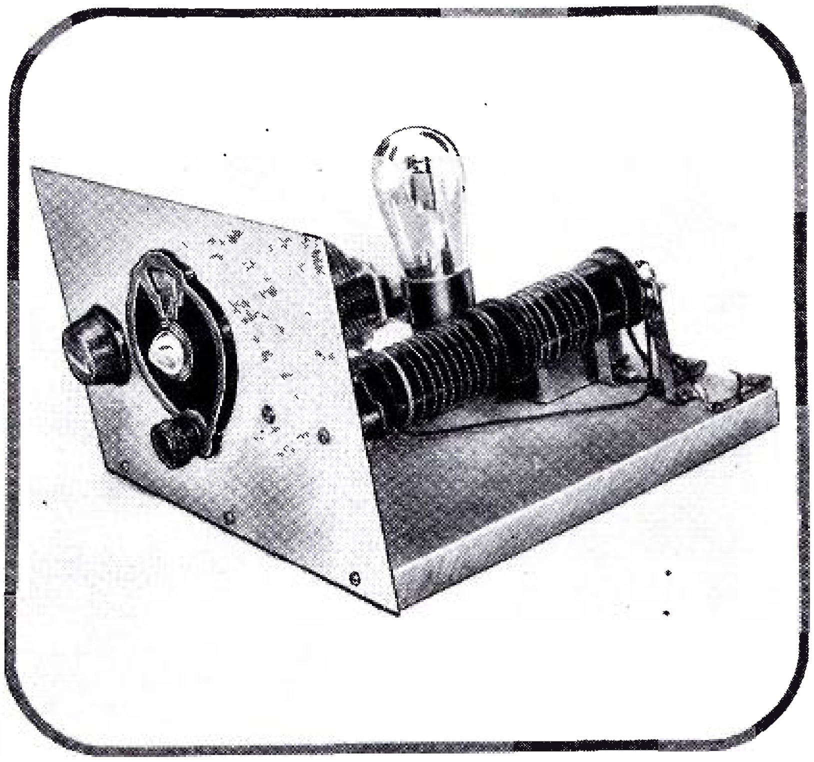
The "3-in-1 • Super-

The Receiver You

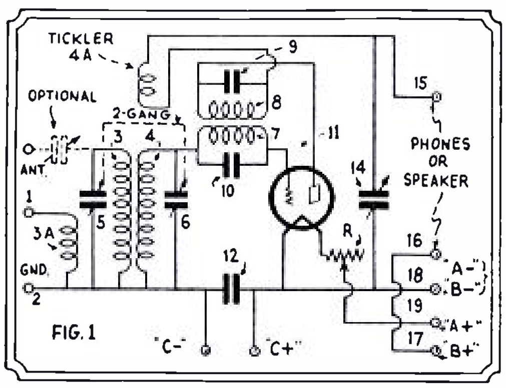
BY R. WILLIAM TANNER



Front view of Mr. Tanner's 1-Tube Super-Regenerative Receiver.

● ONE of the first arrangements of the super-regenerative circuit demonstrated consisted of only one tube feeding directly into a magnetic speaker. The demonstration model operated in the 200-550 meter broadcast band and gave some excellent results.

In the broadcast band it is necessary to employ a very low variation frequency (in the audio range) but at frequencies from 3,000 kc. and up, a higher variation frequency can be used which can be heard faintly only occasionally. Properly designed and constructed, a one tube super-regenerator can operate a magnetic speaker on loud or medium signals, provided the plate voltage is sufficiently high.



Schematic hook-up of the 1-Tube Super-Regenerator arranged for D.C. (battery) operation.

In Fig. 1 is depicted such a circuit. It will be noted that a three-electrode tube is employed. While a screen grid or pentode tube would undoubtedly function better, no output transformer matching the plate impedance of these tubes with a speaker is ordinarily available. The tube 11 should preferably be a Western Electric VT2 or a '10 operated at a plate voltage of 300 to 350 volts; however a '12A will provide satisfactory reception with a plate voltage of 180.

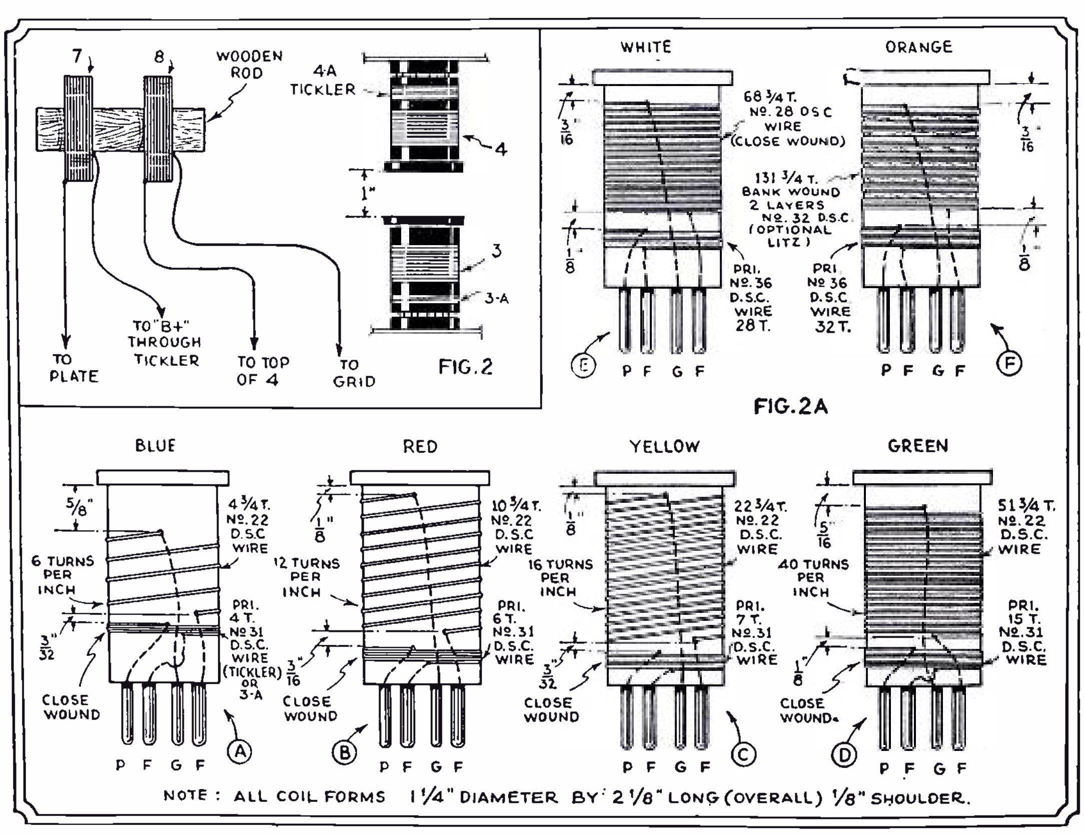
The super-regenerator is a very broad tuning circuit and requires at least two tuned circuits between antenna and grid. This is easily accomplished by means of a simple band-pass filter. This circuit uses such a filter and is tuned by a two-gang condenser. The tuning capacities should be within the range of .000125 to .00016 mf. condenser. A broadcast unit may be cut down by removing plates, 7 plates in each section generally being of approximately the correct number. The antenna coupling condenser C may be a midget .000025 mf. or a compensating condenser of the same capacity. This is set once, generally at a very low value, and then left alone.

If the detector were of the grid-leak type, it would be necessary to employ a grid-leak not lower than 1 megohm, in which case it sometimes happens that an audio frequency is generated within the tube in addition to the variation frequency, resulting in interference.

This circuit employs grid bias rectification by means of a "C" battery connected as shown and by-passed with a .1 mf. condenser. The value of the "C" bias will depend upon the tube and plate voltage. With a '12A the value will be between the limits of 3 and 6 volts. Correct adjustment is where regeneration is smoothest.

The coils 3, 4 and 4A are wound on S-M type 130P midget forms, (details are given in table accompanying this article), and are mounted horizontally as shown in illustrations. The spacing between 3 and 4 when mounted should not be less than 1 inch.

The variation frequency oscillator coils 7 and 8 are both alike and peaked at approximately 20 kc. by means of .002 mf. condensers 9 and 10. The inductance value of the coils is 30 mh. and they are lattice-wound. These may be purchased at all jobbers and are generally used for R. F. chokes. The dimensions are quite small, ¼" thick and 1" in diameter. Holes are provided through the center so that mounting on a ⅜" wooden rod is possible. The rod should be about 2¼" long. The method of mounting these coils is shown in Fig. 2. One coil is made solid by applying a little coil dope, collodion or shellac to the rod before placing the coil on it. The other coil is loose so that the output of the oscillator can be adjusted by varying the coupling between the coils.



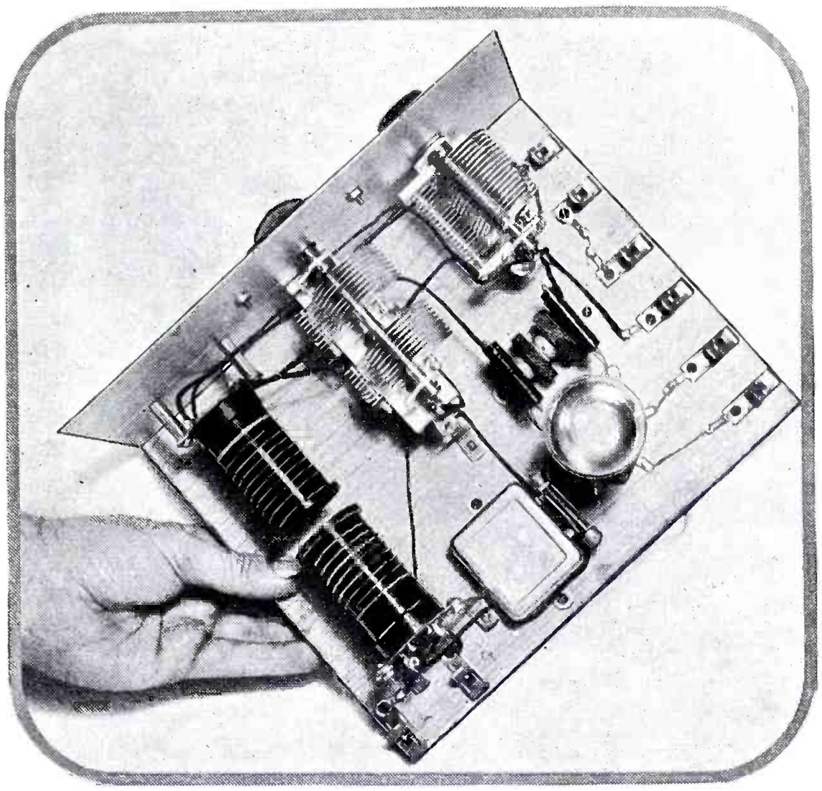
Coil winding data for the plug-in coils, covering both the short wave and broadcast bands; two sets of each are required.

A suggested layout of parts is shown

"MONOTUBE" Regenerator

Have Been Looking For!

Mr. Tanner, well-known to all SHORT WAVE CRAFT readers, here contributes one of the most interesting and timely articles of his career. "What can you do with one tube"—seems to be the motto of the day. This set was actually built and tested as the photos herewith testify. The super-regenerative receiver certainly gives the greatest output for the smallest number of tubes and, therefore, we know that every reader will be anxious to build this set.



Rear view of the Tanner "1-tube" Super-Regenerative Receiver.

in photograph. This will depend considerably upon the type of parts used, as all makes do not have the same size or shape. It is merely necessary for the builder to be sure the leads carrying R.F. currents are as short and direct as possible. No shielding of any kind is necessary or even desirable. The variation frequency coils should not be located too close to the signal frequency coils. The parts not shown should be mounted wherever convenient. The two variation frequency tuning condensers 9 and 10 are located close to their respective coils.

The adjustments are simple: First loosen the coupling between 7 and 8 and tune in a signal, with any set of coils in circuit, exactly as with any regenerative tuner. Then adjust the 5 condenser trimmers to the best value with 14 set at a low value. If regeneration is erratic try different values of "C" bias. At this time it would be well to mention that a '12A tube with 180 volts on the plate will generally oscillate very strongly and the tickler coils may need a turn or two removed. The turns should be such that the tube just oscillates with the regeneration condenser set at nearly maximum when the tuning condenser plates are entirely in mesh.

After all adjustments mentioned have been made tune in a signal and then tighten coupling between 7 and 8 until the tube generates the variation frequency. The signals will then jump up to a value many times louder than with straight regeneration.

Not all stations can be brought in on a speaker, but those of sufficient strength will be.

Special Notes on Construction

The construction of this set is very simple and can be done with a screw-driver and a pair of cutting pliers if the panel is bought ready drilled.

After the front panel is drilled the base-board can be attached to it. Use one inch long wood screws for this.

The tuning dial comes in two pieces and the circular dial portion should be fastened in place by locking the split nut to the condenser shaft. Units 5 and 6. Clip on the small driving pulley and slide the three holding screws into their respective holes. Fasten firmly by means of the three nuts furnished with the dial.

A bracket the same length as those used to mount the coil socket 3 is bent over at the second hole which is drilled in the long arm, and serves to hold the tuning condenser firmly in place, being fastened to the chassis with a wood screw.

The regeneration condenser is mounted by its single-hole threaded bushing. Brass posts are used to hold the socket away from the metal chassis.

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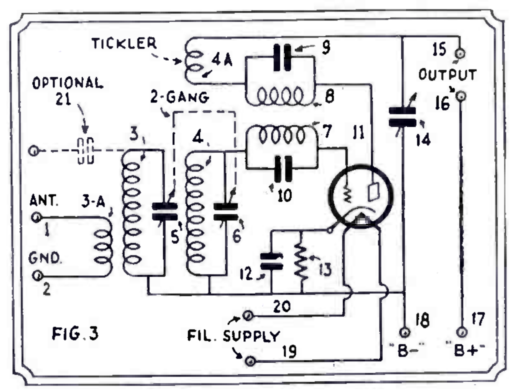
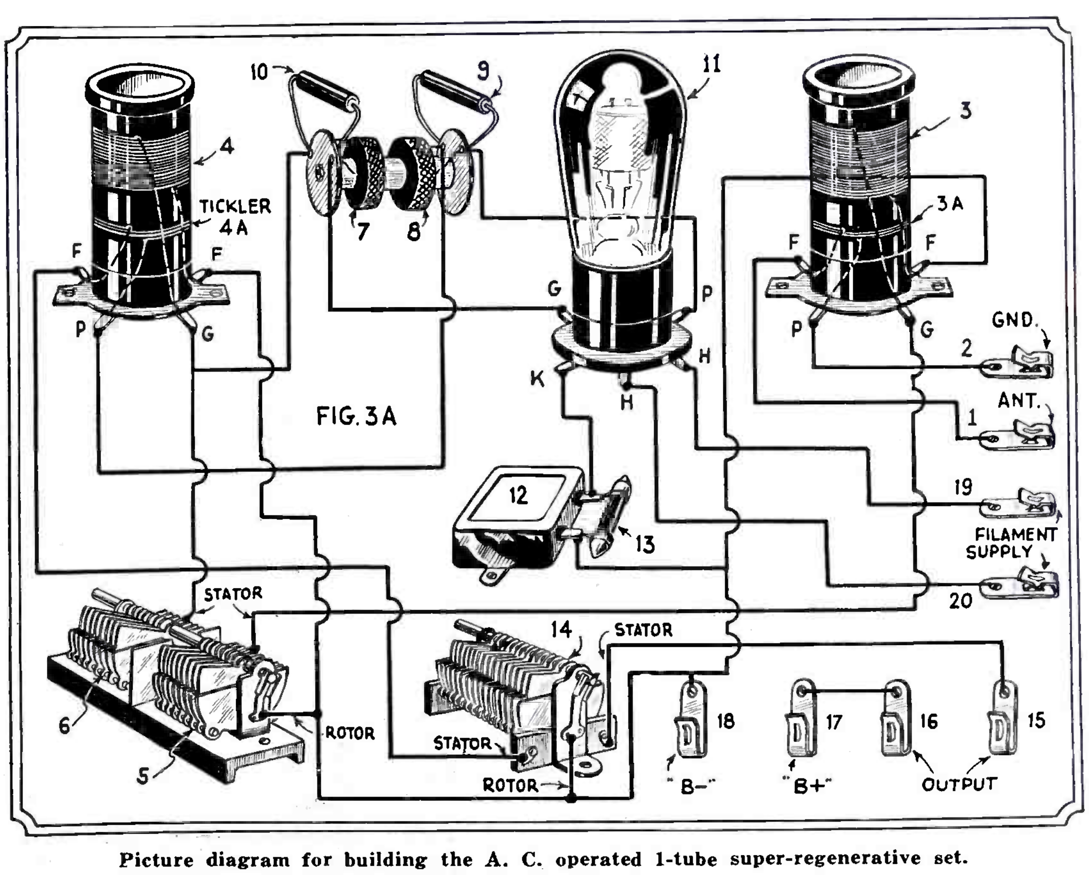
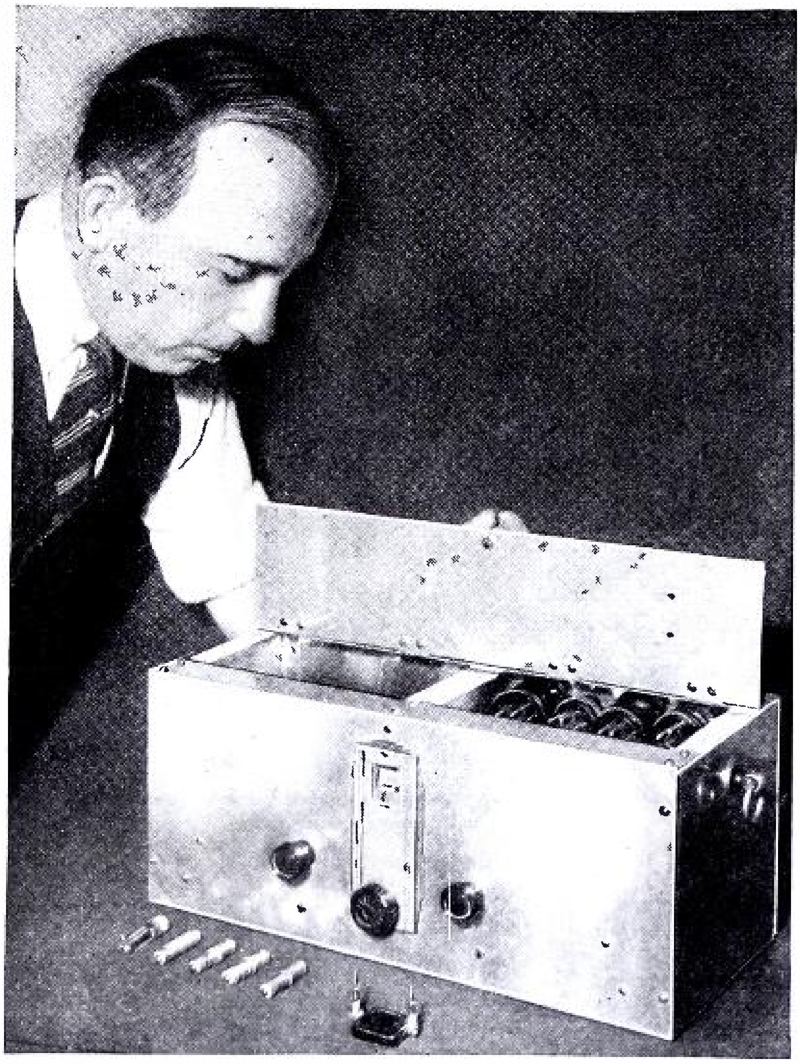


A.C. schematic diagram for the 1-tube super-regenerator.



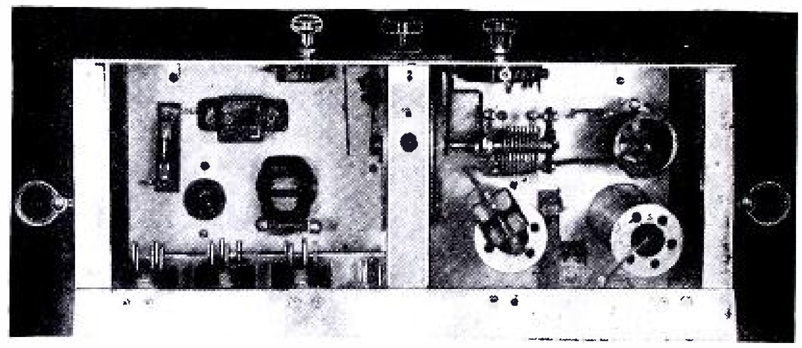
Picture diagram for building the A. C. operated 1-tube super-regenerative set.



WINNERS in the Fifth Set-Builders CONTEST

First Prize $50.00

Won by J. Luther McFarland, Royal Oak, Michigan.



Above and at left—note handsome appearance of Mr. McFarland's "first prize" winner—a 3-tube short-wave receiver of the highest quality, with several new features.

3 TUBE S. W. RECEIVER

● THE receiver illustrated and described herewith was developed with the following in mind:

First, to improve the signal to noise ratio.

Second, to provide absolutely single dial control of tuning, and to use such a dial that more capacity could be added to the tuned circuit, if found necessary.

Third, to have a set which could be operated on either A.C. or batteries.

Fourth, to use such tubes and circuit arrangement that an amplifier of a standard make could easily be attached to the audio end.

Fifth, to provide for plug-in coupling condensers, so that good results could be obtained on both code and phone signals.

To improve the noise-level, regeneration is obtained by using inductive coupling from a combined primary and tickler coil L3, but with the tickler coil removed from the plate circuit and put into the detector-screen-grid circuit and shunt fed. This leaves the tuned circuit free from any connection to the R.F. plate, which will prevent the usual leakage across the grid condenser, as found in the usual circuit.

In order to obtain sufficient *energy transfer* the tickler coil must contain a greater number of turns than usual, of space-wound fine wire, and placed farther from the tuned coil, L2. As the tickler L3 is increased in size, it should be placed farther from L2 in order that approximately the right value (22 volts) may be maintained on the detector screen-grid. The condenser C3 should be of good grade mica, and preferably of 40 mmf.

In order to provide for single dial tuning and also be able to add more capacity at will, the National Type-H 270 degree drum dial was used. This dial also provides for the use of the 270 degree condenser, which is made by the same firm, and will give greater spreading of the bands. The condenser is the type 100 with the stator split into two sections of one and two plates. The single plate is used on the high frequencies, and these three plates on the lower frequencies. Five-prong coil forms are used, so that when the coil is inserted in the socket, a jumper between the grid and cathode prong will cut-in the two plate section of the condenser.

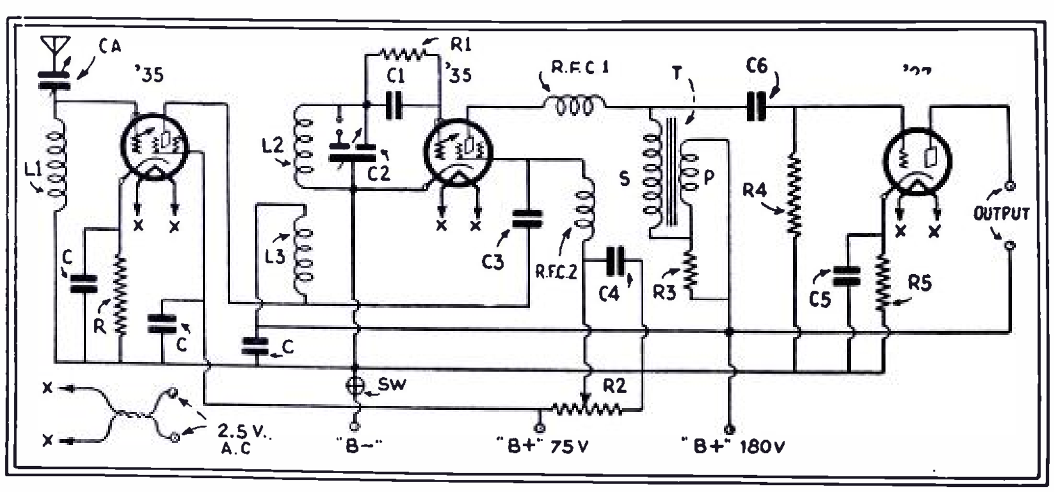
The tubes used in A.C. operation are a 35 in the R.F. stage, a 35 in the detector and a 27 in the audio. To operate on batteries it is only necessary to remove the power supply, attach batteries and insert the 6.3 volt type D.C. tubes. A switch is provided in the negative plate lead to prevent the running down of batteries. By use of the 27 in the audio stage, hum was greatly reduced, and impedance-matching to additional stages is not difficult.

The grid circuit of the 27 is provided with pin-jacks, into which various sizes or condensers may be inserted. Best results are obtained on phones with the higher capacities.

An old audio transformer with the primary and secondary tied together in series is used as an impedance in the plate circuit of the detector; this gave better signals than the resistance coupling. The resistor R3 was added to prevent fringe howl.

The coil L1 is very important, since the set is provided with an untuned R.F. stage. This coil is made "plug-in," a grid-leak mount being used. The form for all except the 80 meter band consists of a $\frac{7}{8}$ inch section of round birch (similar to a small flag stick), wound with No. 30 D.C.C. wire. These

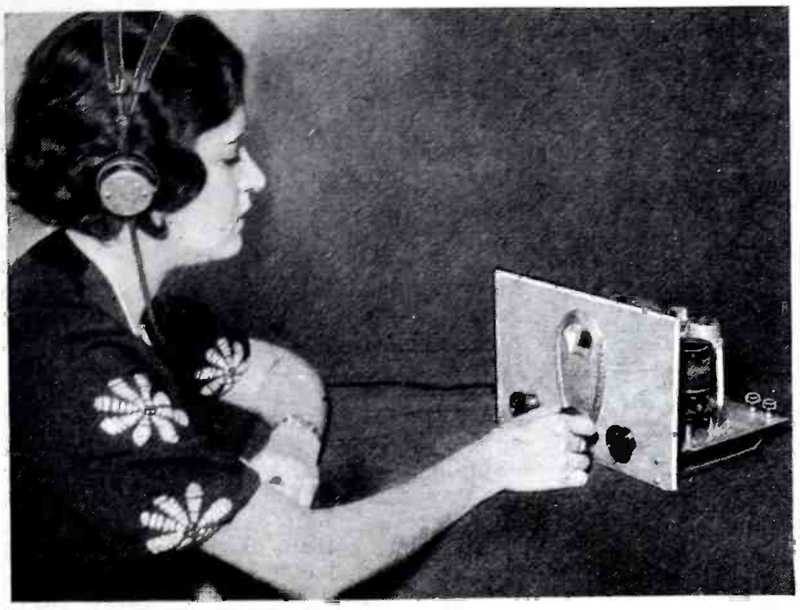
(Continued on page 490)

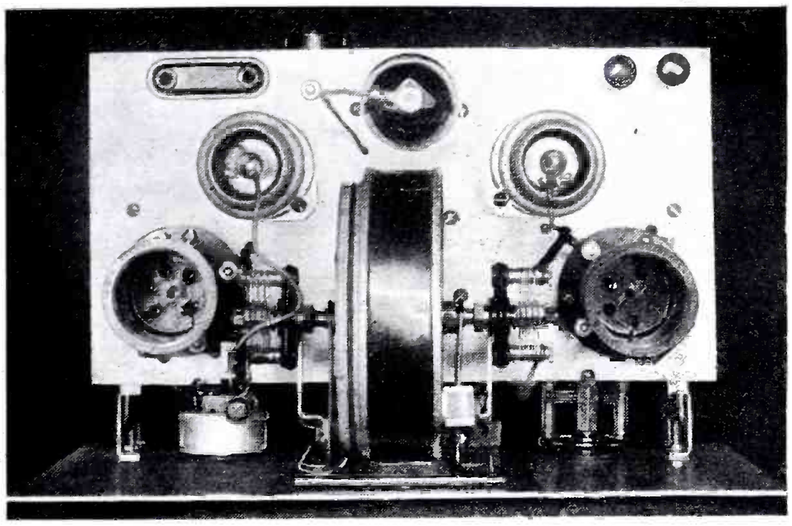


Wiring diagram for Mr. McFarland's first-prize winning, 3-tube short-wave receiver.

SECOND PRIZE—$25.00

Won by ROBERT H. ANDE, Pasadena, Calif.





Above, we see photos of Robert Ande's second-prize winner—a three tube receiver of excellent design and quality.

● "ADOO! ADOO! ADOO! F31CD, French Indo-China"—Have you ever had the thrill of hearing "DX" such as this, on but three tubes and with room volume? The design of this S-W receiver will permit anyone—no matter how inexperienced—and with a little patience, to listen to stations from the "four corners of the earth." This receiver on various tests—and these tests have been conducted in an automobile, speedboat, airplane, and not in motion on the ground—has received a remarkable list of stations over a period of seventeen days. Verifications have been received from eighteen out of the twenty-six distant ones received.

All districts in the writer's home have been worked and heard on phone and C.W. on both 40 and 80 meter bands. Airplanes, ships, and what not are received daily with no trouble at all.

The receiver itself measures 11"x 6½"x7" and it will operate from A.C. or D.C. It requires but 135 volts on the plate. One novel idea incorporated is the use of one "B" plus; the "B" plus is taken care of in the receiver itself in the form of 75,000 ohm voltage dropping resistors in series with the screen-grid lead of the R.F. tube and the regeneration control in the detector circuit. The detector circuit is the quietest that has ever been used in the writer's sets.

Two condensers (.00025 mf.) and one R.F.C. (radio frequency choke) do the work of "filtering" the detector. Regeneration is so smooth that sometimes the tube cannot be heard to go into oscillation.

A bread-board model was first tried before the set shown was constructed.

(Continued on page 490)

THIRD PRIZE—$12.50

Won by DONALD HALE, Oshkosh, Wisc.

The Traveler's Companion Receiver

● THE Traveler's Companion is a portable short-wave receiver with a wavelength range of from 16 to 225 meters, covered by four plug-in coils. The receiver is a two-tube job, incorporating detector and one stage of audio. It gives very clear reception on code and phone when used with earphones.

The case which contains the set and batteries has a compartment for the coils and tubes and a small pair of phones may also be put in it. The case is a small ladies' overnight case, purchased at most any specialty store. The cases measure 12½x8½ inches and has a depth of four inches. A case a little larger would not crowd the parts so much. The panel is 9x7⅞ inches; the panel supports all parts. The tuning control is in the lower left-hand corner and next to it is the regeneration control, with the rheostat in back of it. The tube sockets are in the lower left-hand corner, the audio stage tube being in the corner.

The two phone jacks are placed along the left-hand edge, just back of the tube sockets. The antenna and ground binding posts are on the right-hand edge in the middle of the panel. The socket for the coil is located midway between the tuning condenser and the regeneration control and near the back edge of the panel. The antenna coupling condenser is in the lower left-hand side of the case, in the corner next to the front of the case, the knob being on the outside.

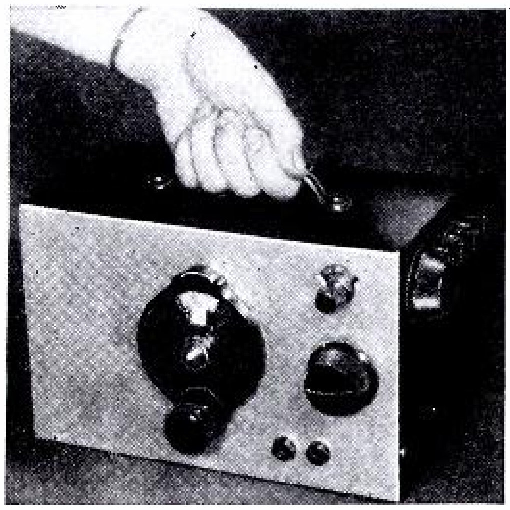
The audio transformer is a small Hedgehog, 3 to 1 ratio, and is held to the panel by the same screws which hold the audio tube socket. The back of the panel has a sheet of copper for shielding the set from hand capacity; this also eliminates some wiring. The two condensers C2 and C3 have their rotors grounded to this sheet of copper. The choke is mounted on the rotor terminal of the regeneration condenser. It is a Hammarlund short wave choke in a bakelite case. The switch and rheostat are insulated from

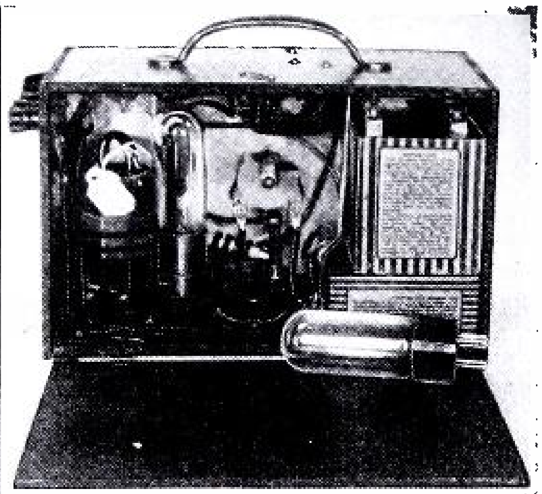
(Continued on page 490)

Donald Hale did a very fine job indeed, when he built this short-wave, "all-band," portable receiver. It surely is a dandy."

FOURTH PRIZE—$7.50

Won by ULSH G. HERBSTER, McClure, Pa.





Two tubes, plus batteries and plug-in coils, a condenser or two, and a dial, make up this nifty little portable—a "delight to the ear as well as the eye."

The Cigar Box Portable

● MANY radio enthusiasts, and very possibly every "ham" has, at one time or another, wished for a radio set that could be taken along on hikes, automobile trips, week-end parties in the mountains, etc., without too much inconvenience as to bulk and weight. The set herein described, although built primarily to keep the writer in touch with the "doings" of amateurs, is admirably suited to just such occasions. It was built after much discussion, and still more experimentation. It was only after many models and circuits were tried and discarded that the present one was finally allowed to stand, and it even surpassed the expectations of the builder.

In order to be most useful to the builder, the receiver had to be very small, yet fairly rugged. It had to be economical in the consumption of both "A" and "B" battery current. It had to operate from the lowest possible "B" voltage, because anything larger than the smallest size batteries was considered too bulky. This made the selection of the type '30 tubes imperative, as they would operate for long periods of time with their filaments supplied from a 4½ volt "C" battery, and on the low "B" voltage of 22½ volts.

Cigar Box Forms Cabinet

The actual construction of the set began with securing a box of the requisite size to hold all the parts nicely. A cigar box (precautions were taken to be sure it was a wooden one) size 8½x5⅜x4½ inches was found to do this nicely, with very little surplus space. The paper on the inside and outside was first removed. Removing the paper also loosened the lid. It was later refastened with small brass hinges. The bottom of the box was next carefully pried off, and was discarded. It was replaced by an aluminum panel of the same size as the discarded bottom. This became the *front* of the set.

However, before it was fastened in place, it was laid out and drilled for the instruments that were mounted on it. The holes in the right end of the box which are to take the rheostat and three binding posts were also drilled at this time. The shiny appearance of the panel was removed by rubbing it with fine steel wool and machine oil. This gave it a beautiful fine satiny appearance. Giving the box a coat of walnut lacquer inside and outside completed the assembly preparations.

(Continued on page 490)

FIFTH PRIZE—$5.00

Won by C. E. UTERMOHLE, Baltimore, Md.

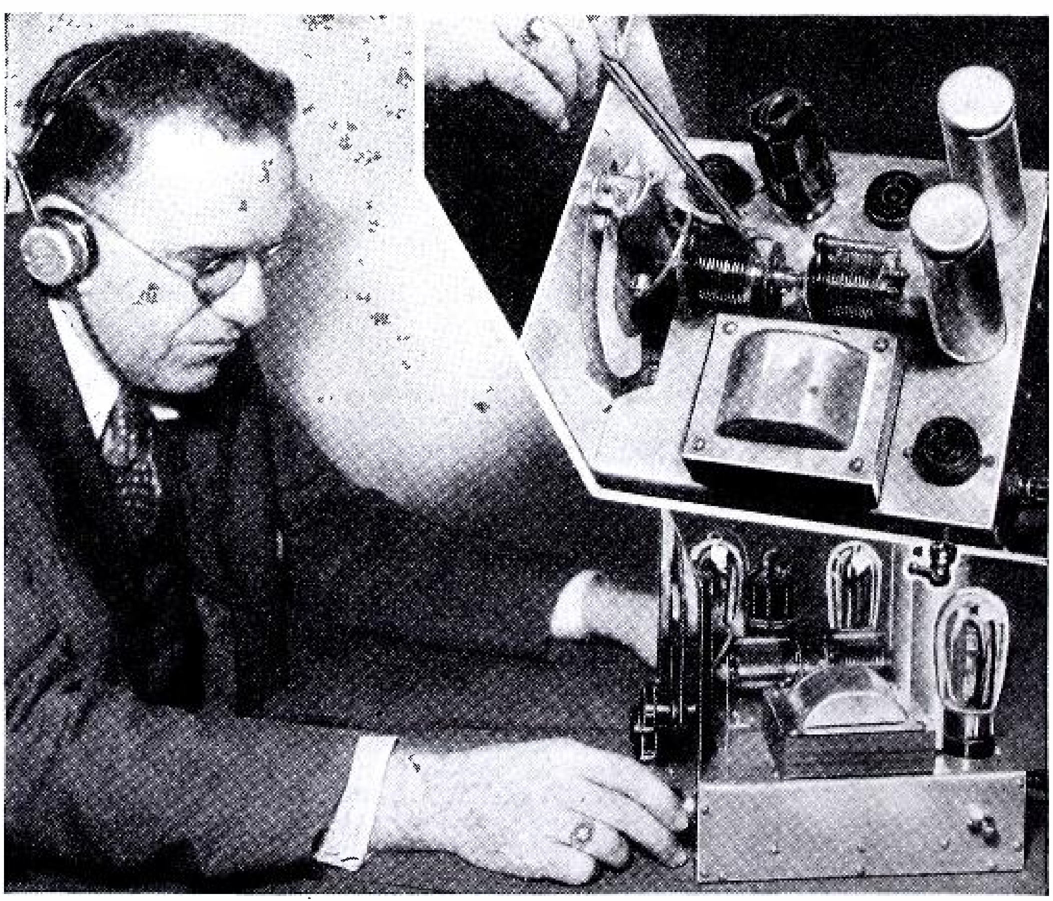
S. W. Converter

● THIS *Short Wave Converter* was designed to include such features as simplicity, compactness, and good sensitivity. The set uses a '24 first detector, a '27 oscillator and an '80 rectifier. Plug-in coils are used for the sake of simplicity, and because there is danger of loose contacts in an automatic switching arrangement, at least if home-made. In order that only a single coil need be changed, *both the first detector and the oscillator tuning coils are wound on the same form.* Coil data are given in these columns. Single dial tuning is used to simplify the tuning.

The chassis, measuring 7½"x8"x8", is small enough to be placed on a small stand or on top of the broadcast set, without inconvenience. This set has a self-contained power-pack which supplies all the power without tapping any wires on the broadcast receiver.

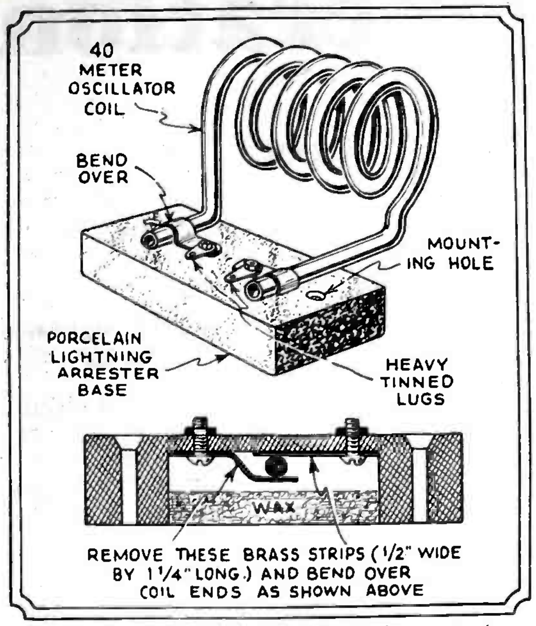
The antenna is coupled to the first detector tuning circuit by a small midget condenser, so that compensation for different length antennas can be made. Grid-leak detection is used to obtain greater sensitivity. The plate of the '24 works into the high impedance of an R.F. choke. Coupling to the broadcast set is secured through a small fixed condenser. The oscillator is of the usual tickler feedback variety. It is inductively coupled to the first detector.

(Continued on page 490)



Fifth prize winner—a high-grade, short-wave converter built by C. E. Utermohle. It permits the reception of short waves on any "broadcast" receiver.

$5.00 PRIZE COIL MOUNTS



Simple coil mount from lightning arrester

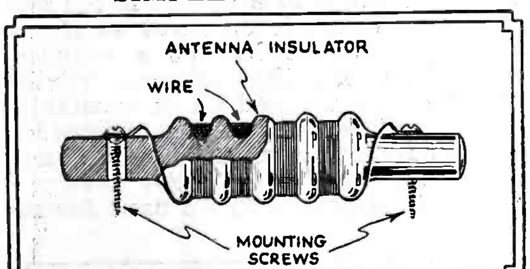
● IN the construction of an amateur transmitter I had need of oscillator coil mounts. After looking in the depleted family budget and consulting with friend wife, I decided to use something from the proverbial junk box.

While gazing dejectedly into the box of junk it occurred to me to use a lightning arrester. The one selected was made of high grade porcelain and sealed with wax. The terminals were too close to mount the coils directly on them. Chipping out the wax with an old screw-driver I found two pieces of strip brass ½" wide and about 1¼" long. Removing these I bent them to fit snugly over the coil stem, as shown in the sketch, and then mounted them on the terminals of the arrester. Putting heavy tinned lugs on the terminals and screwing the clips down tight over the ends of the 40 meter oscillator coil completed the job. The whole thing may be bolted or screwed to the baseboard and will be found to be very rigid.—*Lester E. Kendall, W1ABE.*

$5 FOR BEST SHORT WAVE KINK

The Editor will award a five dollar prize each month for the best short-wave kink submitted by our readers. All other kinks accepted and published will be paid for at regular space rates. 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.

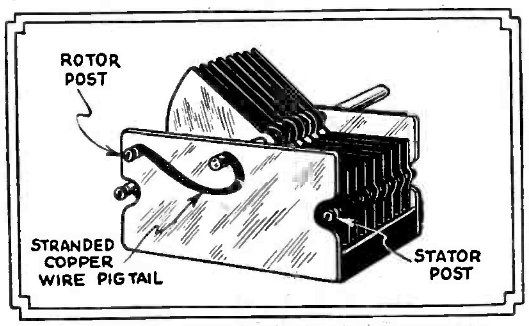
SIMPLE R.F. CHOKE



R.F. choke wound on an aerial insulator—Hot Cha!

● A VERY simple but efficient R.F. choke for transmitters can be made by winding the desired number of turns of wire on a small antenna insulator. This insulator makes the coke coil sectional, well insulated, neat and easy to mount.—*Godfrey Summers.*

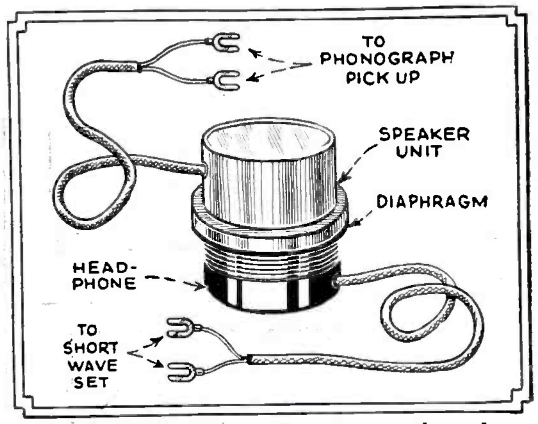
CONDENSER NOISE ELIMINATOR



Pigtail may eliminate your noise trouble

● I HAD a condenser that makes the rotor connection through the rotor shaft. Therefore, it was a sliding contact which became very noisy in a short time. This brand of condenser is very popular so I feel it will be of interest to others to know that I took a piece of flexible stranded copper wire and made a pigtail connection between the shaft and the binding post on the condenser. This took away all trace of noise and works very well. Below is a sketch.—*Harold Bryson.*

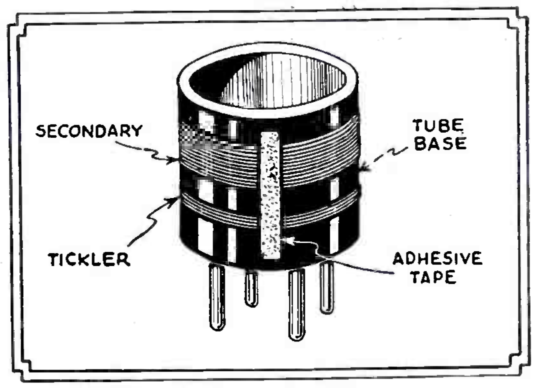
"PICK-UP" JOINS S.W. and B.C. SETS



How to link S.W. and B.C. sets through phonograph pick-up

● HAVING an extra pair of head phones and an old magnetic speaker, I first removed the speaker unit and took off the head, leaving the diaphragm lying loosely upon the magnets, and plugged the cord tips of the unit into the *phonograph pickup* on the broadcast set. Then I unscrewed the earpiece of one of the ear phones, taking off the diaphragm with it, and plugged the head set into the S.W. phone jack. Laying the dismantled head phone on the floor back of the table, open face up, and carefully placing the old speaker unit on top of the phone unit, so that the magnets of both units contacted the single diaphragm of the speaker unit, the job was done and I had a first-class connection that worked excellently. All that remained was to switch on the broadcast and short-wave sets, snap the switch on the phonograph pickup, and "tune in."—*Keith Williams.*

MARKING PLUG-IN COILS



Time-saving coil indicator

● A SMALL strip of adhesive tape placed vertically on the coil so that it faces you, when plugged in, will save much time when changing coils. It eliminates the necessity of having to look at the prongs of the coil whenever you plug it in.—*Blain Menth.*

$20.00 Prize Monthly For Best Set Submitted

● THE $500.00 Short-Wave Set-Builders' Contest closed on September 30; at least, that was the final date for the receipt of entries in the fifth and last monthly "set-builders'" contest. SHORT WAVE CRAFT readers showed so much interest in the contest, especially as it drew to a close, that the editors have decided to offer a $20.00 monthly prize for the best short-wave receiver submitted.

If your set does not receive the monthly prize you still have a chance to win cash money, as the editors will be glad to pay space rates for any articles accepted and published in SHORT WAVE CRAFT. So if your set does not become a prize winner, it still may win space as an editorial article for which you will receive a check.

You had better write the "S-W Contest Editor," giving him a short description of the set and a diagram, BEFORE SHIPPING THE ACTUAL SET, as it will save time and expense all around. A $20.00 prize will be paid each month for an article describing the best short-wave receiver, converter, or adapter. Sets should not have more than five tubes and those adapted to the wants of the average beginner are much in demand.

Sets must be sent PREPAID and should be CAREFULLY PACKED in a WOODEN box!

The closing date for each contest is sixty days preceding date of issue (December 1 for the February issue, etc.)

The judges will be the editors of SHORT WAVE CRAFT, and Robert Hertzberg and Clifford E. Denton, who will also serve on the examining board. Their findings will be final.

Articles with complete coil, resistor and condenser values, together with diagram, must accompany each entry. All sets will be returned prepaid after publication.

REQUIREMENTS: Good workmanship always commands prize-winning attention on the part of the judges; neat wiring is practically imperative. Other important features the judges will note are: COMPACTNESS, NEW CIRCUIT FEATURES, and PORTABILITY. The sets may be A.C. or battery-operated, Straight Short-Wave Receivers, Short-Wave Converters, or Short-Wave Adapters. No manufactured sets will be considered; EVERY SET MUST BE BUILT BY THE ENTRANT. Tubes, batteries, etc., may be submitted with the set if desired, but this is not essential. NO THEORETICAL DESIGNS WILL BE CONSIDERED! The set must be actually built and in working order. Employees and their families of SHORT WAVE CRAFT are excluded. Address letters and packages to the SHORT WAVE CONTEST EDITOR, care of SHORT WAVE CRAFT Magazine, 96-98 Park Place, New York, N. Y.

Super-Regeneration

By CLIFFORD E. DENTON

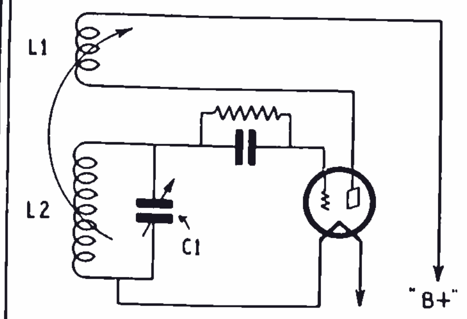


FIG. 1

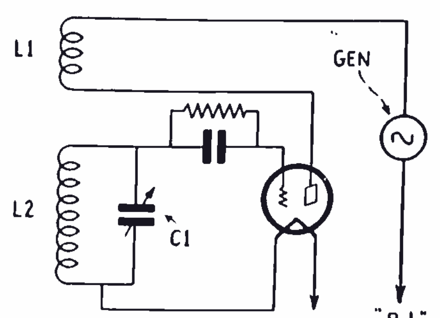


FIG. 2

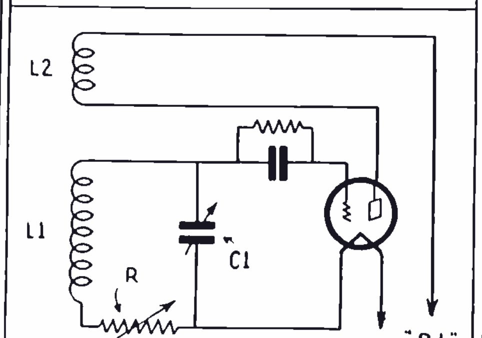


FIG 3

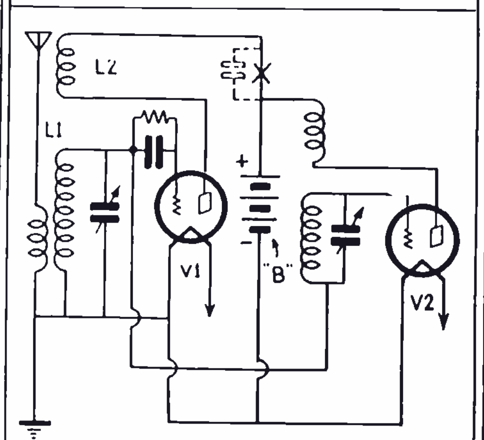


FIG. 4

Figs. 1 and 2, simple regenerative circuits. 3, resistance control of oscillatory circuit. 4, basic super-regenerative circuit.

● MANY of the most avid set builders like circuits using super-regeneration, as the high gain possibilities offer excellent reception with a minimum number of tubes.

Super-regeneration in words of one syllable can be defined as follows: a method of reception by which regeneration can be carried much further than in a circuit using straight regeneration. Thus, by increasing the regeneration we increase the signal strength.

In Fig. 1, showing the circuit of a simple regenerative detector, one finds that the energy is transferred from the plate circuit to the grid circuit by means of the inductive coupling between L1 and L2. The frequency to which the circuit will tune is determined by the constants of L2 and C1, while L1 does not enter into the tuning at all. L1 is simply the conducting means necessary for regeneration.

When the coupling of L1 in respect to L2 is increased to the point past regeneration, then a condition develops where the tube goes into *self-oscillation.* The tube under this condition develops power, as every one knows, and can be used for transmitting signals.

Tests show that if the tube can be prevented from going into *self-oscillation*, then more of the plate energy could be fed back, with resultant higher amplification.

This can be done as shown in Fig. 2, where the voltage which the coil L1 feeds back into the grid circuit depends upon the voltage present in the plate circuit. Variation of the voltage present in the plate circuit can be done by introducing some form of alternating current generator into the plate circuit in series with the "B" supply. If the voltage of the generator is in the same direction as the voltage from "B" plus, then the feed-back will increase beyond the point of regeneration and the current will build up to a very large value. When the voltage of the generator is in the opposite direction to the battery voltage, this high current dies out.

If the resistance of the tuned circuit L1 and C1 can be varied by the resistor R, Fig. 3, then the same action as described in the above paragraph can be duplicated. Feed-back coil L2 should be adjusted almost to the point of self-oscillation; then a reduction of the resistance R will start the current building up in the tuned circuit and will reach a high value. When the resistance is increased again, the current will die out.

Thus *super-regeneration* is produced by the introduction into the simple regenerative circuit of anything which will periodically vary the feed-back energy above and below the point required for self-oscillation.

The Armstrong Circuit

When Armstrong developed this method of amplification he used a separate vacuum tube to supply the alternating current necessary to throw the detector tube in and out of oscillation. The circuit of Fig. 4 shows the grid circuit tuning components of the detector tube VI shunted by the grid filament resistance of the local *quenching frequency* generator tube V2. The tube V2 is oscillating at some frequency lower than the frequency of the signal being received.

The action of this system can be described as follows: During one portion of a cycle generated by the tube V2 current will be drawn from the tuned circuit of V1. This is the current flowing in the resonant circuit consisting of L1 and C1. When the current flowing in a circuit is reduced the same effect is obtained as if the circuit resistance has been reduced. Thus, in effect, the resistance of the tuned circuit L1 and C1 is constantly raised and lowered at the frequency of the current regenerated by the oscillator tube V2.

If this circuit is to be used for re-

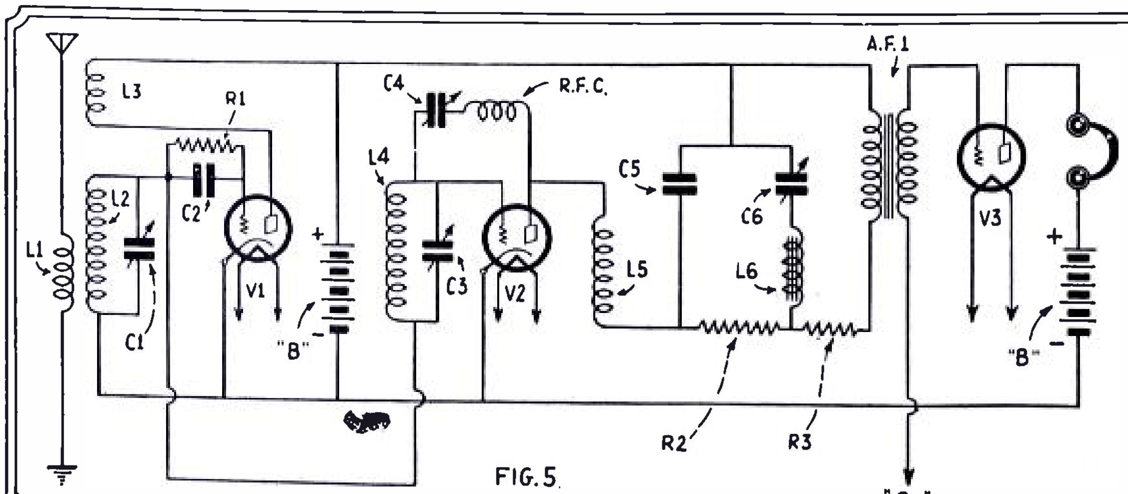


FIG. 5

An experimental 3-tube super-regenerative receiver circuit.

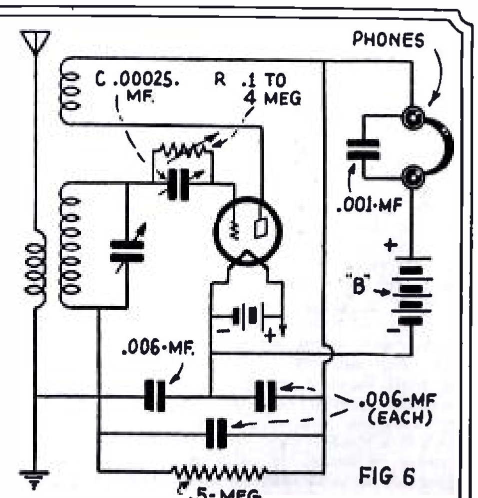


FIG 6

Flewelling circuit; 1-tube for detection, super-regeneration, and oscillation.

ON SHORT WAVES

Mr. Denton, well and favorably known to every reader of SHORT WAVE CRAFT, here presents a complete resume of super-regeneration reception as applied to short waves. Data are given for constructing a 3-tube super-regenerative receiver.

ception a pair of phones or the primary of an audio frequency transformer can be connected in the plate circuit at the point marked X. Note the addition of a small fixed condenser shunted across the phones or the audio transformer as shown in the dotted lines.

An Experimental Super-Regenerator

A circuit showing a super-regenerative detector, quenching frequency oscillator and audio stage is shown in Fig. 5. For those interested in the constants the following information is given.

L1, L2, L3—Ordinary three circuit tuner.

L4—1250 turn duolateral wound coil.

L5—1500 turn duolateral wound coil.

L6—.1 to 1.0 Henry iron core choke coil.

AF1—Any good, high impedance primary audio transformer.

V1, V2, V3—Triode type tubes. A. C. or D. C. type, such as the 27 type.

C1—Tuning Condenser for L2.

C2—Grid Condenser, .00025 mf.

C3—Variable condenser, maximum capacity .0025 mf.

C4—Variable condenser, maximum capacity .001 mf.

C5—Mica condenser, .005 mf. capacity.

C6—Semi-variable condenser, capacity .005 mf.

R1—Grid Leak, 2 megohms or larger.

R2, R3—10,000 ohm resistors.

The specifications for high capacity variable condensers may seem odd. Remember that the local oscillator is generating frequencies in the audio frequency band while the circuit shown tunes normally from 200 to 550 meters.

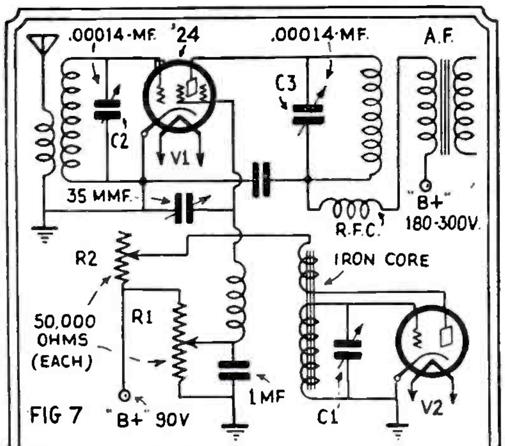
As the frequency generated by the local oscillator is in the audio range it would be amplified by any audio system which would be used with the tuner, so a "whistle filter" is included and is made up of the components C5, C6, L6, R2 and R3. This minimizes or suppresses the signal generated by the local oscillator so that it is not present in the output.

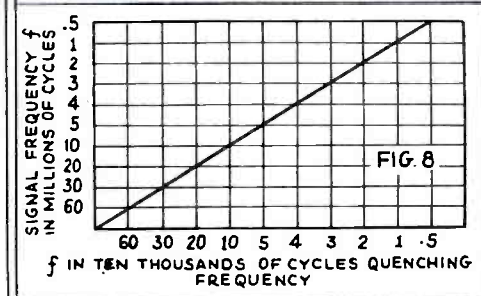
This circuit is one that was set forth by Armstrong in his original design. One of the reasons for presenting this circuit was that the fellows interested in circuits of this type could try it out on the broadcast band first and after the action of the local generator has been studied, then short wave coils and condensers can be substituted. Of course there will be a change in the frequency of the local quenching frequency generator, which will be covered later.

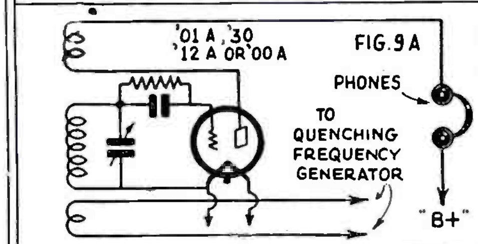
The action of this receiver can be described as follows. The tube V1 is the super-regenerative detector or amplifier tube, V2 is the quenching frequency generator and V3 is an audio frequency amplifying tube. Feedback for oscillation in V2 is capacitive and is controlled by condenser C4. The filter discussed before keeps the output of the tube V2 from the primary of the audio frequency transformer and out of the "B" supply circuits. Condensers C3, C4 and C6 are set once and left alone. They should be set for a frequency of about 15,000 cycles.

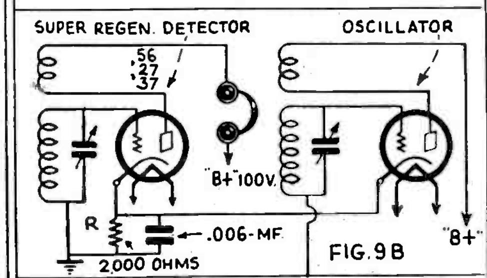
Tune to an incoming signal by means

(Continued on page 494)









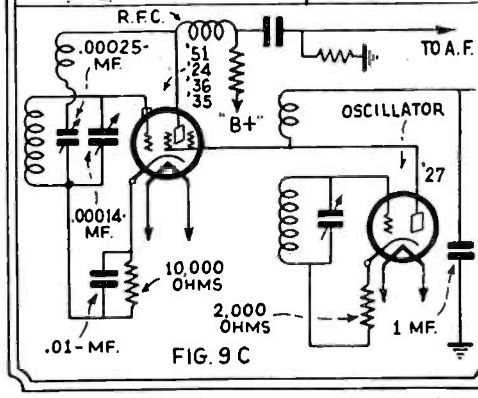
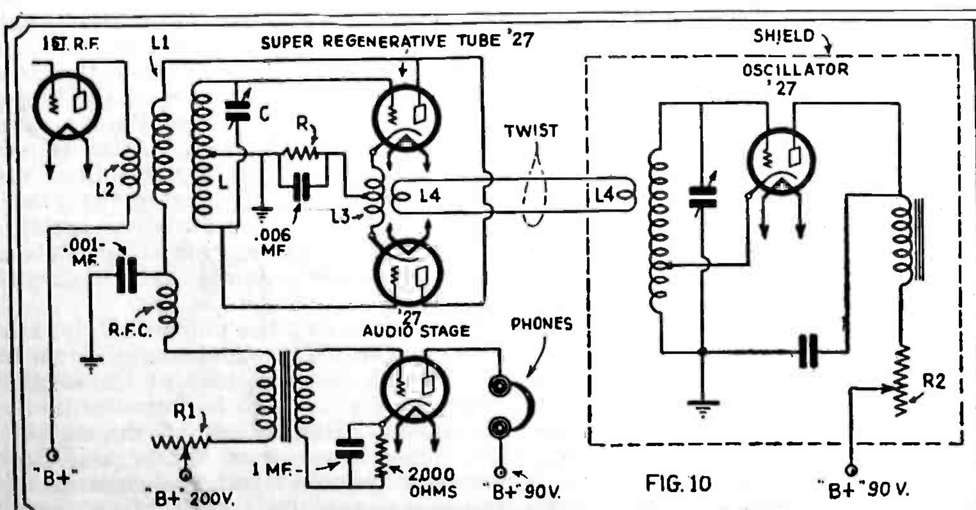
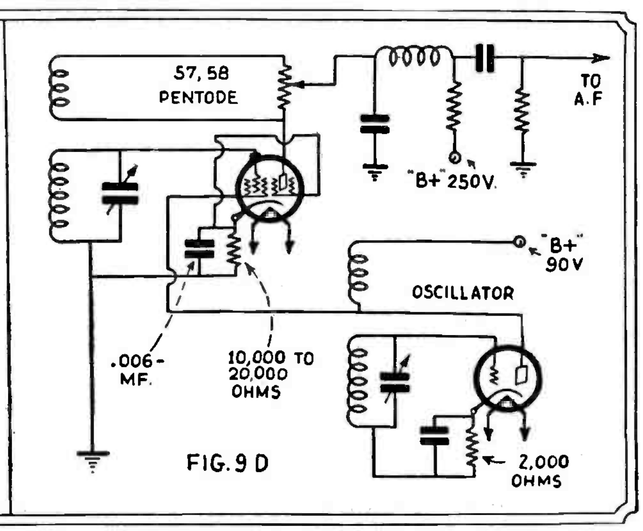


Fig. 7, "Super-regenode" circuit. 8, Relation of signal and quenching frequencies. 9A, B, and C—various ways of connecting "Q. F." generator to super-regeneration tube.





Ideal super-regenerative receiver circuit suggested by the author.

Fig. 9D at right, above—pentode "super" circuit.

W9ZG Saves a Life!

By A. D. MIDDELTON, W8UC

". . . Bill Pike, the straw boss, reached over and jerked the tubes from the transmitter. . . . Hastings was too paralyzed to stop him. . . ."

Jack Hastings was a "natural"—born with "cans" on his head—so they said. Jack joined up with a wood chopping outfit which provided him with his long-sought opportunity to try for some real "DX" out in the tall timber, away from the steel buildings of the cities. You will be highly thrilled at Jack's experience at a great logging camp and how he saved a man's life—thanks to his amateur radio transmitting and receiving set, which he operated under great difficulties.

● "HEY, you Hastings, how many times have you been told that we start to work at seven-thirty—not eight? If you don't quit staying up all night listening to those darn buzzes you'll be put on the cook house squad."

Hastings only smiled and slid his legs over the tall stool that was his resting place for nine long hours daily. What Elmer, the bookkeeper, thought, was nothing to him.

It had been hard to decide between the Rocky Pass Lumber Company and Mineralite Incorporated. The bookkeeping work involved was a minor item. The possibilities of greater DX had made Hastings pick the great woods. Away from street car noise, arc light racket, the ever-present broadcast receiver and the local interference caused by the rest of the boys in Newark. This was a Ham's Paradise and that is where Hastings belonged.

Jack Hastings was a "natural." Born with cans on his head, so they said, at midnight, during a terrific lightning storm, and his whole life had been like that. Filled, first, with the whirring crash of a dazzling rotary gap—later by the droning whine of a 500 cycle chopper—now the "ping ping" of a crystal-controlled signal thrilled him to the core. The music to which he listened was not from the pens of the masters, but from a thousand stuttering keys scattered over the entire globe.

Jack's thoughts wandered idly as he ran through the sheaf of tickets he had to check and enter in the ledger. He smiled as he worked. He could do this work and think of other things. Of the friendly chat he had last night with Peterson, the trans-Pacific mail pilot—of the argument he had in regard to the proper way to key a crystal—this argument with that Spaniard in Buenos Aires. The schedule with Peterson had not "missed fire" for three weeks. Every night, right on the dot, he could hear the droning note of the plane as it sped onward to Honolulu or hurried home to 'Frisco. Hasting's musings were cut short by a harsh voice—

A Threat

"What's this I hear about you being late again?" demanded Peters, the Big Boss, as he strode over to the desk. "One more slip outta you, young man, and you'll be fired! Up here that means one of two things . . . either get out of camp or work in the cook's shanty."

Hastings knew that Peters meant it. Plenty of argument had been given to the erection of the transmitter. Jack had argued and pleaded that it wouldn't hurt anything and that it wouldn't take much electricity. Finally the Boss had let him set up the *rig* in his already crowded cubby hole in the bunk house. Peters turned and went out. He had scored his point. Jack was scared. He couldn't walk the twenty miles to the nearest town over the snow and ice that engulfed the only means of escape from the camp, the Rocky River trail.

Hastings thought long and hard that day over his situation. He couldn't let the radio alone, as it seemed his very life depended on operating a transmitter. But it was either mend his ways or get out, or, what was worse, have to peel spuds and wash dishes—Uh! Jack worked like a trooper all day, thus meriting the clerk's comment, "He's got your goat, ain't he, Kid."

The first opportunity the boy had, he visited the cook, where, for a bribe of a promise of some tobacco, the cook said that he would waken Hastings every morning. This would make impossible the disastrous happening of that morning, the late arrival of Jack at work.

Around the Globe on 14 Megacycles!

The days dragged by. . . . Nights were filled with thrilling contacts for Jack. Even though weak, W9ZG was attracting the attention of amateurs wherever his 14 megacycle signals were heard, and that meant most everywhere. Nightly he "chewed the fat" with operators in all parts of the globe. This was the life! Even Peters came and "sat in" with Jack. Although he knew nothing of radio, the Boss got quite a thrill out of hearing the places he had visited during his globe-trotting days. And Elmer, reflecting Peters' attitude, grew almost friendly with Hastings.

Day after day the snow and the cold grew worse. The wind swept down on the bunk house and tore at the slender strands of wire Jack had strung up for his aerial. Regardless of the outside, the bunk house was warm and Jack sat and pounded out his calls to his fellow operators. The tiny outfit worked well. The colder the better . . . this was LIVING! DX was even better than Hastings had ever anticipated and W9ZG was hitting all corners of the world with ease.

Sleeping quietly after a busy session, Jack was shaken into consciousness by a rough hand. Rousing up he saw it was the cook.

"Get a move on—it's ten-thirty—I clean forgot all about ye."

The boy struggled into his clothes. Just as he was pulling on his boots the door opened and in strode Peters.

"Here you are. Well, you won't be long!"

Hastings stood up and reached for his shirt.

"Get your junk and get out of here —take it over to the cook house—the cook'll see to it that you don't oversleep." Peters went on angrily. Jack started to reply, but thought better of it, for there was really nothing to say; that is, nothing adequate to the occasion.

"Take that darn radio stuff, too. You can't use it in the cook house but get it outta here." Peters turned and left the room.

Jack sat on the edge of his bunk and felt sick at heart. Then, with a shrug, he started to pack up his things. It took several trips over the snow to lug his clothes and the precious transmitter and receiver over to the cook house.

The cook greeted him at the door, heartily, almost too warmly, thought Jack.

"My gosh, Lad, I'm sure sorry that I fergot ye. But I was so busy with the bread that I didn't think about ye."

"Aw, that's all right, Mike; guess I had it comin'," replied Jack.

"You can sleep in that top bunk, Lad, 'n put yore things in the cubby hole there."

Jack stowed away his transmitter and then lifted his little receiver into his bunk. He knew where he could get a nifty shelf to set it on. Then he could listen, anyway. They couldn't deny him that fun. As he started in to help the cook, his thoughts kept going back to the fun he had had. What of his schedules? There *was* a bit of tough luck . . ." Well, maybe the band was going to pieces anyway.

Mike explained the work to the boy, stressing the fact that there was plenty to keep him busy.

> **TO OUR READERS**
>
> **This is a new experiment—Short Wave Fiction! Would you like to see more? If so, just mail a postcard to the "FICTION EDITOR," SHORT WAVE CRAFT, 96-98 Park Place, New York City, and tell him so.**

Jack Hears the Trans-Pacific Mail-Plane

After the work was done and Mike would be dozing over a two-month-old magazine, Jack would crawl into his bunk and listen in. At first he worried over his schedules, but as, one by one, his old standby ceased to call him, he almost forgot them. Finally only one was left, old Peterson, KF6R, flying the trans-Pacific Mail. Every time, even weeks after his transmitter was silenced, Jack listened on the scheduled hour, he would hear the usual "—W9ZG W9ZG de KF6R QTC" and so on for the regular three minutes.

Whenever Jack heard this signal, he got sore. Sore at the Boss, at Mike and, most of all, sore at himself. For it was, he admitted, his own fault that he couldn't operate the transmitter. He worked on, dreaming of the day when the weather would break and he could head south, away from the cook house and the dirty work under the ever watchful eye of Mike.

Midwinter came and one day, shortly after a terrific snow storm, one of the men came over from the office and reported that the Company telephone line had failed. Mike told him this was not unusual during the winter as snow slides and boulders often broke off the rickety poles supporting the single wire connecting the camp with Ridgeville.

"And when they break, they're down till the weather gets good," stated Buck. "No telling where they're down, 's no use to go out to look for the break either, for ya might have ta walk clean to Ridgeville."

Jack wished for a good old fashioned 3.5 megacycle phone outfit, for his up-to-the-minute, though idle, 14 Meg. set was useless to cover the two hundred or more miles between Rocky Pass and the nearest amateur. 14 Megs were fine for DX but useless for short hauls, he knew.

One afternoon several days after the telephone line had failed, Jack and the cook were busily engaged in a game of rummy, when the door flew open and in rushed Bill Pike, the straw boss.

The Boss Is Injured

"Good gosh, boys, the Boss has been hurt bad. Get the medicine chest and some hot water and hurry over to the office."

Mike and Jack got some under way at once, with the required kit and a pail of steaming water. There in the office they found Peters unconscious. Mike, who was somewhat of a hand at doctoring, looked the man over as he listened to the men who had accompanied the Boss on his ill-fated trip through the woods.

". . . was walking along the trail behind the Boss, when I heard a crash and a thud 'n a big limb had broke off and smacked him down."

"Do you think he'll be all right, Mike?" asked the straw boss.

"Dunno, boys, he got a nasty rap, his head is nigh busted wide open."

"Old Doc. Thomas is the nearest man, and it's a slim chance of getting him up here now," said Pike, who had taken charge of things.

Red, you and Smokey get your snowshoes on and get going. Maybe you can make it to Ridgeville. Don't know how you'll get Doc up here but do your durndest." The appointed men set off at once over the snow towards the distant town.

Soon the whole camp knew about the

(Continued on page 502)

The Spread Side-Band System

By C. H. W. NASON

● IN a recent article in Short Wave Craft the writer explained in some detail the adaptation of a single side-band system of short-wave transmissions of the order of 15 meters. It will be remembered that in the case of the Madrid-to-Buenos Aires link the "pilot" wave was removed by about 3.47 kc. from the true carrier position so that reception of the signals on an ordinary receiver would give "inverted" speech —displaced by some 400 cycles from the true frequency range. Such a channel is termed a "privacy" system, the implication being that a listener stumbling onto the wave would be stumped up to the point where his curiosity got the better of him and persuaded him to construct a receiver capable of translating the signals. The privacy gained is therefore limited to the curiosity and technical ability of the potential eavesdropper.

In that article some note was taken of the necessity for maintaining a constant signal level by means of suitable automatic volume controls which combatted the ill effects of "synchronous" fading. There are, however, other types of fading which must be taken into account before a high quality channel can be achieved. First let us review the types of fading which may be encountered:

Diurnal Variation.—This is the hour-to-hour variation in signal strength of such a character that it may be readily offset by the use of manual gain controls.

General Fading.—This constitutes a fading of all components of the signal synchronously—a condition readily combatted by the use of automatic gain controls which may be so designed as to maintain a relatively constant output over a wide range of field intensity.

Selective Fading.—This third type of fading is rapid in its action and of such depth of effect as to wipe out wide bands of frequencies for short periods of time. The rapidity is so great that at times it may approach several hundred fading and recovery cycles per second. The fading is due to the phase relations of signal components arriving over two or more paths at the receiver antenna. An out of phase component may be of such

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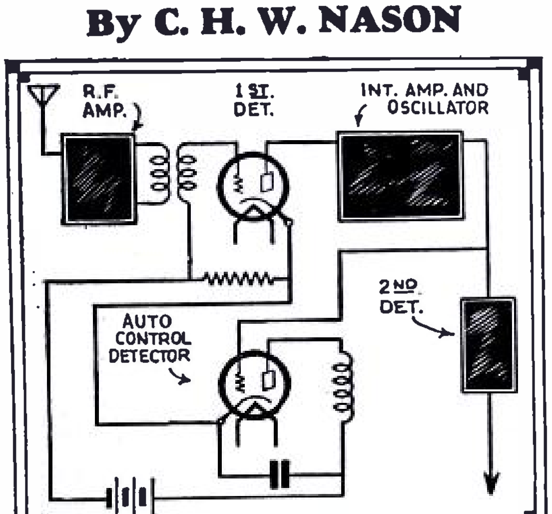
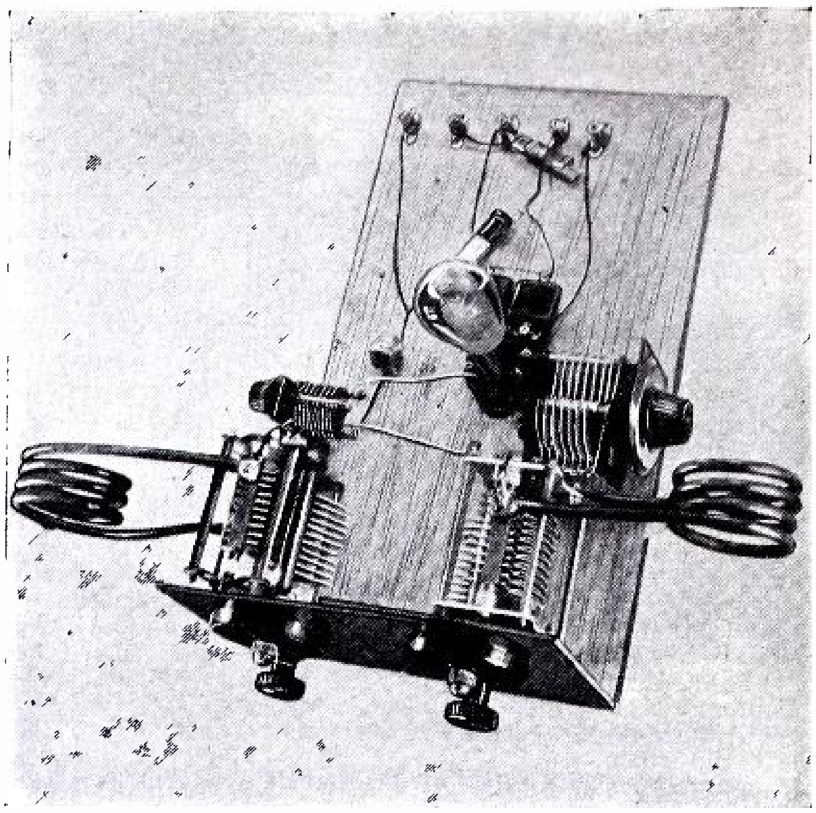


Mr. Nason's circuit, showing automatic gain control.

A 20-Meter Transmitter

By A. BINNEWEG, Jr.

The special requirements of 20-meter transmitters are discussed by the author, including the best type of circuit, methods of coupling and data on a practical 20-meter transmitter.



Appearance of T.P. T.G. 20-meter transmitter built by the author.

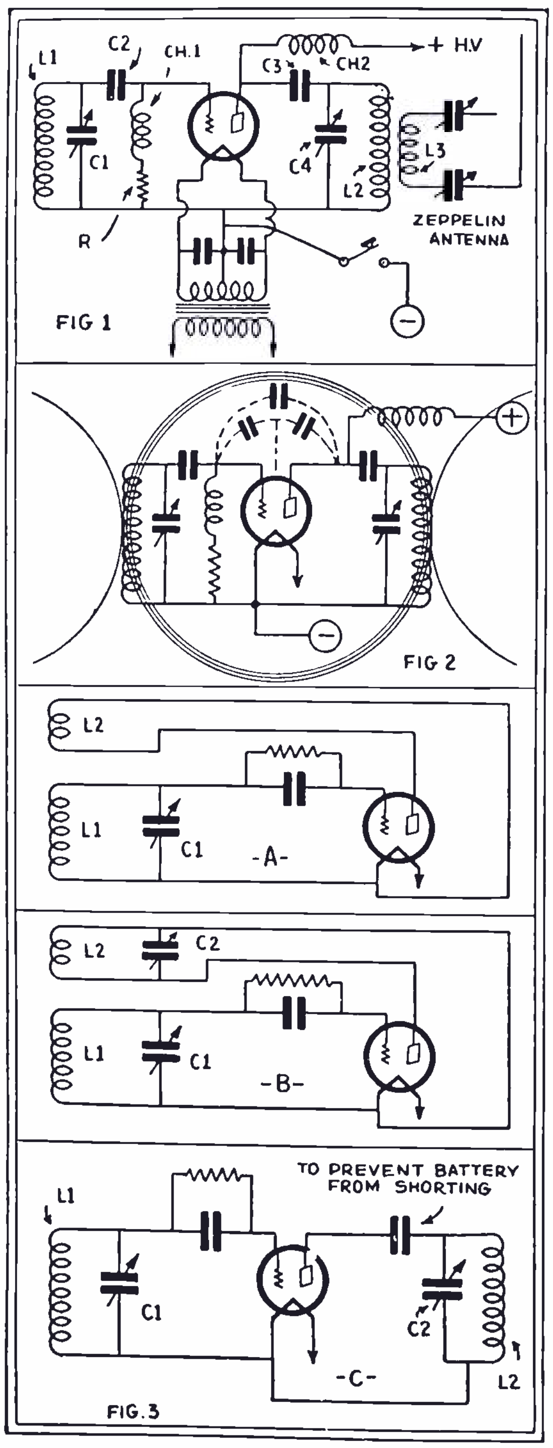


Fig. 1—Tuned plate-tuned grid transmitting circuit. Fig. 2—Showing inductive coupling between coils and internal tube capacities. Fig. 3—The derivation of a T.P. T.G. circuit from a regenerative circuit.

● THERE are some very good reasons why the 20-meter (14 mc.) band is of great interest at the present time. In the first place, a good frequency band has been thrown open for amateur telephone communication. It is now possible to communicate with foreign lands, using low power, by voice. Although telephone communication is restricted to certain amateurs having special licenses, others will experience a new sensation working those using voice. In the second place, the 40-meter (7 mc.) band is overcrowded and thus one experiences considerable interference in working other stations. This is a very important reason for selecting the 20-meter band for operation.

If this band is not used exclusively, one can at least arrange for operation in the 40-meter band also. In any case, it is desirable for the amateur to be fully versed in the special needs of transmitters for operation at 20 meters. Some interesting facts are brought out in this article.

The factors involved are of special interest to those contemplating operation at 20 meters but the remarks, in general, apply to the design and construction of transmitters, if not other apparatus, for use in any of the other frequency bands now in use.

It has been found that for 20-meter operation the tuned plate-tuned grid circuit gives excellent results. It is a circuit which is very popular among amateurs but it is often improperly adjusted and thus does not give the results of which it is capable. The tuned plate-tuned grid circuit, of course, is used for reception also, with screen-grid tubes in an R.F. amplifier, so those interested in such amplifiers will also find much of interest. Figure 1 shows a tuned plate-tuned grid transmitting circuit coupled to a "Zeppelin" antenna, a type used by many amateurs.

In order to fully understand this circuit, some simple theory will be considered first.

In Fig. 2 a simplified wiring diagram of Fig. 1 is shown. The inductive coupling between the plate and grid coils is shown by means of the circles, which represent lines of force threading the coils. The capacities existing between the elements of the tube —grid-plate, grid-filament and filament-plate—are shown by the dotted lines and the small condensers. These small capacities have considerable to do with the efficient operation of the circuit at the shorter wave-lengths.

In order to make this particular circuit clear, we shall go even further back—to the circuit of Fig. 3A. This is an ordinary regenerative receiving circuit in which a tickler coil is used to feed energy back into the grid circuit, thus (if the coupling is correct and there is enough of it) causing oscillations. To convert this simple circuit to a tuned plate-tuned grid circuit, first connect a condenser, C2, across the tickler coil as shown in Fig. 3B; this latter circuit is the same except for the condenser.

In Fig. 3A, the coupling between plate and grid circuits consisted of not only inductive but also capacitative coupling (through the small capacities inside the tube). At low frequencies the internal capacities have only a small effect, and can ordinarily be neglected in calculations. However, on short waves of the order of 20 meters, these small capacitive effects are important. In Fig. 3A, a certain minimum coupling is required to produce oscillations in the tuned circuit L1C1. The required coupling would be greater if there were no internal tube capacities of any kind.

The feed-back current through the tube capacity depends upon the R.F.

(Continued on page 501)

A Super-Regenerator With PENTODES

By R. WILLIAM TANNER

The super-regenerative circuit offers more rewards to experimenters today than most any other circuit. The super-regenerator has the marked distinction of doing the most with the smallest number of tubes and it is moreover particularly efficient on very short waves.

● THE super-regenerator, while not a new circuit, has been given little attention by either the amateur or short-wave broadcast listener, due no doubt to lack of information on the subject. In the last few months a number of articles have appeared in this magazine and other publications describing this remarkable circuit. However, these articles are entirely lacking in data which would help the builder in the elimination of "kinks" and the super-regenerator has a number of such "kinks." In the first place, there is the broad tuning feature which can be improved ONLY by the use of a sufficient number of tuned circuits between the antenna and detector grid. Second, the super-regenerative "hiss" or "mush," which can be suppressed by means described later. Third, distortion of voice or music, which can be cured by an adjustment of the variation frequency oscillation. Fourth, unstable operation due to insufficient tickler turns or coupling, the cure of which is readily apparent. Fifth, when an R.F. stage is employed the detector generally fails to oscillate over a portion of the dial. This is due to absorption by the plate winding on the detector R.F. transformer, the cure being very loose coupling between R.F. plate coil and detector grid coil.

Before describing this new version of the super-regenerator, the writer wishes to settle the question always asked by the novice: "Can this set bring in Europe, South America, etc.?" Any short-wave receiver having one to twenty tubes can receive from any point on the globe, *providing* the time, season, weather, location, etc., are right (also providing the receiver is not located in the "skip" area). The *human element* must be given some consideration, as considerable patience and careful tuning are most important. The receiver itself is not such an important factor as most fans believe; however, with an elaborate multi-tube set, long distance reception will be more consistent and more stations can be picked up on a loud speaker.

R.F. Pentode Ahead of Detector

Referring to the circuit in Fig. 1, it will be noted that one of the new '58 R.F. pentodes is employed in the tuned R.F. stage, resulting in a fair degree of gain even down to 15 meters. The super-regenerative effect is obtained through the use of an oscillator tuned to a comparatively low frequency and a regenerative screen-grid detector designed to oscillate more strongly than in the usual regenerative set. The output of the detector is generally sufficient to operate the '47 pentode power audio amplifier to full capacity, except on weak signals. Experiments which employed a '35 R.F. amplifier in place of a '58 proved that the overall sensitivity was equal to nearly all short-wave superhets with two I.F. stages. Volume was not quite as loud when compared to a superhet having two audio stages.

Selectivity Improved by Band-Pass Filter

Selectivity with a super-regenerator is, *in the usual form of circuit, notoriously poor!* With the tuned circuits,

(Continued on page 504)

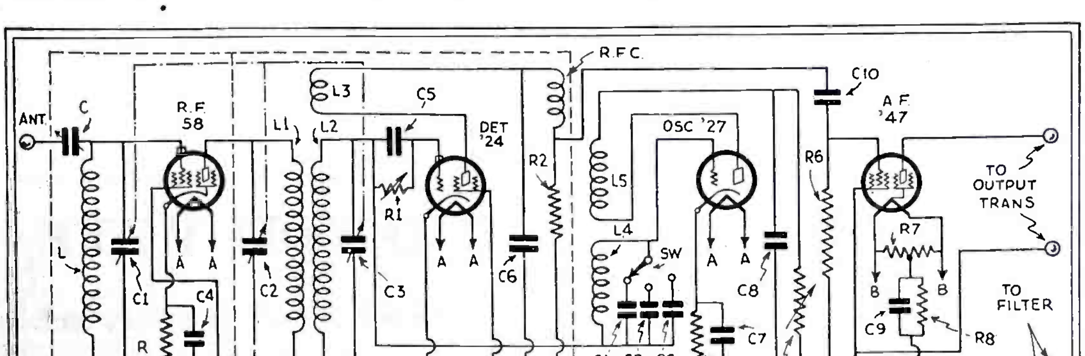


Fig. 1—Complete diagram of Mr. Tanner's super-regenerative receiving circuit which employs a screen grid detector with pentodes in the R.F. and A.F. amplifier stages, which gives some "wallop" to the signal.

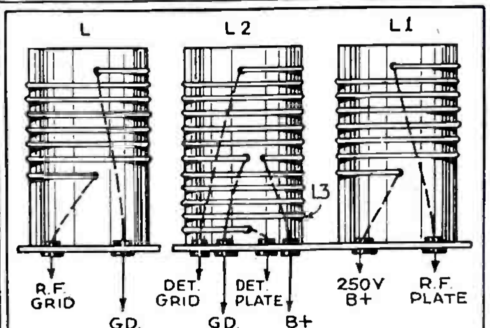


FIG. 2

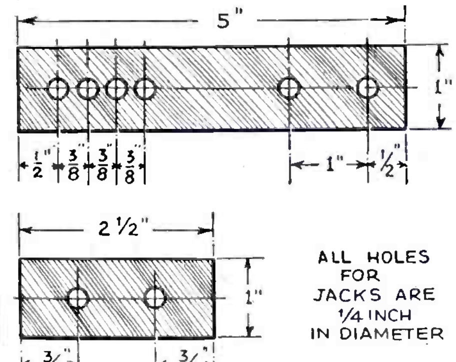


FIG. 3

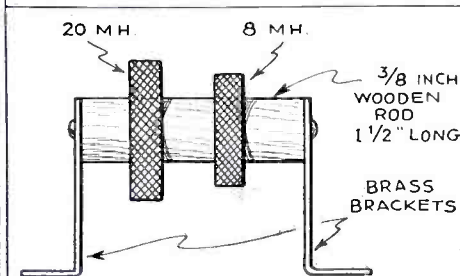


FIG. 4

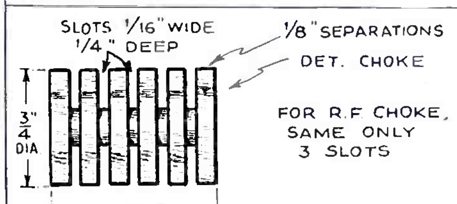


FIG. 5

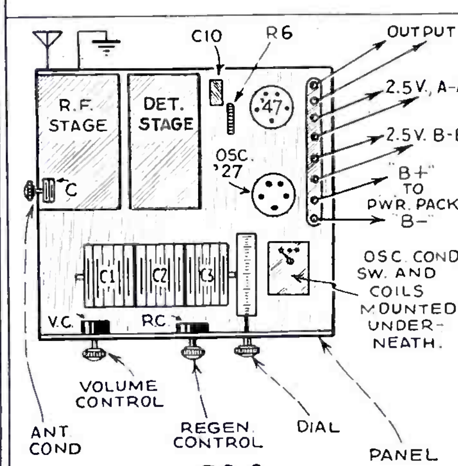


FIG. 6

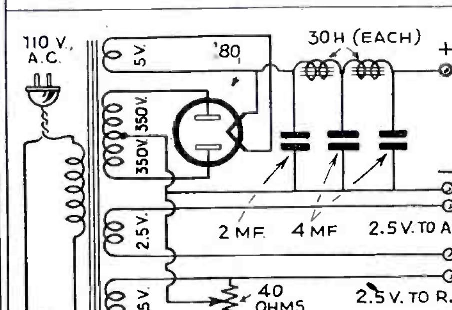
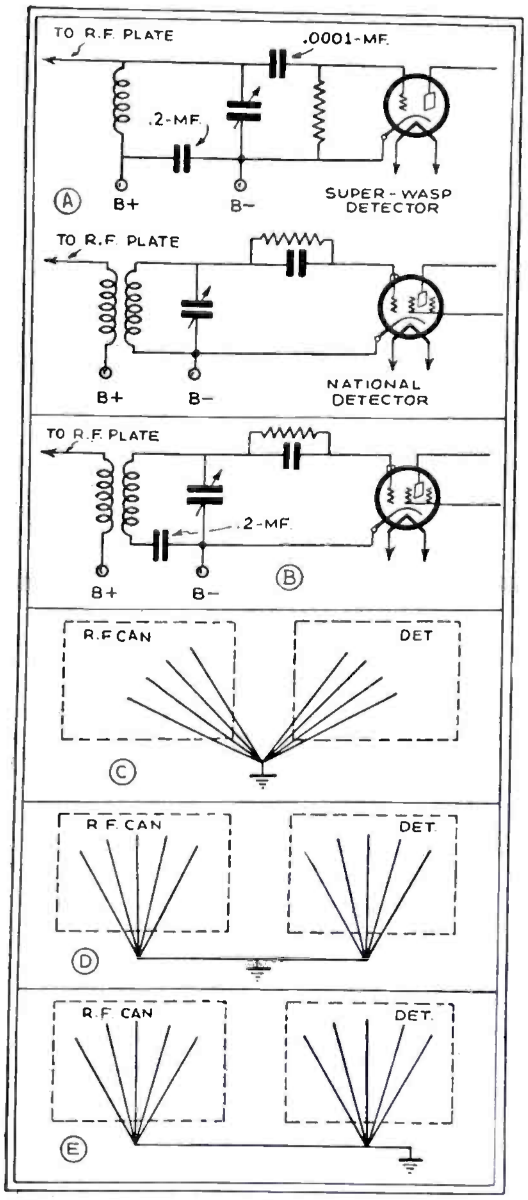


FIG. 7

Details of the various coils, arrangement of the apparatus and the hook-up of plate supply unit.



Diagrams above show improved form of detector circuit as worked out by Mr. Slack; C, D, and E show optional methods of "grounding."

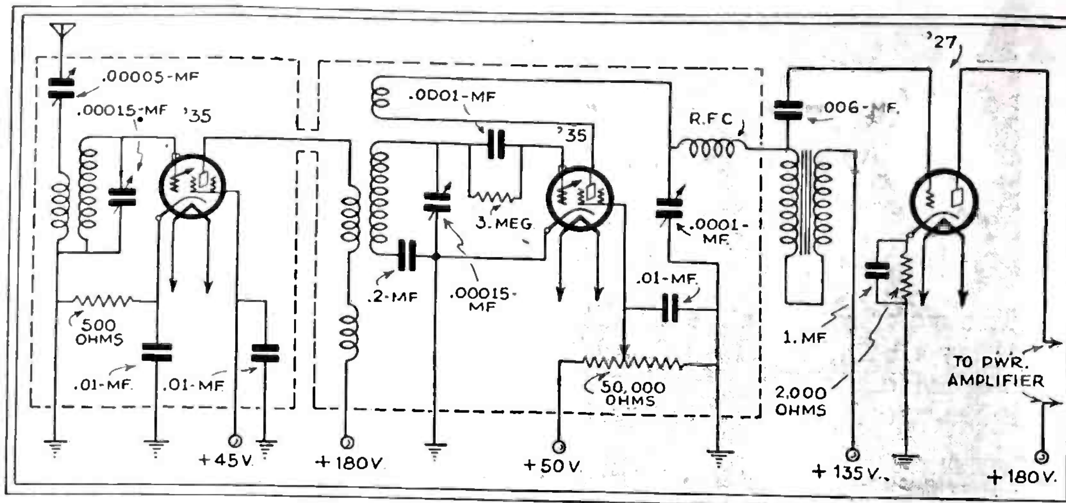


Diagram "F", showing Mr. Slack's idea of a good short-wave receiver with smooth control of regeneration and other features.

Smoothing Up the Regeneration Control

By ROBERT J. SLACK

● MUCH has been said and written as regards capacity versus screen-grid voltage control of regeneration; they both have their merits. The capacity method allows a quieter and smoother control, but has the disadvantage of disrupting the tuning, especially on the higher frequencies.

It is claimed that the new '35 tube, when used as a grid-leak detector plus screen-grid regeneration control, has the ability to hold its critical point much steadier when this arrangement is employed. However, I use a combination of the two methods, by employing a variable voltage to the screen and a .0001-mf. variable in the plate circuit of the '35 detector, thus allowing the screen-grid voltage to be set at its peak operating value (and it has one) and retaining the smooth and gradual features of the condenser.

This adds another control that looks worse on paper than in practice, because the screen-grid voltage knob is just an auxiliary and need rarely be touched when once set, except on extremely weak signals, when every bit of efficiency counts.

When a greater than necessary number of turns are on the tickler coil and the screen-grid voltage is adjusted to its correct value, the tube will "plop" in and out of regeneration. The only alternative is to reduce the number of turns on each coil until the correct number is found.

If possible, separate plate and filament transformers should be used. I wound my own filament supply transformer and when finished it delivered 2.75 volts without a load and I immediately concluded that a 3-tube load would bring it down to "about" the correct value. It did—about. For the next month my set "plopped" until I finally exhausted everything else and measured the heater voltage (under load). It read 2.6 volts. After connecting a 40-watt bulb in series with the primary and reducing the voltage to 2.3, everything began to function again.

When changing over a Super-Wasp circuit from conductive to inductive coupling as per diagram A, I encountered a terrific *tunable hum* and this was solved by combining the Super-Wasp with the National arrangement as per diagram B.

I believe that it is universally agreed that the R.F. plate voltage does not belong on the detector grid condenser. A very slight leakage across this condenser results in erratic behavior of the set and an annoying interlocking between circuits results.

Another prolific source of trouble exists in the method employed in grounding the various apparatus. Each R.F. stage should be completely isolated in its own aluminum or copper can and the different parts inside the can should be grounded as per diagram C, with D and E as second and third choice, respectively. This of course also applies to the detector can.

All "B" voltage leads from set to power-pack should be shielded. A piece of ordinary BX conduit cable with regular wires and wrapping removed is large enough to hold these. Also, don't forget to ground the metal sheath to B-minus. It is also good practice to enclose the 110-volt A.C. leads from the power-pack to line in this cable, if at all near R.F. portion of set. I don't believe there are many cases of inductive hum resulting from proximity of aerial to A.C. lines. However, this can be determined by simply removing aerial from set.

All connections should be soldered with rosin and not acid core solder.

A.C. filament leads from set to pack should be as short and direct as possible, twisted, and not smaller than No. 10 wire. A good A.C. voltmeter should be used to measure the voltage to the heaters of the tubes while under load, and this should come mighty close to the manufacturer's recommended voltage.

The trend in short wave receiver design as in broadcast receivers, is fewer controls and gadgets. This works out very well in a broadcast receiver employing numerous R.F. stages, but in the average short-wave set with its lone little R.F. stage, I don't care to sacrifice my set's sensitivity for simplicity achieved by ganging controls. A casual glance at F will reveal at least five controls. The average "ham" operator will raise his hands in holy horror at this, but it so happens that I am interested solely in tuning in short-wave broadcasts and want every last bit of efficiency when hunting for VK2ME, etc.

It is all very well to quote how well the circuits in this or that set are matched, how the condenser plates are staggered, the low loss of this and that, but the fact remains that there is a slight loss and I don't care to lose a microvolt when I arise some cold, frosty morning to hear HSP2.

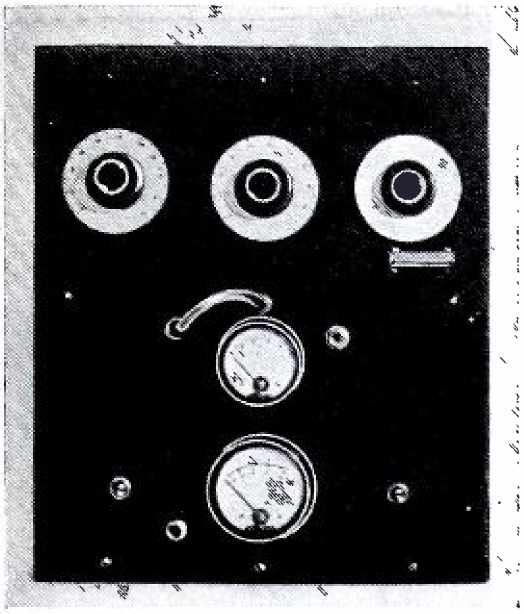
DID YOU VOTE

for your

"IDEAL" S-W Receiver?

IF NOT—

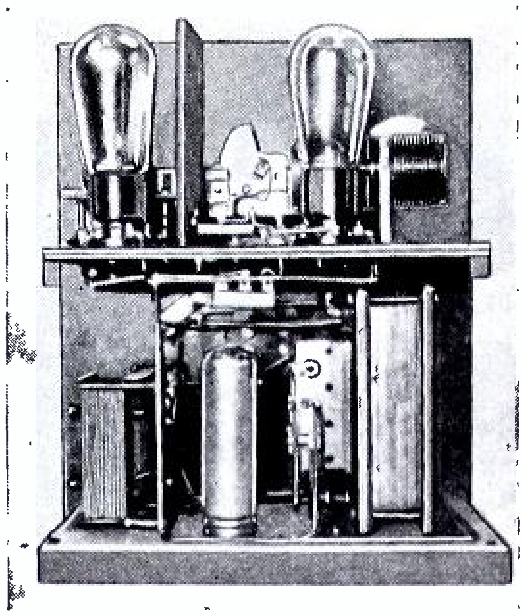
Refer to page 422 of the November issue of SHORT WAVE CRAFT, where the editors explained at length that when a sufficient number of ballots (printed on page 433 of the November issue) have been received, that they will have a composite receiver built embodying all the worthwhile ideas suggested by our readers. If you do not have a copy of the ballot send the editor a brief list of the salient features you would expect in a modern S-W receiver. After the "Ideal" set is built it will be fully described in SHORT WAVE CRAFT.



Front view of 2 tube portable transmitter.

Taking the "Headaches" out of Crystal Control

By George W. Shuart (W2AMN)



Rear view of 2 tube transmitter with crystal control.

A nifty 2 tube portable transmitter is here described, which employs crystal control in a greatly simplified circuit, utilizing '47 type tubes and an '82 mercury vapor rectifier.

● DUE to the popularity of crystal control among both amateur and commercial stations, many new circuits and tubes have been developed to increase the efficiency and stability of radio transmission. The principal tube adapted to crystal control was the type 47, which was originally intended as a pentode. This increased the efficiency and stability of crystal oscillatory circuits considerably, as most of us have discovered. However, the author has discovered a new use for this tube which has undoubtedly been overlooked.

The object of crystal control is obviously to obtain frequency stability. However, good frequency stability has only been obtained by the use of temperature controlled crystals, or by a very low-powered oscillator followed by numerous amplifier stages to obtain sufficient excitation for the amplifier feeding the antenna. It can readily be seen, therefore, that if the oscillator output were increased, a few amplifier stages could be eliminated. With the average circuits the application of 500 volts to the plate of the oscillator tube would undoubtedly wreck the crystal or cause serious heating which would result in *frequency drift.*

The Author's New Circuit Idea

For some time the author has been using a circuit in which 500 volts can be applied to the plate of the tube in the crystal stage and in which there is less heating and frequency drift than in the usual circuit using in the neighborhood of 150 volts.

It has been overlooked that the type 47 will operate very efficiently with the screen and control grids tied together and connected through a radio frequency choke to a filament center tap. This eliminates external grid bias of any kind, and holds the plate current to the order of 3 to 4 milliamperes at 500 volts. This causes the tube to have a very high amplification factor, which results in comparatively large output with a low input voltage. (As it creates a second harmonic only slightly weaker than the fundamental it is ideal when followed by a frequency multiplier.) With the grids tied together in this manner it is possible to drive the current to 80 ma. and still operate efficiently and with stability.

In the diagram is shown the type 47 in its role of oscillator and also class "B" amplifier. These tubes are both operated from a common power supply, as the amplifier has no detectable effect on the oscillator, even when the amplifier is being keyed.

Oscillator Plate Tank Condenser

The plate tank tuning condenser of the oscillator stage should not exceed .00015 mf. in order to obtain full efficiency of the circuit, resulting in high LC ratio. The excitation lead to the amplifier should be tapped at approximately one-third of the distance from the low potential end of the oscillator tank. Extreme care should be taken, as this adjustment is very critical. The recommended capacity for the excitation coupling condenser should be in the order of .0001 mf. or less. Neutralizing for this type of amplifier should be done within the stage itself, as shown in the diagram. It has been found that the amplifier stage would not neutralize if the tuning condenser was shunted across the whole coil, a part of which is used in neutralizing. Therefore, the design of the amplifier tank coil and neutralizing coil should be carefully followed.

Details of Coil

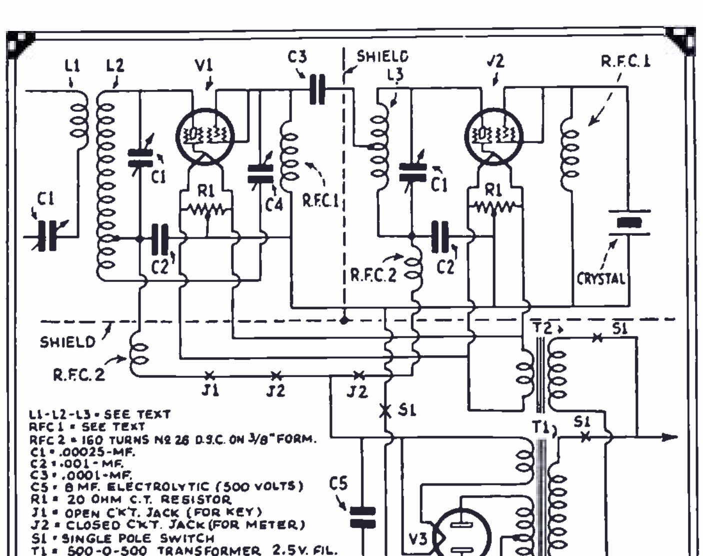
The coils are wound with No. 14 B. & S. enameled wire on 2 inch forms, spaced approximately the diameter of the wire. This is accomplished by winding string along with the wire, then removing the string, and coating with clear Duco. The antenna coil (L1) has 12 turns, and is wound on the same form as the amplifier tank coil. Spacing between the two is one-half inch. The amplifier plate coil (L2) has 25 turns, 20 of which are shunted by the amplified tuning condenser, the remaining five being the neutralizing coil. The oscillator coil (L3) has 20 turns and is wound in the same fashion as the above.

From the description it can be seen *that much apparatus can be eliminated from crystal controlled transmitters.* Therefore this would make an ideal portable. Following is a description of the portable built by the author.

Portable Transmitter

The complete outfit, including the oscillator amplifier portion and power supply, is inclosed in a case 14 inches high, 12 inches wide, and 7 inches deep. An aluminum shelf through the center separates the radio-frequency unit from its power supply. In the lower compartment is mounted T1 as in the diagram. The high voltage secondary of this transformer supplies 500 volts to the oscillator and amplifier, at approximately 150 ma. T2 is the filament transformer suppling 2.5 volts to oscillator and amplifier filaments. However, a transformer with two separate windings could be used in order to key the amplifier at the filament center tap, i the builder does not wish to key the amplifier in the high voltage lead as shown in the diagram. The rectifier problem is nicely solved by the use of

(Continued on page 508)



Wiring diagram of Mr. Shuart's 2 tube portable transmitter, featuring crystal control.

The SHORT WAVE Beginner

By C. W. PALMER

No. 6 of a Series **How Signals are Sent and Received**

Mr. Palmer explains in language for the layman just how radio signals are transmitted and received, also the meaning of wave-length and frequency

● WE have now developed our short-wave receiver to a point that we can sit back and enjoy it. The addition of the amplifier last month permits the powerful stations in the vicinity and even some of the far-distant ones to be heard on the loud speaker. Of course, we can not expect to hear the Dutch East Indies or such remote spots with enough volume to wake up the neighbors, but with careful tuning, it will do all that can be desired.

In the next issue, we will continue to improve the receiver, adding a power amplifier to produce the full loud speaker volume. This will include a power supply device to eliminate the "B" batteries and later the "A" batteries as well. However, this is "crossing our bridges" before we get to them.

The question in mind just now is—how does our short wave receiver work? What makes it pick up stations a thousand miles or more away and how does the transmitter or broadcasting station send out the programs? In other words, how does radio work?

Let us refer back to the first article of this series, in which atoms and electrons were explained. We will remember that each atom was made of a certain number of electrons and protons, arranged in "shells" or orbits very similar to the way in which the stars rotate around the sun. The electrons that move in this way are known as *planetary* electrons to differentiate them from the electrons in the nucleus. It requires the application of a force to move one of these electrons away from the atom, which then leaves the atom with an unbalanced positive charge. Each electron possesses a certain amount of attraction to the atom, depending on the distance separating it from the nucleus.

It is a well-known law of physics that energy can neither be created nor destroyed. It can, however, be transferred from one form to another. There are two kinds of energy—kinetic energy, which is *energy in motion*, as the force of a vehicle in motion—and potential energy, or the *energy at rest*, such as a large rock suspended at a height which becomes very powerful if released. See Figs. 1 and 2.

Now to return to the atom. If an electron is knocked from one orbit to another, some energy is either absorbed or emitted. If the electron is knocked from an outer to an inner orbit, for example, the difference in the attraction of the two positions must be given up. This energy is radiated in the form of electromagnetic radiations and for each electron moved, a certain definite amount of energy known as a "quantum" is radiated into space at the uniform speed of 186,000 miles per second.

All this may seem rather far removed from radio transmission, but we will soon see how the two are connected. According to the theory of radiant energy, it is the scattering or radiating of these tiny units of energy through space that makes up the radio waves or rays. We are not certain whether the energy is transmitted by a sort of wave motion, as in the case of sound waves, which vibrate the air, or if groups of quanta move through space like bullets shot from a gun. To illustrate this, Fig. 3 shows two ways in which a bird may be killed, first by being struck by lead bullets and second by the concussion from large cannon being fired.

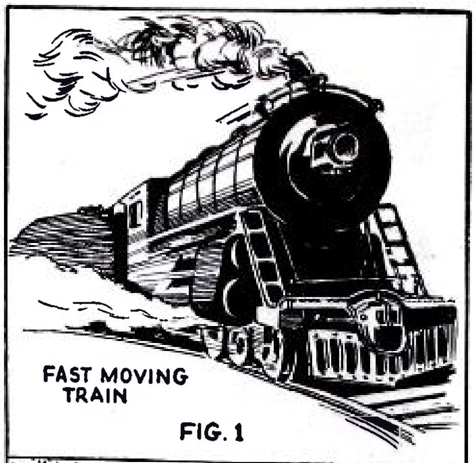
It seems probable at this time that the facts may be best explained by the wave theory, although if we consider the transmission of energy, the quantum theory is necessary for a satisfactory explanation of the conditions. Energy can be transmitted from one place to another by one of two means; either by wave disturbances as illustrated by the cannon or by the motion of particles of matter from some source. According to the wave theory, an electromagnetic disturbance travels by a wave motion and as it is impossible for most people to think of waves without a medium (as the water for ocean waves, the air for sound waves, etc.) a hypothetical "ether" has been used as the medium to carry the magnetic wave motion.

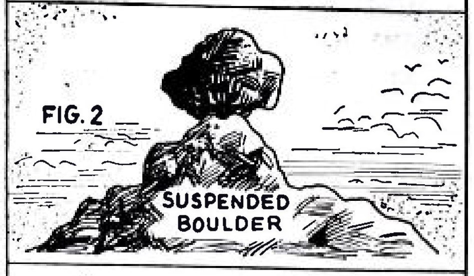
Another Explanation

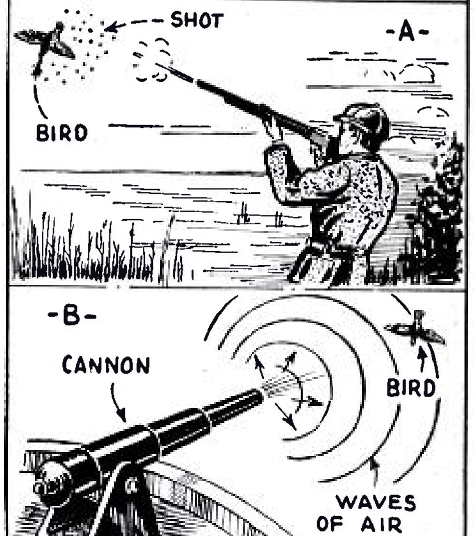
If the above description of the radio wave is difficult to visualize, perhaps we can give another illustration that will make it easier. If we refer again to the first article of this series and read over the explanation of induction, we will find the explanation. In just the same way as the current in one coil can start a similar current in the second coil, the current at the transmitter sets up currents in the receiver. If the two coils of the induction experiment are small, the magnetic field around the coils is small. On the other hand, if the coils are made larger, the field also increases in size.

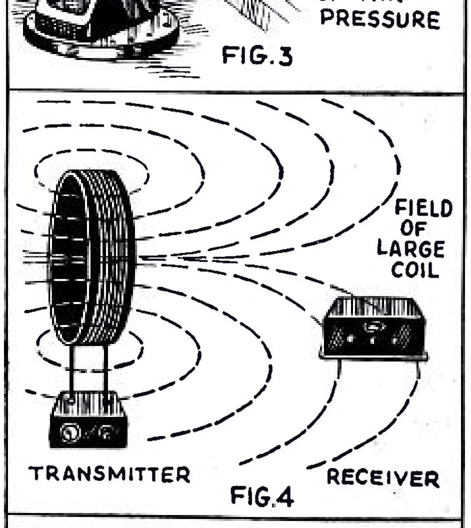
To transport energy over a great distance, it would seem that enormous coils would be necessary. Such a con-

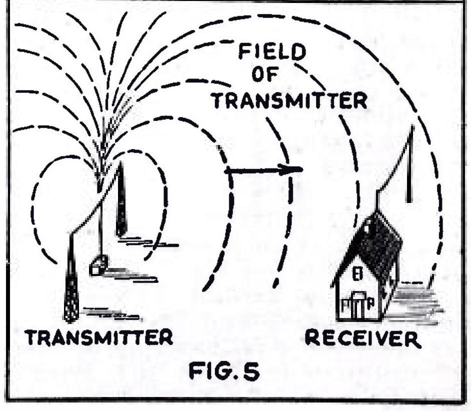
(Continued on page 498)







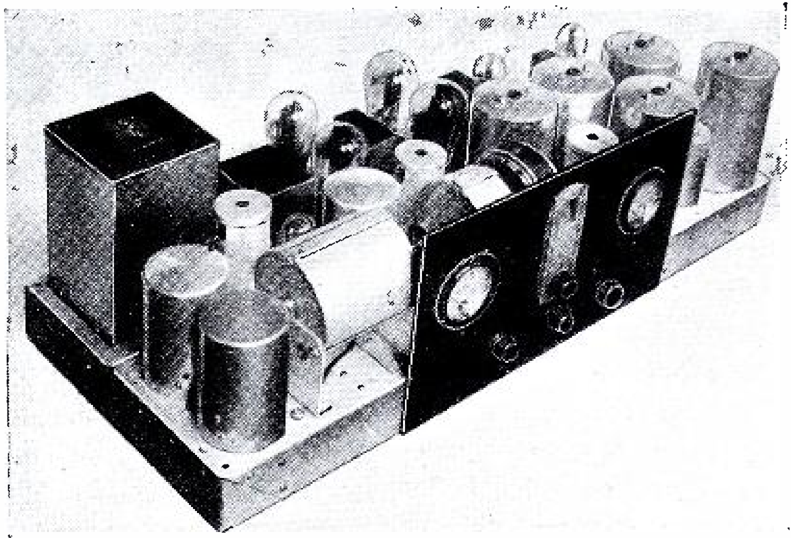




1. Example of "kinetic" energy; 2. "Potential" energy; 3. Direct hit and "wave" action; 4. Transmission by induction; 5. Ether wave transmission.

The Norden-Hauck ADMIRALTY Super-15

This high-class 16-tube super-het receiver tunes all waves from 16 to 560 meters. Has dual loud speaker, band-pass tuning, and uses new R.F. pentodes, providing maximum power and selectivity.



Appearance of the 16-tube, "All-Wave" Norden-Hauck receiver

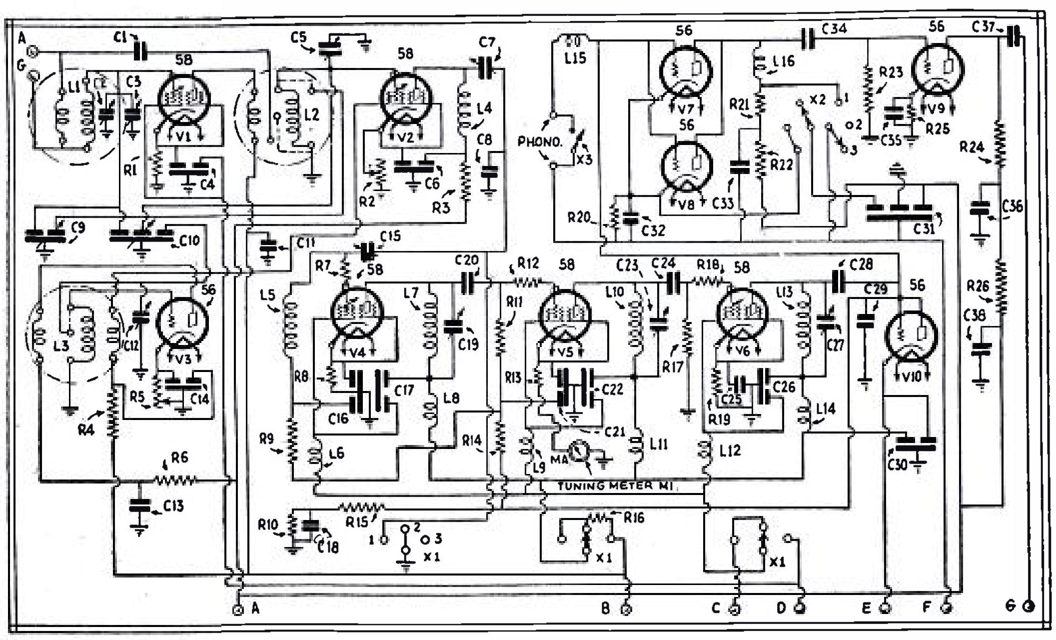
● The Admiralty Super-15 is one of the most impressive and efficient receivers offered to the radio enthusiast. Using 16 tubes of the latest type, it will reach over any distance and at the same time provide keen selectivity with faithful reproduction. It operates both on short wavelengths and the broadcast band, between 16 and 560 meters. The design and construction are very similar to the earlier Super-12, a model which was built for the King of Siam last year.

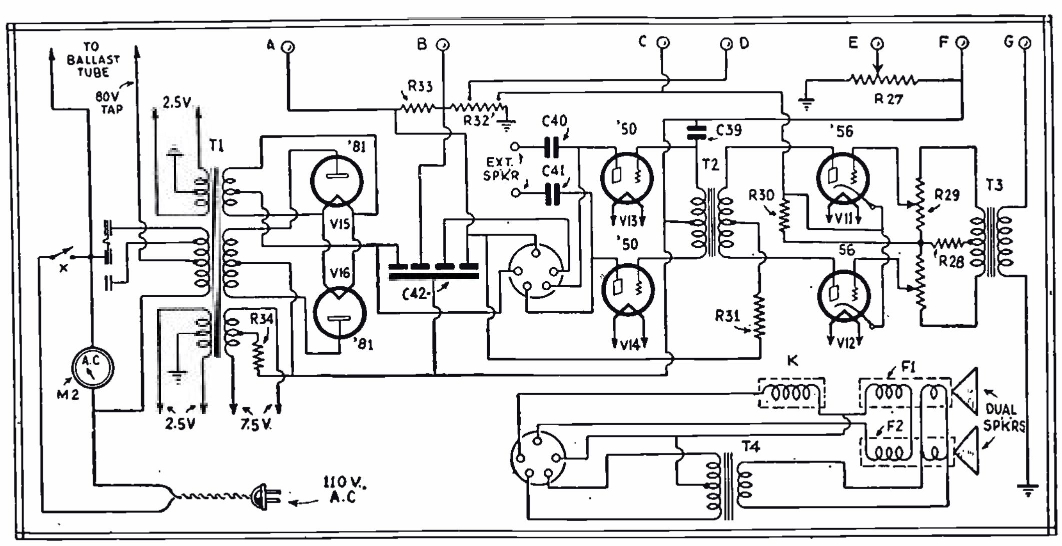
Special dual dynamic loudspeakers are used as standard equipment. The cones are of different diameter so as to respond more readily to upper and lower frequencies with maximum transfer of energy from the amplifier.

Broadcast Coil data: The antenna coupler L-1 consists of an outside coil 1¼" in diameter with 88 turns of No. 30 enameled wire, space wound. The primary consists of a small spool ½" center, ¼" slot, wound with 200 turns of No. 36 D. S. C., scrambled. The detector coupler L-2 has a secondary winding of 88 turns No. 30 enameled wire, space wound, 1¼" tube. The primary consists of a spool with a ½" center, ¼" slot, 75 turns, scrambled wound No. 36 D. S. C. The primary spool of both coils L-1 and L-2 are centered in the secondary coil. The oscillator coupler L-3 has the grid coil wound on a 1¼" tube and consists of 52 turns No. 28 enameled wire, space wound. The plate and pick-up coils are close wound with No. 30 D. S. C. wire, on a 1" tube, centered inside of the grid coil. The middle separation between the plate and pick-up coil windings is ¼". L-5 and L-13 coils consist of 245 turns, close wound No. 36 D. S. C. wire, on a 1½" tube. L-4, 7, and 10 consist of 240 turns each, close wound with No. 36 D. S. C. wire on a 1½" tube. All of these coils and couplers are shielded. The condenser unit C-12 consists of two section 500 mmf. each, straight line wavelength capacity which tune the antenna coupler and detector coil; and the 3rd section is 300 mmf. capacity with special curve plates to track with the other sections. This last condenser of course, is to tune the oscillator coupler.

Short Wave Coil Data: The antenna coupler L-1 is not changed for short wave reception. The detector coupler L-2 and the oscillator coupler L-3 are changed. Both the short wave coils L-2 and L-3 have 5-point selector switches which connect to taps on the coil windings. The amplification obtained in the Super-15 is so great that any small loss incurred by using a tapped coil is negligible. The short wave detector coupler L-2 consists of a single winding of 16 turns No. 24 bare copper wire, space wound ⅛" and tapped at 11 turns, 7½, 4½, and 3 turns; size of the tubing used for the coil form is 2" O. D. Wavelength range approximately 16-80 meters. The short wave oscillator coupler L-3 consists of an outside coil form 2" O. D. with the grid winding of 14 turns, tapped at 13, 3¼, 8¾, 5¾ and 2 turns. The inside coil winding is on a 1¾" form, with a plate coil and the pickup coil at six turns each, close wound in the center and spread from each other ¼". The outside winding of the coupler L-3 is a No. 24 bare copper wire, and the inside windings No. 24 D. C. C. wire. The outside grid winding is spaced ⅛". These coils are listed as type "A".

There is another set of coils type "B" covering a wavelength range between 80-200 meters approximately. The windings are on the same sized forms as the type "A" coils. The detector coupler L-2 has 38 turns, No. 24 bare copper wire, tapped at 26, 17 and 14 turns, by a 3-point selector switch, spaced ⅛". The oscillator coupler L-3 has an outside grid winding of 32 turns, spaced ⅛", No. 24 bare copper wire, and the inside windings consisting of 11 turns each No. 24 D. C. C. wire, close wound in the center of the form and spread from each other ¼". There is no selector switch on this coil, but the small knife switch shunts a 29 mmf. condenser across the grid winding in order to cover the entire frequency band.





Above: Wiring diagram of Norden-Hauck Super-15. Below, dual loud speaker and power audio line-up.

General List of Parts

L1—Antenna Coupler, shielded.
L2—Tuned R. F. Transformer, shielded.
L3—Oscillator Coupler, shielded.

(Continued on page 508)

The Binneweg 2-Tube 12,000

Simplified Description and Constructional Details of an Inexpensive Two-Tube "DX"-Getter, Together with the Greatest Amount of Condensed Practical Information on Two-Tube Sets ever Presented in a Single Article. All About It . . . What You Need . . . How To Build it . . . How to Make the Parts . . . How to Add Another Tube to Make it Into a Three-Tuber . . . How to Use A.C. Tubes Later . . . How To Tune it . . . Completely Detailed List of Parts . . . This Set Can be Built Without Any Radio Knowledge. This popular Article will start thousands of radio enthusiasts all over the World Hunting the Interesting Long-Distant Stations.

By A. BINNEWEG, JR.*

●ADVANCED experimenters will recall the difficulties encountered in building some of their first sets, according to the articles appearing in the early radio magazines. Why, the stuff they *left out* was enough to make a feller "bugs." The writer has endeavored to make this article an exception. The construction of short-wave receivers is going to be made so simple that anyone, without even a knowledge of diagrams, will be able to build one himself and get some of those distant stations that you hear them talk about.

For this purpose, I have selected a good old tested and tried circuit that I can almost guarantee to give you foreign stations the first time you try it out!

The writer described a set like this in 1926. Only a few fans were interested in short waves then. The set described here is an *Improved 1933 Model* of that set. It is designed especially for the thousands of short-wave fans who want to get going on the short waves this winter.

Here goes . . .

Naturally it's going to be a set that uses batteries, because power packs for electric sets cost too much. However, an A.C. hookup will also be given later. We are going to keep the initial cost down as far as we can. The cost of this set is around $10.00, including the two tubes, if you buy from a modern short-wave company. The headphones, if you need them, will probably cost a couple of dollars more. A complete set of batteries will cost around $4.00. Everything is conservatively estimated. You may be able to get the parts cheaper than this, but I wouldn't advise parts that are too cheap, because you may have trouble with them and the set won't work. The parts you will need are listed on the next page. You will need a soldering iron and a few common tools.

* Short-Wave Radio Engineer, Delft Radio Company

Constructing the Coils

It is best for an absolute beginner to buy a completed set of coils if he wants to be sure of results the first time. However, the directions given are quite simple. See Fig. 1. If coils are purchased, get them from an active short-wave concern; all coils are not alike, and some may be left-overs from some obsolete converter and may not work well.

By using an ordinary UX or 4-prong socket and corresponding tube-bases, a very efficient coil-changing arrangement results.

Four 4-prong tube-bases are needed. Clean these thoroughly, being careful not to crack them. Heat the ends of the prongs with a soldering iron, and shake the old solder out. The tube bases are drilled with a small drill for the ends of the windings. The wire is run through the holes, into the prongs, scraped, and soldered at the ends of the latter.

Here are the coil specifications:

Coil Number	Wavelength Range in Meters	Turns on Secondary Coil	Turns on Ticker Coil	Distance Between Windings (See Fig. 1)
1	19-34	5	5	1/16"
2	31-58	10	5	1/16"
3	54-102	20	5	none
4	100-210	55	11	none

For the first three coils use No. 28 D.C.C. wire; for the last coil use No. 28 enamel wire (a longer tube base is necessary for this coil, because of the longer winding and many turns). The condenser used is a .0001 mf. midget variable condenser. Wind all turns of each separate winding close together. Do not "dope" or paint the wire in any way. You may "touch up" the rest of the tube base with shellac, but do not touch the wire.

The antenna series-condenser, shown in the aerial lead in the diagrams, is made of two pieces of aluminum, copper or brass. The two plates are cut with tin-snips to the dimensions shown in Fig. 2. The metal for the plates should be thick enough so that the plates do not vibrate when the completed set is moved. Drill one hole in each plate for mounting to the baseboard. The assembly of the antenna condenser is shown in Fig. 6.

Panel and Baseboard Details

With all necessary parts at hand, and the coils wound, drill the panel for the condensers and rheostat as shown in Fig. 3. The exact size of holes to drill will depend on the condensers and the rheostat you use, but the location of the holes shown will in general be found to be correct. Mount the apparatus on the panel.

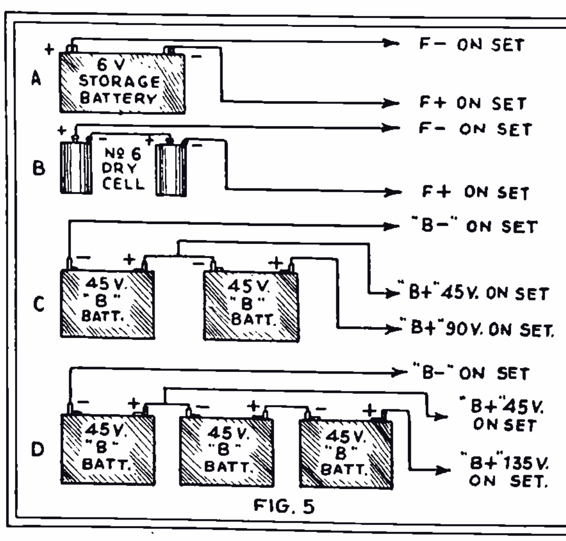
All parts are mounted on the baseboard in the positions shown in Fig. 4. The two plates for the antenna condenser are mounted ⅛" apart. This baseboard arrangement is a good one and should be followed. The panel is then secured to the baseboard. The circuit diagram in Fig. 4A is the same as used in Fig. 4. Compare the letters used on the parts in each of these diagrams.

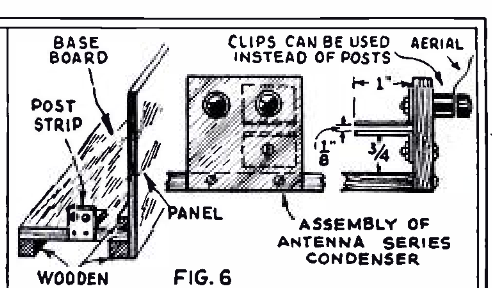
When wiring the set, use rosin-core solder and a good grade of hookup wire. Any good covered wire of No. 18 or 20 gage will serve. Soldering lugs are convenient to solder to, if used, for example, under the screws on the audio transformer.

The connections of Fig. 4 are very easy to follow. The position of each and every wire is shown. Keep the leads between the tube, coil socket and tuning condenser as short as convenient.

The two tubes used (V1 and V2) plug into the two sockets marked "detector tube socket" and "amplifier tube socket." The coils plug only in the socket marked "coil socket" in Fig. 4. The two tubes used must be of the same kind. You can use two 01-A's with a six volt storage battery to supply the filaments voltage, or you can use two two-volt tubes, which need only two dry cells for the filament supply. No matter which tubes you use, two 45-volt "B" battery blocks will operate the set. If you use 01-A tubes and a storage battery, you will need a 6-ohm rheostat. A 10-ohm rheostat is necessary for the two-volt (type '30) tubes.

The complete battery connections are shown in Fig. 5. One clip on the set is





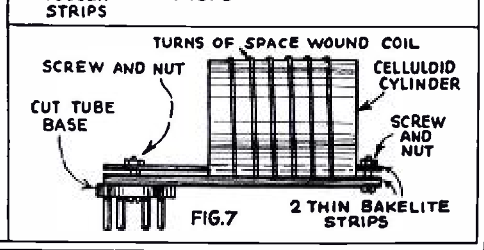


Fig. 5—left, battery connections for the Binneweg 2-tube receiver. Fig. 6—Assembly of the antenna series condenser. Fig. 7—Mounting for celluloid-supported low-loss coils.

Mile "DX" Receiver

marked "plus 90 to 135 volts"; this simply means that you can use either 90 or 135 volts on the set. If you use two "B" batteries, as shown at C in Fig. 5, the "plus B 90" goes to that clip. If you want a little more volume, use three "B" batteries and connect them like D in Fig. 5, running the "plus B 135" to the clip on the set marked "plus 90 to 135 volts." It is suggested that only two 45-volt blocks be used at first.

All the parts needed for this set are listed below, together with other useful information.

List of Parts for Binneweg Two-Tube Set

1 7"x12" Panel.
1 ¾"x9"x11" Baseboard. (If only a thin baseboard is at hand, cut also 3, ¾"x⅜"x9" wooden strips and use the panel supporting idea in Fig. 6.)
Piece of Metal for Antenna Condenser Plates.
2 Dials or Knobs.
1 100 mfd. Midget Variable Tuning Condenser. A .00014 or .00015 mf. condenser can also be used for tuning.
1 .00035 mf. Regeneration Control Condenser.
1 Set of Short-Wave Coils, range 15 to 200 meters.
2 UX Tube Sockets.
1 Rheostat (6-ohm size if '01-A tubes are to be used; a 10-ohm size is necessary for two-volt, type '30 tubes).
1 3-to-1 Audio Transformer.
9 Fahnestock clips (regular binding posts may be used if desired). Note: If posts are used, you need a piece of bakelite for a post strip.
1 Small Bakelite piece for antenna-ground post-strip (2¼"x2¾").
Hookup Wire.
1 3-megohm gridleak.
1 .00015 mf. fixed, mica, grid-condenser.
1 Gridleak holder.
1 85-millihenry R.F. choke (You can operate the set without this choke, but it is best to use one).
Small Screws, Nuts, etc.

If you are going to make the coils, you will need about 25 ft. of No. 28 wire (D.C.C.), and about 25 ft. of No. 28 enamel covered wire; also four 4-prong tube bases, or four 4-prong Coil forms.

This information is sufficient for you to go right ahead and build this set. Following, however, you will find some valuable information on how to tune in distant stations and also how to carry on experiments with a set of this kind. A diagram is given for adding another tube to this set. Should you desire to try out A.C. tubes, a diagram of connections is also given.

There may be some experimenters who may desire to use low-loss space wound celluloid supported coils. If the coils are used for plug-in, a simple mounting arrangement is shown in Fig. 7. Two strips of thin bakelite, arranged as a clamp, are mounted on a tube base. For only secondary and tickler windings, as for this set, the 4-prong base will serve.

Using a .0001 mf. condenser, the specifications of two-inch diameter coils of No. 20 wire (with a space between turns equal to the wire diameter, except the largest coils) are as follows:

Primary (if used) Turns	Secondary Turns	Tickler Turns	Wavelength Range in Meters
5	3	4	16-26
5	6	5	23-39
7	13	5	37-80
9	36	5	76-160

Slight differences in construction will influence the ranges of individual coils somewhat. Connections to the coil socket should be exactly as in Fig. 4, if both coils are wound as shown in Fig. 1. Make the windings the same as for tube-base coils.

Tuning the Set

Turn the tuning condenser so that all its plates are "all the way out," and adjust the regeneration condenser (the larger one) carefully over its entire scale, proceeding slowly until a rushing sound is heard in the head phones; this indicates that the tube is oscillating. While tuning with the small tuning condenser, move the regeneration control condenser so as to maintain the tube at this sensitive point.

Experimenting With Coils

If you want to experiment with coils at short waves, and learn more about short-wave receivers, get the set working first with about a 25-turn secondary coil, then gradually reduce the number of turns to get lower and lower wavelengths, making at the same time proper reductions in the tickler winding. Experiment with the set to learn its peculiarities. Use separate secondary and tickler windings until you know how to operate it properly. If the regeneration condenser must be turned to full capacity for proper oscillation, the tickler coils are too small (too few turns).

If the set will not oscillate, try a different number of turns in the tickler coil; or start with a large size (say about 10 turns closely wound to the same diameter as the secondary coil), and gradually take off turns until you can bring the set smoothly into oscillation at the center of the regeneration control dial. Try each new value with the tickler close to the secondary. It is important to have the tickler coil wound in the proper direction with respect to the winding direction of the secondary coil; both coils should be wound in the same direction for connection as in Fig. 4A.

When testing a tickler coil, first turn the tickler one way with respect to the secondary coil. If no oscillations, simply twist the coil around through 180 degrees and try again; this procedure is repeated for each different coil size until the correct value is reached. It's really easy. Leave the regeneration condenser *in* all the time while testing ticklers. (Note: Don't remove the tickler coil and reverse the direction of its winding and its terminals at the same time, because you will be back where you started. Either reverse the terminals only, or turn the coil around only.) When testing for oscillations, there is more tendency to oscillate when the regeneration condenser has the highest capacity and the secondary condenser its lowest setting at the same time.

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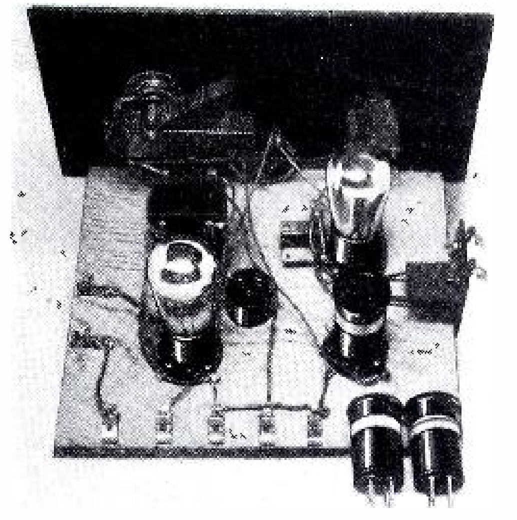
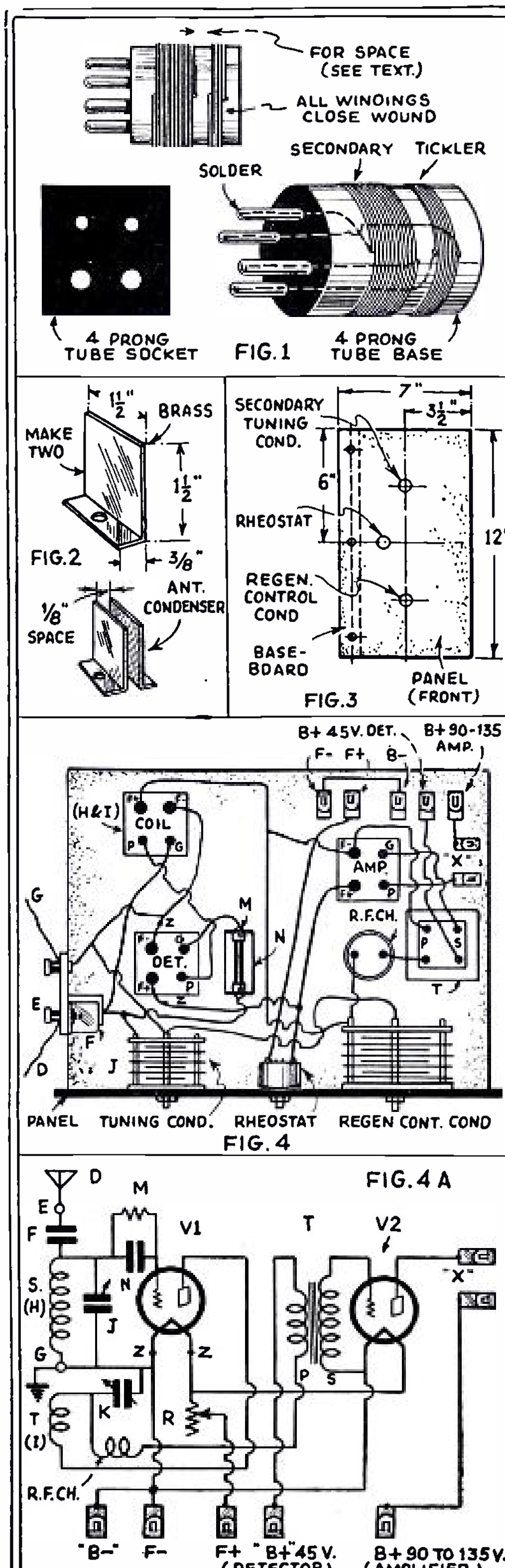


Here's the Binneweg 2-tuber, which has world-wide reception range under favorable conditions, when used with a pair of high-quality phones, such as a 4000 ohm set.



Details of plug-in coils, and also panel, sub-panel, and schematic wiring details.

SHORT WAVE STATIONS OF THE WORLD

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

Short Wave Broadcasting Stations

Wavelength (Meters)	Frequency (Kilocycles)	Call Letters	Address and Schedule
13.93	21,540	W8XK	Westinghouse Electric, East Pittsburgh, Pa. 7:30 a.m.-noon.
15.93	18,830	PLE	Bandoeng, Java. Wednesdays, 4:00-8:00 a.m.
16.87	17,780	W3XAL	National Broadcasting Co., Bound Brook, N. J.
		W9XF	Downers Grove, Ill.
19.56	15,330	W2XAD	General Electric Co., Schenectady, N. Y. Broadcasts 3-6 p.m. daily; 1-6 p.m. Sat. and Sunday.
19.65	15,270	W2XE	Wayne, N. J.
19.68	15,240	FYA	"Radio Colonial," Pontoise (Paris), France. Service de la Radiodiffusion, 103 Rue de Grenelle, Paris. Daily 8:30-10:00 a.m.
19.72	15,210	W8XK	Westinghouse Electric & Mfg. Co., East Pittsburgh. 7:30 a. m. to 5 p.m.
		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	13,940	....	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	11,905	FYA	"Radio Colonial," Pontoise (Paris). See listing for 19.68 meters. Daily 1:00-2:00 p.m.
25.24	11,880	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.
		W8XK	Westinghouse Electric, East Pittsburgh, Pa. 4-10 p.m.
25.34	11,840	W9XAO	Chicago Federation of Labor, Chicago, Ill. 7-8 a.m., 1-2, 4-5:30, 6-7:30 p.m.
25.36	11,830	W2XE	Wayne, N. J.
25.4	11,810	I2RO	"Radio Roma Napoli," Rome, Italy. Daily, 11:30 a.m. to 12:15 p.m. and 2:00-6:00 p.m. Sunday, 11:00 a.m.-12:15 p.m.
25.42	11,800	VE9GW	W. A. Shane, Chief Engineer, Bowmanville, Canada. Daily, 1-4 p.m.
25.45	11,790	W1XAL	Boston, Mass.
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. Programs: 6:30-7:30 a.m. and 12:15-6 p.m. News: 6:30 a.m. and 12:15-6:00 p.m. Transmits every day except Sunday.
		VE9JR	Winnipeg, Canada. Weekdays, 5:30-7:30 p.m.
25.6	11,705	FYA	"Radio Colonial," Pontoise (Paris). See listing for 19.68 meters. Daily, 3:00-7:00 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.
30.4	9,860	EAQ	Transradio Espanola, Alcala 43-Madrid, Spain. (P. O. Box 951). Daily for America, 6:30-8:00 p.m.; for Europe and Canaries on Saturdays only, 1:00-3:00 p.m.
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., 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. Daily.
31.49	9,520	OXY	Skamleboek, Denmark, 2-7 p.m. daily.
31.55	9,510	VK3ME	Amalgamated Wireless, Ltd., 167-169 Queen St., Melbourne, Australia. Wed. 5:00-6:30 a.m., Sat. 5:00-7:00 a.m.
31.58	9,500	PRBA	Radio Club of Brazil, Rio de Janeiro. 4:30 p.m. to about 8:00 p.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., Budapest, Muegyetern.

(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
41.67	7,195	VSIAB	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	CTIAA	Lisbon, Portugal. Fridays, 5-7 p.m.
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.
48.86	6,140	W8XK	Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa. 5 p.m.-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	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. 5:00 p.m. to midnight.
49.18	6,100	W9XF	Downers Grove, Ill.
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, Ltd., 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.; Tuesdays, 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	6,040	PK3AN	Sourabaya, Java. 6-9 a.m.
		W4XB	Lawrence E. Dutton, care Isle of Dreams Broadcast Corp., Miami Beach, Fla.
49.75	6,030	VE9CA	Calgary, Alta., Canada.
49.96	6,005	VE9DR	Canadian Marconi Co., Drummondville, Quebec. 6-10 p.m. daily.
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.

SHORT WAVE STATIONS OF THE WORLD

(Continued from opposite page)

Short Wave Broadcasting Stations

70.20	4,273	RV15	Far East Radio Station, Khabarovsk, Siberia. Daily, 3-9 a.m.
7.05	42,530	....	Berlin, Germany. Tues. and Thurs., 11:30-1:30 p.m. Telefunken Co.
80.00	3,750	F8KR	Constantine, Tunis, Africa. Mon. and Fri.
		I3RO	Prato Emeraldo, 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
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.
			Vienna, Austria, Mon., Wed., Sat.
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. Daily 3-6 p.m., Sunday, 10 p.m.
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.
14.89	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.
15.55	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.
15.94	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.
16.61	18,050	KQJ	Bolinas, Calif.
16.80	17,850	PLF	Bandoeng, Java ("Radio Malabar").
		W2XAO	New Brunswick, N. J.
16.82	17,830	PCV	Kootwijk, Holland. 9:40 a.m. Sat.
16.87	17,780	W8XK	Westinghouse Electric 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	W8XL	Dayton, Ohio.
		W6XAJ	Oakland, Calif.
		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.
20.65	14,530	LSA	Buenos Aires, Argentina.
20.70	14,480	GGBW	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	12,045	NAA	Arlington, Va. Time signals, 11:57 to noon.
		NSS	Annapolis, Md. Time signals, 9:57-10 p.m.
24.98	12,000	FZG	Saigon, Indo-China. Time signals, 2-2:05 p.m.
25.10	11,945	KKQ	Bolinas, Calif.
25.65	18,680	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.
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.
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.
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.

(Continued on next page)

"STAR" SHORT WAVE BROADCASTING STATIONS

The following stations are reported regularly by many listeners, and are known to be on the air during the hours 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, 6:30-7:30 a.m. and 12:15 to 6:00 p.m.

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 5:00-6:30 a.m.; Saturday 5:00-7:00 a.m.

FYA, "Radio Colonial," Paris. On 19.68 meters, daily 8:30-10:00 a.m.; on 25.16 meters, daily 1:00-2:00 p.m.; on 25.6 meters, daily 3:00-7:00 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.

TI4, 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.

EAQ, Madrid, Spain, 30.4 meters, 6:30 to 8 p.m. daily; 1 to 3 p.m. Saturday.

RV15, Khavarovsk, Siberia, 70.2 meters. Daily from 2 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
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.

Wavelength (Meters)	Frequency (Kilocycles)	Call Letters	Address and Schedule
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	WIXAB	Portland, Me.
72.87	4,116	WOO	Deal, N. J.
71.72	4,105	NAA	Arlington, Va. Time signals, 9:57-10 p.m., 11:57 a.m. to noon.

Wavelength (Meters)	Frequency (Kilocycles)	Call Letters	Address and Schedule
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.
193.5	1,550	W2XCE	Passaic, N. J.

Airport Stations

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.
91.52	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.
		KFD	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

3.75 to 5 meters—60 to 80 megacycles.
5.96 to 6.18 meters—18.5 to 50.3 megacycles.
6.52 to 7.11 meters—42 to 46 megacycles.

		W8XF	The Goodwill Station, Pontiac, Mich.
		W3XE	Philco Radio, Philadelphia, Pa.
		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. Sight and Sound Transmission daily except Saturday and Sunday.
		W2XBO	Long Island City, N. Y.
		W3XE	Philco Radio, Philadelphia, Pa.
		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.

130.4 to 136.4 meters—2,200 to 2,300 kc.

W9XAL	First National Television Corp., Kansas City, Mo.

136.4 to 142.9 meters—2,100 to 2,200 kc.

W2VBS	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.
W2XCE	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	Western Television Research Co., Chicago, Ill.
W9XAA	Chicago, Ill.

Police Radio Stations

Wave-length (Meters)	Fre-quency (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.
		KGPW	Salt Lake City, U.
		WRDQ	Toledo, Ohio
		....	Klamath Falls, Ore.
122.0	2,458	YPDO	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.

Wave-length (Meters)	Fre-quency (Kilo-cycles)	Call Letters	Location
		KGPZ	Wichita, Kans.
		KGZF	Chanute, Kans.
122.8	2,442	KGPX	Denver, Col.
		WPDF	Flint, Mich.
		WPEB	Grand Rapids, Mich.
		WMDZ	Indianapolis, Ind.
		WPDL	Lansing, Mich.
		WPDE	Louisville, Ky.
		KGPP	Portland, Ore.
		WPDH	Richmond, Ind.
123.4	2,430	WPDI	Columbus, Ohio
		KGPP	Portland, Ore.
		WPDM	Dayton, Ohio
		KGZD	San Diego, Cal.
123.8	2,422	KSW	Berkeley, Cal.
		WMJ	Buffalo, N. Y.
		KGPE	Kansas City, Mo.
		KGPG	Vallejo, Cal.
		WPEK	New Orleans, La.
		WPDW	Washington, D. C.
124.1	2,416	KGPB	Minneapolis, Minn.
		WPDS	St. Paul, Minn.
124.2	2,414	WPDY	Atlanta, Ga.
		KGPS	Bakersfield, Cal.
		WCK	Belle Island, Mich
		WPDX	Detroit, Mich.

Wave-length (Meters)	Fre-quency (Kilo-cycles)	Call Letters	Location
		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.
		KGZI	Wichita Falls, Tex.
		....	Newton, Mass.
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.

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

Interesting "Highlights" from Our Readers

38,000 Meters! Whoa!

Editor, SHORT WAVE CRAFT:

I am very interested in a letter which was published in the August, 1932, issue of SHORT WAVE CRAFT entitled, "No Code Law Above 3,000 Meters, and signed by Clayton E. Fairer, Woodrow Johnson and H. Wysong of Nezperce, Idaho. I note your answer to their letter and now beg to state my views on same. I have seen a list of commercial stations of the world and find that they go up to a wavelength of about 38,000 meters; above that there is nothing at all. Now, why not work up there? One could go up as high as one liked. In fact, if we could get high enough it might be able to get above all static. I am sure no objection would be raised to anyone trying out experiments, phone or C.W. up there. It would open up new bands for amateurs. It may seem silly at first, but years ago it seemed silly to talk about working on 5 meters. Just after the war a friend and myself tried some experiments on a calculated wavelength of about 60,000 meters and the results were quite good, but owing to my friend passing away, the experiments came to an end. I am sure there is a great deal to be found out up there, and I think that very long waves have more chance of getting through the Heaviside layer than short ones.

Every success to SHORT WAVE CRAFT.

Yours truly,
NORMAN L. H. PLATT, G2AUA,
Daneswood, Borton Court Ave.,
New Milton, Hants, England.

(The radio spectrum cannot be extended indefinitely on the higher wavelengths, as soon the audio frequencies are approached. These would require enormously large aerials and high power for practical transmission. The shorter wavelengths are much more useful, as they involve small, easily manipulated antenna systems and small amounts of power.—Editor.)

5-Meter Arguments!

Editor, SHORT WAVE CRAFT:

About a month ago I joined the SHORT WAVE LEAGUE and because the League is chiefly for American and Canadian radio fans I believe that the two nations will be united in the research of radio.

I agree that the code is of no use to the radio amateur of today, but it has no fears for me, for I have learned the code but have great trouble in reading it. Because of the latter, I agree to the abolishing of the code requirements found in both American and Canadian amateur ham rules.

I am attempting to form a short-wave club in my town, but many of the hams around here only experiment in the fall and winter (the non-static seasons).

After reading Clarence Grimm's letter in the July issue of SHORT WAVE CRAFT, I concluded that Clarence is not intending to go on the air immediately. To prove it I shall go through each paragraph and tear up his facts and his "if" statements.

In his first paragraph he complains of too many articles on "Ultra Short Waves." I complain a little about it myself, but he will find this helpful to him if he goes on 5 meters.

In the second he says he agrees that the code does him no good. Why doesn't he explain why? In the second sentence he says (if) it weren't for the code examination he would be operating on 5 meters. How is it he knows the code will do him no good on the 5-meter band? If he had a friend who was operating on 5 meters he could tell him, so why doesn't Clarence build himself a 5-meter transmitter and have his friend do the testing?

In the third he says he has built many receivers and he knows how they work. What radio amateur ham or fan hasn't? In the next sentence he uses "if" again. He certainly is trying to fool someone that he is going on the air on the 5-meter band (if) the code requirements are abolished. He also claims he would experiment with different apparatus and try to get as good DX as possible. What ham wouldn't?

In the fourth paragraph he explains the transmitter he has in mind. What do we readers care what tubes he is going to use here and some place else? He most likely heard a friend of his who was talking about such and is trying to fool some more of us amateur fans.

If this letter is printed and Clarence happens to read it or in some other manner reads it, and finds I am mistaken in my views, I wish he would kindly accept my apologies.

I hope to see the SHORT WAVE LEAGUE a great League. I remain, a "would-be" ham.

JACK HEATON,
Harrow, Ontario, Can.

Wants Code Test Left Out

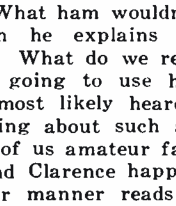
Editor, SHORT WAVE CRAFT:

I read the article on short-wave phone transmission. Now you're getting down to business. That's what I want to know—why a fellow who is interested in phone transmission is required to pass a code test. Most of the people in our town don't give a whoop about code. I want to have a station, but I don't want to send code. Phone transmission gives everybody listening-in a thrill, but who cares for dots and dashes? Phone transmission will increase the popularity of short waves. I hope a new law is passed concerning amateur phone transmission.

Yours with 73's.

RICHARD COLWELL,
439 West Main Street,
Deshler, Ohio.

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.

Why Not "Code-less" Phone License?

Editor, SHORT WAVE CRAFT:

I enclose herewith my application for membership in the SHORT WAVE LEAGUE. I am heartily in favor of removing code from license requirements below 6 meters.

I believe that by so doing these little explored waves will more rapidly become known. Why does the Department of Commerce issue radio telephone licenses for commercial use on crowded wavebands and limited broadcast licenses for use on the congested broadcast band, when it neglects to make provision in the amateur field for a codeless license? I for one would welcome some form of amateur phone license.

My interests in code are practically nil. Of course, I recognize the fact that a transmitter must be a good C.W. transmitter before it can be modulated for phone. For a period of about six months, when radio licenses came into existence, it was possible for a licensed radio telephone operator to operate an amateur phone station of less than 300 watts input. It was during this period that I became interested in phone work. By the time I had received the license, new regulations came into effect making the radio phone license invalid for amateur or broadcast use. Since I have a number of friends who are C.W. operators who could act as operator of the stations, I obtained a station license. Thus I was able to construct and operate phone by having an operator to throw the transmitter switches when I desired to use the outfit. This became a bit tiresome, because I did not always have an operator about when I wished to use the outfit. It seemed a bit foolish, too, because I was much better acquainted with the transmitter than the operator, having constructed and tested it myself.

I have always been very much interested in the experimental end of radio and believe that a new radio telephone amateur license, restricted to the vacant channels below 6 meters, would prove to be a real experimental step.

Yours very truly,
HAROLD R. BLACKSTONE,
121 Walnut Ave., Wayne, Pa.

Hollywood Chapter S. W. L.

Editor, SHORT WAVE CRAFT:

We have organized here in Hollywood a local chapter of the Short Wave League and I am enclosing the memberships. At the present time we have six members but we are in need of five more membership blanks.

Meetings are held on Monday, once every two weeks, at 1506 LaBaig Avenue, Hollywood, at 7:30 p. m.

We also have code practice every Thursday evening at 7:30. The newspapers have promised to co-operate with us in securing new members.

We have been experimenting with ultra-short waves and we have had very good luck. I agree

(Continued on page 506)

LETTERS FROM S-W FANS

TWO HUNDRED SETS!

Editor, SHORT WAVE CRAFT:

I am sorry to say that I have written to a few of the fellows who have promised to "answer all letters," but I never heard from them.

Have built a few short-wave sets and a number of broadcast sets, would say about 200. I do not know if it was luck or something else regarding the broadcast sets, for they all worked wonders, but the short-wave sets have been my headaches.

Right now I have a "Doerle" set and it perks very poorly, when it sees fit to perk at all. I live just two blocks from the Medical Center at 168th Street and Broadway, and have been told that it would not be able to receive short-waves on account of the electrical appliances which are worked all day and night in the hospital.

I would like to hear from some of the fans about this, particularly fans who live in this neighborhood, if any.

I have studied the code for four months and can copy a message sent between 18 and 25 words per. I am anxious to build my own station soon and apply for my license. Perhaps someone near me would like to work along with me.

I promise to answer any letters I may get! 73's.

ANDREW J. THOMA,
623 West 170th St.,
New York City.

(Well, Andrew, you sure take the cake! We thought we had built many sets in our somewhat lengthy editorial experience, but we fall by the wayside when we read that you have built 200 sets! We note that you have not had such great success with the short-wave receiver and from our many friends in the short-wave game we learn that improper aerials and lead-ins constitute one of the main reasons for so many "headaches" in trying to make a short-wave receiver bring in China. In the August issue you will find a very important article by Arthur H. Lynch describing how to reduce interference and boost the efficiency of short-wave aerials and lead-ins. There is also more information on this subject in the September number and we will endeavor to publish still further data on this very important angle of short-wave reception. In quite a few cases we have found, as have many other short-wave experimenters, that the coils used in the set have to be just right, if you expect high efficiency from the receiver. "Don't Shellac Short-Wave Coils" is a very good axiom to remember. The coils are best left to dry, although some manufacturers use a little collodion on the form. The new isolantite forms are just rough enough on the surface to hold the wire, if it is wound on with a fair amount of tension. Still other coil forms have grooves on them so as to obviate the necessity of doping the wire to hold it in place. Another thing to keep in mind is to use large enough wire, with the turns well spaced, for the shorter wavebands. Do not try to choke off the few millionths of an ampere that come to you over your short-wave receiving antenna, by interposing in its path a coil composed of a dozen turns of wire as fine as a "frog hair." Having seen the "innards" of a Telefunken short-wave receiver, with the various circuit connections made with heavy copper bar, we took another hitch in our belts, and so should you—that's the way to build a first class "A1" short-wave receiver, i.e., don't expect the highest efficiency from your receiver when connections between the short-wave apparatus is made with pieces of fine magnet or bell wire, with poorly soldered joints, or in many cases joints that are not soldered at all!—Editor.)

A POPULAR HAM

Editor, SHORT WAVE CRAFT:

I am still reading SHORT WAVE CRAFT and saw my letter in the May number. Since then my phone bell hasn't stopped but I can still find time to pound out a letter to your department on this mill (typewriter).

I have started my code class and I transmit at least one day a week, on Saturday, Sunday or Monday and try to on all three days. I send on about 7,135 kc. and start at 8 p. m. sharp. Listeners can get a copy of transmission from me by sending a self-addressed envelope to me.

In the letters I have received I have been asked everything, from how to make a crystal detector oscillate to how to make a 50 kw. phone job, and have been asked how much I am charging for this course. Hi! Hi! There is no charge for this code or "dope" I send out and the code will be sent on the air only. To the fellows who sent the letters and received no answers, please send me another letter because I may have missed one or two.

About Mr. Hugo Gernsback's SHORT WAVE LEAGUE I will say I disagree with him about letting hams go on the five-meter band without taking the code test. I think if a SWL is not interested enough to learn code he will not be interested enough to watch his signals, and cause a lot of trouble to the fellows who know what they are doing down there and are pioneering that band. What say—Mr. Gernsback? If the "F. R. C." lets that go through, there would be about nine thousand on that band in less than a week. Otherwise I think the SWL will be "fine business."

Hoping to hear from more "will-be hams," I remain,

FRANK MILL, W9HQH-W9HWY,
2524 N. Central Pk. Avenue,
Chicago, Illinois.

(Well, Frank, we found your letter very interesting and we are sure glad to know that they have darn near rang the phone bell off its pedestal since we published your first letter in these columns, you are doing a great piece of work with your code class instruction. We note what you have to say about the SHORT WAVE LEAGUE *and its idea advocating the elimination of the code test for transmitting on the five meter band—but we are just stubborn enough to think that we are still right. We suppose there might be five thousand transmitting stations on the five-meter band if the code requirements were eliminated by the Federal Radio Commission, but following up the arguments, which appeared some months ago when the* SHORT WAVE LEAGUE'S *aims and purposes were completely outlined and if the five-meter band is to be really "popularized," we still believe that "the more the merrier" policy would not do any particular harm. When this five-meter stuff began busting loose some months ago, we admitted we had our doubts as to just how the stations would break through, especially where a lot of the five-meter transmitters were located in a small area. But after talking to some of the hams in this district and learning that in one small section of a few square miles there are over fifty five-meter transmitters in operation nearly every night, and learning further that it is relatively a "cinch" to tune in the desired station and eliminate the others, we believe more than ever that some real good would come of opening up the five-meter band "free for all." Glad to hear from you, Frank, and feel perfectly free to call again.—Editor.)*

IT'S HERE

EDITOR, SHORT WAVE CRAFT:

I have just read Carl Penk's letter in the June issue and heartily agree with him that a department for kids should be published in SHORT WAVE CRAFT. I am 14 years old and can readily understand the feelings of a beginner when he picks up a magazine and finds nothing in it but long-winded articles on new tubes and the latest talking picture equipment. However, I will say that SHORT WAVE CRAFT is the best magazine I have ever found.

I suggest that you publish hook-ups like Oliver Amlie's set and have an occasional transmitter among your features.

My application for membership in the SHORT WAVE LEAGUE has been mailed and I hope that the club goes over with a bang!

Well, good luck and 73's.

NED CHESTNUTT,
Logan, Kansas.

(Here's our hand, Ned. We quite agree with you that it is the younger generation from 12 to 20 years of age who should receive their due amount of attention when it comes to selecting articles for each issue of SHORT WAVE CRAFT. *As you undoubtedly have noted, we have started two new series of articles which should "tickle the palate" of all junior short-wave fans—the new series by Mr. Reinartz on "How to Become a Radio Amateur," and the second series by Mr. C. W. Palmer entitled "The Short Wave Beginner." We admit that a short-wave fan of 14 years of age will undoubtedly find quite a few articles in past issues of* SHORT WAVE CRAFT *which would seem pretty long winded or dry, but when you get a little older you will undoubtedly find these self same articles a very excellent reference source of information. You see, an editor's job is not the easiest one in the world, as he is constantly striving to please short-wave fans of your age as well as the older student who has the hankering for a little mathematics once in a while, and who has quite a complete understanding of electrons and such matters. You will also note that we have been publishing some short-wave transmitter articles right along. The* SHORT WAVE LEAGUE *is growing very fast.—Editor.)*

THE 5-METER "GRIPES"!

Editor, SHORT WAVE CRAFT:

Let me congratulate you on the success of your magazine for the instruction and helpful hints it gives to "hams." There is only one thing that surely "gripes" me and that is the space wasted, in my estimation, on ultra-short waves. We all know a five-meter band is of no commercial good now, unless we have use for it in wartime or where the distance is very limited. Also give us a few more facts and not so much theory, for pure facts are what help us in construction—theory is for those who wish to be analytical. I have built sets from hook-ups in your "mag" and can say about the usual thing—some worked and some didn't. I only tried the hook-ups once, so probably I didn't experiment as much as I should have.

I have built a one-tube straight regenerative type receiver and have heard all districts but numbers 6 and 7, and expect to have these before long.

A few days ago I had W3XAL and VE9DR a loud speaker, via my "one-lung" outfit. That is something, considering distance and size of set.

I would like to correspond with some hams, if any, who are using "loop modulation." Perhaps it is unlawful now to use such a method for modulating a phone transmitter, but if there are any, and it isn't unlawful, I would enjoy QSL with them.

One thing more, don't, if you do not want to have your subscription list decreased, cut out the "ham" page and the editorials—there's the life of your mag.

Cul DM es 73½s—Urs trly,

HERCHEL PLOTTS,
Cuba, Illinois.

(Hi! Hi! yourself, Herchel, and we were sure glad to hear from you. Well, we'll admit the five meter stuff looked rather doubtful a few months back, but the "boys in the trenches" are lapping it up like nobody's business. Hardly a day passes that we don't have a letter or else a personal visit from some prominent "ham" who tells us some startling experiences about the activities and distances covered in the five-meter band. Just the other day one of the boys from Irvington, New Jersey, dropped in to see us and told us that there were, in his estimation several hundred hams in the New York City area "busting loose" on five-meters.—Editor.)

SHORT WAVE QUESTION BOX

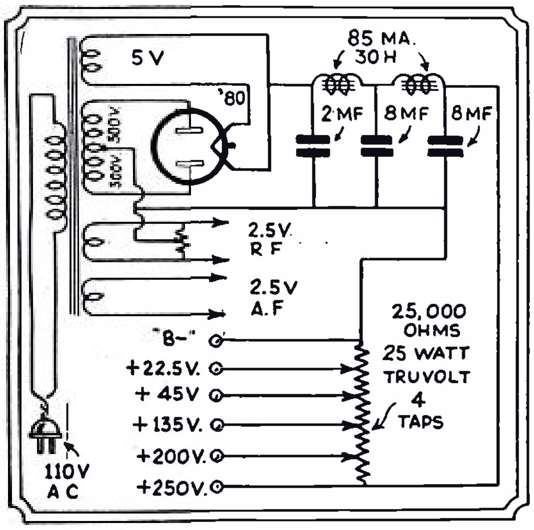
Edited by R. WILLIAM TANNER

POWER-PACK CIRCUIT AGAIN!

Richard Webster, Alameda, Calif., asks:

Q. For a circuit of a power-pack to use with set described on page 154, July issue?

A. The circuit appears in these columns.



Power-pack circuit requested by Mr. Webster, and in which an '80 type rectifier tube is used. The two 30 henry chokes have iron cores.

HAND-CAPACITY EFFECTS

Frank Zawaski, Webster, Mass., asks:

Q. I have a two-tube set with a shielded panel. *Hand capacity* effects are still present. What is wrong?

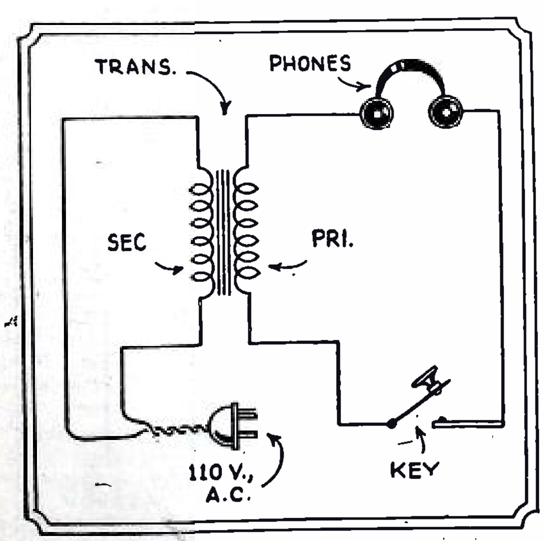
A. The rotors of the tuning condenser and regeneration condenser may be connected to the high potential side of the circuit, in which case the shafts, projecting through the shield panel, may be the cause of *hand-capacity effects*. Possibly the panel is not grounded to "B" negative. An ungrounded shield is worse than useless. Also make sure that the "B" negative is connected to a good ground.

CODE TEACHER

John. Staricco, Alameda, Calif., writes as follows:

Q. I want to build something with which to learn the code. This should be heard only in the headphones and not out in the room.

A. A circuit for such an instrument is shown in these columns. The transformer may be a regular audio unit, with phones connected to primary and 110 volts A.C. to secondary.



Probably the simplest code teaching device is that illustrated above.

WAVE TRAP DATA

Bradford Stait, Jersey City, N. J., inquires:

Q. What are the values of L1 and C1 (wave trap) in the circuit on page 474, April-May, 1931, issue?

A. The values will depend upon the wavelength of the station you desire to eliminate.

Q. Will a one-tube transmitter produce a signal with 45 volts on the plate?

A. Yes, but only over very short distances.

TELEVISION RECEIVER

Robert Heilman, San Francisco, Calif., writes:

Q. What value of R.F. voltage can be applied to a three electrode tube connected as a diode detector in a television superhet?

A. With the new RCA 56, a maximum of 40 volts can be applied before distortion takes place. A 227 would handle considerably less.

56, 57 AND 58 TUBES—HOW TO USE

A. E. Chartier, Ft. Edward, N. Y., wants to know:

Q. The combination of 56, 57 and 58 tubes to use in a short wave superhet, employing a crystal *second* detector.

A. A very good combination would be a 58 first detector preceded by a two-section *band-pass filter* between antenna and detector grid, a 56 oscillator coupled to the detector through the detector screen grid, two 58 I.F. stages with dual tuned (band-pass filter) transformers, a biased Carborundum crystal second detector, a 57 first audio stage and a 47 pentode power audio stage. This would mean six tubes or seven with '80 rectifier. The resulting sensitivity, selectivity, volume and tone quality would be entirely satisfactory.

Q. Would you advise a tuned R.F. stage ahead of the detector to help in the elimination of image frequency interference, or would a high intermediate frequency of, say 500 kc., prevent this trouble?

A. While a high I. F. helps slightly, it is not a cure. A two-section band-pass filter will eliminate image interference and not be another cause for trouble as would a tuned R. F. stage. The filter does not have to be adjusted to 10 kc. selectivity, 50 to 100 kc. separation of signals at this point being sufficient. Therefore the filter would not result in loss of sensitivity.

Q. I have a set of Sickles 175 kc. dual tuned I. F. transformers. Would these be suitable for a short wave "super-het"?

A. The 175 kc. units could be used without trouble from image interference if you use a band-pass filter preceding the first detector. An I. F. of 300 to 500 kc. is preferable, however.

TYPE 202 TUBES FOR TRANSMITTER

O. Whitley, Ottawa, Canada, inquires:

Q. I have some old Radiotron tubes type UV202 rated at 5 watts output. Could these be used in a transmitter?

A. The UV202 tubes may be used in any circuit designed for '10 tubes and using the same plate, grid and filament voltages. Look through back issues of SHORT WAVE CRAFT for '10 circuits and take your choice.

INDUCTANCE QUERY

James Lindsey, Chicago, Ill., wants to know:

Q. What are coils L5, L6 in circuit page 167 July issue, also how can I wind them?

A. Coils L5 and L6 are 1250 and 1500 turn honeycomb coils respectively. These cannot be wound without the use of a special machine. Better buy them.

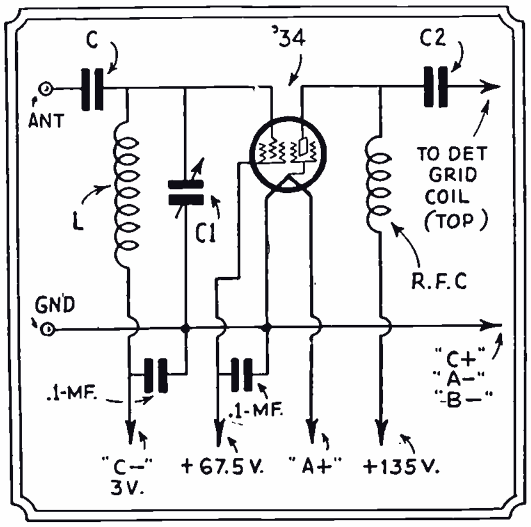
IS THERE A 2 VOLT PENTODE?

Jack Hirron, River Forest, Ill., asks:

Q. Is there a 2 volt R.F. pentode manufactured?

A. Yes, the RCA type number is 234.

Q. Please print a circuit, if such a tube is available.



Hook-up for 2 volt R. F. Pentode

A. The circuit is given in these columns. C is an antenna coupling condenser not greater than .000025 mf. C1 should be same as detector tuning condenser. C2 may be .000025 to .0001 mf. The R.F. choke should be any GOOD short wave type.

CONDENSER CAPACITIES

Charles Gould, Des Moines, Iowa, writes:

Q. I want to build the receiver shown on page 252, January issue. Can you tell me the capacity of the Hammarlund condenser ML-5 and also the capacity of the regeneration condenser ML-11?

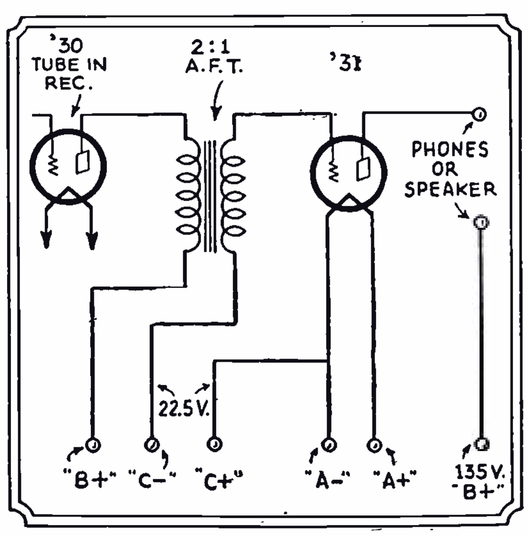
A. The ML-5 is .00015 mf. and the ML-11 is .00025 mf.

ADDING A. F. STAGE

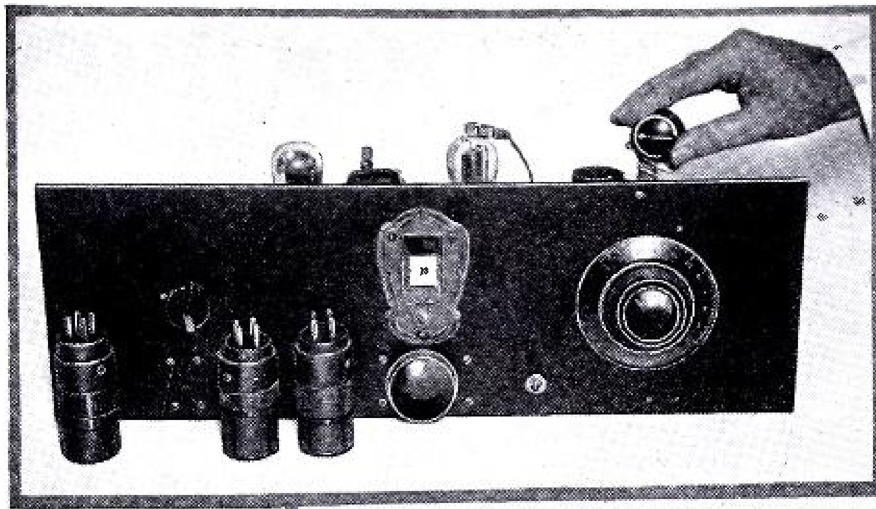
Charles Schultz, Highland Park, N. J., desires:

Q. A circuit of an audio stage of amplification to add to the receiver on page 258, Dec.-Jan. issue.

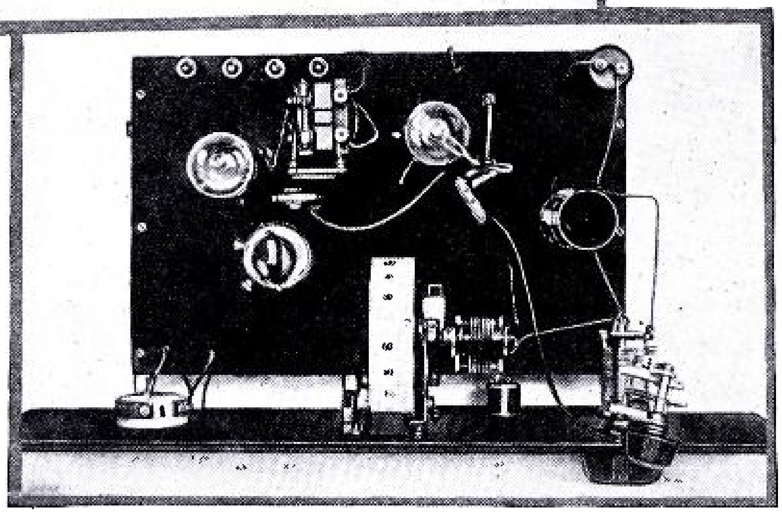
A. The circuit and constants appear in these columns. A 231 power tube is shown. If a 230 is preferred, employ a plate voltage of 90 and a grid bias ("C"-batt.) of 4.5 volts.



An audio stage of amplification suitable for adding to a first audio or detector stage.



Above: Front view of the real "DX" short-wave receiver built and tested by Mr. Haas, with some of the plug-in coils standing in front of the set.



Top view of the 2-tube, short-wave receiver recommended by Mr. Haas.

How To Get A-1 Results With A 2-Tube Receiver

By NELSON G. HAAS

Mr. Haas, a veteran DX'er, has done a lot of experimenting with short-wave receivers of many types. The receiver here described is the result of dozens of set-building experiments conducted by Mr. Haas, who holds a responsible position in the electrical engineering field. Much valuable advice is here presented for the beginner.

● THE writer has here taken into consideration the uselessness of repeating things in the text which are clearly shown on the diagram and thus the reader will find that the diagram and list of parts give the complete hook-up, values and type of parts used, (the make of course is optional), the remainder of the article being devoted to a description of some of the little "tricks" which have been built into this set which help it to do everything any other short wave set of its size will do and then—pardon the misquoting of an old saying—"lick the other set!"

The set is built upon a bakelite sub-panel with a bakelite front-panel supported by aluminum brackets, and is an attempt to produce a happy medium between the old style "breadboard" outfits with their six to twelve inch spacing between the parts—and the modern "vest pocket" receivers which the beginner is too often led into constructing. Of course, with experience it is possible to construct a compact short-wave receiver and commercially it is being done, but for a beginner or for one who wishes a home-built outfit that will produce good results, with a minimum of expense, the writer's suggestion is to stick to well-spaced parts.

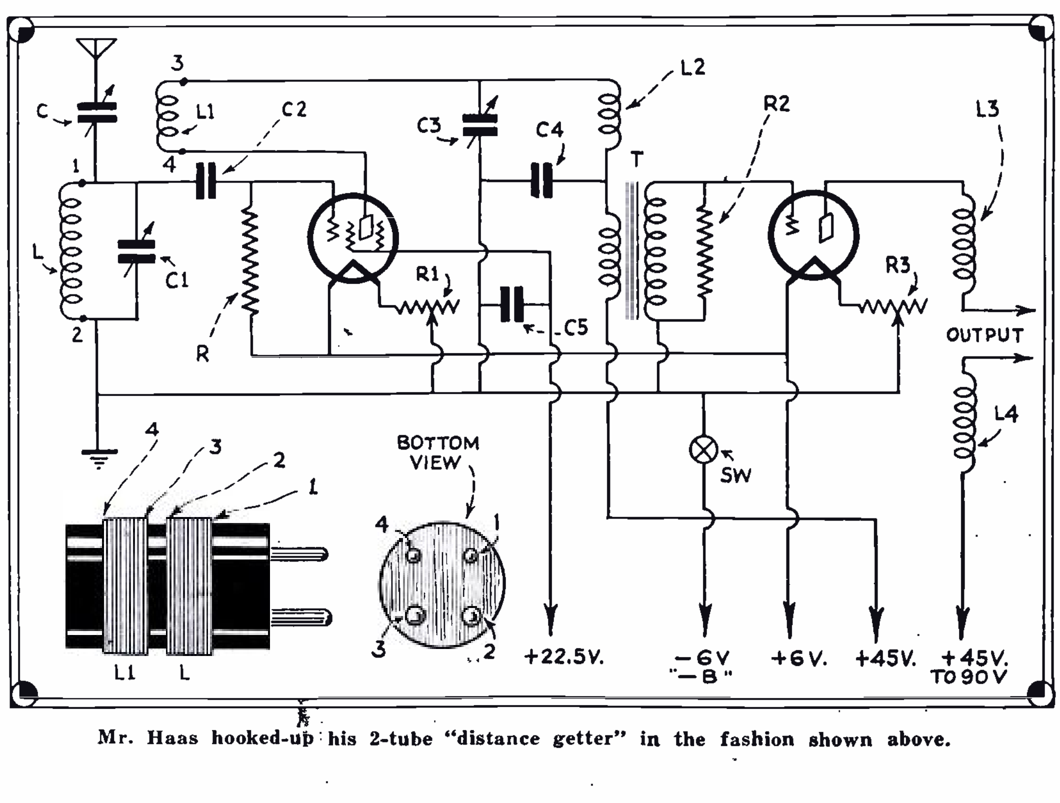
Minimum Body-Capacity

The absence of the usual metal panel, cabinet or shielding is not noticed as far as "body-capacity" is concerned. This is due to the fact that the mounting of the drum dial supports the tuning condenser well to the rear of the front panel and it is also due to the simple radio frequency filter system in the amplifier output circuit, details of which are given later in the article.

The builder should attempt to follow as closely as possible the mechanical layout of the set, a good portion of the success of the outfit depending on this. The placement and spacing of the various parts have been gone into pretty thoroughly by the writer and care should be taken to observe this.

Several items which spell success for long distance reception on short waves are noticeable in the photographs: low-resistance radio frequency wiring, with rounded bends and well-soldered joints, provides an easy path for the minute currents with which one must contend in this portion of the circuit; and last but not least, good, standard parts. With standard reliable apparatus as cheap as it is at the present time, it is foolish to rummage through the attic for that solder-smeared paper and tin-foil condenser that you salvaged from Aunt Minnie's Neutrodyne in 1927! Short-wave sets have been built with these "junk" parts, but the fact that they have worked has been more a matter of "good luck" than good management, and the writer has yet to see a set that has been "thrown" together like this that will do much except fall into regeneration like the proverbial ton of bricks and delight the ear with an assortment of crackles and noises—so readily explained by the fond owner as being static—which originated in just such instruments as the one mentioned above!

(Continued on page 496)



Mr. Haas hooked-up his 2-tube "distance getter" in the fashion shown above.

How to Become a Radio Amateur

Obtaining a License

No. 6 of a Series

By JOHN L. REINARTZ

Member IRE

● THE United States is divided into nine radio districts. This makes it less burdensome for the Supervisors of Radio who have to handle all communications regarding radio activities in their respective districts. These headquarters are as follows:

1st radio district, Custom House, Boston, Mass.

2nd radio district, Sub-Treasury Bldg., New York City.

3rd radio district, Fort McHenry, Baltimore, Md.

4th radio district, Post Office Bldg., Atlanta, Ga.

5th radio district, Custom House, New Orleans, La.

6th radio district, Custom House, San Francisco, Calif.

7th radio district, Exchange Bldg., Seattle, Wash.

8th radio district, David Scott Bldg., Detroit, Mich.

9th radio district, Engineers Bldg., Chicago, Ill.

When you have to communicate regarding radio activities, send your communication to the supervisor nearest to you. The districts are not clear cut as to states, some states being divided as to districts. For instance, New Jersey is partly in the second and partly in the third radio districts. We are interested in the location of our Radio Supervisor as it is to him we turn when we desire to put our new transmitter on the air. You see we cannot do this indiscriminately. Since 1912 there have been radio laws governing radio communication throughout the world and, while designed primarily for commercial stations, apply also to amateurs. Amateurs in the United States have been especially fortunate in that they have been allowed radio communication, while other countries did not provide for their amateurs for many years, and then only reluctantly, and surrounded them with many restrictions.

The only restrictions we have is that we must obtain a license to operate a station, as the operator, and another license for the station itself. Should you live at a distance from the office of the Supervisor nearest to you such that it would impose a hardship upon you to appear in person for an examination, you may request a license by mail; application papers will then be sent to you, which you must fill out and return. If, in the opinion of the Supervisor, you are qualified to operate a station, he will send to you a temporary license, good for not more than one year. During that year and before the expiration date of the temporary license you will either have an opportunity to meet the radio inspector while he is on a tour in your vicinity to take a regular examination, or you will go to his office and take the examination there. You must not fail to take the regular examination some time before the temporary license expires, as it will not be renewed. After you have taken an examination in person, and passed, you will receive a regular amateur license which can be renewed by mail; request for renewal should be sent in at least two months ahead of the expiration date on the old license, this is necessary as the "paper work" in the supervisor's office is heavy.

There is also an amateur license termed the "unlimited" license for amateur *phone* operation; this license you cannot obtain until you have had at least one year's operating experience. This license, when obtained, will allow you to operate a phone station in the 3,900 to 4,000 and in the 14,150 to 14,250 KC bands in addition to the 1,875 to 2,000 and the 56,000 to 60,000 KC bands, open to every amateur.

Code Test Important

The first and most important part of the amateur operator's license examination is the *code test*. This is given first; if you do not pass it, you must wait three months before taking a second examination. You are required to receive at the rate of ten words per minute, which is really pretty slow. It is not advisable to acquire *too* much speed, as it has been the experience of the various supervisors that applicants find themselves confused when they hear the comparatively slow machine sending used in the license tests.

If you pass the code test satisfactorily, you are then given a written examination. You are required to draw complete diagrams of your transmitter and receiver and to explain their operation in detail. A number of other simple questions are included. For further suggestions for passing this part of the test see Lieutenant Eddy's new book entitled *"How to Become an Amateur Radio Operator and Secure a U. S. Government License."*

Do not fail to memorize the section of the law: *secrecy of messages*.

Contrary to the general impression, no examination of any kind is required for a *station* license. You simply fill out a set of application blanks, one of which must be notarized. You are also required to swear to the fact that you are a citizen of the United States.

Amateur station licenses are issued to holders of amateur operator licenses. However, it is possible for an amateur, who is not a licensed operator, to obtain a station license if he specifies a licensed operator who will operate the station for him.

If you pass the operator's examination, you are given your operator's license immediately. You can then fill out your station application blanks and leave them with the radio supervisor. Station licenses are not issued immediately but as a rule take several weeks before they are cleared through the office of the Federal Radio Commission in Washington.

There is no age limit of any kind for amateur operators. As long as you demonstrate your ability to receive the Continental Code and show that you understand the operation of the apparatus you intend to use, you will have no trouble in obtaining the coveted ticket. Amateur operator's licenses run for a period of three years, and station licenses for one year.

When you visit the radio inspector's office ask him for a copy of the special bulletin containing the rules and regulations of the Federal Radio Commission as they concern the amateur. Read this carefully and bear all the regulations in mind. You cannot afford to break any of them.

Amateurs who made good

JOHN L. REINARTZ

● JOHN L. REINARTZ, well-known to every radio amateur and "ham," and who is now doing a series of articles for SHORT WAVE CRAFT, made his first step toward fame in the "short-wave" world, by designing the famous receiving circuit which is known all over the world as the "Reinartz" circuit.

In brief, the career of Mr. Reinartz in radio is high-lighted by the following events:

Designed the Reinartz tuner in 1921 that was and still is used by radio fans the world around.

Designed the short-wave transmitters that were used by Deloy, Schnell and Reinartz in first "two-way" contact with Europe.

Went with Byrd to Etah, Greenland, in 1926 and provided complete radio contact with the world, while the exhibition was in the North.

Was first to transmit across continent during daylight at noon using twenty meters.

Proposed first short-wave *reflection theory* and indicated behavior of short-wave transmission in 1924; this has since been substantiated by others, notably Dr. A. Hoyt, Taylor and Mr. Hulburt of the U. S. Naval Laboratories.

Which just goes to show what a real "live" ham can do if he applies himself to some "real" study and experimentation.

John L. Reinartz, well known short wave expert and author.

First Prize Winner

(Continued from page 466)

coils must be wound with various amounts of wire (bank wound), to suit the various bands and the size antenna used. There should be several of them wound, and the one giving the greatest signal strength for the particular band should be used.

LIST OF PARTS USED WITH VALUES

CA Small trimmer condenser
C 0.01 mf. mica condensers
C1 0.0001 mf. grid condenser
C2 Described in text
C3 0.00004 mf. good grade mica condenser
C4 1 mf. by-pass condenser
C5 0.5 mf. by-pass condenser
C6 0.01 mf. (code), 0.5 mf.-1 mf. (phones)
L1 Described in text
R 500 ohm biasing resistor
R1 5 megohm grid leak
R2 50,000 ohm potentiometer (Pilot)
R3 9,000 ohm resistor
R4 250,000 ohm grid leak
R5 2,000 ohm biasing resistor
RFC1 80 mh. Hammarlund choke
RFC2 Small broadcast receiver r. f. choke
S Pilot switch
1—National type G. projection dial.

COIL DATA FOR MCFARLAND SET

Band covered	L2 Turns	L2 Size	L3 Turns	L3 Size	Tuning condenser used
1750 kc.	66	36 D.S.C	17	36 D.S.C.	Both sections
3500 kc.	34	30 D.C.C.	10	28 D.S.C.	Both sections
7000 kc.	20	22 E.N.A.	9	30 S.S.C.	Single section
14000 kc.	9	28 D.S.C.	6	28 D.S.C.	Single section

Spacing of turns in L3 is the diameter of the wire.

Spacing between coils L2 and L3 is from one-quarter to three-eighths of an inch.

Second Prize Winner

(Continued from page 467)

PARTS LIST—ANDE SET

CONDENSERS

C1—Pilot J7 Midget Cond. (variable) .000025 mf.
C2—Pilot J7 Midget Cond. (variable) .000025 mf.
C3—Polymet .01 mf. Filter type cond.
C4—Polymet .01 mf. Filter type cond.
C5—Polymet .01 2000 D.C. Cond.
C6—Sangamo Illini Condenser .0001 mf. rating
C7—Polymet .1 mf. Bypass Condenser
C8—Cub .00025 mf. Filter Condenser
C9—Cub .00025 mf. Filter Condenser
C10—Polymet .01 mf. Coupling Condenser
C11—Polymet .01 mf. Filter Condenser
C12—J5 Trimmer Condenser (midget variable) .000015 mf.

RESISTORS

R1—400 ohm biasing resistor (any standard make)
R2—75,000 ohm voltage dropping resistor
R3—75,000 ohm voltage dropping resistor
R4—50,000 variable carbon, switch-type resistor
R5—100,000 ohm 1 watt resistor
R6—250,000 ohm 1 watt resistor
R7—1000 ohm 1 watt resistor
R8—10 meg. grid leak, Pigtail type.

TUBES

RF '36—RCA type '36 Automobile type, radio frequency tube
Det. '36 same as RF (above)
AF output '38—RCA type '38 automobile Pentode

CHOKES

RFC 1 85 millihenry Meissner choke
RFC 2 85 millihenry Meissner choke

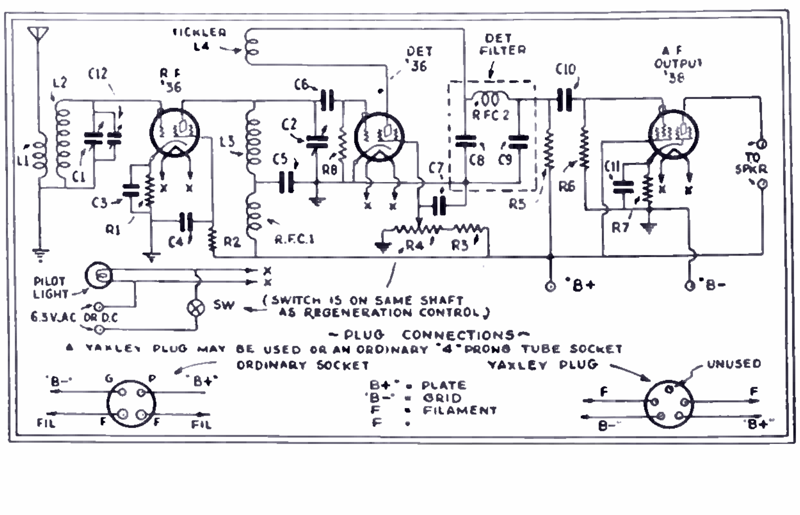


Diagram for Mr. Ande's S-W Receiver.

COIL DATA—Number of turns

	R.F. coil L1	L2	Det. coil L3	L4 (tickler)	
10- 20 meters	8	3	8	5	slot wound
20- 45 "	14	4	14	8	" "
40- 80 "	21	6	21	13	" "
74-120 "	33	10	33	17	" "
115-170 "	38	12	38	18	" "
150-200 "	44	14	44	19	" "

All L4 (tickler) windings wound with No. 30 single cotton covered copper wire.
All L1 (primary RF coil) windings wound with No. 30 single cotton covered copper wire.
All L2 and L3 windings wound with No. 24 enameled or single cotton covered wire.

Miscellaneous

1—National type "F" drum dial (also illuminator)
2—knobs—any small knobs; 3/16" shaft
1—Yaxley Plug or 1 tube socket 4-prong wafer type
1—Magnavox dynamic speaker, 6" or 8"

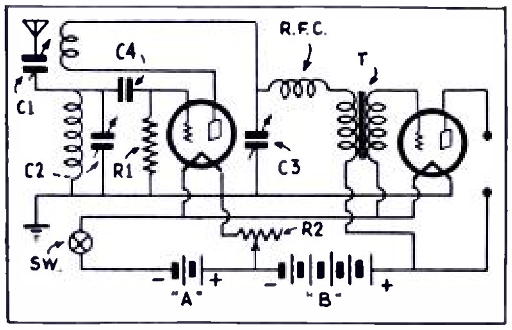
Power-pack, if set is used on alternating current.

Parts

1—Power transformer, 600 Volt C.T.
1—'80 type tube, full wave rectifier
1—4 mf. Mershon Cond. (Filter)
2—8 mf. Mershon Cond. (Filter)
2—30 Henry chokes—Thordarson
1—4 prong socket
1—10,000 voltage dropping resistor

Third Prize Winner

(Continued from page 467)



NO.	WAVE LENGTH RANGE	SECONDARY WINDING	TICKLER WINDING
1	14 TO 30 M	6 T. NO. 12 +	6 T. NO. 28 E.
2	29 TO 58 M	13 T. NO. 14 +	13 T. NO. 28 E.
3	54 TO 110 M	23 T. NO. 16 +	16 T. NO. 28 E.
4	103 TO 225 M	56 T. NO. 28 E.	26 T. NO. 28 E.

+ BARE WIRE. SECONDARY TURNS ARE SPACED. WOUND TO DIA. OF WIRE ON FIRST THREE. E. ENAMELED WIRE

Coil data and diagram for Mr. Hale's Set.

the shield by fiber washers. The holders for the batteries are formed of brackets with one inch arms. C2 is a Pilot, .00025 mf. with four of its plates removed, two on the rotor and two on the stator, making a capacity of .00015 mf.

PARTS LIST—DONALD HALE SET

1 set of Octocoils
1 Pilot condenser .00025 mf. C2 remodeled
1 Pilot midget .00005 mf.—C1
1 Pilot midget .0001 mf.—C3
1 Pilot grid condenser .00025 mf.—C4
1 Variable grid-leak—R1
1 Switch—SW
1 Rheostat, 30 ohm—R2
1 Transformer, Hedgehog-T
2 '30 tubes
2 small "B" batteries
2 Small flashlight cells
1 dial (any three inch type)
3 knobs
Miscellaneous screws, wire, etc.

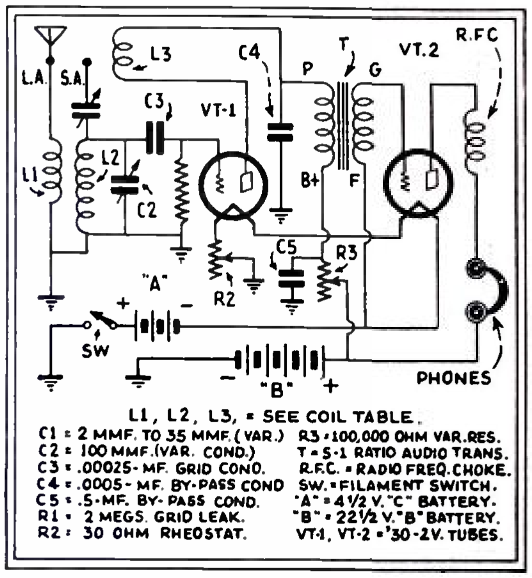
Fourth Prize Winner

(Continued from page 468)

Coil Winding Data

METERS	L-2	L-3	L-1
20	5 turns	4½ turns	5 turns
40	12 "	6½ "	6 "
80	24 "	8 "	7 "
160	60 "	13½ "	10 "

All windings of the 20, 40, and 80 meter coils were wound with No. 22 D. S. C. magnet wire. The 160 meter coil is wound with No. 28 D. S. C. magnet wire. The spacing between the windings on all coils is approximately ¼ inch.



Hook-up for Mr. Herbster's 4th prize winner.

LIST OF PARTS USED IN THE CIGAR BOX PORTABLE

1—Pilot midget variable condenser—100 mmf. (C-2)
1—Hammarlund equalizing condenser—2 mmf. to 35 mmf. (C-1)
4—Pilot coil forms
1—National dial—type BMD 0-100-0
1—National ultra-short-wave choke (RFC)
1—Hedgehog audio transformer—5 to 1 ratio (T)
1—Centralab potentiometer—100,000 ohms (R-3)
1—Yaxley Jr. rheostat—30 ohms (R-2)
1—Yaxley midget battery switch (SW)
1—Pair Yaxley insulated phone tips
1—Sprague fixed condenser—.00025 mf. (C-3)
1—Sprague fixed condenser—.5 mf. (C-5)
1—Carter fixed condenser—.0005 mf. (C-4)
1—I R C Resistor—Type MF-4—2 meg. (R-1)
2—Eby sockets—UX type 12.
1—Eby socket—UY 12
2—Eby binding posts marked—ANT.
1—Eby binding post marked—GND.
1—Aluminum panel
¼ lb.—Magnet wire—No. 22 DSC.
¼ lb.—Magnet wire—No. 28 DSC.
2—Tubes—Type '30 (VT-1) & (VT-2)
1—Burgess—4½ Volt "C" battery No. 2370 ("A")
1—Burgess—22½ volt "B" battery No. 5156 ("B")

Fifth Prize Winner

(Continued from page 468)

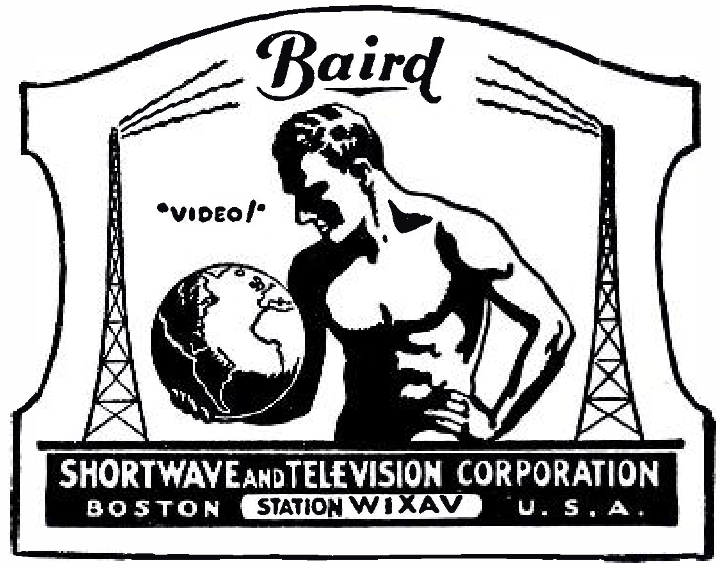
The sub-panel is made of 1/32" sheet aluminum, and it is well braced by ¼" square brass rod. The front panel is made of 1/16" sheet aluminum. When completed, this forms a very substantial chasis on which to build the converter.

This set was designed for use with an I.F. of about 530-540 kilocycles, as this is above the broadcast band and no interference will be encountered from broadcast stations. This frequency can be reached on most standard broadcast receivers.

Coil Data

Coil	Range	Det. Turns	Osc. Turns	Tickler Turns
1	16-31	4¾	4½	3⅞
2	30-52	10	11	8
3	50-85	21⅞	17¾	6⅞

(Continued on page 506)



(Trade Mark Reg. U. S. Pat. Office)

Shortwave and Television Corporation

AN AFFILIATE OF GENERAL ELECTRONICS CORPORATION

Radio and Television Consultants and Engineers

Owners and Operators of Television Station W1XAV, 1000 watts, Sound Station W1XAU, 500 watts and Ultra-short wave station W1XG, 43 megacycles. Operators of International Short Wave Station W1XAL, 5,000 watts power.

Shortwave and Television Corporation

LABORATORIES, STUDIOS AND STATIONS LOCATED AT 70 BROOKLINE AVENUE, BOSTON, MASS.

Baird

General Electronics Corporation

AFFILIATES AND SUBSIDIARIES

SHORTWAVE AND TELEVISION CORPORATION
SHORTWAVE AND TELEVISION LABORATORY, INC.
AERADIO CORPORATION OF AMERICA
ELECTRONICS RESEARCH CORPORATION

SHORT WAVE RADIO RECEIVERS
BROADCAST RADIO RECEIVERS
PUBLIC ADDRESS SYSTEMS
REMOTE CONTROL SYSTEMS
STRIAL ELECTRONIC APPLIANCES
X-RAY AND ULTRA-VIOLET RAY APPARATUS
PHOTO-ELECTRIC CELLS
CATHODE RAY TELEVISION TUBES
TC.

s Corporation

BOSTON, MASSACHUSETTS

R4, R5—Voltage divider tapped at 3400 ohms. Total value 17,900 ohms
R6—One 17,900 ohm bleeder resistor
P—25,000 ohm potentiometer with AC switch
6 UY sockets
1 UX socket
1 Dial (vernier type)
2 '24A tubes
2 '27 tubes
1 '80 tube
4 binding posts
Hardware
1 25 foot roll "pushback" hook-up wire

Condenser

Split-stator type, for medium power push-pull transmitters. Fine for 5-meter work—give extremely accurate balance between both sides of tank coil. Heavy polished plates, rounded edges, self-aligning conical bearings, rigid frame construction, 3000 and 6000 volts.

A STATEMENT

By Hugo Gernsback

I HAVE been publishing radio magazines since 1908, and during this period I have learned to know what radio readers want.

Last summer I made a trip through central Europe, in order to acquaint myself with radio conditions as they are in Europe today. I was amazed at the tremendous amount of radio experimenting that is now going on, in practically all of the western European countries. I found conditions similar to those during the 1921-1923 boom in America. Radio stores were prospering and doing a land-office business. The reason, of course, is the intense interest of the European radio experimenters who are building sets on a scale undreamt of before.

The European radio publications are abounding with new circuits and new radio developments that have found their way slowly over to the United States. The reason is that, since there is such a tremendous amount of orignial radio engineering going on in this country, there has been no publication that catered to the foreign developments. All the American radio publications must, of necessity, report the American activities first and as a rule, have no room left for what is going on in Europe unless an epoch-making development appears.

I therefore conceived the idea of bringing to my American readers a totally different radio publication, the like of which has never been published before; and the result is RADIO REVIEW AND TELEVISION NEWS.

This is not entirely a new magazine; it is, really, *two magazines in one*. A section devoted to television has been retained, which will report in every issue, the major American and European television advances; but the big, front section is given over to an international radio digest. This magazine, therefore, will perform the function that, for instance, the LITERARY DIGEST is serving in literature. You may not be aware of the fact that there are some 160 radio publications printed outside of the United States; but from all of these publications RADIO REVIEW is extracting the best—the Radio Meat—which you want.

There are literally thousands of new circuits, due to the new tubes, and there is so much new material for the experimenter that I would have to fill several pages to tell you all about it.

RADIO REVIEW AND TELEVISION NEWS then is a new mirror, which will accurately show you a true perspective of what is going on in radio all over the world, and will give you material in such profuseness as you never have seen before. Hundreds of new radio hook-ups, special circuits, new time-saving kinks, new money-making ideas galore. You will find here the latest radio circuits and sets from France, Germany, England, Italy, Russia, Norway and even Japan.

Dozens of translators have been busy to make the first issue of the new combination magazine a memorable one, that you will not soon forget, and you will wonder why I hadn't done it before.

And now I will ask you for a favor. Go to the nearest newsstand and get a copy of RADIO REVIEW AND TELEVISION NEWS. Pay your quarter for it, go home and look it over. If at the end of a week, you find that for *any* reason you do not like the magazine, return it to me with a letter stating why you don't want it, and I will refund your quarter. I am that sure that you will not wish to be without this magazine in the future.

Remember, you don't have to pay for the magazine unless you think it is what you are looking for.

If your newsdealer is sold out or does not stock the magazine send 25c to us (see coupon); money refunded if you don't want the magazine.

I thank you in advance for your patience and for your confidence.

Cordially yours,

Hugo Gernsback

A few of the outstanding articles in the RADIO REVIEW section:

- 1 Tube D. C. Power-Loudspeaker Special
- The VM-Three Receiver
- The Diodion Screen-Grid Circuit
- Improved Reinartz Hook-Up
- Preventing Radiation from the Local Oscillator
- Modern Tuning Coil Practice
- The Shielded Antenna for Noise Reduction
- New Transmitting Antenna Decrease "Skip Zone"
- The Champion Three — a Prize French Receiver
- Adding Automatic Volume Control
- A D. C. Super-Heterodyne
- Locating Hidden Pipes by Radio
- One Tube Super-Regenerative Loop Receiver
- A Two for 7 Meters
- Review of American Radio Literature
- Digest of American and Foreign Patents
- Dozens of Circuits, Kinks and Practical Suggestions and NEW HOOK-UPS.

Features in TELEVISION NEWS section:

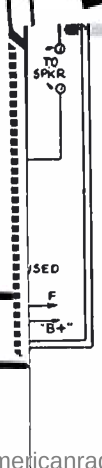
- A Combination Sight and Sound Receiver
- A Powerful 7 Meter Super-Regenerative Television Receiver
- New Baird Televisor Built Like Camera
- Television Transmitter for Topical Events
- Diode Detection for Television Receivers
- Myers Mercury Vapor Television Lamp
- Ideas in Television Circuit Improvement
- Schedule of Active Television Stations
- Television Question Box

Be sure to read full details in coupon!

THIS MAGAZINE COSTS YOU NOTHING UNLESS YOU LIKE IT. YOU TO BE THE SOLE JUDGE!

IMPORTANT . . .

Do not confuse the former TELEVISION NEWS with this magazine. RADIO REVIEW AND TELEVISION NEWS are two distinct magazines in one.



- 2 '30 tubes
- 2 small "B" batteries
- 2 Small flashlight cells
- 1 dial (any three inch type)
- 3 knobs
- Miscellaneous screws, wire, etc.

Diagram for Mr. Ande's S-W Receiver.

the converter.

This set was designed for use with an I.] of about 530-540 kilocycles, as this is above th broadcast band and no interference will be encountered from broadcast stations. This fre quency can be reached on most standard broadcast receivers.

Coil Data

Coil	Range	Turns Det.	Turns Osc.	Tickle
1	16-31	4¾	4½	3⅞
2	30-52	10	11	8
3	50-85	21⅞	17¾	6⅞

(Continued on page 506)

An A. C. Converter

(Continued from page 463)

and filter. This voltage is cut down to 165 volts by R4, which has a value of 14,500 ohms and is connected in the plate circuits of the two screen-grid tubes. R5 is another section of the voltage divider and its value is 3,400 ohms. The output tube's plate, oscillator plate and screen voltages are taken from this point. R6 is a bleeder resistance of 17,900 ohms.

The matter of terminal connections on the modulator and oscillator coils is optional; however, the following instructions are given but they need not be followed.

Modulator coil T: G on the coil socket to P on the R. F. tube socket; F minus on the coil form to "B" plus 165; P on coil socket to G on modulator; F plus on the coil socket to ground. The coil terminals on the form should be made to the prongs in the corresponding manner.

The oscillator coil T1 should be wired as follows: G on coil socket to G on the oscillator socket; P on the coil socket to P on the oscillator socket; K on the coil socket to ground; HP on coil socket to "B" plus for screen voltage; HK on coil socket to grid on modulator tube socket. The terminals of the oscillator coil should be connected in the corresponding manner, two terminals being connected to HP.

To insure oscillation G and P should be far apart. The pick-up winding should be on the side of the tuned winding opposite to that of the tickler. Using Pilot coil forms, the number of turns is as follows:

20 Meter Band

Modulator coil:
- Primary 1 turn
- Secondary 4 turns

Oscillator coil:
- Primary or pick-up 1 turn
- Secondary 5 turns
- Tickler 3 turns

40 Meter Band

Modulator coil:
- Primary 4 turns
- Secondary 8 turns

Oscillator coil:
- Pick-up 3 turns
- Secondary 9 turns
- Tickler 7 turns

Coils for other bands may be wound at will. The size of the wire is not so important; anything between No. 20 and No. 26 will be satisfactory.

List of Parts for Converter

T—Set of modulator coils as described
T1—Set of oscillator coils as described
T2—1 to 1 ratio R. F. coil for midget condenser
T3—Power transformer
Ch—30 henry choke
L—2-85 millihenry chokes
C1, C2, C3, C5, C6, C8, C9, C10—Eight .1 mf. by-pass condensers.
C4, C7—Two .00015 mf. tandem tuning condensers
C15—midget condenser across C4, approximately .00005 mf.
C11—.00025 mf. fixed condenser
C12, C13—Two 4 mf. electrolytic filter condensers
CX—Small tuning condenser, such as a trimmer.
R1—300 ohm bias resistor
R2, R3—Two 1000 ohm bias resistors
R4, R5—Voltage divider tapped at 3400 ohms. Total value 17,900 ohms
R6—One 17,900 ohm bleeder resistor
P—25,000 ohm potentiometer with AC switch
6 UY sockets
1 UX socket
1 Dial (vernier type)
2 '24A tubes
2 '27 tubes
1 '80 tube
4 binding posts
Hardware
1 25 foot roll "pushback" hook-up wire

Super-Regeneration on Short Waves

(Continued from page 471)

of C1. Then tune for the loudest signal with C3. Generally this adjustment necessitates the readjustment of C1 for maximum results. Be sure that the position of the tickler coil is just beyond the point of regeneration and into the region of self-oscillation.

If the local oscillator is removed from the socket then the detector will function as an ordinary three-circuit tuner and the results can be noted, especially the distance that the dial controlling the amount of regeneration energy that can be fed back to the detector can be moved, without going into self-oscillation. When the local generator is placed into operation note that the coupling between L2 and L3 can be increased so that more energy can be transferred.

In this case the function of super-regenerative amplification is combined with that of detection and the local frequency is generated in a separate tube. This is but one of the many ways in which this method of amplification can be used. A simple circuit which was developed by Flewelling will be found in Fig. 6 and in this circuit the actions of detection, super-regeneration and oscillation are combined in one tube. Now that there are tubes with more than one grid on the market it seems possible that some ingenious person will use a modification of this circuit to advantage.

Before going on to this circuit let us note that the frequency generated by the local oscillator which is used to periodically vary the feed-back voltage of the super-regenerative tube in Fig. 5 was 15,000 cycles. This choice of quenching frequency was chosen because it is inaudible to the average ear and will not pass through the ordinary audio frequency amplifier. For the best operation this frequency should be lowered, because the lower this frequency the more time will be allowed for the incoming signal to build up. The sensitivity of this method is proportional to the ratio of the received frequency to the quenching frequency and for this reason the system shows marked increase in amplification on the extremely high frequencies or low wavelengths.

Simplicity of Circuit a Virtue

Getting back to the circuit of Fig. 6, mentioned a few paragraphs ago, the reader will note the simplicity of the circuit. Many readers will remember this circuit as one having a great following at the period just preceding the introduction of *reflex* receivers. If you think real "D.X." could not be received on this set, when "perking" right—ask some "old-timer" in the game!

In operation it is difficult to find the proper constants of the grid condenser C and the grid leak R. The resister R should be of the continuously variable type and should have a range between 100,000 and 10,000,000 ohms. The circuit as shown is very sensitive and can be adapted for short wave reception, using the two-winding coils so popular today. In many ways this circuit gives the most amplification for the minimum amount of material and the minimum number of tubes.

A circuit introduced by the author last year was called the *Super-regenode,* as it incorporated the super-regenerative action in an interesting way, plus the gain at audio frequencies, due to the use of a pentode output tube. This receiver is capable of giving surprising results and letters from all over the country and outside the United States as well testified to the remarkable sensitivity. Sadly enough, many builders experienced results that were disappointing, and gave up. Those writing in to the technical staff of SHORT WAVE CRAFT sometimes experienced trouble in obtaining the super-regenerative action. Those who did get the receiver working correctly were pleased.

For those interested in the circuit, the super-regenerative tube and the quenching frequency generator are indicated in Fig. 7. The screen of the 24 type tube forms the critical control element for the maintainance of tube operation just at the point of self-oscillation. Constant control of this condition over the various short wave bands is maintained by adjusting R1. R2 controls the strength of the signal generated by the quenching frequency tube V2, and under the proper conditions a distinct effect on the sensitivity of the receiver. C1 should be variable so that the proper frequency for quenching purposes will be generated. This point of proper quenching frequency is an important one and will be covered in succeeding paragraphs.

The way to tune a receiver of this type is as follows. Turn R1 to the position giving the screen grid the full 90 volts and R2 to the setting that will provide the minimum plate voltage on V2. True condensers C2 and C3 simultaneously until a signal or whistle is heard. This whistle will be due to the beat generated by the mixing of the oscillation frequency of V1 and the incoming carrier. Reduce the screen voltage on V1 by means of R1 to the point just above the region of regeneration. Adjust the voltage of the local oscillator for the most sensitive condition and after this it may be necessary to reset the tuning controls C2 and C3 slightly. Now this may seem complicated but it really is not. After the set has been placed in operation for a short time, the position of R1 and R2 can be left unchanged, even when changing from band to band. This leaves the major controls C2 and C3 the only ones requiring radical shifts so necessary to tuning.

Quenching Frequency

As the sensitivity of this method of reception depends upon the time available for the current to build up to large values, it stands to reason that the lower the quenching frequency the greater the amplification. Tests show that a ratio of one to one thousand (quenching frequency to signal frequency) will provide the best average results. From this it can be seen that the quenching frequency generator should be built for the band over which it is desired to receive and if the set has wide band coverage, then the oscillator should be capable of tuning to the various recommended quenching frequencies as set forth in the graph of Fig. 8.

There are many ways in which the output of the quenching frequency generator can be connected to the super-regenerative tube; several are shown in Fig. 9a, b, c and d.

Figure 9A shows the oscillator inductively output coupled to the secondary of the detector tube. In 9B the output of the quenching frequency generator is coupled through resistor R, which has a three-fold purpose: bias for the detector tube, bias for the oscillator tube and the coupling means for the introduction of the quenching frequency into the detector.

Figure 9C shows the quenching frequency being introduced into the screen circuit of a screen-grid tube. The screen voltage is modulated by the plate current changes of the oscillator and in turn modulates the electron stream flowing between the cathode and the plate.

The new type radio frequency pentodes can be used as detectors in super-regenerative receivers and the output of the local oscillator can be fed into the detector circuit by the connections of Fig. 9D, or through the method shown in Fig. 9B. Both methods work well.

Pre-amplification before Detection

Even though high gains in amplification are obtainable in receivers using the super-regenerative action, it is necessary to have a signal of some magnitude on the grid. Unless the incoming impulses are great enough to "trigger" the grid, there can be no action. As in any other system where vacuum tubes are used some voltage must appear across the input so that the tube can function. The use of at least one stage of radio frequency amplification ahead of the super-regenerative tube will serve to raise the value of the voltage applied to the input of the detector stage and will aid in making the receiver more selective.

Another point in passing. Super-regenerative receivers are fully capable of causing quite a disturbance to near-by receivers and for that reason alone, at least one stage of R. F. amplification should be used ahead of the detector. It is the opinion of the author that every short wave receiver should have at least one stage of stable radio frequency amplification placed ahead of regenerative detectors (or first detectors in short wave superheterodynes). The super-regenerative receiver is no exception to this rule! *Some day when short waves become even more popular than they are now, watch what* *public opinion will do in regard to interference from the ignition equipment of the average motor car!*

So many circuits have appeared in SHORT WAVE CRAFT covering the design of suitable radio frequency stages for short wave reception, that this phase of the subject can be left to the ingenuity of the reader and the back numbers of this magazine.

One of the difficulties encountered in the operation of super-regenerators is that when the feed-back is increased to such a point that the tube does not function in a super-regenerative manner but goes into oscillation, it generates power at the frequency determined by the "LC" value of the coil and condenser in the input or grid circuit.

An "Ideal" Super-Regenerative Circuit

Figure 10 shows a super-regenerative circuit which avoids this condition and is one worth experimenting with and developing. The coil L and the condenser C form the *signal tuning* circuit. Note that the signal is applied to both grids but in opposite phase. The voltage drop in the resistor placed in series with the center-tapped coil L3 determines the bias on both tubes. The value of this resistor should be such as to limit the plate current per tube to .1ma. (milliampere). Note that the same bias is applied to both grids; in other words the *input* circuit has the tube input impedances in series, commonly push-pull. The *output* circuits are in parallel and as the coil L1 is mounted on the same form as L, some means must be provided to control the feed-back action of the tube; R1 serves this function.

Coils L4 make up a coupling circuit and couple the quenching frequency generator to the detectors. The frequency of the local oscillator will depend on the frequency being received; the strength of the oscillator is varied by resistor R2 and this can have a value of 50,000 ohms.

Normally there is no feed-back action, as the grids are in opposite phase when a signal is applied, so that the sum of the plate currents will be constant. This is the condition when the quenching frequency oscillator is not working.

On one half cycle of the quenching frequency, a voltage will be set up in coil L4 and the bias of one of the tubes will be *increased*, while the bias on the other tube will be *decreased*. With this change in bias there will be a change in the mutual conductances of the tubes to the incoming signal and as a result there will be a flow of current in the feed-back coil L1. The action repeats its self on the succeeding half-wave from the quenching frequency oscillator, although the feed-back is in the opposite phase. With this action carried on there is regenerative and also *degenerative* feed-back from coil L1 to coil L.

The current built up in the resonant circuit L and C during the regenerative period will be destroyed during the degenerative period, even though the strengths of the two feed-backs are equal.

It is hoped that this brief resumé of the past and present in super-regeneration will serve as an aid to those having a desire to build "high gain" detector circuits. There are so many modifications of the fundamental circuits and principles involved that in this article we can only touch on the "high-lights" of the past ten years and trust that it will prove of some benefit to the student of the subject.

IS IT SAFE

To Apply SHORT WAVES TO THE HUMAN BODY

¶ Read in the January issue what an expert has to say from actual experience. C. H. West of the U. S. Public Health Service, tells of his experiments in an interesting article, illustrated with photos and diagrams of the high frequency apparatus used.

How to Get A-1 Results With a 2-Tube Receiver

(Continued from page 488)

Short-wave reception over long distance is quite possible and this little outfit, if properly constructed, will bring in plenty of "DX." Of course the tuning is extremely sharp, especially on the long distance stations. This is the case of course on all short-wave receivers regardless of their size and the average person may be pretty much disgusted until he gets the "hang" of it, but if he has the patience to stick it out—"Oh Boy! What a thrill!"

A Few Mechanical Tricks

A few words might be said about some of the mechanical details which would show the builder some of the "bugs" that have been worked out. The drum dial is of the cable drive type, thus entirely eliminating backlash. Its usual small knob has been replaced with a larger, knurled one, making possible a much finer adjustment and also being a lot less tiresome to the fingers when one decides on an "all night session" with the outfit. The control on the regeneration condenser is one of the old four-inch graduated dials. The operator can forget the graduations as far as regeneration is concerned, but the advantage of the large diameter dial, which he can grasp at the extreme edge with the tips of his fingers, is "fine business" when he needs that extra "one-thousandth of an inch" of regeneration. Perhaps the builder may wonder why a vernier type of dial wasn't installed at this point. The reason is that the action of most vernier type dials is far too slow for the extreme sensitiveness required of this control.

Another little point worth noticing is the two small radio frequency choke coils comprising a radio frequency filter system in the audio amplifier output circuit. These entirely eliminate all capacity effects due to the operator being coupled to the set by the phone cords. No accurate specifications need be given for these. They consist simply of 150 to 200 turns of some fine wire "jumble wound" on two small fibre spools. Incidently, be sure that the bolt that you run through the spool to hold it down is made of *brass* and not of iron or steel. This is a small point but one which the beginner is very apt to overlook.

The builder should secure several good—and again let the word "good" be stressed—grid leaks in values of say, 2, 3, 5 and maybe 7 megohms. He will be surprised to see how changing from one to another will increase the sensitivity on some bands and will bring a supposedly "dead coil" to life, bringing in stations that formerly refused to even let their carrier wave be heard.

What Tube to Use

The selection of tubes is largely a matter that can be left to the builder. Having a spare storage battery on hand, the writer was able to take advantage of the '12A for the output, which when operated at the voltages shown gave a rather pleasing mellow tone, eliminating almost entirely the harshness due to the regeneration. (Tube engineers will probably mutter strange words in their beards at the thought of no "C" bias!) However, with a regenerative detector as a start there is very little use in attempting to get much quality from the audio end.

At this point it might be well to mention the two rheostats which are visible in the photographs. The one on the panel at present controls the filament voltage of the audio amplifier and can almost be considered a luxury. However, the writer finds it very handy for controlling the tone of the output, which it does to a considerable and useful extent in this particular set. The one that is mounted on the sub-panel is there to provide the required four-volt drop for the filament of the screen-grid detector, which is of the two volt type. Once this is set it need not be adjusted again. If the builder has a source of suitable voltage he can eliminate both of these by using two volt tubes throughout.

The Plug-in Coils

Regarding coils and coil forms, the writer has at his disposal a considerable accumulation of short-wave coils wound on almost every kind of form from the lowly tube base to the manufactured form and with almost every kind of wire, fine to coarse and enameled to silk covered. There seems to be little difference as long as the standards of construction are kept to a high degree and the turns-ratio between the secondary and the tickler windings is correct for the particular tube used. A table is given covering a good set of coils for this receiver. The amount of tickler turns may need to be varied a slight amount to match the particular tube the builder intends using.

As an example in coil construction, the writer has three sets of coils, exact as to the number of turns, diameter, etc., one set being made up on bakelite tubing mounted on tube bases, another on manufactured ribbed, composition forms and the third set is wound directly on tube bases, using a somewhat finer wire. Outside of the fact that the manufactured ones are somewhat prettier, there is absolutely no difference between them in operation. There also seems to be little difference noticeable due to changes in the size of wire as long as it is kept within a reasonable size, although the writer has some experimental coils wound with about No. 40 enameled wire, which have given quite satisfactory results except for their fragility. Perhaps a good standard size is either No. 22 or No. 20 for the smaller coils and No. 26 or No. 28 for the larger ones. No. 28 enameled makes compact ticklers for all sizes. The spacing between the secondary and tickler coils should not be much over one-eighth of an inch and the coils themselves should be wound quite tightly to prevent the unstable condition which will exist if the turns are allowed to shift in relation to one another.

Very little else need be said regarding the set. If the builder follows the circuit shown using the values and voltages indicated and using reliable, well-made parts, he will have a set which for quietness of operation and smoothness of regeneration will be hard to equal.

The writer keeps a regular "Log Sheet" for each time the set is used and it is surprising with what regularity the long distance stations are received. Either side of the ship-to-shore telephone comes in with excellent volume and clarity and there are lots of police and airport stations that provide plenty of thrills for the short wave listener. The larger foreign broadcast stations are easily available, even for the beginner on this set, and if he cares to learn the code he can get plenty of enjoyment out of listening to the code stations, which practically fill each coil from beginning to end and then he'll know what the feel of real long distance reception is.

List of Parts Required

C—.00002 mf.—Hammarlund MC-20S—3 plate midget
C1—.0001 mf.—Hammarlund MC-100M—14 plate midget
C2—.0001 mf.—fixed mica condenser
C3—.00025 mf. Hammarlund MC-250M—34 plate midget
C4—.001 mf.—fixed mica condenser
C5—.01 mf.—fixed mica condenser
R—2 to 7 megohm clip mounting type grid leak

R1—60 ohm wire wound rheostat
R2—200,000 ohm resistor 1 watt size (or grid leak type will do)
R3—20 ohm wire wound rheostat
L & L1—See coil table
L2—Standard radio frequency choke—from 2 to 5 millihenrys
L3 & L4—Small radio frequency chokes described in article
T—3½ to 1 ratio audio frequency transformer

Coil Table

Coils to be wound on standard tube bases or other forms of the same diameter. Secondary windings (L) may be of No. 22 or No. 20 D. S. C. or S. C. C. All ticklers wound with No. 28 Enameled. Turns wound close. Spacing between L and L1 about one-eighth of an inch.

Wavelength Band	L	L1
20 to 40 meters	6	6
40 to 60 meters	10	10
60 to 80 meters	25	20
80 to 150 meters	40	30

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

Of Short Wave Craft, published monthly at Mount Morris, Ill., for October 1, 1932.
State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Hugo Gernsback, who, having been duly sworn according to law, deposes and says that he is the Editor of the Short Wave Craft and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Popular Book Corp., 98 Park Place, N. Y. C.; Editor, Hugo Gernsback, 98 Park Place, N. Y. C.; Managing Editor, H. Winfield Secor, 98 Park Place, N. Y. C.; Business Managers, None.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Popular Book Corp., 98 Park Place, N. Y. C.; H. Gernsback, 98 Park Place, N. Y. C.; H. Winfield Secor, 98 Park Place, N. Y. C.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

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

H. GERNSBACK, Editor.

Sworn to and subscribed before me this 28th day of September 1932.

JOSEPH H. KRAUS.
(SEAL) (My commission expires Mar. 30, 1933.)

Short Wave Events of the month

Sept. 1—10:00-11:00 p. m. from Berlin to New York. "Lucky Strike" Program, Marek Webber Dance Orchestra. (N. B. C.)

Sept. 19—4:00-4:30 p. m. Promenade Concert from London. (C. B. S.)

Sept. 25—4:30-4:32 p. m. Pierre Le Comte Nouy. This program was cut after two minutes because of atmospherics. Program shortwaved from Paris to New York. (N. B. C.)

Sept. 26—4:30-4:45 p. m. Ramsay MacDonald from London. (C. B. S.)

Oct. 12—4:00-5:00 p. m. Exchange program to and from Madrid, Spain. (C. B. S.)

Take a tip and read the important announcement on page 492

The Short Wave Beginner

(Continued from page 478)

clusion is correct, but instead of having a very large coil generating the field, as pictured in Fig. 4, a long wire suspended high in the air is used. This wire, called an *aerial* or *antenna*, generates a large field that extends many miles and may induce a current in another wire, similar in construction to the first. Fig. 5 shows how this is accomplished.

Frequency of Radiation

We will remember that the frequency of an alternating current flowing in a wire is the number of times that it changes its direction of flow, or in other words, the number of times the electrons change their direction back and forth. Frequency in radio transmission is similar to this, except that the energy is transmitted without the use of wires and instead of moving in a definite direction, it is carried in all directions away from the aerial of the transmitter, returning through the ground is it were.

If the wave reversals are between 550,000 and 1,500,000 times a second, we say that the waves are sent at a frequency of 550,000 to 1,500,000 cycles or more commonly 550 to 1500 kilocycles, which is the band of frequencies used for the regular broadcasting of programs. The short waves are reversing even faster, from 1,500 kilocycles to 60,000 kilocycles.

We are all familiar with the term *wavelength*. This is only another way to express the *frequency*. If we consider a single impulse of current that is sent out on the aerial of the broadcasting station, we will find that it travels a certain distance before another impulse is emitted. The distance between these impulses or reversals of current is the *wavelength*. This has been expressed in meters instead of the more common feet or yards. A meter is about 39 inches in length.

Radio waves travel at a speed of 186,000 miles per second. Suppose we consider a radio wave of a frequency of 1,000,000 cycles. It takes one millionth of a second before the reversal of current starts. Then the impulse travels at a rate of 186,000 miles per second, for one millionth of a second or about 0.18 miles. This can also be expressed in meters instead of miles and when converted it becomes 299.8 meters.

An easy way to convert frequency to wavelength is to divide the figure in meters into 300,000 to find the frequency in K. C. and divide the frequency in kilocycles into 300,000 to ascertain the wavelength in meters.

How Radio Radiations Are Produced

The electromagnetic radiations used in radio work are produced by generating electric currents of the frequency to be used for the transmitter and connecting the source of these high frequency currents to the aerial and ground. The high frequency currents are generated by large vacuum tubes known as "oscillators," which are made on the same principle as the vacuum tubes in our receiver. In fact the receiver can be used to transmit radio waves, if we turn the regeneration control to the right until the set starts to oscillate. Of course, these waves are very feeble and do not travel very far.

Vacuum tubes are used to generate the currents, as it is not practical to make generators of the usual rotating type employed for generating the electric light current, for such high frequencies. Every broadcasting station in the United States is assigned a certain frequency, by the Federal Radio Commission. Practically all stations in one vicinity are assigned different frequencies or wavelengths, so that we may select the one we want without hearing any of the others. This selection, as we know, is accomplished by tuning the receiver.

The amount of energy picked up in an aerial is extremely small. It is interesting to note that it has been estimated that the amount of energy picked up by the average receiving aerial, coming from a broadcasting station 2000 miles away, if made continuous day and night for thirty years, would about equal the energy expended by a common house fly in climbing up a wall the distance of one inch. The voltage induced in the receiving aerial from a nearby transmitter of average power is in the neighborhood of 50 millionths of a volt—0.00005 volt.

If our eyes were capable of responding to the radiations sent out from the aerials of broadcasting stations, these aerials would appear like so many huge lighthouses flashing on and off, each one a different number of times each second, corresponding to the sound vibrations in the program being sent out. Since each station sends radiations of a different frequency, these beams would all appear as lights of different colors to our eyes. Such a sight would be truly fantastic and would enable us to understand more easily how these radio rays travel from the broadcasting station to receiving sets.

The 3-in-1 Monotube Super-Regenerator

(Continued from page 465)

When mounting the coil socket 3 be sure that enough distance is left between the coils to permit their removal, one at a time. The two chokes are mounted on two small brackets with a through bolt; make provision in this assembly so that the distance between the two coils can be varied. This will give the proper adjustment of the energy transfer for the quenching frequency action of the tube.

Condensers 9 and 10 are soldered into place on chokes 7 and 8.

The rest of the parts should be fastened into place with wood screws and the constructor should place all parts as shown in the photographs.

Trouble-Shooting on the Set

SET WILL NOT OSCILLATE.

Reverse the connection to small winding of coil mounted in socket 4.
Tube defective.
No plate voltage.
Choke 8 open.
Resistor 13 too high in value, reduce to lower value.

SET "OSCILLATES" BUT WILL NOT "SUPER."

Reverse the connections to Coil 8.
Coil 7 and 8 are placed too far apart. Bring them together.

SET OSCILLATES AND SUPERS BUT WILL NOT TUNE.

Large windings of coil mounted in sockets 3 and 4 open.
Wires left off of the tuning condensers.
High resistance contacts, due to poor soldering.

POOR PICK-UP.

Defective tube.
Improper bias on the tube.
Coils in sockets 3 and 4 too loosely coupled. Bring them as close together as possible by resetting the socket mounting brackets.
Antenna not long enough.
Poor ground connection.

GOOD RECEPTION BUT NOT ENOUGH VOLUME.

This cannot be overcome under all conditions and not all stations can be tuned in at loud speaker volume.

Parts List for Both One Tube Super-Regenerator

One—Hammarlund Midget Condenser. Type MC250M. 250 mmf. (14)

One—Hammarlund Midget Condenser. Type MCD-140. 140 mmf. (5, 6)
One—Fletchtheim By-pass Condenser. Type GB-100. 1 mf. 200 volts. (12)
Two—Flechtheim Tubular Condensers. Type AZ-10. .002 mf. 1000 volts. (9, 10)
Two—Sets Alden Mfg. Co. Short Wave Coils. 15 to 200 meters.
Eight—Fahnstock Clips, (1, 2, 15, 16, 17, 18, 19, 20)
Two—Eby Chassis type sockets. (3, 4) Four prong for the plug-in coils.
One—Eby Socket, type depends on the choice of tube used for reception. (11)
Two—Blan Special choke windings. (7, 8)
One—International Resistor 10,000 ohms, 1 watt. (13)
One—Hammarlund Equalizer Condenser. Type EC-80. 25 to 80 mmf. (21)
(Optional method of antenna coupling.)
One—Blan 6 inch by 10 inch aluminum panel.
One—Wooden base-board 8x10x¾ inches.
All small brackets and incidental hardware can be purchased from Blan the Radio Man.

One Tube Super-Regenerator

Type of Tube	Plate Voltage	Voltage of Grid Bias	Value of Resistor 13 in Ohms
01A	135V	—13.5V*	....
210	350V	—35.0V*	....
112A	180V	—20.0V*	....
22**	135V	—13.5V*	....
24**	250V	— 9V	5,000
27	250V	—30V	15,000
30	180V	—20V*	....
32**	180V	— 6.75V*	....
36**	180	—6V	5,000
37	180	—20V	15,000
56	250	—20V	15,000
57**	250	—10V	5,000

*Bias furnished by "C" battery.
**Requires very large coupling impedance.

S-W Thrills Galore on 2 Tubes

(Continued from page 462)

ment control type) jack. This connects the phones and turns on the filament supply as well. The left-hand knob controls regeneration and the central dial is used for tuning. The antenna compensating condenser will have to be readjusted for each coil. There should be a point on this condenser which will allow the set to oscillate at all positions of the tuning dial for each coil. If the set does not oscillate try a shorter aerial (about 50 feet is sufficient) or try reversing the connections to the tickler coil.

Parts List

1—140 mmf. variable condenser (Hammarlund midget)
2—UX type sockets.
1—UY type socket (for coil).
1—R. F. Choke (short wave type: about 85 M. H.).
1—50,000 ohm potentiometer.
1—50,000 ohm, 1 watt resistor, R2.
1—.2 mf. non inductive condenser.
1—.02 mf. cond.
1—½ meg. fixed resistor. R3.
1—Amperite (¼ ampere type) with mounting.
1—3 megohm grid-leak.
1—.00015 mf. mica condenser.
1—.001 mf. mica condenser.
1—Screen grid clip.
1—Single Circuit jack, with extra switch closed when phone plug is in.
2 ft. of bus bar wire.
1—Roll of flexible insulated wire.
1—audio transformer (primary not used.)
4—Fahnstock connectors.
1—4 inch vernier dial.
Hardware, etc.

WHAT DO YOU KNOW
About T. R. F.
S-W Receivers?

¶ Don't fail to read Mr. Currie's article on the "De Luxe 5" T. R. F. Receiver in the January Issue!

Turn to page 503 and read about the big 50c worth

New "Royal" Short-Wave Receivers

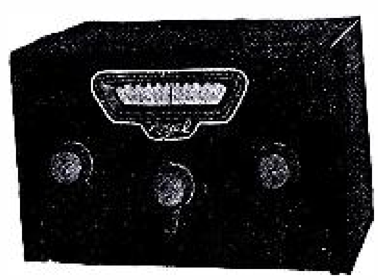
● THE line of "Royal" apparatus has been rounded out to include a new series of short-wave receivers. It is a well known fact that no one receiver can be built to suit every need or budget. With this in mind, the manufacturers are presenting the Royal Star, the Royal Chief, and the Royal Olympic.

The Royal Star, formerly known as the Model RP, has only two tubes, a '32 and a '33, yet it has scored as an enviable and consistent DX-er. The '32 tube as the screen-grid detector provides a sensitivity not approachable by the triode. The '33 pentode as the combined audio amplifier and output tube provides gain and power output approached by neither the triode nor the four-element tube. Equally as important as the selection of tubes is the method of coupling them. This is doubly important with screen-grid tubes, where the amplification possibilities are tremendous. The manufacturers, working towards this goal of optimum amplification and transfer of energy, invented a device known as the Trans-X unit.

Another feature of Royal operation is really *smooth action* regeneration control. Because of its position in the ordinary circuit, the regeneration control is inherently prone to upset normal tuning, necessitating constant readjustment of the frequency selector. These new receivers incorporate an exclusive circuit which eliminates this so-called *regeneration tuning effect*. It is so designed as to have no effect whatsoever on the tuning or logging of stations.

The use of two-volt tubes makes for maximum economy of operation, the filaments of both tubes drawing only 320 milliamperes. The receiver is equipped with a dual ratio dial, with fast and slow motion for tuning. The regular tuning ratio is 12 to 1. By a click of the lever, the ratio becomes 60 to 1, thus giving five times the spread previously available.

Up to now each of these receivers has been supplied in either of two models. The *regular* model was supplied with four coils, covering continuously from 15 to 200 meters; the amateur model was supplied with three coils, spreading the 20, 40, and 80 meter bands respectively across the tuning dial. The main difference between the two models was the use of a different capacity tuning condenser; the amateur model using a very small condenser, just large enough to spread each of the "ham" bands. Now each receiver is supplied in one form, so designed that the same set can use either a "ham" coil or a "regular" coil. Standard equipment is either four regular coils (15 to 200 meters) or three "ham" coils (20, 40, and 80 meter ham bands). Therefore the owner of one of these sets, who has a set of regular coils can obtain a set of "ham" coils and use it with the same receiver, without making any changes. There is also an additional coil available for the 160 meter amateur band and one for the broadcast band. The entire broadcast band is covered with one coil.



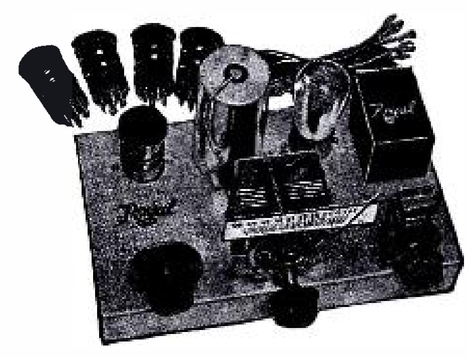
Front panel appearance of new Royal Short Wave Receiver. Note neat cabinet.

This new line of receivers is enclosed in a dust-proof six-sided metal cabinet. It is provided with a hinged swinging top permitting easy accessability to coils and tubes. Heavy metal is employed in its construction, and it is finished over all with a baked Japanned shrivel.

A new addition to the family is the "Chief." This is a three-tube receiver, similar to the Star, but with a stage of radio frequency amplification added. The radio frequency stage is like the detector, screen-grid, and it provides a high gain to the incoming signal before it is impressed on the detector. The Chief also embodies all the features found in the Star.

The Olympic is a four-tube receiver and is very similar to the Star and the Chief. Its circuit consists of one stage of screen-grid radio frequency amplification, detector, and two stages of audio amplification. All the features found in the Star and the Chief are incorporated in the Olympic: trans-X unit—high gain coupling, screen-grid detector—more sensitivity, pentode audio—with greater output, smooth regeneration, etc.

In addition to the controls located on the front panel of the other sets, the Olympic makes use of a novel volume control.



Note the neat construction of the Royal S-W receivers: plug-in coils in background.

The new feature of regular 15 to 200 meters reception, as well as amateur *band spread* reception with the same receiver, is likewise included in the Olympic.

Each of the receivers is available in either a battery operated or an all-electric A.C. model. The battery model is equipped with a neat tagged cable for easy connection to the batteries. The A.C. model is complete and ready to plug into the 110 volt, 60 cycle A.C. line. The battery model uses the economical two-volt tubes, while the A.C. model uses the new pentode A.C. tubes. The A.C. Star uses one 58, one 47 and one 280; the A.C. Chief two 58's, one 47, and one 280; the A.C. Olympic two 58's, one 56, one 247 and one 280. The A.C. models are available in 25 cycle and 220 volt models, in addition to the regular 110 volt, 60 cycle model. Special models are also available for line voltages and frequencies found in foreign countries.

"THE TRUTH ABOUT SHORT WAVE RECEPTION"

This is the title of an exceedingly interesting 16-page booklet which has recently been published by Kolster Radio, Inc. It is so well written, and is of such great interest to short wave enthusiasts, that we have asked the manufacturer to set aside a number of these booklets for our readers.

We shall be glad to send it to you free upon receipt of a postal card. Just say, "Send me a free copy of the booklet—The Truth About Short Wave Reception," and we will send it to you at once. Address;

Service Department

SHORT WAVE CRAFT
98 Park Place, New York City

A 20 Meter Transmitter

(Continued from page 474)

voltage at the plate; consequently if a condenser is connected across the coil in the plate circuit and tuned into resonance with the generated frequency, more feed-back is produced. The large impedance of the tuned circuit results in a higher voltage drop across the circuit. Thus, when a tuned plate circuit is used, the tickler coil can be removed further from the secondary circuit and oscillations will still occur at a greater coupling. This effect is especially noticeable at wavelengths near 20 meters.

When the requisite feed-back is provided oscillations will be maintained by the tube. There is more power in the plate circuit. Normally a much higher current circulates in the plate circuit, and, as we shall see later, the plate circuit must use heavy conductors for best results in the case of the transmitter.

Due to feed-back through the tube capacities in the tuned plate-tuned grid circuit, one can usually operate at short waves without extra coupling between plate and grid coils; the feed-back (capacitive) is sufficient in itself to give satisfactory oscillations. Thus the average amateur set will make no provision for inductive coupling between plate and grid coils. This is just what the receiving operator tries to avoid in his R.F. amplifier, but of course he has no control over the internal capacities inside the tube; these are eliminated from consideration by using a screen-grid tube.

Practical 20-Meter Transmitters

In a practical set, therefore, it is not necessary to couple the plate and grid coils together. A transmitter designed and constructed for 20-meter use is shown in Fig. A. Although one could use very small conductors in the grid coil with the same results (this might be especially advantageous if space were limited), it is often convenient to use the same size copper tubing for both plate and grid coils if plug-in coils are used for operation in more than one band.

The circuits of Fig. 3 are of course theoretical, which means that they are suitable for use in explaining the electrical actions themselves. The condenser C3 (also grid condenser C2—see Fig. 1) should be about 70 mmf. at 20 meters if a type '10 tube is used. Larger condensers are neither required nor desirable. Heavy copper tubing is necessary in the plate circuit (L2 of Fig. 1). Tubing ¼-inch in diameter will be found suitable for a low-power set, although this size actually becomes hot in some installations. Vibrations of the coils should be eliminated. If small tubing is used, there will be excessive heating and expansion of the coils, as well as unnecessary losses.

The small choke in series with the grid resistance (Ch 1) consists of 60 turns on a one-inch diameter tube. This same size can be used for the plate choke (Ch 2), although this choke is more important and should preferably be a spaced winding. The grid resistance (R) is 10,000 ohms. Both condensers in the tuned circuits (C1 and C4) can be made as small as .00015 mf., although if plug-in coils are used, in the tuned circuits, a .00035 mf. size will suffice for 40-meter work. A large amount of capacity should be used in the tuned circuits if a constant frequency is to be maintained. The correct L/C ratio is dependent upon the tube employed. Very high values of capacity are not recommended because the efficiency drops off rapidly as the L/C ratio is reduced.

Although it is often stated that filament by-pass condensers are necessary, it is never stated why. The purpose is to make both ends of the filament of the tube "coincide" as far as the R.F. is concerned. Although across a condenser there may exist a high D.C. voltage, a large condenser will show practically no difference in voltage with respect to a very high frequency signal. Thus the R.F. finds its way to filament without hindrance. Since 14 megacycles or so is a comparatively high frequency, it is not necessary to use large condensers for filament by-passing; however, large condensers (such as a 1 mf. size) do improve keying somewhat.

The complete circuit, with its "Zeppelin" antenna, is shown in Fig 1. However, any type of suitable size antenna can be coupled to the plate coil of the completed oscillator.

W9ZG Saves a Life

(Continued from page 473)

accident. There was little they could do. The simple remedies they knew were useless in the face of such a serious case. Men had been hurt before, but never had the telephone line been down and anybody hurt at the same time. Mike applied all his skill in an effort to keep the Boss alive till a doctor could get there, although deep in his heart he didn't think the injured man had a chance in a million.

By nightfall Peters was holding his own, that was all. Still unconscious, he appeared to be growing weaker. His pulse was fainter and starting to skip. Pike started two more men out towards Ridgeville, with wire and tools, in the hope that they could repair the line and get a call to Doc. Thomas before Red and Smokey could get through. Pike tested the telephone every few minutes, but it was still dead.

Supper did not take long that night and Jack was soon through his work for the day. The accident had almost demoralized the camp and no one noticed Hastings as he sneaked out of the mess house and struggled over the snow with his precious box of apparatus. Seeing the confusion that existed, he was determined to try to get in touch with the outside world by means of his radio transmitter. He worked feverishly and at last he had the outfit hooked up. It was pretty haywire, but, he thought, "Maybe it'll work." He turned on the current and the outfit started up.

The Short Waves Seem Hopeless

"Boy, oh boy, now if I can only raise someone. Guess I'd better try 7 megacycles," mused Hastings. "Maybe I can raise that kid in North Junction."

He swung the dials and listened. The evening "jam" was on. The band was crowded with rotten signals—a perfect jamble. He sent a QST, then another. Desperately he twisted the dials on his receiver. No response. He answered other calls. Regardless of whom he called, his faint signals were not getting through the crowd. Jack was frantic now. He sent out an SOS—even though it was illegal—this was an emergency. Even this plaintive cry brought no response.

With a sigh, Hastings changed over to 14 megacycles. He went over the dial carefully and was heartsick to find the band almost dead. There was little doing. LU1AA, in far off Argentina, was calling CQ DX. KA1PY and XU2XT were handling messages. There were no signals from the States at all. No sixes or sevens. A long CQ URGENT brought only one reply—OA4T. After fifteen minutes of struggling, Jack learned that he had "contacted" a negative in Arequipa, Peru, and that said Peruvian could talk no English and didn't even know the "Q" signals.

"That was that," thought Jack. Trying to get help from a foreigner over four thousand miles away was a little too much.

Glancing at his watch, Hastings saw that it was about time for his old schedule with KF6R. He rolled the dials over to the setting for Peterson and right on the dot—there was the signal: . . . . ZG W9ZG de KF6R, QTC? ar."

With a jerk of his hand Jack flashed a reply, "KF6R KF6R KF6R de W9ZG QTC URGENT ar K."

He listened. No response. Once again he sent this call into the night. He strained his ears, and his fingers ached as he twisted the dials, trying to force the signals from the receiver.

W9ZG Crashes Through!

There Peterson was again, this time calling "R R R W9ZG de KF6R QSA3 R4 WHERE YOU BEEN? ar K."

"NEVER MIND THAT," flashed Hastings. "GET THIS—BIG BOSS, ROCKY PASS LUMBER CO., HIT ON HEAD, CONCUSSION OF BRAIN LIKELY, UNCONSCIOUS FOR HOURS, NEED DOCTOR AT ONCE, NEAREST AVAILABLE RIDGEVILLE, TWENTY MILES, NEAREST GOOD MAN NORTH JUNCTION, MINN. WHAT CAN WE DO?

Back over the miles of ocean and snow, Jack heard the reassuring reply:

"HAVE SKED NRU AT 11EST WILL GET DOPE THRU THEN HOLD THE FORT TILL 1115EST CUL 73 KF6R." . . .

Hastings heaved a sigh of relief as he noted the contact in his log book. It was his first entry in many weeks. His celebration was cut short when the door opened and in came an angry man.

"At it again, huh?" queried Bill Pike, the straw boss. "Soon as the Boss gets laid up and can't keep his eye on you, you set this durned thing up and start fiddling around with it."

A Dark Moment

"Aw, Bill, I was trying to get some help for the Boss."

Jack saw that his replies were only making a bad situation worse.

"I ought to give you a punch in the nose," angrily, from Pike. "Instead, I'll do something that will teach you a lesson."

He reached over and jerked the tubes from the transmitter, throwing them on the floor. Hastings was too paralyzed to stop him or even to make any sound. He just sat and watched Pike ruin a perfectly good transmitter. When the straw boss turned on his heel and went out, Jack was nearer tears than he had ever been in years.

"Come over to the office; the rest of the boys will have something to say about your durn ticking at a time like this," he shouted as he went out of the bunk house and slammed the door.

Jack got up and walked away from his broken transmitter. He felt pretty rotten. Now he had lost all chance of helping the Boss, and of redeeming himself in the eyes of the men. Now they would be down on him worse than ever.

Over in the office the men gave Jack an unmerciful razzing, making a grand joke out of his attempt to "help the Old Man with his doggoned wireless gadget." Jack felt that he was absolutely sunk now.

A little past eleven Hastings slipped off from the bunch and went back to the bunk house. No one missed him and as soon as he was seated at his receiver tuned in for Peterson.

"At least," thought Jack, "the darned fool didn't bust my receiver."

"— NRU de KF6R QTC URGENT."

He listened carefully. Then came the droning signal again—"NRU de KG6R, BIG SHOT OF ROCKY PASS LUMBER BADLY HURT, CONCUSSION OF BRAIN, MEDICAL AID IMPERATIVE, RUSH GOOD MAN TO ROCKY PASS, MINN., SPARE NO EXPENSE, POSSIBLE TO GET TWENTY MILES FROM ROCKY PASS BY MOTOR SLED, REST UP TO DOCTOR."

Hastings was pleased with the way Peterson had jumped to the right conclusion. He listened on and heard Pete give the operator at NRU all the details he, Peterson, had concerning the accident.

Shortly afterwards, KF6R signed off to NRU and began to call Hastings. Jack reached for the switch and then realized that it was useless. He was once more cut off from civilization, now more completely than ever.

Peterson called again and then again. This time Jack heard him say "MESSAGE TO NRU OK 73 KF6R sk."

He turned the switch and left the receiver and went back to the cook house and his bunk. He rolled and tossed on his tiny bed, worrying about the message. Would NRU act at once? If they did, what could they do? Even if they started a man from North Junction it might be days before he could come up through the snow and ice-choked valley. Finally Jack went to sleep.

Help Via the Air!

He slept fitfully and no one came to awaken him, but about dawn he roused with a start. What was that unearthly noise? "Only one thing could make that," thought Hastings. A stunting plane! Then the truth dawned on the boy. Some one had come up to the camp in a plane and was trying to attract the attention of the sleeping men.

Hastings hurried on with his clothes and rushed out to find several other men already in the clearing.

"Who is it?" they cried, as they dashed about trying to signal the plane. There was room to land if they could only notify the pilot.

Jack didn't have to ask who was in the plane. He knew it must be a doctor. He turned and dashed into the bunk house and pulling blankets off the bunks he ran for the clearing. He would make a panel. Several of the men who had been in the Service came over to help him. They spread the blankets in a large + in the center of the clearing. If the pilot was an expert he could make a fairly good landing. "If he wasn't an expert—well, he had to be, that's all," thought Jack.

The plane dived on the "panel" and pulled up, wiggling its wing as the pilot signalled that he understood. The plane banked sharply and started down, fishtailing, sideslipping to lose altitude. Slowly it neared the clearing. It turned into the wind just over the trees at the edge of the cleared space and with a snappy "fishtail" settled on to the snow. The men ran out and grasping the wings pulled the plane to a stop.

The cabin door opened and out jumped a man carrying a black leather bag. There was no need to question him. He had "Medical Man" written all over his face. He turned and helped two women out of the cabin.

Bill Pike came over, puffing from the tussle with the wing, and greeted the party. The pilot stood leisurely by and smoked while the man explained that he was Doctor Adams, a brain specialist, from Minneapolis, and these were his two nurses.

Pike took the doctor and the nurses off to Peters' residence and the boys stood around and examined the plane. The pilot did not seem very friendly and not much information could be obtained from him. After a while Pike came back and the men all went into the office.

"How's the Boss?" he was asked.

"Well, boys, that Doc sure knows his stuff and there is a chance the Boss will get out of it."

"Where did that Doc come from, Bill?" queried one of the men who had not been in the clearing when the plane came in.

"The Doc says he's from Minneapolis," replied Bill. "Guess the boys must have got to Ridgeville and sent out a call from there."

"No, you're wrong," spoke up the pilot of the doctor's plane. "Doctor Adams spoke of a telegram from the East."

"Gosh, wonder how that happened," returned Bill. "Have to ask the Doc when he comes back."

The men waited anxiously for almost an hour and then they were rewarded for their wait by the entrance of the surgeon.

Good News!

"Well, boys, your Boss is going to get well. We removed the pressure by a slight operation and unless he takes a turn for the worse he will pull through in good shape. His fine physical condition kept him alive. By the way, there must be some mistake in this wire. It reads, 'News via radio, man seriously injured at Rocky Pass,' and so on. I didn't see any towers when I came in. You don't have a broadcasting station here, do you?"

Pike turned red and wheeled on Jack and demanded, "Did you send for the Doc?"

"Sure, I had just gotten the message through to Peterson when you stopped me."

"But, my lad," asked Doctor Adams, "how is it that the wire I received is not signed 'Peterson,' but 'MacCauley NRU,' whatever that means?"

"Well, doctor, it is a rather complicated story," replied Hastings. "But, you see, I have an amateur station up here and I told Peterson on the Frisco-Hawaii plane of the Boss' condition and asked him to send aid. He got in touch with NRU—that's a station on the East coast, and they sent you the wire."

"Remarkable!" gasped Doctor Adams. "What do you do up here, run your radio all the time?"

"No, doctor, I'm the cook's ——"

Jack Gets Credit at Last!

"Well, Doc, the lad's been doing a lot of things, but at the present he is the bookkeeper's best assistant," Bill Pike went on. "And when the Boss gets well, I think that he will agree that this camp needs a good wireless gadget and a man to run it. I kinda think that the man will be Hastings here."

"Hastings, you should be proud of your work in connection with your Boss' injury." Doctor Adams drew himself up in his professional manner and went on, "You and your radio saved a man's life last night. Where is this remarkable outfit?"

"It's over in the bunk house, doctor," replied Jack. "Come on, I'll show it to you."

The doctor, Pike and Hastings left the office and plowed through the snow to the bunk house. Jack pointed out the different parts of the rig and was deeply involved in a one-syllable description of amateur radio when he was interrupted by the doctor.

"Why, what happened to your tubes? They are all broken."

"Well, you see it was this way, Doc," Bill Pike started and then hung his head.

"You see, Doc, it was kinda dark in here last night," Jack interrupted, "and I stumbled and dropped the tubes."

"Remarkable, but very careless, wouldn't you say," replied the surgeon.

"Guess it was," Jack smiled as he looked at Pike, "but I don't think it will happen again."

TO OUR READERS—This is a new experiment—Short Wave Fiction! Would you like to see more? If so, just mail a postcard to the "FICTION EDITOR," SHORT WAVE CRAFT, 96-98 Park Place, New York City, and tell him so.

A Super-Regenerator With Pentodes

(Continued from page 475)

R.F. grid and detector grid, tuning is still too broad. However, by adding a band-pass filter either between antenna and R.F. grid or between R.F. plate and detector grid, very satisfactory selectivity can be obtained. In the original model this filter was placed between R.F. plate and detector grid to help in the reduction of regenerative feedback and to prevent unstable detector oscillations.

In order to permit best super-regenerative action over the range of 15 to 100 meters, the variation frequency oscillator is provided with three fixed condensers of different values, controlled by means of a three-point tap switch. With a grid coil of 20 mh. inductance, the frequencies are 25, 35 and 50 kc. at capacities of .002, .001 and .0005 mf. respectively. If the 100 to 200 meter band is desired it will be necessary to add capacity in parallel with the .002 mf. section until the frequency is approximately 100,000 to 15,000 cycles. The output of the oscillator is controlled by the variable resistor R4

Pentode Audio Amplifier

The pentode *audio amplifier* is conventional in design, it being resistance-coupled from the detector. The output transformer will depend upon the choice of magnetic or dynamic speaker.

Coil Construction

Due to the use of three tuned circuits and to the fact that no form of tapped coils can equal plug-in coils in efficiency, the plug-in type was employed. These are of different construction than the usual coils. Figure 2 shows how the various coils are arranged on strips which are provided with General Radio coil plugs. A pair of strips having G.R. jacks are used as mounting bases. The layout of the strips is given in Fig. 3. Drill the base and coil strips exactly alike, in fact, it would be well to drill them all at the same time. The stock for the coil strips should be 3/16" thick and 1/4" for the base if hard rubber is used. If bakelite is used for the base, the thickness may be 3/16" since it is much stronger than hard rubber.

The three-gang tuning condenser was an old broadcast unit with all but three rotor and four stator plates removed from each section. The resulting capacity is uncertain but it is in the vicinity of .0001 mf. With this capacity condenser the coil values given in the accompanying table were employed. It must be remembered that variable condensers vary in capacity even though the number of plates is the same. The coil table may require modification to cover the exact range.

It will be noted that the tickler specifications are somewhat greater than usual. This is for the purpose of providing a stronger oscillation in the detector.

The method of coupling between L1 and L2 is somewhat different than is generally employed but the results are the same. In this case, the two coil sections do not require wide spacing.

The older types of inductances used in the variation frequency oscillator, such as honeycomb coils and iron core transformers, were eliminated in favor of a much more compact type consisting of a 20 mh. grid coil and one of 8 mh. for the plate. These were both of the lattice wound types having diameters of 1" and 3/4" for the 20 and 8 mh. coils respectively. Each coil has a center hole of 3/8" which allows them to be mounted on a 3/8" wooden or hard rubber rod, making it possible to slide one coil along the rod for the purpose of adjusting the oscillator output. Both coils MUST be wound in the same direction and placed on the mounting rod correctly. These coils may be purchased at nearly any radio store in the larger cities. The mounting arrangement of this unit is shown in Fig. 4. The oscillator coils, switch and fixed tuning condensers may all be mounted on a small bakelite base if desired.

R.F. Chokes

The R.F. chokes are easy to construct and are sometimes better than manufactured ones. The choke in the R.F. "B" positive lead may consist of 1,500 turns of No. 36 enamel or silk covered wire wound in three slots, 500 turns per slot. The choke in the detector plate circuit must have a higher inductance, since no R.F. currents can be allowed to get into the A.F. amplifier. This choke should be wound with 5,000 turns No. 36 wire in 5 slots, 1,000 turns per slot. Dimensions of the wooden forms are given in Fig. 5.

Shielding

The dotted lines in Fig. 1 shows how much of this circuit requires shielding. Box shields are necessary; Alcoa 5" by 6" by 9" aluminum boxes are ideal. Copper was employed in the original but aluminum will do just as well. The three gang tuning condenser is, of course, mounted outside of the shields. Figure 6 shows how the condenser, shield boxes and audio amplifier are placed on a baseboard or metal sub-base.

The R.F. bias resistor R, bypass condensers C4 and R.F. choke are located within the R.F. shield. The detector grid condenser C5, leak R1, RF choke, bypass condensers C4 and plate condenser C6 are placed within the detector shield. Other resistors, condensers, etc., are located underneath the sub-base. If the oscillator variable plate resistor R4 is used, it may be mounted on the panel at the right of the tuning dial.

When wiring, use at least No. 14 wire for the filaments and No. 22 to 18 pushback hookup wire for the other circuits.

Adjustment and Operation

While the adjustments are not difficult, they should be made with care in order to realize maximum efficiency. First, plug in the 80-meter coils and set the antenna coupling condenser C at approximately halfway in. Separate the two coils in the oscillator as far as possible, or, if R4 is used, set at maximum resistance. Tune in a loud signal by means of the tuning dial and regeneration control. Adjust trimmers on the gang condenser to best point. Now turn volume control down so that signal is just above audibility. Then bring oscillator coils close together with switch set on the .002 mf. condenser. The regeneration control RC should now be turned considerably beyond the *normal*, point of oscillation although no oscillations should be present until RC is still further increased. The signal should now be extremely loud.

If a loud rushing noise is heard, first adjust the variable grid leak R1. This should help matters considerably, but if the noise still persists, try adjusting the coupling between oscillator plate and grid coils or the oscillator plate resistor R4. Sometimes both adjustments are necessary. When all adjustments are made correctly, music and speech should be of fine quality. C.W. code signals can be picked up by increasing the regeneration control.

If the coils have been made so that L, L1 and L2 are exactly alike, no additional trimmer condensers will be necessary. If not, it would be well to shunt .000025 mf. midgets across all three sections of the tuning condenser. These would be adjusted only once for each band shift.

Power Supply

The power pack may be any type giving an output of 300-350 volts and having two 2.5 volt filament windings. For the benefit of those who desire to build this unit as well as the super-regenerator, details will be given. The circuit is shown in Fig. 7. The filter chokes should be capable of carrying 85 ma. The 2 mf. input filter condenser should have a rating of at least 600 volts. The other two condensers may be 450 to 600 volts. The leads from the filament windings to set *must* be heavy, No. 14 to No. 8 wire, and should not be longer than 18 inches.

Like any other rather complicated receiver, the builder will probably not make it work as soon as it is hooked up. Use your head and radio knowledge if some kink develops.

Data Applying to Figure 1

C—.000025 mf. antenna coupling condenser
C1, C2, C3—.0001 mf. three gang tuning condenser
C4—.1 af. bypass condensers
C5—.00001 mf. detector grid condenser
C6—.0005 mf. detector plate bypass condenser
C7—.25 mf. bypass condenser
C8—.25 mf. bypass condenser
C9—1 mf. bias bypass condenser
C10—.1 mf. audio coupling condenser
R—270 ohm R.F. bias resistor
VC—50,000 ohm volume control
R1—Variable grid-leak such as Pilot or Clarostat
RC—50,000 ohm regeneration control
R2—100,000 ohm detector plate resistor
R3—25,000 ohm detector plate resistor
R4—50,000 ohm resistor variable
R5—1,000 ohm oscillator bias resistor
R6—500,000 ohm pentode grid resistor
R7—20-60 ohm center tapped filament resistor
R8—400 ohm pentode bias resistor
R9—25,000 ohm 75 watt Electrad Truvolt resistor with 3 taps
RFC—R.F. chokes
SW—Three-point tap switch
CA—.002 mf.
CB—.001 mf.
CC—.0005 mf.

Coil Table

Band	L	L1	L2	L3
20	4	4	4	4
40	9	9	9	7
80	20	20	20	11

Use No. 26 enamel wire on L, L1 and L2 and No. 30 on L3. All coils close wound.

A heavy piece of metal foil mounted directly in back of the secondary tuning dial will shield the condenser from your hand if such effects should become troublesome. Connect the piece of metal or the metal foil to the grounded (filament) side of the secondary condenser. The shield may not be necessary.

Adding Another Tube

Be sure to try the set out first hooked up exactly as in Fig. 4. If it works good that way, and you want a little more volume, add another tube to the set as suggested in Fig. 8. The extra parts necessary are: One 3:1 ratio audio transformer, one UX tube socket, 1 tube with same filament voltage as the other two tubes in the set.

The connections are as in Fig. 8. The letters M and N in this diagram are connected to the two leads at "X" on the other diagram, Fig. 4A. Connect points "O" and "P" directly across the filament terminals (at the tube—points "Z,Z" in Fig. 4 and Fig. 4A) of the detector, so that the filament supply will reach the new tube. Connect "Q" to the post marked "plus B 90 to 135." Move the clips at "X" there, to the position marked "T2" here; thus the headphones will be connected so as to have the volume supplied by the three tubes. "S" in Fig. 8 is the new amplifier tube.

Building an A.C. Two-Tube Set

If desired, A.C. tubes can be used as shown in the circuit diagram of Fig. 9. The tubes are 27's, with a filament voltage of 2.5 volts A.C. The connections are the same as for D.C. tubes except that, for A.C. tubes, there is a heater which operates separately, so changes are made as shown in the diagram. The heaters operate directly from the 2.5-volt filament transformer. This two-tube A.C. set can be operated with all the parts used in the D.C. set, but 5-prong sockets will be necessary for the A.C. tubes. A filament transformer will also be necessary.

The set is normally operated with A.C. filament supply, and batteries can be used for the plate supply also if desired. The plate batteries are connected exactly the same as for D.C. sets, as shown in Fig. 5. In fact, A.C. sets are exactly the same as D.C. sets in every respect except that, because A.C. filament supply is used, another terminal appears on A.C. sockets, making 5-prongs in all.

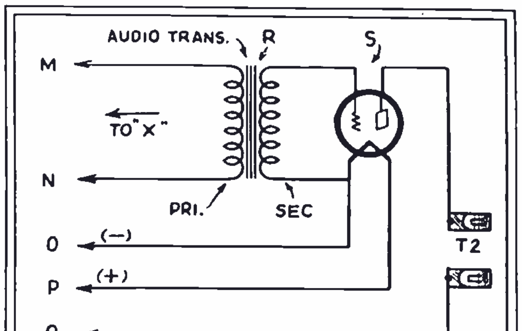


FIG. 8

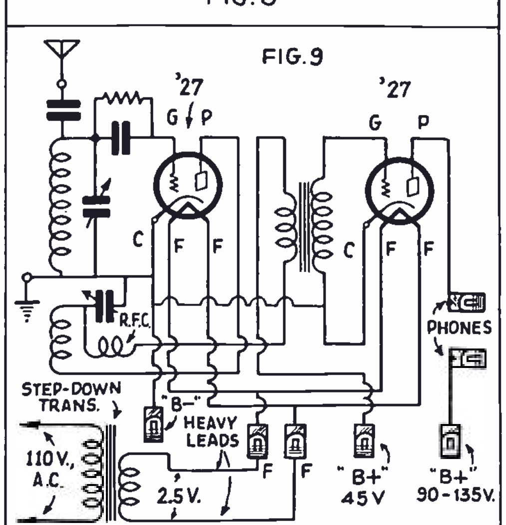


FIG. 9

Fig. 8—Adding extra A.F. stage; Fig. 9—A.C. Tube hook-up.

The Binneweg 12,000 Mile Receiver

(Continued from page 481)

The tickler coils should be placed at the end of the secondary coil which connects with the filament of the detector tube. Wind the tickler and secondary coils in the same direction when you are winding a complete unit at the same time.

Be sure of your detector tube! Old tubes seldom give good results. The '01-A and '30 tubes make good detectors. Adjust the "B" voltage and the tickler until oscillation starts with a gentle hiss. If oscillation starts with a click, the most sensitive spot—at the exact point at which oscillation starts—is lost; this point is very important for distance work. Try reversing the filament connections to the set and note if the oscillation control improves. A good grid condenser and leak are required; try several values of grid leaks up to about 9 megohms resistance. To eliminate ringing noises, obtained with some tubes, mount the detector socket on a piece of rubber bath-sponge and use flexible leads to the socket.

"Dead-spots" (positions on the tuning dial at which the set will not oscillate) are caused by too great a capacity in the antenna-series condenser, or resonance with nearby wiring, coils, etc. Another condenser (.0001 mf. variable) in series with the condenser, already in the aerial will allow you to shift any such spots that may occur, if caused by the antenna.

Use a long aerial for good distance, and keep it in the clear as much as possible. If tuning is sharp, use a vernier dial. Hand effects are minimized in this set. *Be sure to connect the condenser rotors (movable members) to the filament side of the secondary coil.*

Most Powerful U. S. W. Station

(Continued from page 458)

as well as the radio amplifier and the modulator for radio and television. The base, which carries the actual transmitter, contains in the usual fashion the controls for regulating the machines and the necessary measuring instruments.

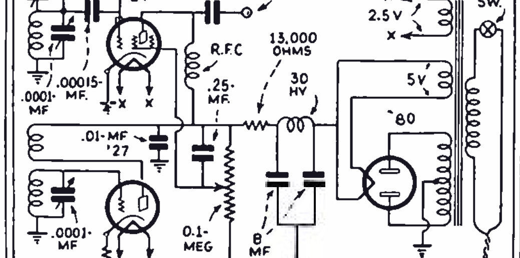
There has recently been effected a very interesting and practical solution of the problem of the connections between the antennas and the reception building. As shown, the directional antennas are chiefly in two rows, about a kilometer (.6 mile) in length, each and west of the station building, so that the greatest distance is some 700 meters. For these connections there are used (just as at the transmitting side) so-called *energy conductors*, which serve the purpose of conducting the energy received in the antenna to the receiving set with a minimum of losses, and particularly without lessening the directional effect of the antenna by self-reception. The *energy conductors*, which can be formed as one or two-wire conductors, were formerly made out of thick copper pipes or of parallel wire conductors.

Fifth Prize

(Continued from page 490)

List of Parts for Mr. Utermohle's Converter

1—Pilot illuminated dial
2—Pilot J-23 midget variable condensers
1—Pilot condenser coupling unit
3—5 prong sub-panel sockets
1—4 prong sub-panel socket
1—Pilot J-5 midget variable condenser
1—Pilot 100,000 ohm potentiometer
1—Power transformer
1—30 henry choke
2—8 mf. electrolytic condensers
1—1.5 megohm grid leak
1—10,000 ohm wire wound resistor
1—3,000 ohm wire wound resistor
1—2,000 ohm Lynch metallized resistor
1—Pilot switch
1—Pilot R.F. choke
1—.00015 mf. fixed condenser
1—.00025 mf. fixed condenser
1—.01 mf. fixed condenser
1—.25 mf. fixed condenser
3—insulated binding posts
1—5/8" hard rubber bushing
1—'24, 1—'27, 1—'80 tube
3 pilot coil forms
1—spool No. 24 D.S.C. wire (green)



Mr. Utermohle's hook-up.

S. W. League

(Continued from page 485)

that we should be allowed to "xmit" on wavelengths below 5 meters without the necessity of passing a code test; however, I think we should be required to have a greater knowledge of radio theory so that there would not be so much QRM caused by "haywire" transmitters and RAC.

Best of 73's.

WEEKS SELLERS, Pres.
EMETT CODY, Treas.
GARRETT PRANGE, Sec.

High Frequency and Gases

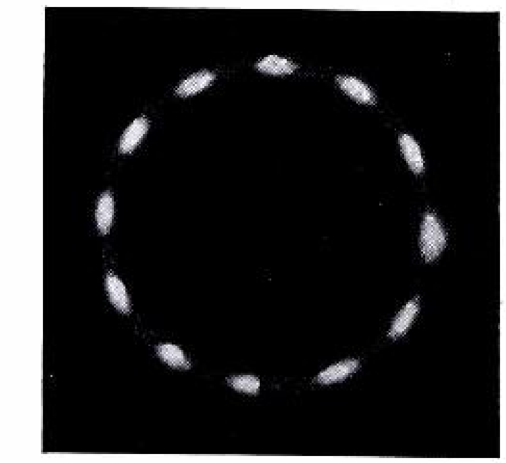
(Continued from page 461)

ized. That is the reason why in high frequency one needs no electrodes in the tubes. It is sufficient to place the electrodes outside. Instead of the electrical high frequency field one can also use the magnetic field. Then one speaks of *electrode-less ring* discharge.

All the experiments from which the accompanying pictures were taken were performed on a wavelength of 4 meters (75,000 kilocycles).

Figure 2 shows a discharge in a glass tube which is filled with neon at a pressure of 2 mm. of mercury. That is 1/380 of the normal pressure. The bright spots in the tube are caused by *oscillating electrons*. The electrodes by which the high frequency is supplied are placed about the tube outside as metal rings. One can send currents of many amperes through such an evacuated tube; then a very intense light arises. The light intensities thus far attained in advertising signs are only a small fraction of the degree of light which one obtains with high frequency.

To produce a light of one candlepower, the metal filament lamp needs in the most favorable case .5 of a watt; the ordinary *glow discharge* .25 of a watt, and the high frequency gas discharge only .1 of a watt! If the spectral light composition of the gas discharges were better for the eye, perhaps the metal filament lamp



Electrons oscillating in the electrodelless gas filled glass ring illustrated in Fig. 6. ..The ring is filled with Neon and Helium.

would soon be replaced. Perhaps it will some day be possible, by proper choice and mixing of gases of several kinds, to produce a light pleasant for the eye. Now, we mostly use neon, argon, helium, nitrogen, hydrogen, and the vapor of sodium and mercury for filling tubes, or else mixtures of these.

While thus far the high frequency gas discharge has found no use for illumination, it has become of the highest importance for *television!*

Inertia of Gas Discharge Slight!

If a discharge tube burns with high frequency which is modulated, *the light intensity follows the modulation! The inertia of a gas discharge is very small; one can reproduce frequencies up to 100,000 cycles, i e., for example produce a television image of just as many pictorial elements.*

Very interesting phenomena are obtained, if one holds in an oscillating circuit a glass sphere filled with mercury vapor and neon. If the current in the circuit is about 20 amperes, the gas mixture lights up in the form of a ring, as shown in Fig. 5. The oscillation circuit, which is built for a 4 meter wave, consists, as shown in Fig. 5, of merely a wire loop and a condenser, which the two plates form; one plate can be moved by means of a screw for tuning. In place of a sphere one can make the discharge glow in a ring (Fig. 6). The light from this discharge is extraordinarily strong. The discharge in Fig. 5 gives *2000 candle-power of whitish red light!* If two gases are mixed in a definite proportion, one can attain the condition for producing *oscillating electrons*. There then results in the ring (Fig. 6) a division of the discharge into many individual spots.

How Sun Affects S-W Reception

(Continued from page 460)

Shift of Most Favorable Wavelengths

The newest measurements by *Transradio* experts have shown the following result: The displacement of the most favorable wavelengths toward lower frequencies, i. e., longer wavelengths, which is explainable by the assumption of the ionization of the air for the various times of day and wavelengths, has made itself plainly perceptible as early as the beginning of 1930. Mogel at first tried to attribute this phenomenon to *disturbances of the earth's magnetic field.* As a matter of fact, a sudden change in the field of terrestrial magnetism did occur in March, 1930, which lasted over six months. Formerly such disturbances were only of short duration; in March, 1930, however, a disturbance set in which lasted until the autumn of that year. These disturbances, which in themselves were not very great, lacked the typical great amplitudes and the ordinary dying out of the signals. According to the new results, it seems as though the disturbances of terrestrial magnetism play a subordinate role.

On the other hand, there has finally resulted the following picture of the cause and course of the short wave disturbances. The displacement of the most favorable waves to lower frequencies, i. e., longer waves, is not uniform for all directions and distances. It is the greater, the greater the magnetic density along the course, i. e., the closer the short wave line is to the zones of the magnetic poles. It is, for example, greater on the lines between Berlin-New York or Berlin-Mexico or Berlin-Japan than on the lines to South America or Africa or for example to Java or Siam. The upward displacement of frequencies at the end of 1931 amounted, toward North America, on the average to about 50-90 per cent and toward South America and Africa only to about 10 per cent. This points to the fact that it is not the *ultra-violet*, i. e., the non-deflectable radiation of the sun, which has become less—but rather the *electron radiation*, which is deflected by the *terrestrial field* toward the zones of the *magnetic poles.* This is in a certain measure a confirmation of the theory of Birkeland and Stormer.

The Spread Side-Band System

(Continued from page 473)

magnitude as to completely neutralize and wipe out the other components reaching the receiver. The fading action is at times too rapid to be followed by a manual type of control and the width of the frequency band affected may be quite narrow, so that even were it possible to speech would have a chopped up effect. Before the fading becomes quite so bad as to give this "chopped" effect, the quality becomes very poor and the received speech sounds exactly like the output of an overloaded amplifier—pointing to the possibility of a large number of spurious harmonic components being introduced into the speech by the fading action.

Fading can occur in the carrier alone, in the carrier and one side-band or in either or both side-bands simultaneously. The automatic volume control such as is shown in Fig. 1, is operated in such a manner that it increases the gain through the R.F. stages when the voltage across the detector is reduced. Its control effect is a function of the average power as distributed over carrier and side-band components and it would be non-effective in combating fading not of a general character.

The "Spread Side-Band System" is a method of transmission which prevents the introduction of such spurious frequencies into the speech channels. The method employed is merely that of offsetting the pilot-carrier by a wide range so that the spurious frequencies resulting from selective fading lie entirely outside the desired speech range and may be filtered out by simple high or low-pass sections. It should be remembered that we have tacitly agreed that our speech component is a single frequency, while in reality it covers a range of frequencies suitable to good articulation and intelligibility.

New Delft Receivers

● The circuit diagram of the new Delft Radio "International" Model four-tube all-wave pentode receiver is given herewith. This new receiver employs many new circuit details.

The radio-frequency input stage is *tuned* and gives maximum amplification because of the use of one of the latest pentodes which cannot be equalled for all-around performance and amplification. To call a set a "four tube set" means more today than it did before the new tubes were developed.

By using a special two-gang short-wave tuning condenser in both R.F. amplifier and detector input circuits, an unusually flexible arrangement is obtained without the use of switches.

For reception on any wavelengths between 15 and 200 meters, capacitive input coupling is employed to the R.F. and detector stages. However, for broadcast reception, simply plugging in the necessary coil *automatically* changes the R.F. stage input to inductive coupling and changes the detector input connections as well. In addition, extra tuning condensers are automatically connected into the circuits, which gives the set full broadcast-band coverage, without changing any coils.

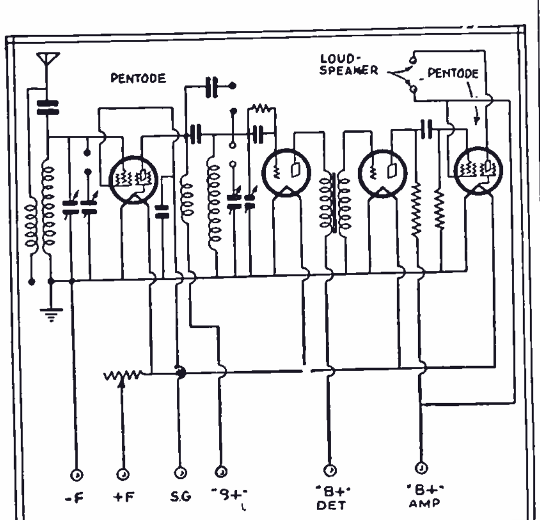
For broadcast reception, primary coils are provided on the broadcast coil forms. A four-prong plug-in coil socket is used in the R.F. input stage, while a six-prong socket and corresponding plug-in coils are used in the detector input. This not only allows an automatic change in connections, without the use of complicated switches, but also makes it impossible for the operator of the set to confuse the R.F. and detector plug-in coils.

Another interesting point is that the two gangs of the condensers used are automatically connected in parallel by simply plugging in the broadcast coils, allowing full broadcast band coverage. Another feature is that, for reception between 15 and 200 meters, the *rear* section of the two-gang variable condensers is employed, therefore giving no hand capacity even with ordinary panels and without the use of special shielding or dials, reducing the cost.

The two and three-tube sets are also of the latest designs, using modern tubes and other ingenious features.

Superior DX reception is possible with these sets, due to the use of tuned R.F. pentode input and a regenerative detector which is always more sensitive than non-regenerative detectors.

The same manufacturer also builds an inexpensive *wavemeter*, which has become popular for locating the positions of foreign stations on the dials of short-wave receivers. To use one of these wavemeters with the four-tube set (or any similar set, for that matter), for example, the proper coil is plugged into both receiver and wavemeter. The coil at the top of the wavemeter is then brought near the detector coil (the one outside the shield box) in the receiver. When the receiver is just oscillating, and the dial of the wavemeter is tuned, oscillation will immediately cease when the wavemeter (accompanied by a click in the headphones of loudspeaker), is tuned to the same wavelength as the receiver.



Delft Pentode Receiver Hook-up

Taking the Headaches Out of Crystal Control

(Continued from page 477)

the type 82 tube, which is a full wave mercury vapor rectifier, capable of passing more than sufficient current for the set. In order to obtain a pure D.C. note an 8mf. electrolytic condenser shunted directly across the output of the rectifier tube is all that was required. This combination gives fine regulation.

Separating the oscillator and amplifier is an aluminum shield, through which only the excitation leads pass. All low potential wiring is done beneath the shelf. The center-tap filament resistors are mounted directly at the base of the tubes, and it has been found that filament by-pass condensers are not needed with these short leads. If a center tapped filament transformer is used, by-pass condensers must be located at the base of the tubes where the resistor is shown in the diagram.

Following the shield is the amplifier tank condenser, next to which is the antenna tuning condenser. As explained before the plate and antenna coils are both wound on the same form. These are mounted directly behind the two condensers. Behind the plate coil is mounted the amplifier tube. This is the layout used by the author and will give the reader a general idea of how these parts can be mounted.

The grid chokes which are of the lattice-wound variety commonly used in broadcast receivers are mounted as close as possible to the tube case. The lead connecting the choke to the grid terminal should be as short as possible, the other end going to the aluminum shelf, which serves as a common connection for all negative leads. The neutralizing condenser is of the variety manufactured by Hammarlund, and mounted directly on the amplifier tuning condenser with a small bakelite post. This condenser is very small and can be easily mounted, with no danger of breaking down, due to its mica insulation. This condenser, of course, must be adjusted with an insulated screwdriver. Once adjusted this will need no further attention.

How Set Is Tuned

The tuning of this set is very simple. With every thing connected and checked carefully the builder should have no difficulty in getting the set to work. The filament voltage should be applied first, as these tubes take comparatively long to heat. Next is to plug in the 0-100 milliammeter into the jack provided for it in the plate lead of the oscillator tube. Now the plate voltage is applied to the entire set, providing the keying circuit of the amplifier tube is open. If the tube is not oscillating the plate current will be extremely low. (From 3 to 5 ma.) The plate turning condenser should be swung slowly from zero upward, watching the meter carefully. When the plate circuit approaches resonance with the crystal the plate current will rise, and as resonance is passed the current will begin to decrease. Absolute resonance is the point at which the plate current is the highest. The value of the current will be between 60 and 80 ma., depending on the quality of the crystal. The adjustment of the oscillator should be left in this position.

Now to neutralize the amplifier. Under no consideration should the key of the amplifier be closed at this point, as it may damage the tube. Adjust the neutralizing condenser to full capacity, swing the amplifier tuning condenser gradually from zero upward until the point is reached, where there will be a dip in the plate current of the oscillator. At this point the capacity of the neutralizing condenser should be gradually reduced, and the amplifier tuning condenser swung gently back and forth till no dip occurs. When this point is reached the amplifier is sufficiently neutralized. The point at which the dip occurred is the approximate point of resonance, and the circuit should be left tuned as near as possible to that point. The plate circuit of the amplifier can now be closed, providing the milliammeter has been plugged into the jack provided for it in the circuit. The amplifier tuning condenser should be adjusted to a point where minimum plate current exists (approximately 20 ma.). The entire set is now properly tuned and ready to be coupled to the antenna.

The Norden-Hauck Admiralty Super-15

(Continued from page 479)

L4—1st Detector Plate Coil (band pass).
L5—1st Int. Grid Coil (band pass).
L6—1st Int. S.G. Choke.
L7—1st Int. Plate Coil.
L8—1st Int. Plate Choke.
L9—2nd Int. S.G. Choke.
L10—2nd Int. Plate Coil.
L11—2nd Int. Plate Choke.
L12—3rd Int. S.G. Choke.
L13—3rd Int. Plate Coil.
L14—3rd Int. Plate Choke.
L15—Second Detector Grid Choke.
L16—Second Detector Plate Choke.
K—1st Filter Choke, 300 ohms, 175 mils.
F1, F2—Speaker Field Windings, 2500 ohms each, carrying 70 mils.; used as second choke for filter.
C1—15 mf. Mica Condenser (used on short-wavelengths).
C2, C3—Ant. Circuit Trimmer Condensers.
C4—.25 mf. 2-sec. By-pass Condenser (1st R.F., S.G. and Cathode).
C5—1st Detector Trimmer Condenser (panel control).
C6—.25 mf. 2-sec. By-pass Condenser (1st det. S.G. and Cathode).
C7—100 mmf. Air Condenser, 1st Detector Plate Tuning circuit.
C8—.03 Mica, 1st det. to 1st Int. Coupling Condenser.
C9—2-sec. Air Condenser R.F. and 1st Det. Tuning Compensator.
C10—3-sec. R.F., 1st Det. and Oscillator Tuning Condensers.
C11—.25 mfd. R.F. Plate By-pass Condenser.
C12—65 mmf. Oscillator Trimmer Condenser.
C13—.1 mf. Paper Condenser, osc. plate.
C14—.25 mf. 2-sec. By-pass Condenser, osc. cathode and 1st det. S.G.
C15—100 mmf. 1st Int. Grid Tuning Condenser.
C16—1st Int. Grid and Cathode By-pass Condenser, 2-sec. .25 mf. ea.
C17—1st Int. Plate and S.G. By-pass Condenser, 2-sec. .25 mf. ea.
C18—.25 mf. By-pass Condenser.
C19—100 mmf. Air Condenser tuning 1st. int. plate.
C20—100 mmf. Mica Condenser, 1st int. to 2nd int. coupling.
C21—2nd Int. Grid and Cathode By-pass Cond., .25 mf. ea.
C22—2-sec. .25 Mfd. Cond., 2nd Int. Plate and S.G. By-pass.
C23—100 mmf. Air Condenser, 2nd int. Plate tuning.
C24—100 mmf. Mica Condenser, 2nd Int. to 3rd Int. Coupling.
C25—.25 mf. Paper Cond., 3rd Int. Cathode By-pass.
C26—2-sec. .25 Mfd. Cond., 3rd Int. Plate and S.G. By-pass.
C27—100 mmf. Air Condenser tuning 3rd Int. Plate.
C28—100 mmf. Mica Condenser coupling 3rd Int. and Detector.
C29—1. mf. Paper Condenser, A.V.C. Plate By-pass.
C30—2-sec. .25 Mfd. Paper Condenser, A.V.C. Cathode and Plate voltage.
C31—3-sec. 1. Mfd. 2nd Det. Plate, Cathode and Grid By-pass Cond.
C32—.03 mf. 2nd Det. Cathode By-pass Condenser.
C33—1. mf. Paper Cond. Detector Plate By-pass.
C34—1. mf. Paper Cond. Det. Plate to Audio Grid Coupling.
C35—.25 mf. Paper Cond. 1st Audio Cathode By-pass.
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C38—.25 mf. Paper Condenser, 1st Audio Plate Voltage By-pass.
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XR13—3000 Ohms, 2nd Int. Cathode Bias Resistor.
XR12—10,000 Ohms, Grid Suppressor 2nd Int.
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R15—100,000 Ohms, Auto. Vol. Control Plate.
R16—30,000 Ohms, Compensating Resistor, Int. Plates.
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R18—10,000 Ohms, Grid Suppressor, 3rd Int.
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R31—15,000 Ohms, 2nd Audio Plates.
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R34—775 Ohms, 3rd Audio Bias.
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X2—Audio Tone Switch, 2-pole, 3-position.
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VT1, VT2, VT4, VT5, VT6—Type '58 R. F. Pentodes.
VT3, VT7, VT8, VT9, VT10, VT11, VT12—Type '56 Tubes.
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IT IS always the well-trained man who wins out over the horde of thousands of superficially trained and incompetent men. You are reading this magazine because you are interested in radio. Sooner or later, the time will come when you will wish to cash in on your knowledge. Your chance may come over night, and then the big and vital question will be, "How well equipped am I to fill the job?" You are in radio because you like it. You also realize that, at the present time, there are many branches of the radio art which you do not know as thoroughly as you should. Knowledge, these days, can be gotten cheaper than ever before. It isn't necessary for you to go to college to become proficient in radio. Start today, to build a REAL radio library and become acquainted with all branches of this great and growing art. In this page are listed the world's best radio books. We have combed the market for the really important books in radio; so that, no matter what branch you are interested in, you can pick out the best books that are now printed. Start, now, to build a complete radio library. You do not have to get all the books at once, but make up your mind to get one book a month; so that, when your chance comes, you will be fully equipped to win out over the others not so well equipped.

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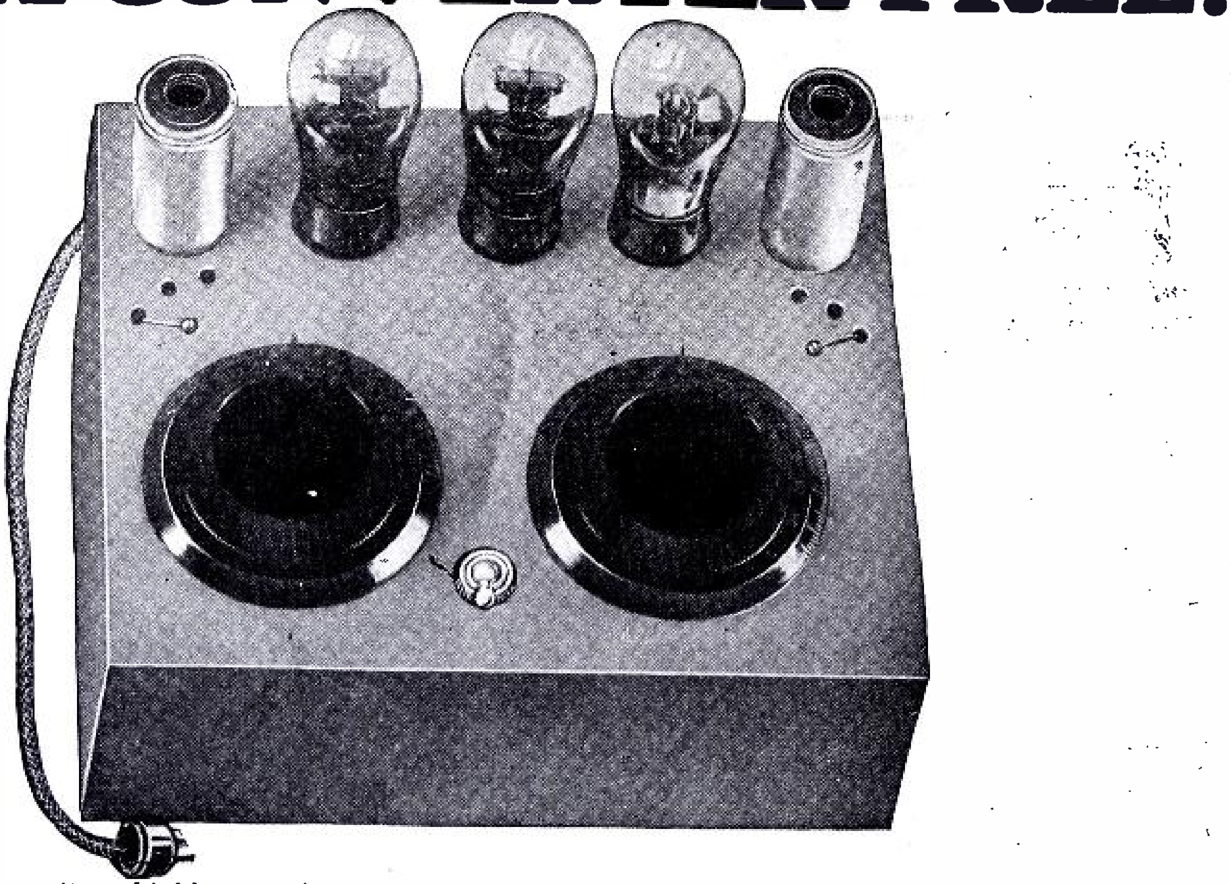

HERE at last you have it—a highly sensitive short-wave converter, 15 to 200 meters, that works on *any* set and that has its own A, B and C supply built in and that does not use plug-in coils for band shifting.

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.

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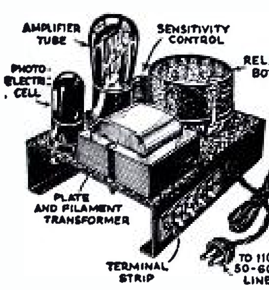

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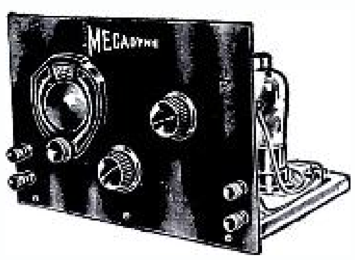
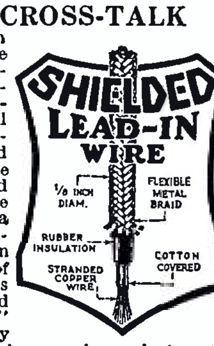


1 B.M.S. Fixed Crystal Detector; 1 6-ohm Filament Rheostat; 1 3-circuit tuner for use with a .0005 mf. tuning condenser; 1 Na-ald type 481 UY 5-prong socket; 1 Hammarlund type ML-23 Variable Condenser; 2 sets of Cinch double binding posts; 1 Polymet .00025 mf. fixed condenser; 1 X-L Variodenser; 1 Polymet .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

ELIMINATES NOISE AND CROSS-TALK



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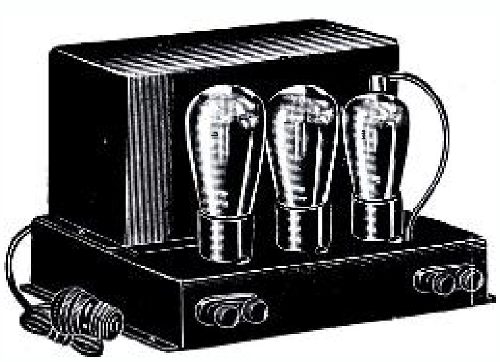

All the latest features in amplifier design have been incorporated in this direct coupled amplifier. Input terminals for permitting phonograph attachment, and in addition, by attaching the proper microphone transformer, also dry cell batteries, a microphone may be used for public address work. Any type of receiver can be connected to the input terminals without fear of loss of energy. These amplifiers are for use with dynamic speakers.

Amplifiers supply field current of 2500 ohms to dynamic speakers. Resistors are furnished when A.C. speakers are used. Amplifiers operate on 110 volts, A. C., 60 cycles.

Model SP-5003 uses 1—224, 1—245 and 1—280. Output is rated at 3 watts.

No. SP-5003—Your Price........$10.95 (less tubes)

Exactly the same amplifier, but employs a power pentode in place of the 245 tube. Output 3.5 watts.

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Model SP-5005 uses 1—224, 1—250 and 1—281. Consumption is 85 watts; maximum undistorted output, 6 watts. Gain rated at 1000 cycles, 55db; gain at 10,000 cycles, 51.5. Input direct to 224 control grid; output direct from 250 plate.

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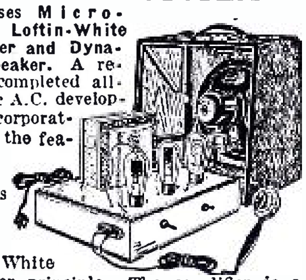

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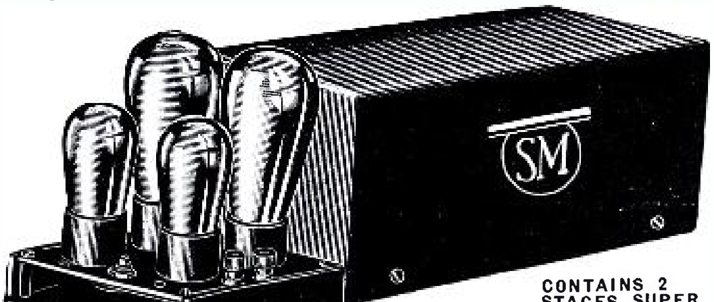

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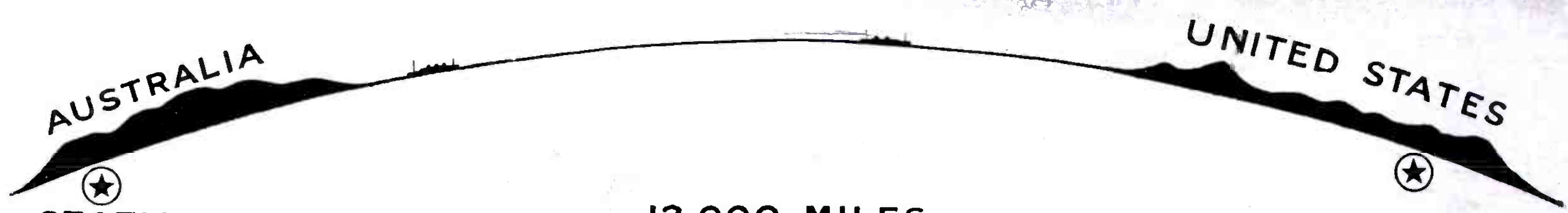

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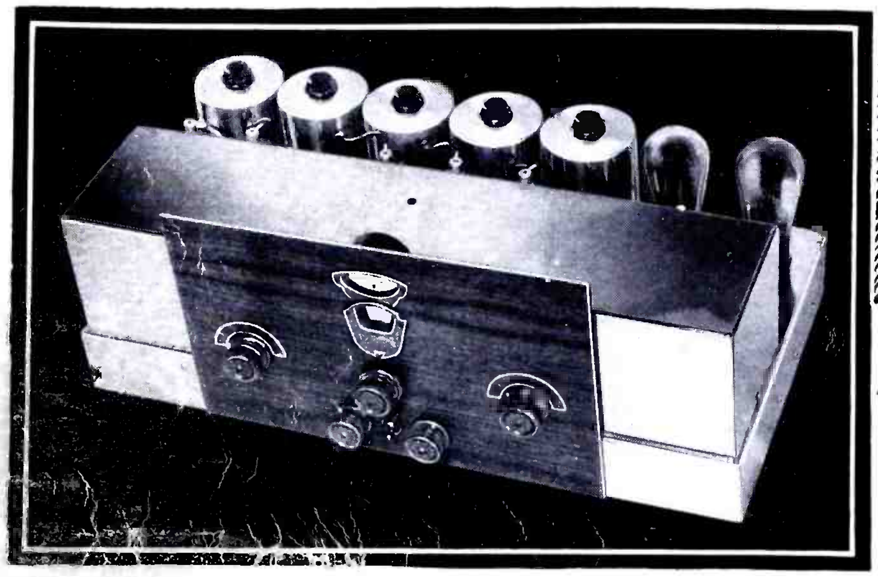

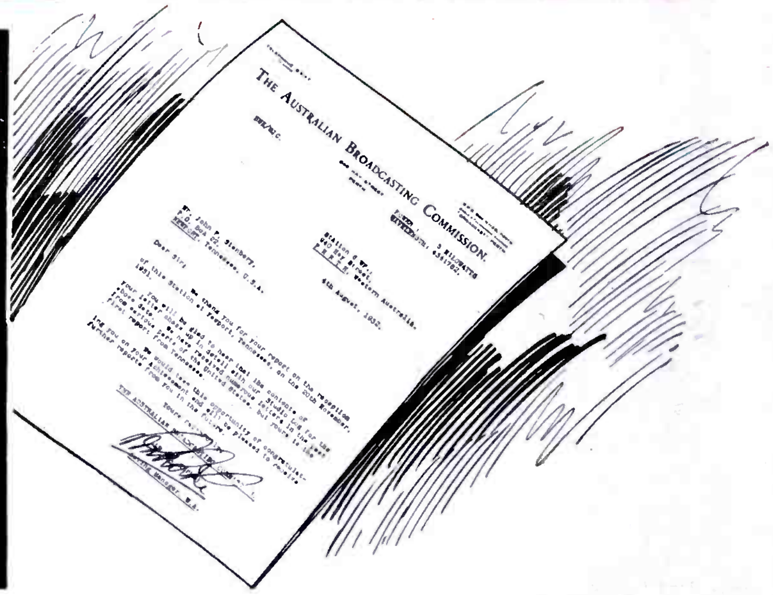

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If you have never tuned the New Lincoln, you have missed the treat of your life.

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