THE RADIO EXPERIMENTER'S MAGAZINE

SHORT WAVE CRAFT

Edited by
HUGO GERNSBACK

NOW 25¢

IN THIS ISSUE

ARTICLES BY

Lt. Myron Eddy,
C. H. W. Nason
H. Harrison
A. Binneweg, Jr.
Beryl B. Bryant

Jan.

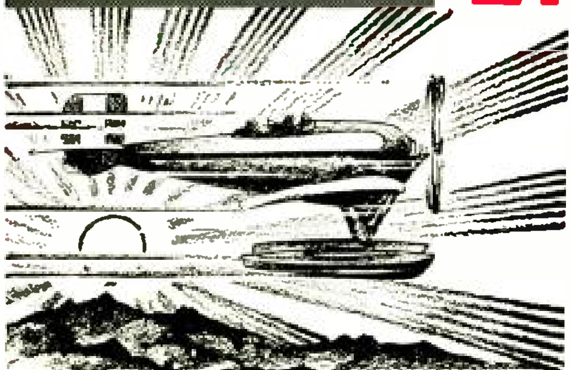
How to Make the New All-Wave Receiver, Using 6.3 Volt "Auto" Tubes

EXCLUSIVE NEWS FROM

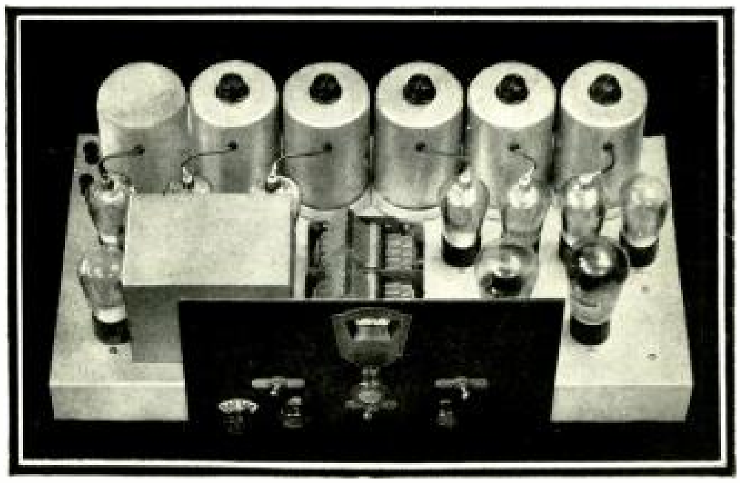
LINDBERGH PLANE

FLYING OVER ARCTIC WILDERNESS, RECEIVED ON A

LINCOLN RADIO



On the eve of August 5th, Roscoe H. Johnson, operator and owner of a powerful short-wave station, using a LINCOLN RECEIVER, had just finished his daily schedule of messages with the Bowdoin ship of the MacMillan expedition, now located off the shores of Baffin Land; turning his dials to the frequency of the Lindbergh transmitter, strong and clear came in the signals from the Lindbergh plane, flying over the Arctic circle. Realizing that this was the first message received for some time from the famous aviator and that the public were much concerned as to the safety of the plane, Mr. Johnson immediately phoned the United Press and in a flash it was headlined in newspapers throughout the world.



When the operator, in Chicago, turned his dials to the 20 meter band, the sharp clear note of the Lindbergh transmitter brought its message through the violent storms and electrical disturbances of the Arctic. Hundreds of amateur and commercial stations in all parts of the world were vainly combing the air for some news of the flying colonel and his wife. It remained for a LINCOLN receiver to catch the anxiously-awaited signal from the far north reassuring the world that all was well.

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Do you wonder why Lincoln equipment out-performs any known receiver and is chosen by the Polar Expedition, Broadcasting Station, and individuals who want the best?

Months of intensive laboratory study has been put into these two new receivers. Capitalizing on years of advanced engineering developments, Lincoln engineers have worked out every detail of performance—Selectivity—Sensitivity—Fidelity and Stability, to work perfectly from frequencies of 15 to 550 meters. The tremendous amplification of the new models now applied to short-wave, as well as broadcast stations, gives a new conception of what is possible in radio.

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◆ ◆ ◆ ◆

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This receiver is designed for use with new low drain series 2-volt tubes, employing three '30 type, five '32 type and two '31 type in push-pull output. Will operate on any two volt "A" supply and dry "B" batteries. For quietness of operation due to elimination of AC line interference, the new DC DeLuxe gives perfect reproduction on extreme distance.

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Vol. II **SHORT WAVE CRAFT** No. 4

HUGO GERNSBACK, Editor H. WINFIELD SECOR, Managing Editor

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Keying with a "Vacuum Contact" Relay
Building a Simple and Inexpensive "Amateur Band" Receiver
The All-Wave Super-Booster and S. W. Converter, by H. G. Cisin, M.E.
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OUR COVER—— Illustrates an Extremely Compact and Efficient 3 Tube "All-Wave" Receiver Employing New 6.3 Volt Auto Tubes; for Construction Data, see .... Page 252

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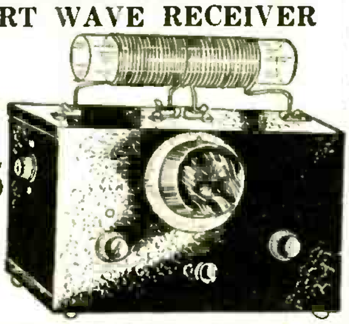
Adapter cable with socket for DC sets.......... .95

AERO WORLD WIDE—2 TUBE SHORT WAVE RECEIVER



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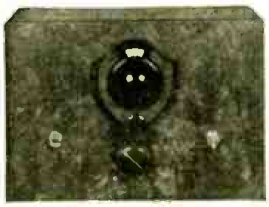

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Convert your AC or DC radio set into a short-wave Superheterodyne. With this converter on your regular set you will be able to tune in short-wave stations from many different parts of the world. The Aero Converter contains its own filament supply. B voltage can easily be obtained from your regular set, or you may use a single 45-volt B battery. No plug-in coils. Single tuning dial. Very easy to tune. No whistles or squeals. Uses two UX227 tubes, one as oscillator and one as mixer. Price.

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DC model for battery-operated sets, $11.50. Two matched UX227 Tubes at 75c each, $1.50; one 45-volt battery, $1.45.

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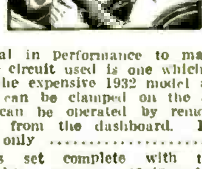

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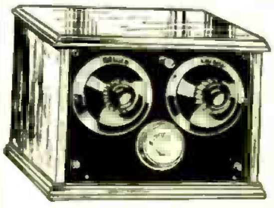

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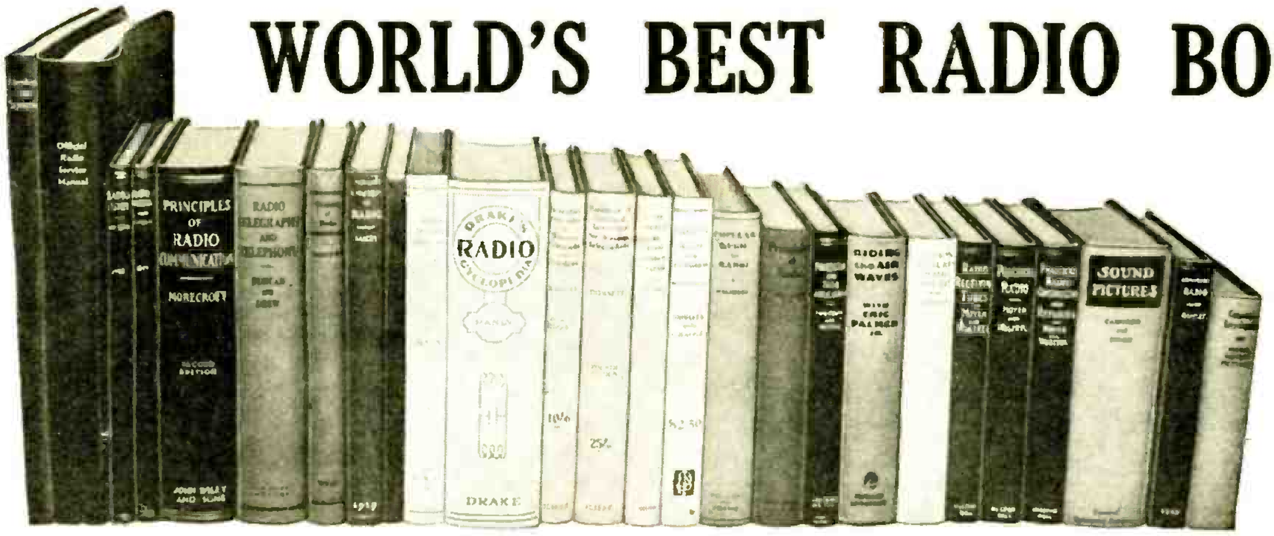

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This book by Professor Ramsey is written in the nature of an experimental radio course and contains 128 experiments, illustrated and described in a clear and interesting style. The experiments cover such valuable subjects as: A test on a loud speaker; the impedance of coils; construction of a filter, screen grid tube; beat note audio oscillator; etc.

PRINCIPLES OF RADIO COMMUNICATION, by J. H. Morecroft, Prof. of Electrical Engineering, Columbia University. Cloth covers, size 9¼x6", 988 pages. Profusely illustrated. Price **$7.50**

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

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

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

PHOTOCELLS AND THEIR APPLICATION, by V. K. Zworykin, E.E., Ph.D., and E. D. Wilson, Ph.D. Cloth covers, size 5¾x8", 210 pages, 97 illustrations. Price **$2.50**

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

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

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

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

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

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

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

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

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

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

This handbook is one that every radio set tester and general student will want to read carefully. These experts have given a very complete description of instruments used to test and repair modern radio sets, together with complete diagrams of many modern receiving sets, with explanations on how to test the radio and audio frequency stages for faults.

ELEMENTS OF RADIO COMMUNICATION, by Professor John H. Morecroft. Cloth covers, size 9x6", 270 pages, 170 illustrations. Price... **$3.00**

Professor Morecroft explains in an authoritative and clear manner such important radio phenomena as current flow in circuits containing capacity and inductance; propagation of radio waves; vacuum tubes as detectors and amplifiers; fading of radio waves and its causes; neutralization; superheterodynes for short waves, etc.; audio frequency amplifiers; how filters work, etc.

RADIO TELEGRAPHY AND TELEPHONY, by R. L. Duncan and C. E. Drew. Cloth covers, size 9¼x6", 950 pages, 468 illustrations. Price **$7.50**

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

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

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

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

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

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

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

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

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

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

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

SOUND PICTURES AND TROUBLE SHOOTER'S MANUAL, by Cameron and Rider. Cloth covers, size 8x5¼", 1120 pages, profusely illustrated. Price **$7.50**

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

RIDING THE AIR WAVES, WITH ERIC PALMER, JR., by himself. Cloth covers, size 7½x5¼", 328 pages. Price **$2.00**

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

A POPULAR GUIDE TO RADIO by B. Francis Dashiell. Cloth covers, size 5½x8¼", 286 pages, profusely illustrated. Price, prepaid **$3.50**

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

RADIO VISION, by C. Francis Jenkins. Cloth covers, size 9¼x6", 144 pages, profusely illustrated. Price, prepaid **$1.25**

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

RADIO MOVIES AND TELEVISION, by C. Francis Jenkins. Cloth covers, size 9¼x6", 144 pages, profusely illustrated. Price, prepaid **$2.50**

An absorbing history, handsomely illustrated, of the Jenkins system of transmitting and receiving movies "via radio." One of the chapters gives constructional details and drawings for building your own Radiovisor or machine for making the radio movies visible in your home. Diagrams of amplifiers are given, with some other very valuable information.

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HUGO GERNSBACK
EDITOR
DEC.-JAN.,
1931-32

SHORT WAVE CRAFT

H. WINFIELD SECOR
MANAGING EDITOR
VOLUME II
NUMBER 4

Wanted: A Short Wave "Phone" League

By HUGO GERNSBACK

I HAVE before me a number of letters, received during the past few months from short-wave enthusiasts, urging me to organize a Short-Wave 'Phone League.

The letters are all of a similar tenor; most of the writers pointing out that, inasmuch as I was the originator of the first Radio League in the world (*i.e.*, the old *Wireless Association of America*, dating back to 1908), I should take it upon myself now to organize a 'Phone League.

Code Amateurs Not Interested in Phone

It is pointed out by the writers of the letters that most of the 17,000 licensed radio amateurs in the United States are interested only in "CW" and "code" transmission, and that, as a rule, they are not interested in 'phone transmission.

It is also pointed out that the 'phone "hams" have no magazine wherein they can discuss their thoughts and their experiences, and to print a regular "ham" section on radio 'phone matters. The correspondents usually suggest that SHORT WAVE CRAFT would be the ideal magazine to take up the cause of 'phone "hams." Communications such as these have been coming in ever since SHORT WAVE CRAFT was started; and the letters are becoming so numerous lately, that something has to be done about it.

Easy to Organize a League

I, therefore, take this means to ascertain the sentiments of the 'phone amateurs and would-be 'phone amateurs with respect to a new league to be formed. Naturally, if there are enough 'phone amateurs who respond, it will be an easy thing to organize such a league for you. If not, no harm is done.

Of course, the would-be 'phone "ham" who does not know much about the legal regulations is apt to jump to the conclusion that all he has to do, is to rig up a transmitter and go ahead and use 'phone transmission all over the globe. It is not quite as simple as that; because, in the first place, he cannot get a license from the Department of Commerce unless he can actually transmit code. Even though he need not be an expert, he must be able to read signals with a fair degree of accuracy; otherwise he cannot obtain a license and, for that reason, cannot operate a radio 'phone transmitter. I am making these few remarks merely for those new short-wave fans who have not known about the Department of Commerce regulations.

A Powerful Amateur Aid

If the serious-minded 'phone "hams" are interested, I shall be glad to be instrumental in the foundation of the new league; and I believe a league such as this can, in time, be worked up to not only national, but even international importance. It is certain that, in time to come, the league would attract literally hundreds of thousands of "hams" to it; and enough new inventions would be forthcoming to make the league a most powerful organization in this and every other country.

Are You Interested in Forming a League?

If, therefore, you are interested in the formation of such a league, I suggest that you write to me, giving me your thoughts in the matter, and also fill out the blank printed on page 286 of this issue.

In addition to this (inasmuch as not every 'phone "ham" sees this magazine regularly) it would be an excellent idea for those who have 'phone transmitters to call the attention of this article to others by radio and so broadcast the idea that, if there is sufficient demand, a new 'phone league will soon come into life.

Plenty of Room for 'Phone League

It should be noted that, in all of this, there is no thought of either displacing or hurting C.W. amateurs; because I sincerely believe there is room for both classes in amateur radio. Each has its own sphere and neither one need interfere with the other.

If sufficient answers are received, an announcement of the formation of the league will be made in the next issue of SHORT WAVE CRAFT.

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

THE NEXT ISSUE COMES OUT JANUARY 15th

HOW HIGH IS THAT BALLOON?

MIDGET SHORT WAVE TRANSMITTER Radio's Answer

By CAPTAIN JAMES A. CODE, JR.
U. S. Signal Corps.

Super-midget transmitter suspended from weather balloon, radiates signals which have been heard up to eleven miles, on a direction-finding receiver fitted with angle-indicating loop.

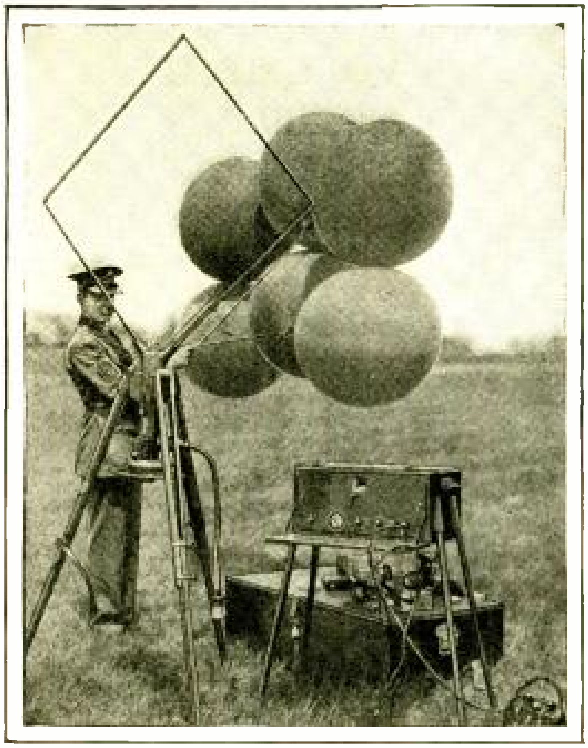
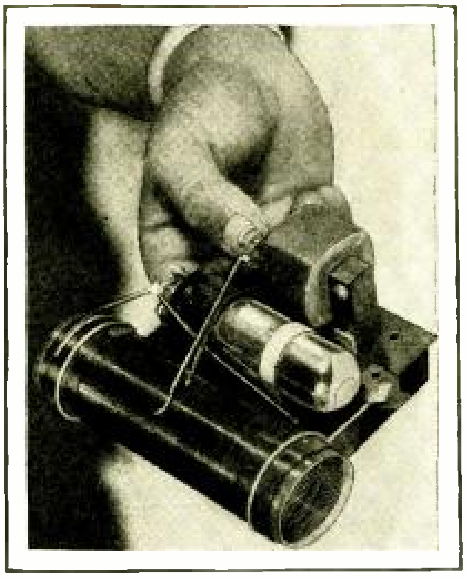
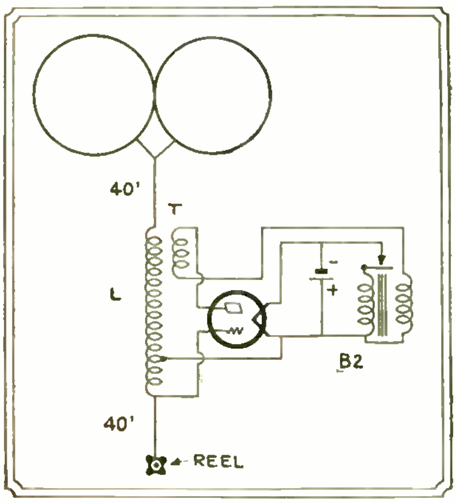


Photo at left shows group of "weather balloons" about to be sent up, together with miniature radio transmitter; receiver at right.

UPPER-AIR observations, over terrain which is inaccessible during fogs and inclement weather, are often desirable; though to obtain such meteorological data, which are useful to commerce and industry, is, from the point of view of the forecaster, extremely difficult. Upper-air meteorological observations at night, or under the conditions mentioned, have been limited to the visual means of attaching some source of light to the meteorological balloon; which is observed through theodolites, and successive readings of azimuth ("*bearings*") and elevation are obtained by means of the balloon theodolites. Other special methods are used; such as attaching a small bomb with time-fuses to the balloon, and "sound-ranging" for the explosion of the bomb. These methods present difficulties which the Signal Corps has attempted to eliminate by devising a small, compact, radio transmitter which is attached to the balloon and, when released, is tracked by means of radio direction finders.



Above—Comparative size of super-midget radio transmitter containing '99 tube, battery, transformer and inductance; weight, 17½ oz. Right—operator listening to balloon radio signals.



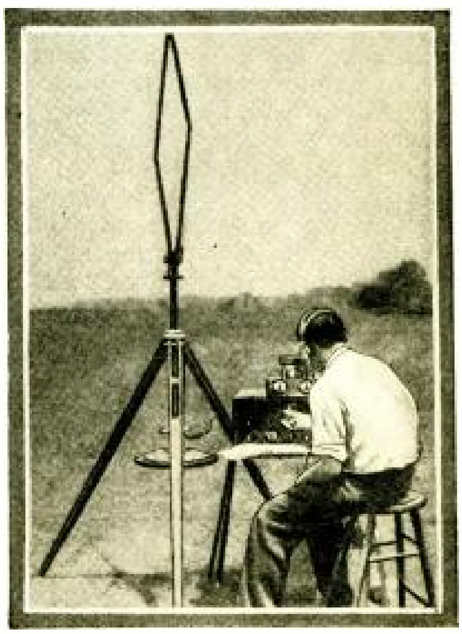
Wiring diagram of the balloon short wave transmitter.

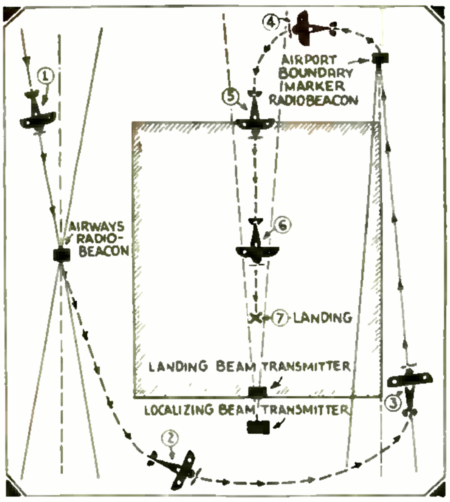
While the initial work was done in the Signal Corps Laboratories at McCook Field in 1923, it was not until 1931 that Major Wm. R. Blair, of the Signal Corps Laboratories at Fort Monmouth, was able to bring the transmitter and the range finder to its present state of perfection.

Transmitter Weighs But 17½ Ounces

The two problems necessary for the engineer to solve were: the development of a light inexpensive transmitter, and the building of a rugged, reliable, portable direction-finding receiver with minimum controls. The transmitter which has been developed approaches quite satisfactorily the requirements. Its weight is but 17½ ozs. It consists of a small flashlight 4½-volt battery, which serves to heat the filament of a '99 tube and, simultaneously, to energize the primary circuit of a buzzer transformer. The turn-ratio of the transformer is approximately 50 to 1; and its iron core is provided with an air gap, to give leakage flux for the operation of the vibrator, which is included in the primary circuit. The secondary voltage is, of course, intermittent at the rate of vibration of the interrupter; and it is part of this voltage which makes the plate positive, once during each cycle of the vibrator, and is thus applied as "B" voltage to the '99 tube.

(*Continued on page* 292)





Plan view, showing airport and how landing beam short wave signal is picked up and used to guide plane in landing safely.

Planes Can Land in Fog!

Thanks to Short Waves

Airplanes have been repeatedly landed while "flying blind" by the aid of this new short wave "landing beam", which has been developed by Uncle Sam's radio experts. This means that all airports will shortly be made "visible", even in a fog, thanks to short waves.

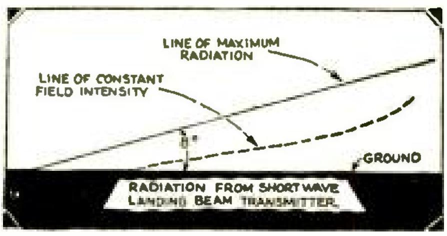
By LIEUT. MYRON F. EDDY*
U. S. N. Retired

FOR the past three years the Bureau of Standards have been working on the short-wave landing beam for airplanes. Now they have it. The beam makes blind landings possible.

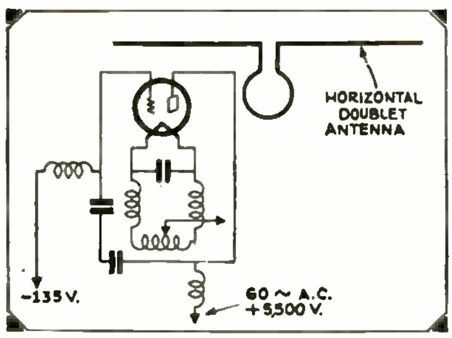
The why and wherefore is most interesting. In the first place you realize that the blind *flying* of planes has been going on for some time. All the U. S. airways have radio-beacons that a pilot can follow from one airport to another, But suppose that he can't see an airport —how is he to land? The short-wave landing beam is the answer. And here is how it works.

The regular airways radio beacon transmitter is located at one side of the airport—not ON the airport. There is also another (marker) beacon, projecting a beam a short distance along the other side of the airport. But the beam transmitter is put right on the airport—right at the end of the landing runway. The pilot follows the *airways beacon* to the airport where he wishes to land. He knows when he passes over this beacon, because its signals change. Therefore, upon passing the beacon, the pilot turns sharp left to the marker beam, straightens out on it, turns sharp left again and so hits the landing beam. He then turns left once more and follows the beam to a landing. It is as simple as "no right turns" and "one-way traffic"—sometimes simpler!

The value of this system is obvious. It is literally a "life-saver". The landing beam may be set at the airport in the direction of prevailing winds or any other safe landing direction. It may be made steep, for a short approach, as in mountainous localities, or more gradual when a longer approach is desired. It can be picked up at any altitude between 500 and 5,000 feet. No manipulation on the part of the pilot is required since the tuning is fixed. He merely switches in his "landing-beam" receiver at the proper time. This receiver is visual and is mounted on the flight instrument board. If he keeps the needle on this instrument in the middle by controlling the plane's elevators, he will come in at a normal landing glide and level off *without ever seeing the field.* His altimeter will tell him when to cut the throttle completely; although he could hit with it partly on and do nothing worse than bounce.



No matter what altitude the plane has when entering zone of the Landing Beam, the "Landing Indicator" will immediately show whether the plane should commence gliding by reading "Too High" or "Too Low".



Oscillator circuit of Landing Beam Transmitter.

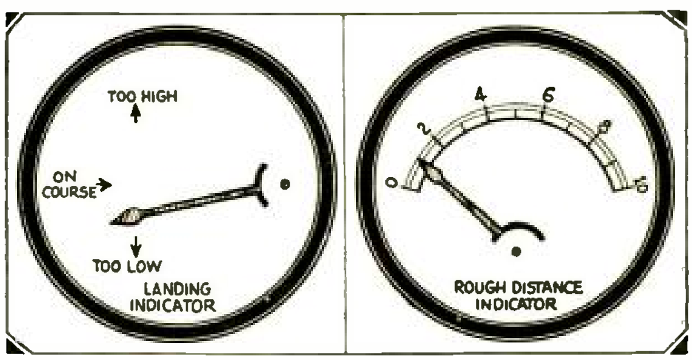
Landing Beam Operates on 3 Meters

So much for the system; now about the apparatus. Remember that there must be control, or guidance, over three dimensions. For this reason a beam (called a "localizing beam") must be directed along the runway to form a lane, which will keep the pilot from swerving off the runway to right or left, while gliding down the landing beam. Also, the landing beam itself, although projected as a straight line (tangent to the horizontal runway) must guide the plane down a curved path, which becomes flatter and flatter near the ground end. This path is actually the line of equal intensity and is always below the axis of the projected beam.

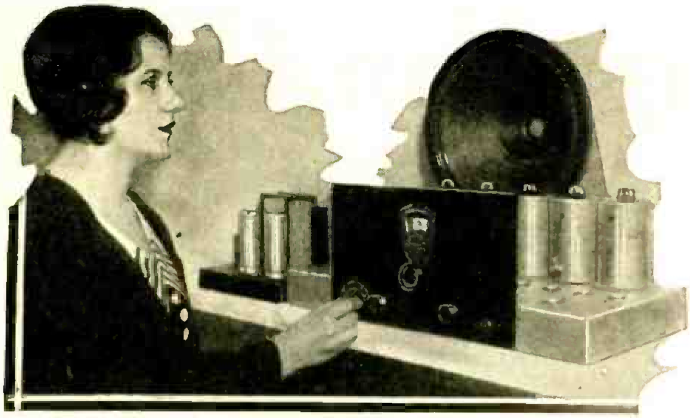
The landing-beam transmitter operates on about 3 meters. A directive antenna system is, of course, required; this consists of a number of short doublet horizontal antennas, which run perpendicular to the main supporting structure, which in itself is not high enough to be a flight obstruction. This whole outfit can be tilted and locked into position to give

(*Continued on page* 288)

Simplified dials used to indicate landing conditions to pilot in plane; how close he is to the ground and if he is "*off*" or "*on*" the course.



* AeronauTech Institute.



The young lady here shown has her hand on the special knob controlling the wave-band "change-switch", a new feature of the Lincoln "All-Wave" Super-het.

The LINCOLN *ALL-WAVE* SUPER-HET

By H. WINFIELD SECOR

The new Lincoln De-Luxe combination short and long wave receiver here illustrated, tunes in all waves from 10 to 550 meters. Plug-in-coils are eliminated by a cleverly engineered switching scheme. A super-heterodyne circuit is used, providing sharp selectivity and powerful volume.

WHAT! Another "all - wave" Super-Het? So it seems, but as the old adage has it—"The proof of the pudding is in the eating thereof," and agreeable surprises came fast, one after another, when the new Lincoln All-Wave Super-Het, known as their "De Luxe 32 Model," was lugged home and tested out. In the first place, the Lincoln circuit is of very excellent fundamental design. The intermediate amplifier stages being individually tuned, this operation being a simple one performed but once when the set is first placed into operation. The person operating the set merely adjusts the five midget condenser knobs placed on the tops of the shield cans covering the intermediate amplifier transformers, until a weak signal is heard with maximum strength on the loud speaker.

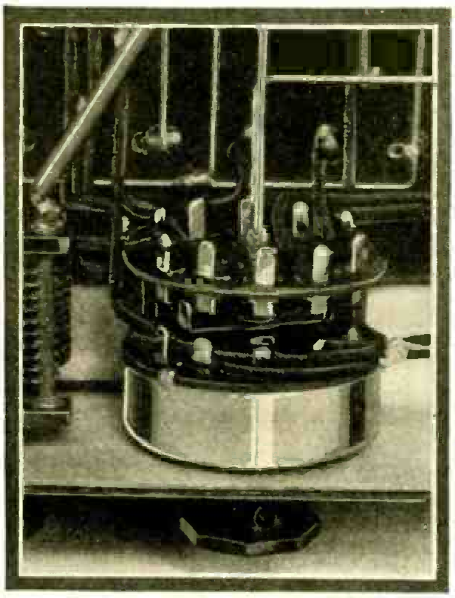
Tuning In Short Waves a Cinch!

Whether the purchaser of a Lincoln new All-Wave Super is interested particularly in short-wave reception, or only listens in occasionally on short waves, this cleverly designed and highly efficient receiver, will appeal irresistibly. Tuning in short waves is a "cinch" with the new Lincoln—a simple twist of the wrist on the band-selector switch puts immediately at your service the following wavelength ranges: 15-30; 30-50; 50-100; 100-200; and finally the broadcast range of 200-550 meters.

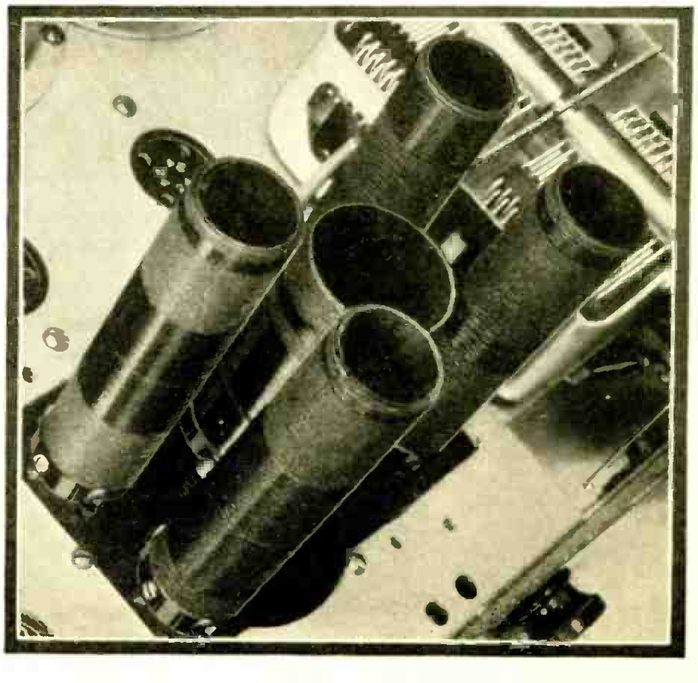
Aside from the excellent design and workmanship of the intermediate transformers, which are wound on bakelite tubes with ample spacing between the coils and the shields, the short-wave inductances are wound very accurately on threaded bakelite tubing. The short-wave coils are mounted in a group inside a shield can placed just behind the panel, at the left of the set, as the illustrations show.

High and Low Power Switch

The double tuning-condenser unit was specially selected for this set, to be of the proper capacity and plate spacing to work equally as well on the short waves as on the broadcast waves. The condenser is fitted with ball bearings. The small knob just to the right of the main tuning knob is a trimmer condenser; the knob to the right of the main dial is the volume control and switch. The small switch at the right of the front panel provides "high" or "low" power, which obviates *blasting* from the local stations (which, you may be sure, come romping in like a "ton of bricks" on this powerful receiver, with its four "high-gain" stages of shield-grid intermediate amplification).



Above — "Close-up" of wave-band "change switch", showing short leads from various coils mounted directly over switch.

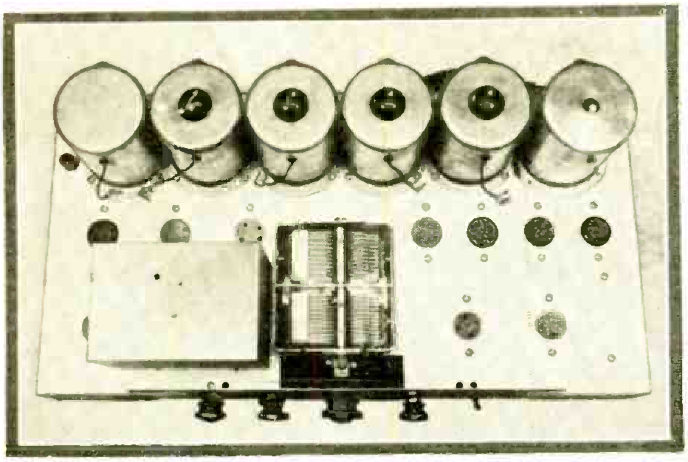


Right — Close-up of "short" and "broadcast" wave coils, with shield removed.

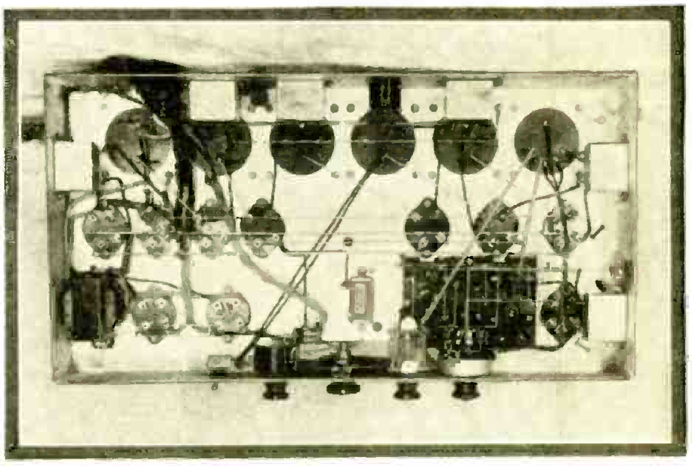
Powerful Output Stage

In the output audio amplifier stage, two '45's are employed. These tubes were selected as the very best from the viewpoint of powerful volume and exquisite tone quality for this particular receiver, in preference to the use of pentodes.

Besides the powerful amplification due to the very careful design of the inductances, for both short- and long-wave tuning, it was soon demonstrated after bringing in many *broadcast* and *short wave* stations, both from overseas and various parts of this country, that even better than 10-kc. selectivity had been



Top view of new Lincoln "All-Wave" super-het.



Bottom view—showing simplicity of wiring.

attained by the engineers behind this receiver.

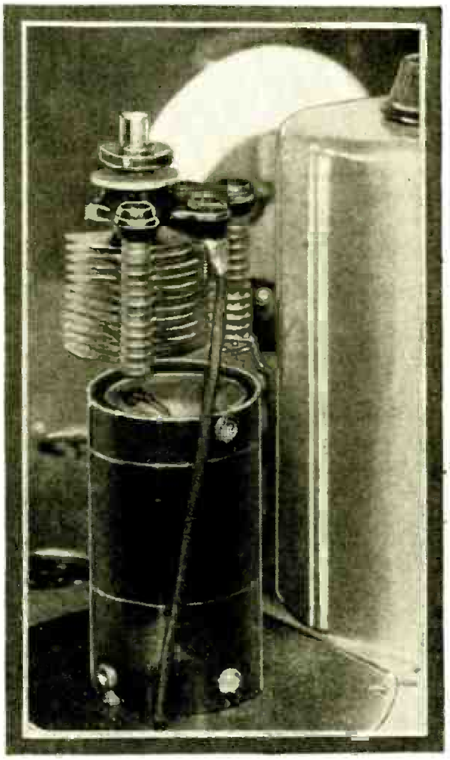
Each Receiver Individually Tested

Furthermore, each receiver is actually tested on distant signals, before the customer ever receives it. One feature which many sets claim to have, but which the Lincoln receiver really demonstrates, is that it actually can produce loud-speaker volume on relatively weak signals. This means that every amplifier stage in the set is working at the "peak" of efficiency.

The Lincoln De Luxe receiver is an extremely high-powered and selective equipment, using the high amplification of six screen-grid tubes. The chassis is very carefully constructed, employing strictly laboratory methods. The position of every wire is carefully figured out to eliminate feed backs and allow high amplification.

Connecting Chassis, Power Unit and Speaker

Cables leading from chassis to power equipment are of different colored wire. Labels on the power equipment clearly indicate where connections should be made. Connections from speaker are indicated on power equipment for energizing the field of the speaker.



One of the I.F. transformers and 100-mmf. tuning condensers.

The length of antenna depends on local absorption. Ten feet of antenna in one locality will equal a 50-ft. antenna in another. As a general thing, buildings of steel construction require a longer antenna to compensate for loss of absorption in steel, state the Lincoln experts. Antennas from 15 to 100 feet will work satisfactorily.

Operation Hints

First you connect A.C. line to wall socket; turn right-hand control knob until switch is turned on, and see if all heaters are operating.

See that all adjusting knobs on top of I.F. (intermediate amplifier) cans point to marks on top of can. Turn volume control (right hand knob) about half-way on and tune in a station with main dial (center knob), adjusting trimmer (second knob from left) to loudest signal. Then reduce your volume control to a weak signal and carefully go over all of the adjustments on top of the transformers, peaking each one at the loudest point. Next, tune in a distant signal and go over the operation again. Once this adjustment is done, no further attention need be paid to it. Adjustments of the I.F. transformer should be made with the *low-high power switch in high power position.*

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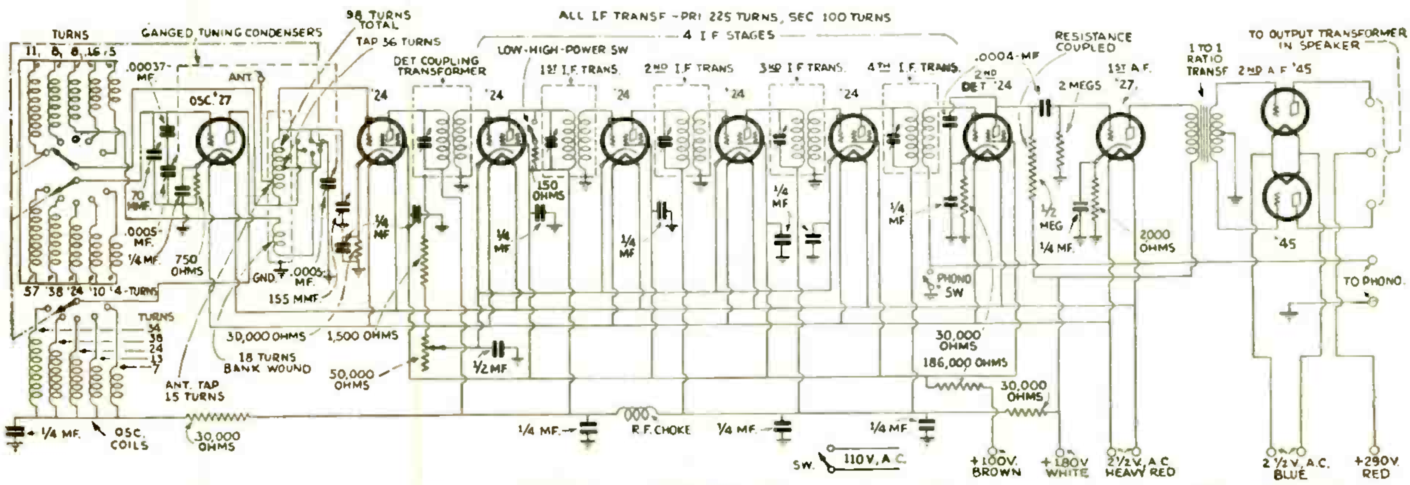
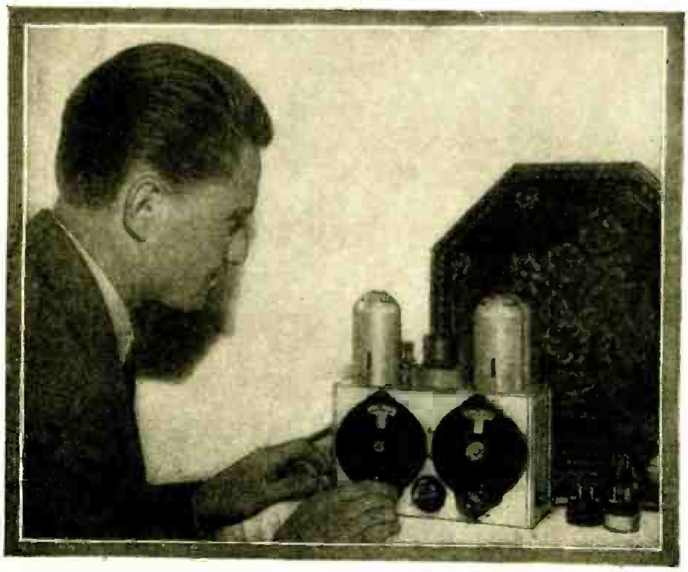


Complete wiring diagram of the new Lincoln De-Luxe "All- Wave" super-het, which tunes from 15 to 550 meters at a single "twist of the wrist". The various coils used for tuning in the different wavelengths and their connections to the "ganged" control switch, are shown at the extreme left of the diagram.



The "All-Wave" receiver, using three "auto" tubes, as tested by the editors.

New ALL-WAVE

Many readers have requested that we publish a circuit and describe a receiver using the new 6.3 volt automobile tubes. We aim to give our readers whatever they want, whenever possible, so here is a special receiving set which was built and tested by Mr. Bryant, formerly director of Radio News' Laboratory. Loud speaker reception is obtained with but three tubes, one of which is a pentode. This receiver operates with smooth control of the regeneration, as actual tests demonstrated.

A FEW years ago, when short-wave reception above 2000 kilocycles was given its impetus, and the A.C. operated broadcast receiver was in its early stages of development, engineers dreamed of an A.C. operated short-wave receiver. Short-wave receivers with '01A or '99 battery-operated tubes were then the thing of the day.

Soon, progressive engineers and short-wave operators were employing a single-tube regenerative short-wave receiver, followed by an A.C. operated power amplifier. During this time the writer was conducting experiments leading to the design of a satisfactory A.C. operated short-wave receiver. The preliminary design consisted of a '27 regenerative detector, and a '27 first audio stage, followed by '71 tubes in push pull. Needless to say, the hum level on frequencies above 3000 kilocycles was extremely high. To reduce the hum level it was necessary to change to '27 tubes for the push pull stage, which was later accepted as standard practice. This receiver was the first complete A.C. operated system to be described in public print, and was made possible through the collaboration of Mr. H. G. Cisin, M.E., of the Allied Engineering Institute.

After the introduction and adaptation of the '24 tube into short-wave receivers as a radio-frequency amplifier, no great progress was made in the design of the receivers other than natural refinement. The writer soon learned of, and had the opportunity to operate, a special short-wave transatlantic superheterodyne receiver developed by the Bell Telephone engineers. This receiver did not employ the '27 and the '24 tubes, as might be expected, but used tubes of the '99 type; their filaments being supplied with rectified and filtered A.C. This method was far more satisfactory than the use of the heater type tubes; although the public had accepted the latter as the ultimate tubes for use in short-wave receivers. Many attempts were made to use the heater tubes with rectified and filtered A.C.; but the apparatus required to deliver high amperage at low voltage was unsatisfactory. It is recognized, however, that slight hum modulation caused no difficulty in the reading of continuous-wave signals.

Thus it was, that the writer recognized the usefulness of the automobile tubes for short-wave work, when the first experimental designs were submitted to manufacturers prior to their introduction to the public. Because of other, more pressing duties the writer was unable to conduct any tests along these lines until recently; when the editors of SHORT WAVE CRAFT asked him to design a standard circuit around these tubes, for their readers.

The receiver to be described in the following paragraphs has a single stage of radio-frequency amplification, with untuned antenna, and tuned-impedance coupled to a regenerative detector. This is followed by a single stage of audio-frequency amplification, in which the new '38 pentode output tube is used. Using a standard broadcast antenna, the writer was able to receive a number of short-wave phone stations on a loud speaker with room volume. Needless to say, the volume is determined by the antenna power of the sending station. The receiver is designed for appearance, low cost, simplicity of construction, and greatest efficiency for the tubes employed in its circuit. The only additional apparatus required is the necessary power supply and a sensitive magnetic or dynamic speaker of 15,000 ohms impedance to work out of the pentode power stage. Any speaker may be used providing the impedances are matched through the use of special transformer. Specially-designed high impedance speakers may be had from any of the major speaker manufacturers.

Construction

The aluminum box is first prepared. This is of the type assembled from sheet aluminum, the edges of which fit into slotted corner posts. The top panel is laid out in accordance with the drawing (Fig. 1A) and the holes drilled out with a fly cutter; or else by the more laborious method of drilling a series of smaller holes around the inside diameter of the larger holes, by filing down the edges until the larger hole is perfectly round and smooth. The tube sockets (V1, V2, V3) are of the wafer type; while the coil socket V4 is of the base type. The latter was used in order to keep the coil above the metal, to reduce

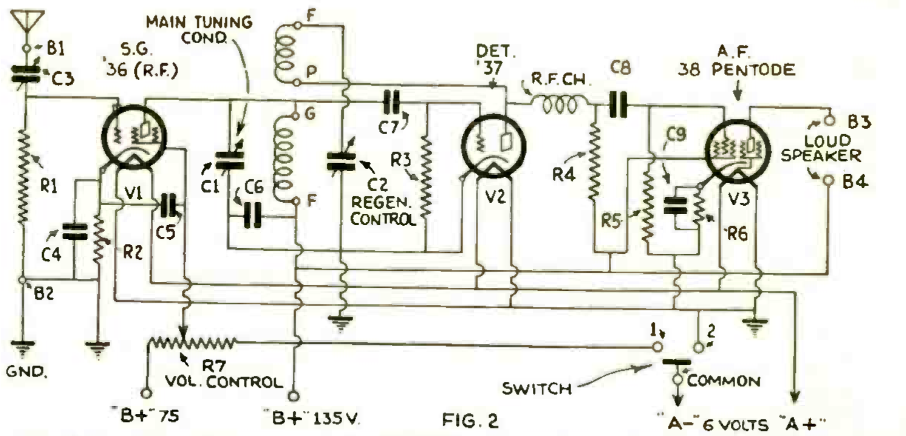


FIG. 2

Complete wiring diagrams of the "All-Wave" receiver, which employs three of the latest type, highly efficient tubes, the famous 6.3 volt "automobile" tubes.

RECEIVER USING *AUTO* TUBES

By BERYL B. BRYANT

losses due to eddy-current absorption. After the panel has been prepared, the sockets should be mounted in their proper positions with the bases of the tube shields; after which the panel is temporarily laid aside.

The front panel is next laid out and drilled, in accordance with Fig. 1B, for the mounting of the tuning C1 and regeneration C2 condensers; with the volume control R7 placed in the lower center. The holes for the mounting of the vernier dials should be drilled at the same time. The two condensers, with their respective dials, are mounted, and then the volume control.

The rear panel is next drilled for the output binding posts B3 and B4, or, if desired, these may be mounted on the top panel behind the shield can that houses the tuning coil. Needless to say, these binding posts must be insulated from the metal.

The right side panel is next drilled in the lower left corner, as shown in Fig. 1C, for the filament switch, and the switch mounted. Notice that this is a two-pole single-throw switch, serving to break the volume control circuit as well as the filament circuit, in order to conserve the batteries.

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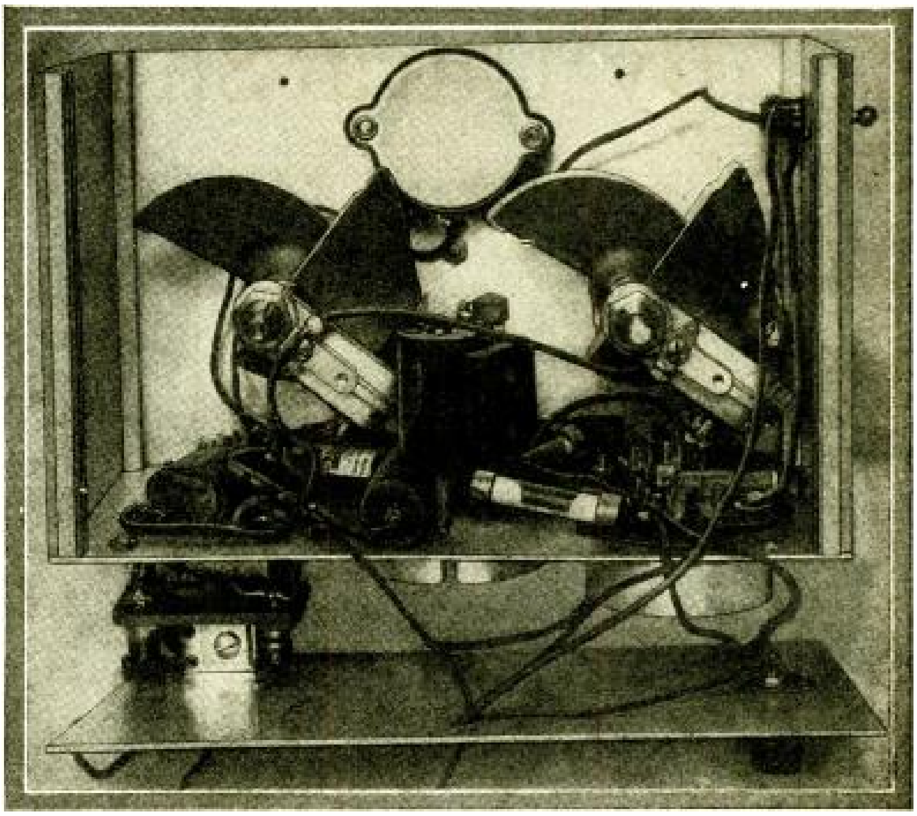
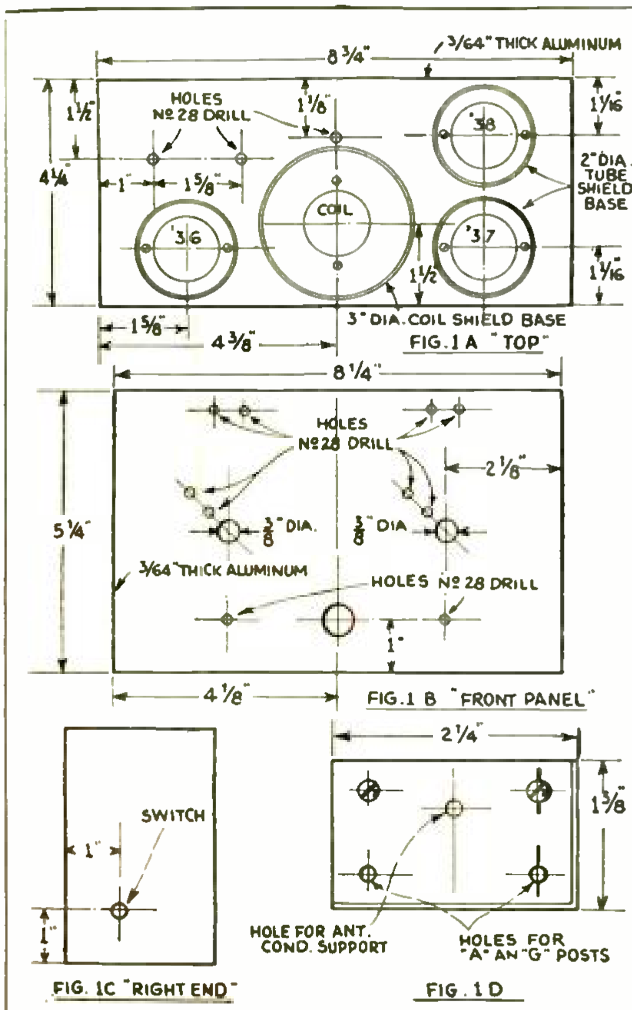
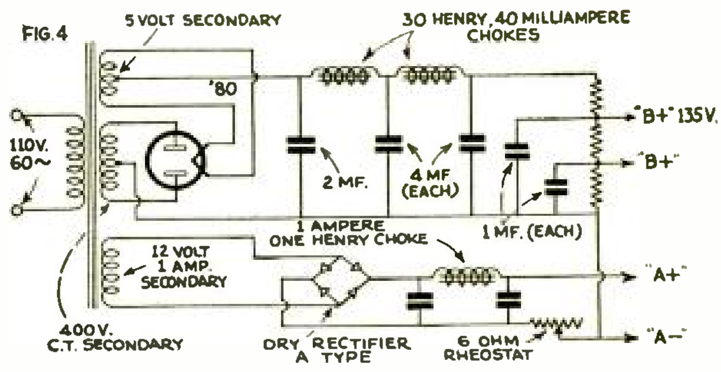
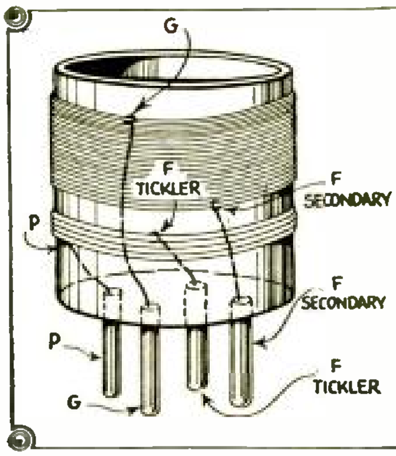


Interior view of the "All-Wave" receiver, which possesses very smooth regeneration control.





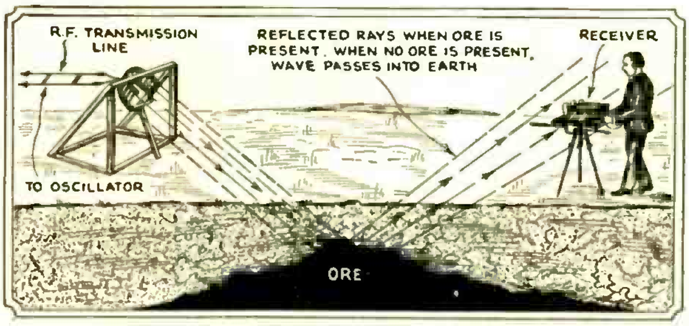
Above—Hook-up of "A" and "B" supply, which some may wish to use with the "All-Wave" receiver here described. Left—Drilling plan and dimensions of aluminum shield cabinet. Below—Data for winding various tube base coils.



COIL	RANGE METERS	SEC TURNS	TICKLER TURNS
A	170 TO 73	50 Nº 28 D.S.C.	16 Nº 36 D.S.C.
B	77 TO 32	15 Nº 28 D.S.C.	6 Nº 36 D.S.C.
C	45 TO 12	8 SPACED Nº 18 E.	4 Nº 28 D.S.C.
BROADCAST D	125 TO 295	136 Nº 30 E	10 Nº 36 D.S.C.
E	250 TO 560	220 Nº 36 D.S.C.	20 Nº 36 D.S.C.

FIG. 3

Locating ORE DEPOSITS By Ultra Short Waves



Here we see how ultra short waves are reflected by a metallic ore deposit and this fact indicated by the reception of signals in the receiver.

By A. Binneweg, Jr.*

What is more interesting than the possibility of locating ore deposits by some electrical means? As Mr. Binneweg points out in the accompanying article, there are excellent possibilities of applying very short waves to this problem. The author describes how to build an ultra short wave transmitter and also a receiver, together with suitable focusing reflectors for locating ore or other metallic masses

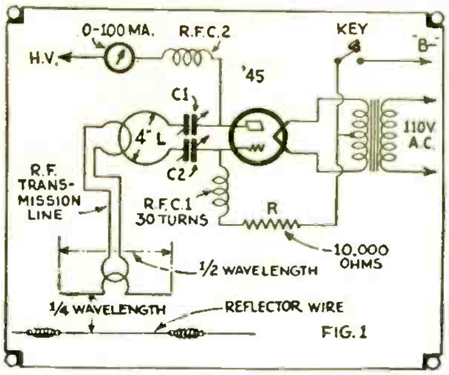
CONSIDERABLE interest has been shown lately in radio apparatus for electrical prospecting. Those interested in this kind of work are, almost without exception, non-technical men who desire to try their luck at prospecting. It is not necessary to be technically trained in radio in order to conduct an experiment with electrical prospecting apparatus. Truly, this is an age of specialization in which the knowledge in one field is often of considerable value in another.

The writer has specialized for many years in the design of ultra-short-wave transmitting and receiving apparatus, equipment of special interest to those who wish to try this modern method of prospecting. (An article on this subject by Mr. J. I. Heller appeared in the June issue of *Radio-Craft.*) However, there are many improvements which can be made in electrical prospecting apparatus to make it of more practical use to the non-technical reader. Improvements in such apparatus will be considered in this article.

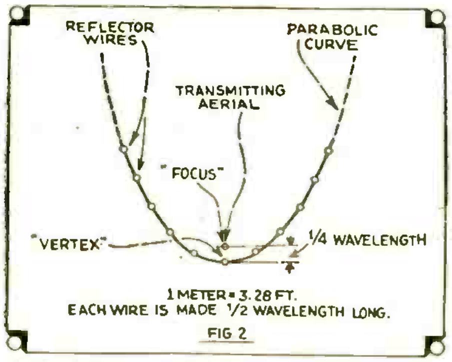
The reader is advised not to attempt the construction of such ultra-short-wave equipment without first experimenting at home. It is not an easy matter to develop apparatus which can be immediately used in the field without some tests, of course.

It is suggested that the reader first try experimenting with apparatus of this kind, employing a tube of either the '45 or the '10 type. These tubes will give sufficient power so that the results obtained are more easy to apprehend. The filament of the tube used can then be operated directly from the light socket, thus saving batteries. The circuit of such an arrangement is shown in Fig. 1. For test work a key is convenient; be sure to make the leads connecting to both the plate and grid of the tube as short as possible, for otherwise it may be difficult to make the tube oscillate at wavelengths as low as 1½ meters. Condensers C1 and C2 in Fig. 1 may be 30 mmf. midgets.

* Engineer, Delft Radio Co.



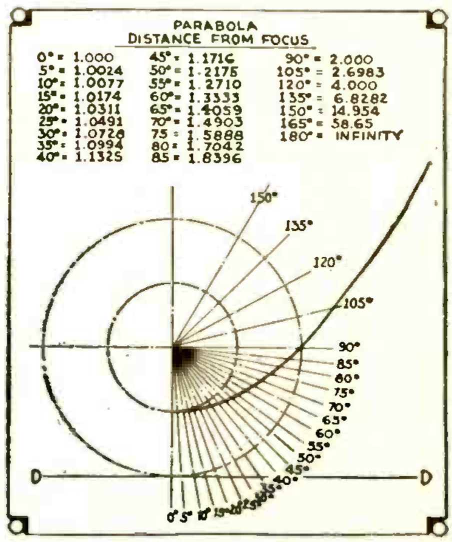
Ultra short wave transmitter and arrangement of antenna with reflector.



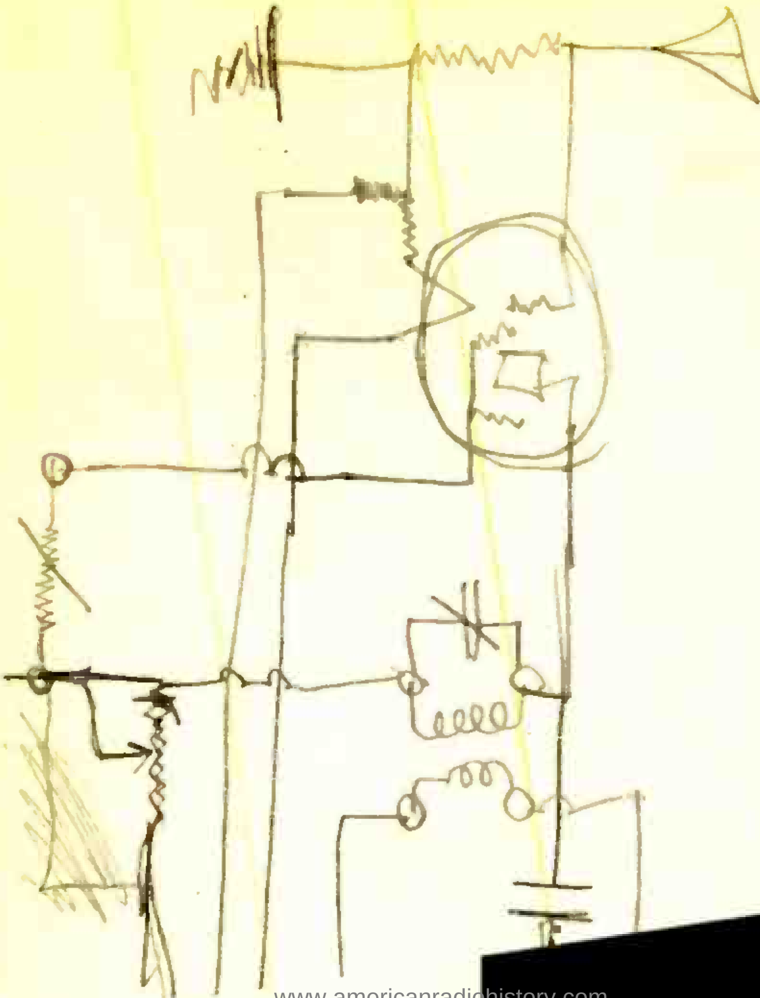
How to arrange the parabolic reflector wires and aerial.

The coil, L, consists of a loop of copper tubing 4 inches in diameter. The use of tubing is due, not so much to heavy currents to be carried, as to the fact that it is desired to maintain the inductance at a rigid value. The choke coil, RFC1, consists of 30 turns, spaced about ⅛-inch between turns, on a piece of dowel ½-inch in diameter. The grid-leak, R, is of the heavy-duty type and has a value of 10,000 ohms. The other choke, RFC2, may be made the same as RFC1. For tubes having higher power, such as the type '45, a 0-100-scale milliammeter may be necessary. For smaller tubes a 0-10-scale instrument will be satisfactory. If the smaller type is available, it can be shunted with a resistance of the proper value for the larger tubes. If a filament center-tap is not available on the secondary of the filament transformer, shunt a resistance of about 200 ohms across the secondary and run the center-tap lead to the center tap of this resistance.

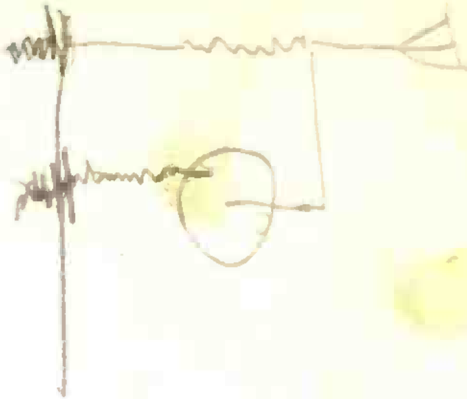
Another advantage of high power is that a radio-frequency transmission line of considerable length can be used; and still sufficient power will be obtained at its far end for coupling into the antenna. The antenna wire is made ½ wavelength long and has at its center a small half-turn loop for coupling to the R.F. transmission line, which has a similar loop at each of its ends. Such a transmission line consists of only a pair of parallel wires, spaced any convenient distance apart, such as one or two inches. The

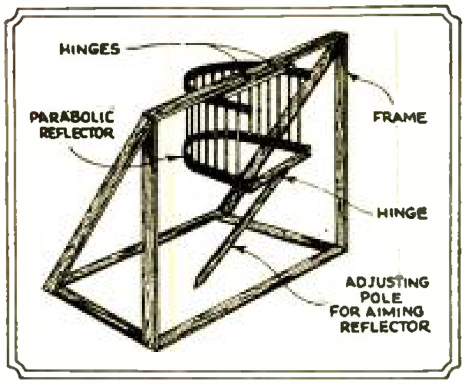


Data for laying out parabolic reflector.



MEMORANDA





Frame for supporting parabolic short wave reflector and stick for adjusting it to different angles.

wire used in the transmission line can be any convenient size, such as No. 18, or so. By using an R.F. transmission line the transmitting apparatus can be left in some convenient point and the neighboring territory easily explored, without carrying all the apparatus along.

It is important to make the proper choice of tubes for operation at very high frequencies. Some tubes are not very good for this purpose, and perhaps will not oscillate at all. The reason is that the losses in the stem of the tube become quite high, and the oscillator can not supply them. This is shown clearly in Fig. 4. There is a certain value of capacity, between the leads in the stem, which is of considerable importance when the frequency becomes very high. The glass in the stem itself functions as the dielectric of the condenser, and the loss in solid dielectrics is relatively enormous at ultra-short wavelengths. If a plate voltage of about 400 volts is applied on ordinary transmitting tubes at these wavelengths, the dielectric loss is so great that excessive heating results. This heating lowers the dielectric strength of the glass greatly and the plate voltage is able to spark through the glass in the stem, completely damaging the tube. For this reason, it is advisable to use much lower voltages than normally employed in such tubes.

In oscillators, such as shown in Fig. 1, it is sometimes necessary to use small chokes in the filament leads. Such chokes, however, may not be necessary and are not shown in Fig. 1. However, if such

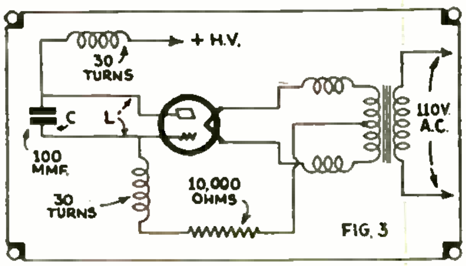
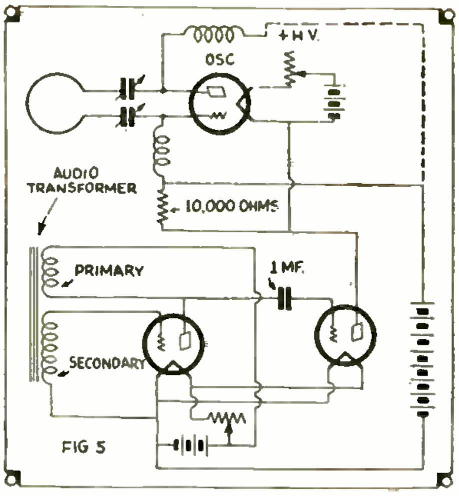


Fig. 3, above, shows the essential connections for a ¾-meter oscillator.

should be necessary, two chokes having the dimensions of RFC1 and RFC2 can be connected in the two filament leads to the tube. Such chokes must be constructed, however, of a wire having sufficient current-carrying capacity so that the filament voltage will not be reduced too much. The proper filament voltage is absolutely necessary for satisfactory operation at these frequencies. Although at low frequencies a tube may oscillate with a very small plate voltage, higher plate voltages are necessary at the higher frequencies.

When testing, study the operation of reflectors. For use in the field, start in with a simple reflector like that shown connected to the end of the R.F. transmission line shown in Fig. 1. Of course, if no transmission line is used, the antenna is directly connected to the inductance, L. A simple reflector consists of the antenna itself and a single wire spaced from it, by one-quarter of a wavelength. Such a reflector wire gives a signal in the direction from the reflector wire through the antenna, of twice the value obtained when the antenna wire alone is used.



Hook-up showing how to connect an audio frequency oscillator into the grid circuit of the short wave transmitter.

Fig. 2 contains some essential data for the construction of a complete parabolic reflector. The distance between the antenna wire and the vertex wire of the reflector should be a quarter-wavelength. The transmitting aerial itself (or the receiving aerial, if the reflector is used for reception) is mounted at the focus of the parabola. The balance of the wires in the reflector are mounted along the parabolic curve having the aerial at its focus. The greater the number of wires used on the parabolic curve, the sharper will be the beam transmitted. If such a reflector is used for reception, the gain will be greater with a greater number of wires. If the number of wires in the reflector is increased, the size of the aerial must be reduced slightly because of the *loading* effect of the reflector wire.

The beam will also be sharper as the sides of the reflector are extended as shown by the dotted lines in Fig. 2. In determining the correct distance from focus to vertex, divide the operating wavelength by four; this gives the correct distance to space in meters; if this value is changed to feet, one can easily measure it with a common yardstick. The length of the antenna itself will be somewhat shorter than the lengths of the reflector wires, because of the coupling coil at its center, which loads it.

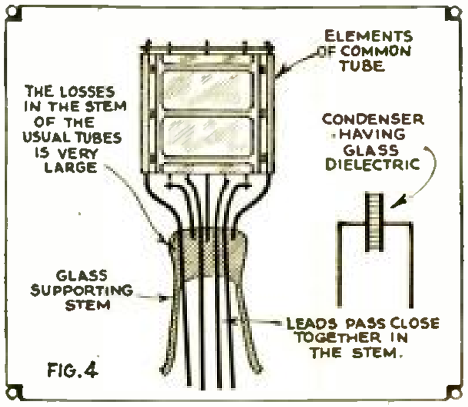


Diagram showing parts of vacuum tube wherein losses are noticeable at high frequencies.

Prospecting Apparatus of the Future

The writer sees absolutely no reason why the radio prospecting apparatus of the immediate future will not be in a greatly simplified form. The apparatus now employed operates at wavelengths close to 1.6 meters. However, at even this frequency the size of the aerial and reflector systems is yet rather cumbersome. By employing a wavelength such as ¾-meter, the size of this equipment could be radically reduced and even a gain in efficiency obtained. The reflectors would be greatly reduced in dimensions and the sides of the reflector considerably extended to obtain much greater selectivity. This would result in less interference with other services and, at the same time, extraneous waves and unsatisfactory reflections would be to a great extent eliminated.

Another outstanding advantage is that an amateur band of frequencies exists at ¾ meter. This allows any one with an amateur transmitting license to construct and test such apparatus. At present, a special license is required for transmitting in wavelengths other than the amateur bands. The reader is, perhaps, familiar with the fact that *a government license is required for radio*

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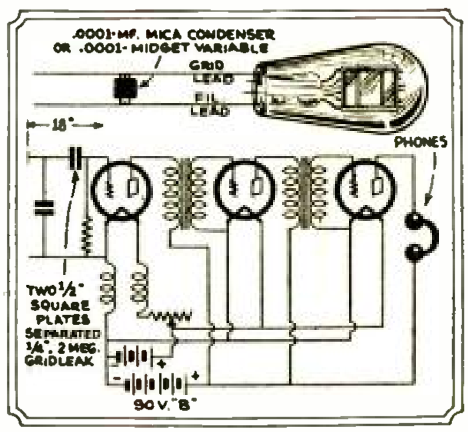
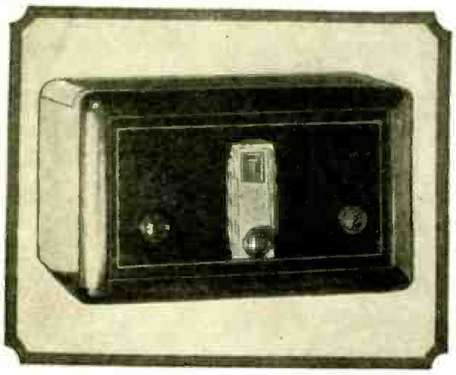


Connection of tubes in ultra short wave receiver, suitable for use in locating ore.



Handsome appearance of the new National short wave converter; operates without "plug-in" coils.

A NEW CONVERTER of Novel Design

By JAMES MILLEN*

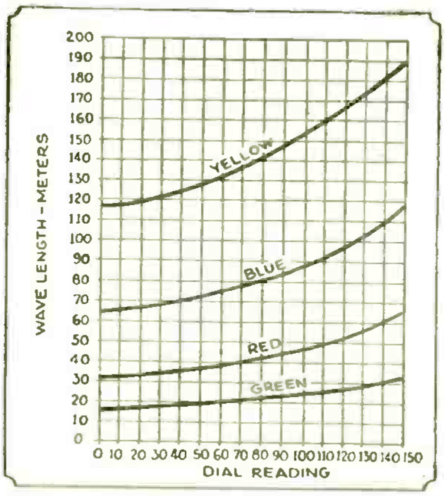
"Interlocking" and "dead spots" are eliminated by new engineering ideas in converter design, which include variable-mu tube; novel oscillator circuit; a stage of high-gain intermediate frequency amplification; a new switch to eliminate plug-in-coils; similarity of dial settings for different coils; easier tuning and a brand-new dial, which "shows a different color for each wave band!"

AFTER a hurried first glance at the accompanying circuit diagram, one might be inclined to jump to the conclusion that the new "National NC-5" is merely a conventional type of so-called "short-wave converter" to which two additional tubes have been added; one a high-frequency pre-amplifier, or input tube; and the other a lower-frequency I.F. amplifier, or "output" tube.

Fundamentally this is partially true, even though it fails to consider the many months of careful laboratory development work before such additions were possible. As Robert S. Kruse stated, in the introduction to one of his articles in SHORT WAVE CRAFT some time ago (June-July, 1930) on the design of a short-wave receiver: "The circuit diagram should not be taken too seriously, as all the circuit diagrams in the world mean little if anything when it comes to short-wave receivers."

Short-comings of Some Converters

In the past the so-called short-wave converters have merely been frequency changers and, while they would give extremely satisfactory results with many sensitive broadcast receivers, they were not at all universal in their application and frequently resulted in excessively poor signal-to-noise ratio. Moreover, practically all of the commercial models that we were able to secure and test in the laboratory, during the past year, had bad "interlocking," which made tuning extraordinarily difficult. Although frequently advertised as being "single-control," such was generally far from the case.



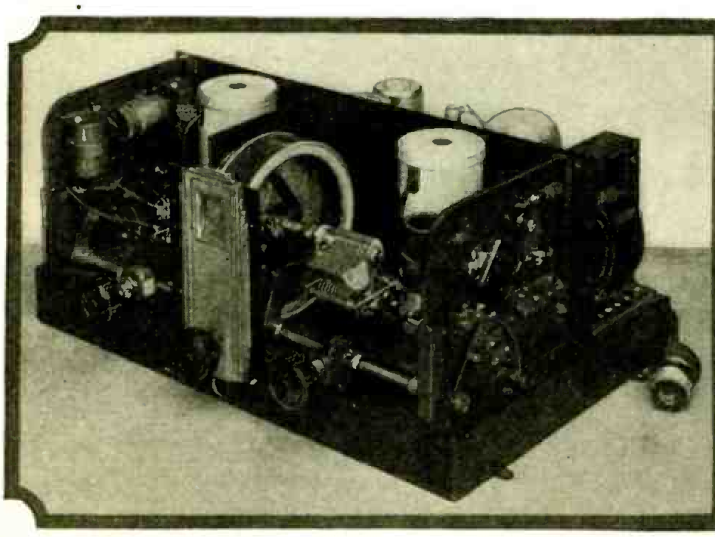
Curves showing wavelengths covered by the various coils in the National converter.

In order to improve the signal-to-noise ratio, the stage of pre-amplification was developed, to insure efficient antenna coupling and the application of a signal of sizeable magnitude to the grid of the first detector, or mixer tube. To avoid complicated tuning, as well as intricate constructional details, due to the introduction of an additional set of coils and tuning condenser for the input to the radio stage, the special harmonic-tuned input arrangement, shown in the diagram, was developed.

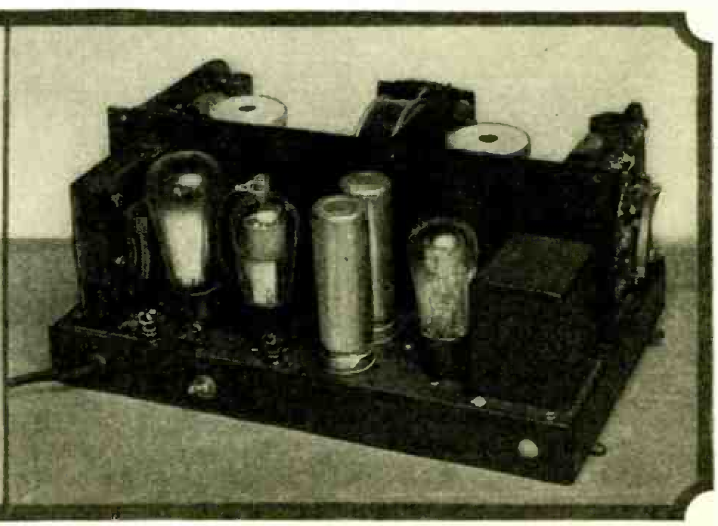
Variable-mu Tube Solves Riddle

This trick was an outgrowth of a circuit designed in the National Company's laboratory back in 1926, when we were working on the original National short-wave receiver, but which lacked commercial possibilities until the advent of the UX-235 variable-mu tube. When used in

* Consulting Engineer: General Manager, National Company, Malden, Mass.



Front view of the National "Plug-less" S-W converter.



Rear view of converter, which has inductance change switches connection with this new tube, there is absolutely no tendency to "cross talk" or to "pre-rectify" the incoming signal.

While the harmonic self-tuning peaks are so selected that they fall in the center of the different short-wave broadcast bands, their resonance curves are sufficiently broad so that the input impedance of the grid circuit of the '35 is at all times of an extremely high value. Consequently, a really worthwhile amount of amplification is obtained on all frequencies.

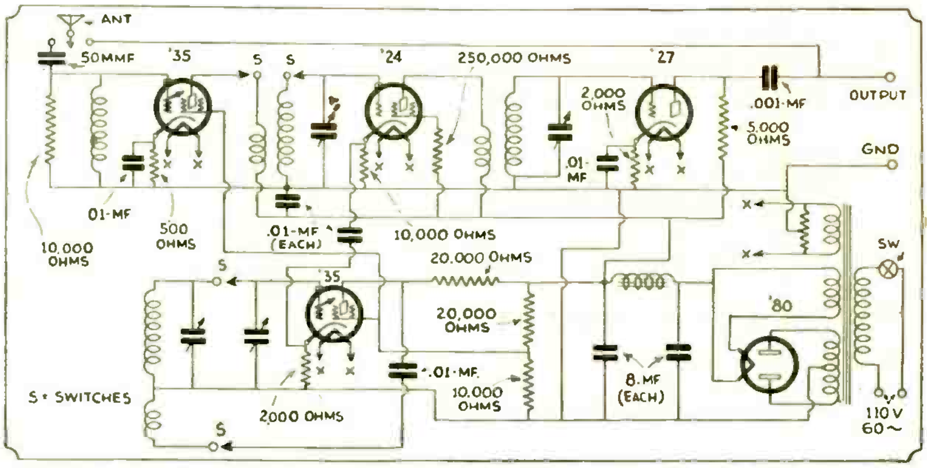
The Oscillator of New Design

A rather unusual oscillator, or frequency-changing arrangement, will be noticed upon examination of the circuit diagram. In the first place, a '35 tube is employed for this purpose, rather than the more conventional '27 and, in addition, coupling is *not* obtained through a small condenser between the grids, as has been common practice in the past. Instead, a new and unique coupling arrangement has been developed whereby the cathode return circuits of the detector and the oscillator are coupled together. Such a method automatically provides just the right amount of coupling, at all times, to produce a minimum of "hiss" and other such noise; which has been so troublesome with converters in the past.

In fact it is rather surprising that more engineers, working on the short-wave superhet and superhet converter design problems, have failed to realize to what an extent improper "mixing" is responsible for the bad reputation of "converters" and "superhets," for high noise-to-signal ratio. The use of a properly designed pre-amplifier, in conjunction with the variable-mu oscillator, and the cathode-return "mixing circuits," results in a signal-to-noise ratio closely approaching the very favorable one obtainable from a good T.R.F. set, such as the "SW5 Thrill Box."

"Interlocking" Eliminated

Furthermore, this arrangement of coupling, in combination with the complete shielding of the oscillator and detector grid-circuit transformers, in the manner illustrated, entirely eliminates any "interlocking" tendency; which is one of the limiting factors in the wavelength range of converters in general. With this circuit, no trouble from interlocking is encountered; even at 15 meters, the lower wavelength range of the converter described herewith.



Circuit diagram used in the National short wave converter, with "inductance change" switches.

Power Supply

The use of the '80 permits full-wave rectification with a single tube which,

(*Continued on page* 294)

New Workrite Converter

Left—Note the appearance of the new Workrite model 4X super-converter, which converts any T.R.F. broadcast receiver into a superheterodyne for the reception of short waves. The converter includes its own "power supply" and operates from 110 volt, 50 to 60 cycle A.C. circuits.

Diagram below shows how the four tubes, including the rectifier, are used in the Workrite super-converter.

WHERE is the radio fan who will not recall the thrill he experienced upon tuning in his first out-of-town station? How many did not keep a carefully compiled log of those stations received and proudly force it upon the attention of their friends at every opportunity? Those days are gone but not forgotten!

Thousands today are not only experiencing those same thrills, but are getting far greater ones. They are reaching out and receiving new and wonderful radio programs from practically all the countries of the world. They are, for instance, hearing at first hand, beautiful music and opera from Rome, speeches of world-wide interest from England, the native bands of India, the castanets of Old Spain, the geisha girls of Tokyo, the thrilling strains of the Marsellaise as only a French band can play it, etc., through the marvelous medium of short waves.

The Model 4X super-converter here illustrated was designed by Mr. George W. Walker, who has carried on a tremendous amount of experimenting and research on converters of every description; if anyone knows how to design and build a converter it is Mr. Walker. The converter here shown employs four tubes

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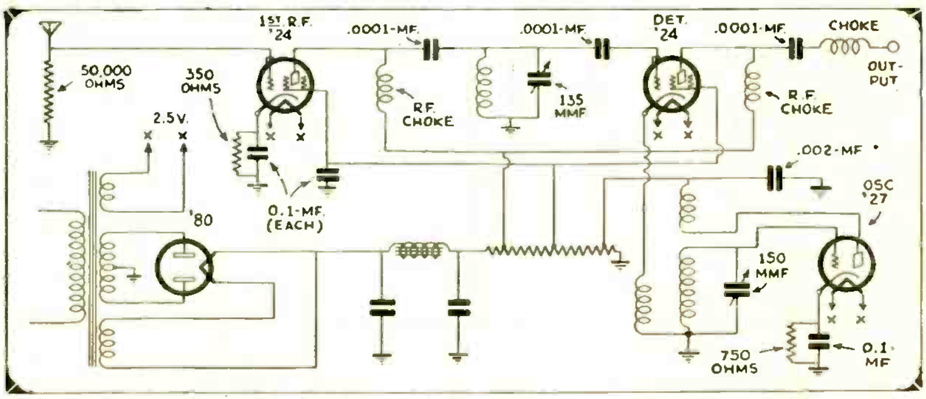
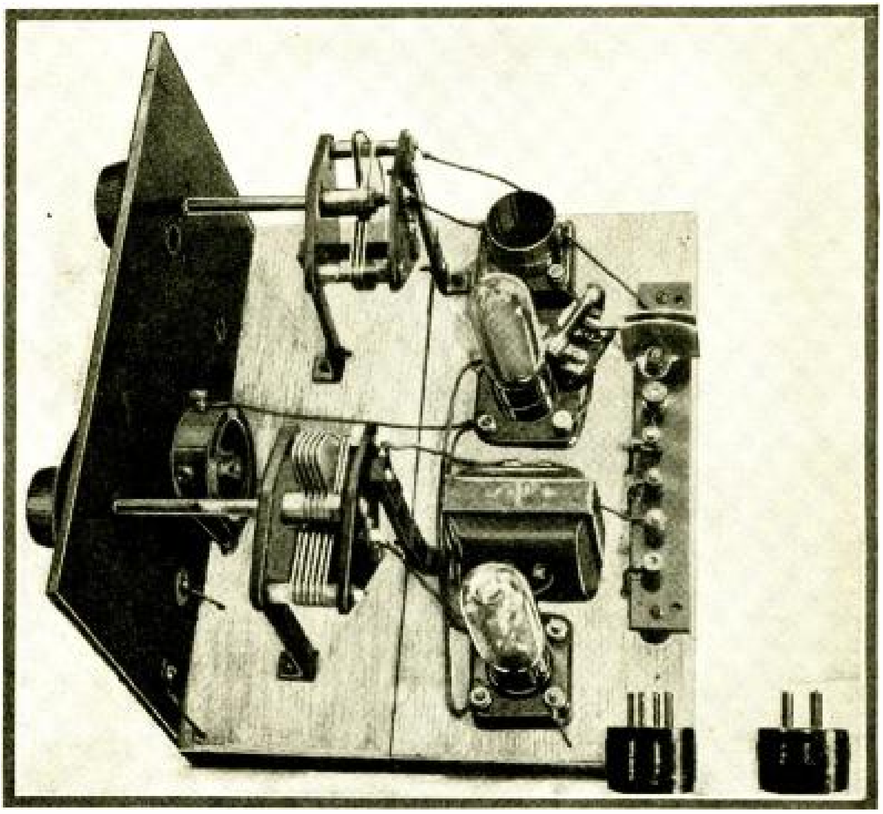


The Short Wave Beginner

A 2-TUBE *Receiver That* REACHES *the* 12,500 Mile MARK

By Walter C. Doerle

This low-priced head-phone receiver comprises a few well-chosen parts arranged in a well-tried circuit.



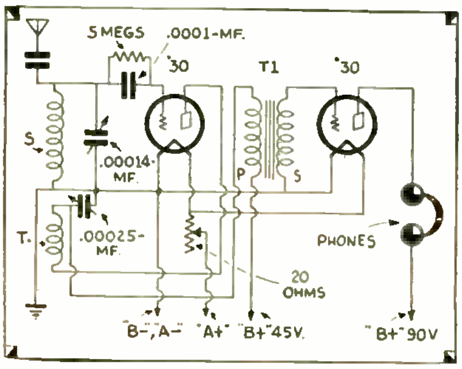
An easily built short wave receiver for the beginner, using but few parts of low cost. Note anti-capacity condenser controls.

WHAT the heck's" the idea of wasting power, of blasting out ear-drums, of going "bugs" with the performance of a costly short-wave receiver, when you can build a two-tube outfit that gets signals from the 12,500 mile meridan? Why, there is nothing to brag about when you "log" a bunch of stations with a powerful receiver; but listen to a man who "pets" a two-tube set, and then you get the "thrill of a lifetime".

It's quite possible to continue the entertainment with words, but our problem is to tell how you too can get thrills that will last a lifetime. Here we go on our journey of description—hold your breath, read vigorously and absorb all details—everything is important.

Good night, my pencil is nearly worn to the wood and I haven't even let you fellows in on a diagram; but here she follows and with the losses reduced maybe to a third, because of careful and thoughtful construction and consideration, you could very well guess it's our old timer—the *Schnell* method of regeneration control for the detector, and a stage of audio frequency. (See hook-up diagram.)

We know that some people write backward and think forward; but let's start the discussion just as you perhaps draw a radio hook-up diagram—starting with the antenna symbol and completing the diagram with a few curves or loops to represent the output load—in our set we intend to use head "phones".



Circuit used by Mr. Doerle for the 2-tube "globe circler".

Antenna and Ground

Now as to the antenna, a wire strung twice across the living room and anchored to the picture molding with small finishing nails, together with a good "water-pipe" ground connection, has enabled the author to pick up signals with such a receiver from stations 6,000 miles away, even on a hot summer day on the Pacific Coast (Oakland, California.) Say, fellows, if a well-insulated outside antenna had been possible of erection, why the other 6,500 miles of "no-man's land" would have been easily heard and conquered.

Time is moving along, and there is much ground yet to be gained. Let us consider for a moment the antenna "series condenser". For the operator's convenience, a seven-plate midget is quite suitable for the purpose; but in a small receiver of this price, a condenser made of two pieces of old condenser plates, cut to about 1½ square inches in area and spaced on the binding-post strip ⅛" apart, will serve very well for coupling the R.F. energy from the antenna to the oscillating circuit of the receiver.

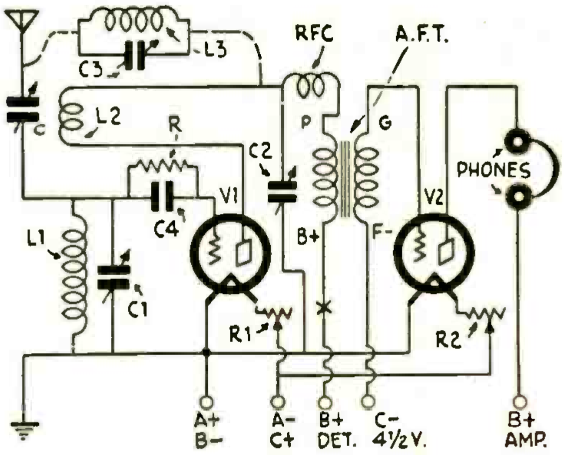
Keeping Down Those "Losses"!

Be sure that the post strip is of bakelite; as this is the cheapest, though not the best, insulation for the purpose. In some experiments made by the author, a home-made series condenser was mounted on ¼-inch plywood baseboard, but a surprise awaited—the signal intensity as heard in the phones was about three-quarters its value when the series condenser plates were mounted on the bakelite strip. If there is nothing else to gain from this article, be sure that, when you make a two-tube set, *you keep all losses as low as possible. It's hard to compensate for them.*

Since this type of receiver would un-

(*Continued on page* 285)

A "TRAP CIRCUIT" *for* SHORT WAVE RECEIVERS



A 40 per cent increase in signal strength and elimination of interference from a local broadcast station, are claimed for this "trap circuit" devised by Mr. Swenson.

I HAVE always enjoyed most reading the experiences of other short-wave enthusiasts and therefore I would like to see published this idea, which I have evolved after a great deal of experiment. By including the *trap circuit* shown in the diagram, I have obtained a 40 per cent increase in signal strength from a standard short-wave receiver circuit, and also eliminated the program of our local broadcast station which, without it, is heard weekly over the entire dial. Reception I can compare to another stage of average transformer-coupled audio; it is very much clearer, and there is no trouble with audio howl or feedback.

Sometimes, when using this improved circuit, it is necessary to reduce the tickler coil, as the set oscillates better without it; and a ground is not necessary. It is sometimes desirable to put a 500,000-ohm Centralab variable resistor in the plate lead at X, to obtain the exact plate voltage for best operation; a 1-mf. condenser shunts it.

The parts required are:

L1, L2—Aero "LWT 11" short-wave coil kit;

L3—Coil of 42 turns on a 3-inch tube;

C1—National .00015-mf. "Equicycle" 270° condenser;

C2—National .00025-mf. "Equicycle" 270° condenser;

C3—Variable .0005-mf. condenser;

C4—Sangamo .0001-mf. grid condenser;

RFC—Silver-Marshall short-wave choke;

AFT—Pilot "391" audio transformer, 3½:1;

R—5-megohm resistor;

R1, R2—Frost 30-ohm rheostats;

VI, V2—De Forest 401A tubes (very efficient for short waves);

Phones—Baldwin.

I have received these stations very clearly (at Hot Springs, Ark.) using this hookup:

W3XAL—Bound Brook, N. J. 49.18
W2XE—New York City 48.99
W9XF—Chicago, Ill. 49.83
VE9CL—Winnipeg, Canada 49.50
VE9GW—Bowmanville, Canada... 49.17
W8XK—Pittsburgh, Pa. 48.86
W2XAF—Schenectady, N. Y. 31.48
W8XAL—Cincinnati, Ohio 49.50
W1XAZ—Springfield, Mass. 31.35
HRB—Tegucigalpa, Honduras 48.50
W9XAA—Chicago, Ill. 49.31
W2XAL—New York City 49.61
VZA—Drummondsville, Can. 62.70

Not to mention the amateurs and C. W. stations.—*Contributed by C. R. Swenson.*

Simple Sending Antennas for Amateurs

OF the very greatest importance, in determining the efficiency of a transmitter, is the use of a good antenna, of exact dimensions; so arranged that, according to its function at any time, all the possibilities are fully utilized. Especially in the city, it is often very hard to maintain good radiation; since a great part of the energy is absorbed by the surroundings (metal roofs, trees, etc.). One must therefore endeavor to arrange the antenna so that the radiating part of it is placed as high in the clear as possible.

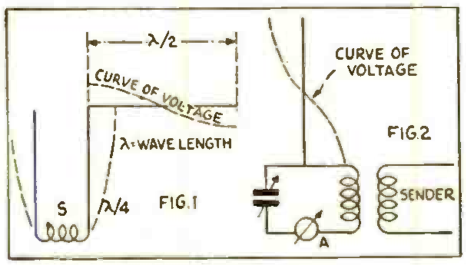


Diagram above shows distribution of voltage along short-wave antenna; Fig. 2 shows new single wire antenna, which connects to one side of oscillating circuit.

The amateur can consider only an antenna of simple construction; therefore, only two kinds are generally used. The "Zeppelin" antenna utilizing a feeder has the advantage of letting the actual radiator be placed at even a considerable distance from the sender. The flow of energy through the feeder takes place almost without loss. The correct construction of such an antenna presupposes certain knowledge, which is important for determining the length of wire.

Dimensions of the "Zepp" Antenna

Fig. 1 shows, schematically, the distribution of voltage along the antenna. The feeder consists of two parallel wires, 4 to 6 inches apart; between the ends toward the transmitter there is connected a coil "S" consisting of a few turns, which is coupled to the transmitter.

At the other end, connected to one of the two parallel wires, is a single wire —the radiator—which must be stretched where it is free of interference. The length of the feeder must be so proportioned that, at the upper end there is an "antinode" or peak voltage. It will therefore depend on the length of the wave to be sent and must be *an odd multiple of one quarter of the wavelength*. The length of the radiator, on the other hand, must be *half the wavelength*, or any multiple of this; since otherwise there will be no radiation. In designing such an antenna, one must take care that it will radiate at both 20 and 40 meters. (Slight variations, say 5%, are of no importance.) We may select values which will make it possible to work on both waves. The radiating part is, therefore, 20 meters long; this corresponds, for the 40-meter wave, to half of the wavelength, and for the 20-meter wave to the full wavelength. Therefore, no change is needed.

The feeder on the other hand, is so erected that the last 5-meter section (one quarter of the 20-meter wave) is located in the transmitting room and can be switched in and out of circuit. If, for example, the wire is 30 meters long, then this is suitable for the 40-meter wave; as it equals ¾-wavelength. With the 20-meter wave, however, it is an even multiple (6/4-wavelength); and it could not be used. But, by switching in the last 5 meters, we obtain 35 meters, or 7/4-wavelength. (Five meters equal 16 feet 4⅞ inches.)

The feeder must be at least 8 to 12 inches away from the wall, but can follow any desired course; even around corners.

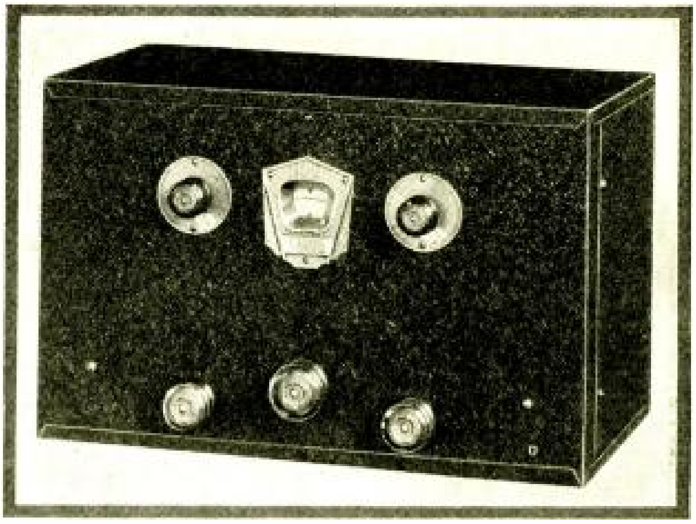
A Simpler Antenna Arrangement

The second very popular type, known as the "Fuch'ic antenna, is characterized by great simplciity and lack of sensitivity to fluctuations. Fig. 2 shows the theoretical plan. It consists of a single wire, which is connected at one side with an oscillating circuit coupled to the transmitter. The excitation takes place by voltage-feed; and the length of the

(*Continued on page* 298)

A SHORT-WAVE Super-Converter *That's* Different

A new, easily operated, short wave converter recently perfected by McMurdo Silver, prominent radio engineer. The waveband coils are changed by means of an ingenious switch, thus eliminating "plug-in" coils. Short waves can be received on any broadcast set with this converter.



Above: Front panel appearance of the new Silver-Marshall short wave converter. Tuning in short waves is really very simple, once this converter is connected to your regular "broadcast" receiver. All the tuning is done with the single dial on the converter, the other knobs being used for volume control, coil switching, etc.

Left: Appearance of the new Silver-Marshall "short and long" wave receiver, described in detail in the last issue of SHORT WAVE CRAFT.

THERE are many different kinds of short-wave converters being sold on the radio market today, but it does make a difference "who" builds the converter you are eventually going to purchase.

Mr. McMurdo Silver, well-known radio designer of Chicago, has recently evolved a brand new circuit for a shortwave superheterodyne converter; by adding this to his set the owner of an ordinary "broadcast receiver" can listen to short-wave stations all over the world.

What the Public Expects of a Converter

From any short-wave converter the average radio enthusiast expects to obtain, today, simplicity in adapting or connecting the converter to the broadcast receiver. If possible, he also wishes to have ease of adjustment and tuning without bothering with "plug-in" coils. Finally, the converter should tune easily and smoothly. All of these features are found in the new Silver-Marshall converter here illustrated and described.

Wave-band Coils Changed Easily by Turn of Switch

The various oscillator coils for the different wave-bands are wound on special low-loss insulating tubing; as the diagram shows, the various coils are switched into circuit as required by means of a three-gang switch, connected to a single control knob projecting through the front panel.

The wave-changing switch has four positions and provides tuning in the following wave-bands: 10 to 20 meters; 20 to 40 meters; 40 to 80 meters; 80 to 200 meters.

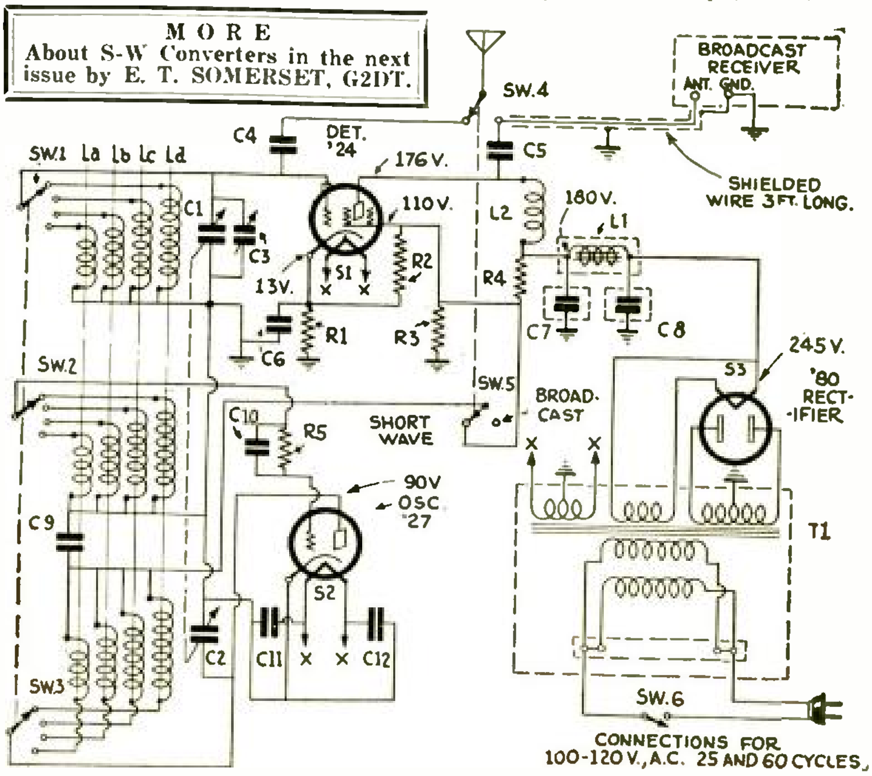
The small knob, at the right of the main tuning dial, changes the antenna lead from the "converter" to the "antenna post" on the "broadcast" receiver with which the converter is operating. This allows the permanent installation of the converter, with optional "short-wave" or "broadcast" reception at will. The converter is mounted in a neat steel cabinet with black crystalline finish.

Converter Uses Only Three Tubes

The "S-M 739" Super converter is a full A.C.-operated screen-grid one, with

(*Continued on page 293*)

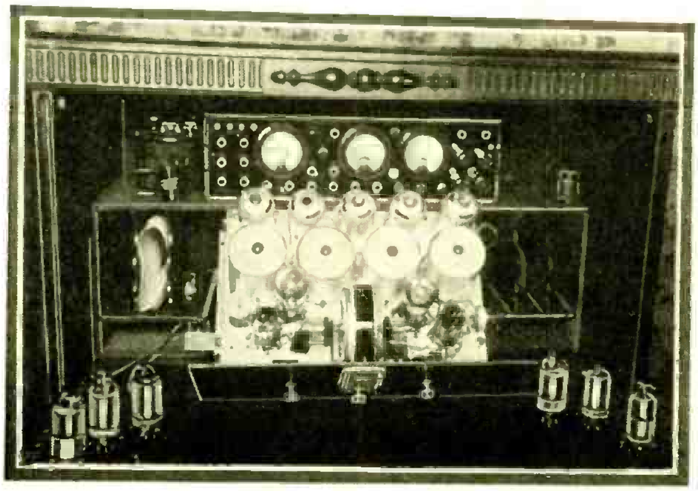
MORE
About S-W Converters in the next issue by E. T. SOMERSET, G2DT.



Wiring diagram of the new Silver-Marshall short wave converter here described.

MARVELLOUS RECEPTION *By Coupling* Short & Long Wave *"Super-Hets"*

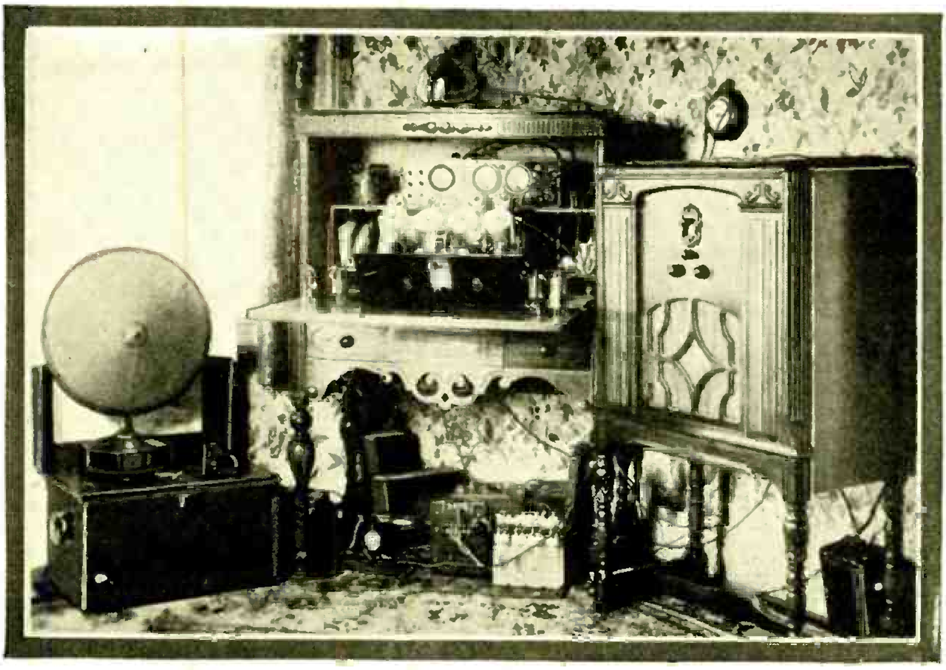
By BURT H. TAYLOR
(W1KB) Haverhill, Mass.



The Hatry-Young "short wave super-het" used by Mr. Taylor in conjunction with his Graybar broadcast super-het, to listen in on the "whole world".

THIS arrangement, I am certain, is one of the best, most complete, automatic all-wave receivers, and one that will perform with anything shown so far; and on top of that it is a wonderful "code" receiver.

Long-distance short wave stations are received by Mr. Taylor with tremendous volume on loud-speaker, thanks to a simple coupling between a short wave and a broadcast super-het.



Mr. Taylor's complete layout, showing broadcast super-het at right, short wave super-het at center, with loudspeaker and power amplifier at left.

Here is the layout—a complete "HY-7" Short-Wave (super-het described in the April-May, 1931, issue of SHORT WAVE CRAFT) receiver and a standard broadcast super-het (Graybar 700, R.C.A., GE., or Westinghouse).

The intermediate train of the "HY-7" is tuned to 1530 kc., this being just below the broadcast band. Now, to use the combination of the two receivers, a test cord about 7 or 8 feet long with a plug on each end (the one I use belongs to a Diognometer) is used between the two receivers—one end connecting to the *antenna post* of the Graybar super, and the other end plugged to the grid of the second detector socket, after the second detector tube has been removed; thus giving three stages of I.F. (1530 kc.) in the "HY-7," ahead of the standard broadcast receiver, which is now dialed down to 1530 kc. All short-wave tuning is now single-control on the "HY-7," using the volume control on the Graybar for "output" control.

Dual Wave Reception Simple

Now suppose we are listening to G5SW or "Radio Roma", and want to come in on WLW or WEAF. All that is necessary is—simply to turn the dial of the Graybar to WLW's wave; just that one operation of turning the one dial, on the Graybar; the short wave I.F. (intermediate frequency) on the "HY-7" is dropped and the cord between the two receivers then acts automatically as the pickup for WLW or WEAF! And, of course, "Radio Roma" or G5SW still is "all tuned up" and, by again setting the Graybar dial back to 1530 kc. (and these sets will do this if correctly lined up) there you have the short-wave broadcast again!

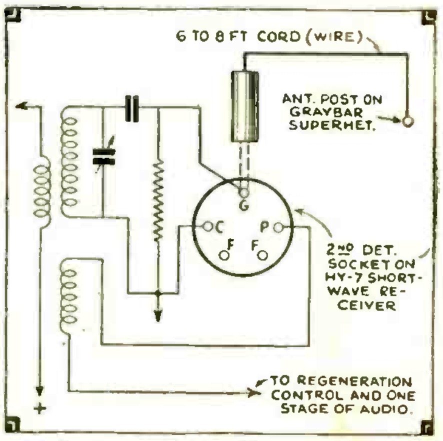
In plugging the cord to the second detector, the connection is to "grid" on the socket; I should have added that the grid-leak is first removed. Another way of doing this is to plug into the "plate" at the same socket (2nd detector) and then adjust the regeneration control for best results and leave it.

You see, this whole thing is about the simplest arrangement and quickest to work that one could wish for—either tune the short-wave dial (with the Graybar dial set at 1,530 kc.) or tune the Graybar dial for "straight" regular programs. Now, in regard to performance,

Hears Foreign Amateur Stations

I have tuned in programs from literally everywhere, listened to Amateur

(*Continued on page* 280)



Simple connecting wire used by Mr. Taylor in joining broadcast and short wave super-hets for phenomenal long distance reception.

A New Console Receiver *for* Short and Broadcast Waves

The absence of "plug-in" coils for receiving the different wave bands, is one feature of this combination short and broadcast set; television reception is provided for, and there is a pentode tube in the output stage of the broadcast superhet receiver.

The "short wave" tuning dial and control knobs are in the top group on this new Stewart-Warner console; the larger dial and knobs below, are for tuning in the broadcast waves.

THE classic grace of line of French provincial cabinet work is beautifully expressed in this charming console. The top is a panel of selected American Walnut; the front is Oriental wood, with contrasting overlays of imported Koa wood, with soft, lustrous rubbed finish. The console houses the new six-tube super-heterodyne Stewart-Warner broadcast receiver with electro-dynamic reproducer and built-in short-wave converter models are available for 60-cycle A.C., 25-cycle A.C., and for D.C. but not for battery.

"Short Waves" at Turn of a Knob

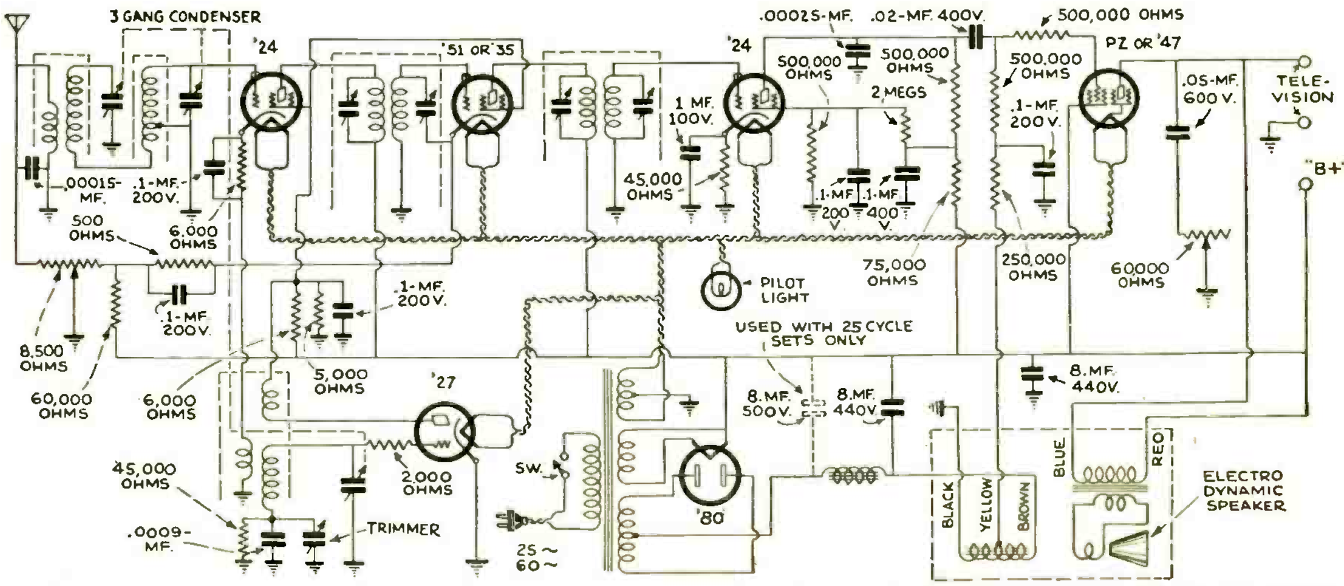
Change-over from standard broadcast band to short-wave band between 20 to 200 meters is instantly accomplished *by turn of a single control knob.*

Chassis Details

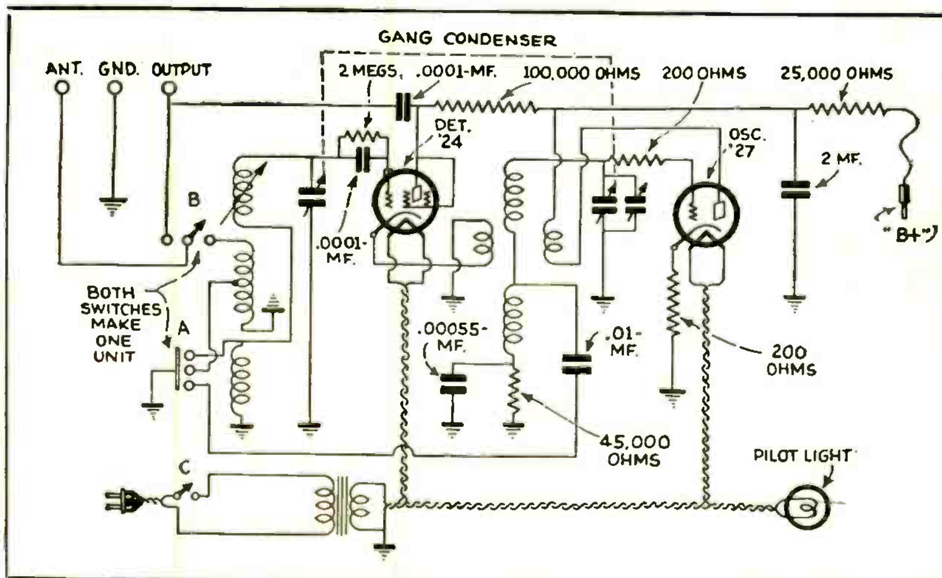
All electrical units are mounted on a heavy rectangular steel frame, which insures absolute rigidity and prevents wiring connections from becoming loosened, due to accidental jolts or careless handling.

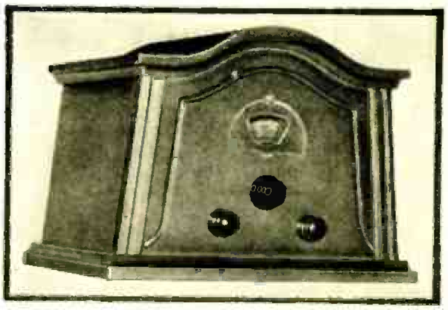
Six tubes are used as follows: two '24-type tubes in the first- and second-detector stages; one '27-type tube as an oscillator; one No. 551-type (or 235-type) Variable Mu tube in the intermediate-frequency amplifier; one PZ-type (or '47-type) pentode tube as an audio-frequency amplifier; and one No. '80-type rectifier tube to furnish plate current to the set.

This circuit incorporates a pre-selector stage, a first-detector or "mixer" stage,



Wiring diagram of the new Stewart-Warner super-heterodyne broadcast receiver, using a pentode tube in the output stage, with television terminals provided as shown.





Above—Appearance of new Stewart-Warner short wave converter of the super-het type, supplied separately if desired; the same S-W converter, shown diagramatically at the left, is also "built in" on the new Stewart-Warner console for broadcast reception.

an oscillator, an intermediate-frequency stage, a second-detector stage and an audio-frequency stage in the order named.

The radio-frequency coils and the oscillator are shielded with aluminum enclosures, and steel shields cover the intermediate transformer coils to prevent extraneous electrical disturbances from impairing reception. Volume control is accomplished with a hand control knob operating a variable resistor, so connected in the circuit that it gives maximum volume, without overloading the detector stage.

An output transformer is provided to protect the reproducer from damage, due to the high voltage of the last stage, and to improve the tone quality, by keeping the flow of direct current out of the speaker windings.

Overall dimensions of the chassis are: 7 3/16 in. high; 12¾ in. wide and 11⅝ in. deep.

The "Plug-less" Short Wave Converter

While most standard sets are limited to domestic reception only, the new Stewart-Warner short-wave converter now extends their range of reception beyond the seas and makes possible the direct reception of foreign broadcasts, police, amateur and television signals. This new converter is a built-in feature of the new console and also portable sets. It may also be purchased separately, in the compact walnut-finished cabinet illustrated, for use with practically any 110-volt alternating current (A.C.) set.

Unlike commonplace converters, this converter does not require changing a number of coils, or the manipulation of several dials to tune-in at various low-wave lengths; it incorporates fixed coils that do not require changing. Tuning is controlled by a single dial only, in conjunction with a "range" switch. By turning this switch to the left, the converter is turned off. Turning it to the next position to the right permits the converter to cover from 1,500 to 4,660 kilocycles; turning it to the extreme right permits the converter to cover from 4,610 to 15,120 kilocycles. Thus, the converter covers all frequencies from 1,500 to approximately 15,000 kilocycles—or a wavelength range from 200 down to approximately 20 meters.

(*Continued on page* 299)

WHEN TO LISTEN IN

By "BOB" HERTZBERG

Another Woman Announcer

THE woman announcer at station 3IRO is well known to all listeners who have tuned in "Radio Roma Napoli." Her place in front of the microphone was endangered by a recent decree of the Italian broadcasting authorities, who had decided to replace her and the other woman announcers at Italian stations by men. However, a flood of complaints from listeners all over the world has caused a change in this order, and the women —Lord bless 'em—will remain.

Another woman announcer is making a bid for honors. She hasn't been heard yet in the United States, to the best of my kowledge, but she is beginning to attract attention in Europe. She broadcasts from a new Soviet short-wave station in Leningrad, which has the call letters RVRI and is supposed to be working on 31.1 meters. This station is reported to be testing from 2.00 to 3.00 o'clock in the afternoon, Eastern Standard Time. If you hear it please drop me a card.

No Polar Broadcasts This Year

The radio tests between the submarine *Nautilus* and the National Broadcasting Company in New York, arranged with the object of possible relay broadcasting from the polar regions, seem to have been as unsuccessful as the trip itself. Sir Hubert Wilkins has been the victim of considerable misfortune on this daring venture; but he has the indomitable spirit characteristic of explorers, and he will probably succeed the next time.

Zurich

There is a station in Zurich now broadcasting regular programs, European evening time, on 32.85 meters. The call letters are HB90C. The transmissions are preceded by two strokes on a gong and the announcement "Hier Radio Zurich."

Java

Probably the shortest wavelength used for regular short-wave broadcasting is 15.9 meters, one wave of the Dutch station in Bandoeng, Java. Musical programs are transmitted usually on Tuesdays between 1400 and 1600 GMT.

Moscow

The Russians are evidently making ambitious radio plans. There is already a powerful station in Moscow on 50 meters, and now another one, using the power of *sixty kilowatts*, is projected. Details of wavelength, hours of operation, etc., have not yet been announced.

Portugal

I am glad to present some "dope" on station CT1AA, which has been mentioned vaguely in this department. This is a private station owned by Señor Abilio Nunes dos Santos. This ordinarily works on 291 meters, but it has a 42.9 meter short-wave channel working on Thursdays from 5:20 to 7:20 p. m., EST. Announcements are made in Portuguese, and also French, English, German and Italian. This fashion of announcing in a number of different languages was started by PCJ, and is being adopted by other stations to make identification on the part of the listener easier.

France

Station FYA, the French colonial station located just outside of Paris, is being heard with great regularity in the United States. I am indebted to Mr. Vincent Ryan, 16 Hamilton Avenue, South Norwalk, Conn., for a copy of its complete operating schedule, which was sent by Mr. Ryan along with a letter verifying his reception of the station's programs. I quote from it as follows:

"Our transmissions are being made at the present time with an antenna power varying between 12 and 14 kilowatts, at the following periods:

"On 19.68 meters, from 14:30 to 17:30 GMT, intended particularly for the French colonies in Asia.

"On 25.20 meters, from 18:30 to 20:30 GMT, intended particularly for the African colonies.

"On 25.63 meters, from 21:00 to 23:00 GMT, intended particularly for America."

Many interesting programs are broadcast by FYA. Recently General Pershing appeared before its microphone, and was heard by many short-wave fans in the United States.

(*Continued on page* 299)

The A. C. Superregenode

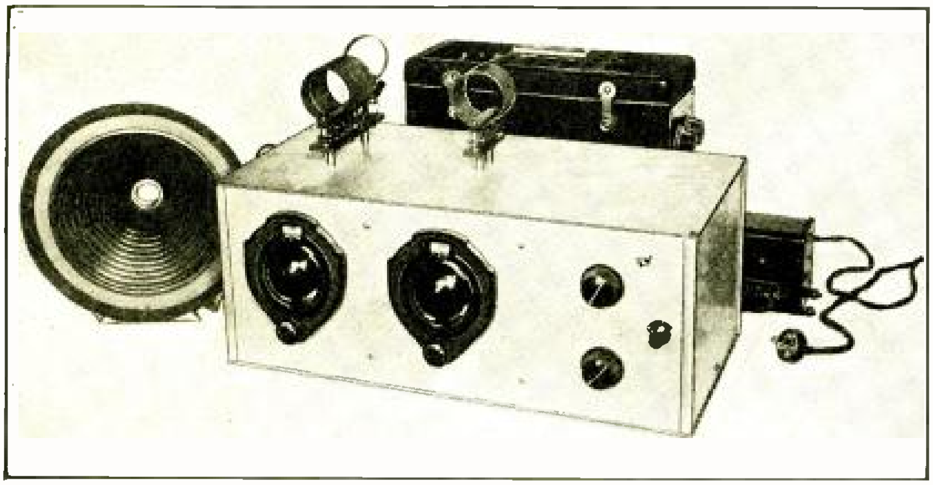


FIG. A
The A.C. receiver, showing the exterior coil mountings. The external "B" power unit, filament transformer, and dynamic speaker appear behind it. The controls are easy to operate.

By CLIFFORD E. DENTON

A superregenerative receiver of extraordinary sensitivity on the highest frequencies; simple in construction and certain in its operation with the high power obtained with A.C. Operation. The D.C. model was described in the last issue.

THE author's article on the D.C. "Superregenode," which appeared in the last issue of SHORT WAVE CRAFT, has occasioned many favorable comments, judging by the immense amount of mail received from readers. The special information requested by some of those interested in building the superregenode is given in this article describing the A.C., model of the instrument.

First, let it be said that, tube for tube, the super-regenerative circuit gives greater sensitivity than any standard regenerative arrangement on short waves; and *the advantage so gained increases as the wavelength shortens.* Equal selectivity may be obtained by the use of an equal number of tuned circuits.

Experiments indicate that the best value for the locally-generated suppressor-frequency (the action of which was fully explained in the preceding article) is in the order of 1/1000 of the received signal frequency; that is, the former is expressed in cycles corresponding to the kilocycles of the latter. (See the appended Table I.)

At the highest frequencies, therefore, the locally-generated frequency is quite inaudible; it falls to 7,500 cycles only above 40 meters (7,500 kilocycles)! At five meters, the local oscillator should be a radio-frequency generator, with an output of 60,000 cycles. For this reason, the suppressor-frequency causes no interference and requires no audio filtering for the reception of broadcasts on very short wavelength. At the same time, the sensitivity of the receiver increases steadily as the signal frequency becomes higher.

Alterations Give Efficiency

The A.C. model incorporates a few improvements which make its performance vastly better than that of the battery model previously described. The greater sensitivity of the type '24 tube, which is less critical in adjustment than the '32, improves the R.F. end considerably. An additional stage of audio has been incorporated, and gives a tremendous increase in volume on distant stations; other considerations dictating its addition are discussed later.

The previous method of tuning has been retained; but, for convenience in exchanging them, the plug-in coils are mounted externally. Once the plate voltages have been correctly regulated, and the screen-grid voltage control adjusted, tuning can be accomplished with the receiver in stable operation from one end of the band to the other. This cannot be said of the ordinary short-wave receiver.

Table I

R. F. Input Signal		*Suppressor Frequency*		*C3 Cap.*
Meters	*Kc.*	*Cycles*	*(Meters)*	*Mf.**
10	30,000	30,000	10,000	None
15	20,000	20,000	15,000	.001
20	15,000	15,000	20,000	.0025
24	12,500	12,500	24,000	.004
30	10,000	10,000	30,000	.006
37½	8,000	8,000	37,500	.01
50	6,000	6,000	50,000	.02
60	5,000	5,000	60,000	.03
75	4,000	4,000	75,000	.05
100	3,000	3,000	100,000	.08
120	2,500	2,500	120,000	.10
150	2,000	2,000	150,000	.2
200	1,500	1,500	200,000	.3

* Approximating computed value.

Modifications of the circuit may be employed; such as placing the oscillator's pick-up coil in the cathode lead, instead of the screen-grid lead, of V1; still controlling the oscillation by varying R1 (see Fig. 1A).

Various methods for the construction of the local-oscillator circuit were shown in the preceding article. The constructor may consult this or, if he prefers, use his own pet oscillator design. The Superregenode is sure to work if the fundamental principle is followed and the oscillator V2 feeds enough energy to V1; at 90 volts on the plate, the '27 type oscillator will deliver ample power.

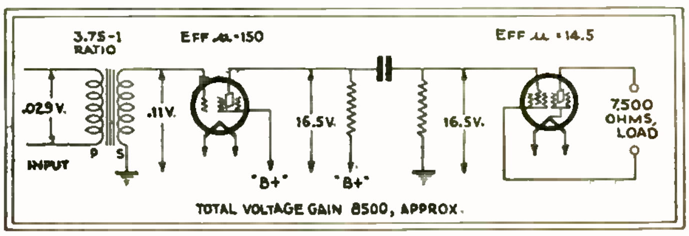
High Audio Output

The audio end has been redesigned, to give larger output on *weak* signals. An output pentode was retained for the final stage, but with the added power of a '47; while a first A.F. stage tube V3 was added. The latter is of the '24 screen-grid type, with resistance-capacity coupling into the power stage. A consideration of the effective circuit (Fig. 2) will show that an A.F. signal of only .029-volt will develop the full 2.5-watt output of the pentode; that is, the total effective voltage gain of the audio amplifier is approximately 8,500.

Although such a first A.F. stage may be included in the battery model, the type '32 tube has been found to have microphonic tendencies when so used.

The increased output brought the speaker volume to such a point that it was uncomfortable to listen to American stations, especially, even in a large room. On extremely weak signals, however, the receiver was tremendously pepped up; while the reproduction obtained with the transformer-coupled input and interstage resistance coupling is of very high quality.

FIG. 2
This diagram, showing the effective amplification of the Superregenode's audio circuit, which gives a margin of power for automatic control to overcome fading.



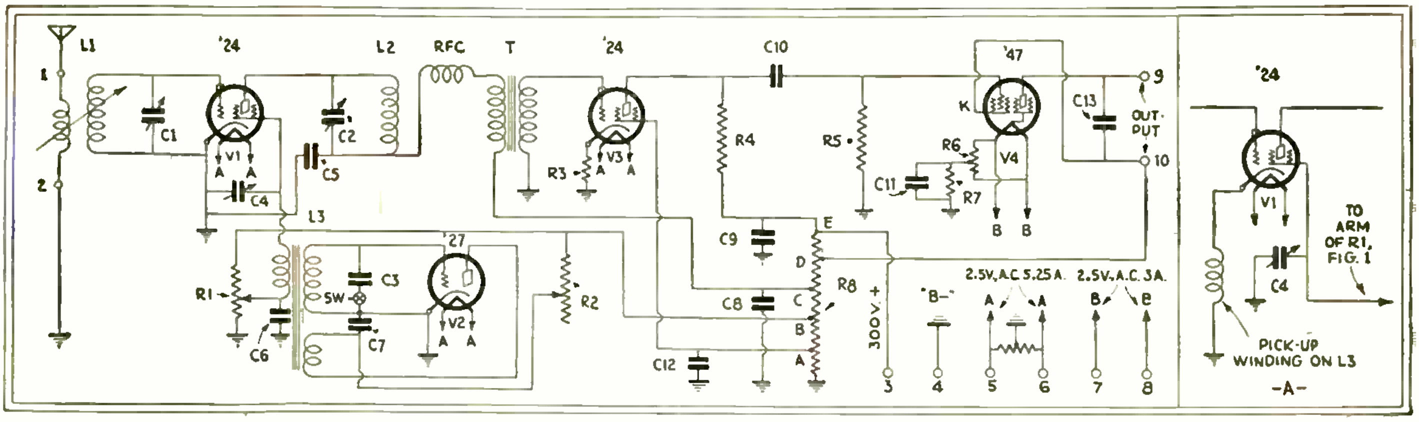


FIG. 1

The circuit of the A.C. Superregenode follows the principle of the receiver using 2-volt battery tubes, which was illustrated in the last issue of SHORT WAVE CRAFT; but incorporated a screen-grid first audio stage, as well as the necessary changes for current supply. At the right, an alternative method of coupling the suppressor-frequency into the detector tube is shown.

Supplying Operating Voltages

The receiver is shown in Fig. 1 without its power supply (which is external); consisting of a filament transformer and a plate voltage supply. Several commercial power packs were tested; and all gave satisfactory results with the A.C. Superregenode.

A small 2½ volt filament transformer having two windings, and a Majestic "B" eliminator were used in the combination of Fig. A. The high-voltage tap of the eliminator illustrated gives only about 200 volts; and to obtain the required higher potential, indicated in the schematic circuit, two heavy-duty 45-volt "B" batteries were connected in series and cut into the circuit, between the eliminator's high-voltage tap and the "B + 300" connection, to the receiver chassis.

This method may place two voltage dividers in shunt—one in the receiver chassis and, perhaps, one in the "B" eliminator; differences in eliminator design determine whether it is desirable to connect in the "B" supply circuit to the receiver chassis a circuit-opening switch, to prevent drain of the "B" blocks when the set is not in use. Where the "B" eliminator circuit from "B + Max." to "B —" tests "open", when disconnected from the light-line, there is no need to use such a circuit-opening switch.

Any standard '45-type power pack may be used, as long as it delivers about 65 ma. at 300 volts or more; in the latter instance, it may be necessary to connect in series with the "B +" lead of the eliminator a heavy-duty variable resistor, such as the compression-type Clarostat, with a range of *zero* to one megohm to reduce the voltage to the correct value to match the characteristics of the voltage divider in the receiver chassis.

The type '47 pentode operates best at a plate potential of 250 volts and a control-grid bias of 16.5 volts. In the A.C. Superregenode, this plate or "B" potential is obtained directly from the current-supply system; while from the total output of this system must be subtracted the required "C" bias (obtained by means of bias resistor R7 and, for V3, R3).

The voltage divider in the receiver proper must be adjusted carefully to obtain maximum efficiency; the setting of its taps will vary with the output obtainable from the power pack, as well as with the demands of the individual pentode tube selected. The voltage readings at the taps should be about as follows: A, 18; B, 90; C, 180; D, 250; and E, 350 volts. A slight readjustment of A may be needed to obtain maximum A.F. amplification; this is the most critical operating value in the receiver.

The use of a separate filament winding for the pentode, as specified, is not absolutely essential; it is possible to operate all the tubes from a single 2½-volt winding, to which the two sets of filament leads shown are connected.

The power supply should be kept away from the set; so that the magnetic fields between iron-core units in the receiver do not couple with the filter chokes and the power transformer.

Assembly of the Receiver

For details of the aluminum case employed, the reader is referred to the Oct.-Nov. issue of SHORT WAVE CRAFT. No mechanical detail drawings are included in this article; since experimenters will use the parts that are available; and it is impossible to specify drilling holes for all the existing types of suitable equipment on the market.

If the constructor follows the mechanical design of the author (see Figs. A and B), the following method of assembly works out well:

On the top cover, mount the antenna coil and secondary plug-in base L1, and the plate coil base L2; spotting them so that they are mounted in line with their tuning condensers. The effect of placing the coils on top helps the type '24 tube to oscillate more readily; since magnetic coupling between the plate and grid coils is added to the inter-element capacitative coupling of the tube V1.

On the rear panel, or back, mount the antenna and ground posts 1 and 2, the output tip-jack terminals 9 and 10, and the receptacle for connection to external power supply leads Nos. 3, 4, 5, 6, 7 and 8.

The front panel carries the grid and plate tuning condensers, C1 and C2 respectively, which are mounted beneath

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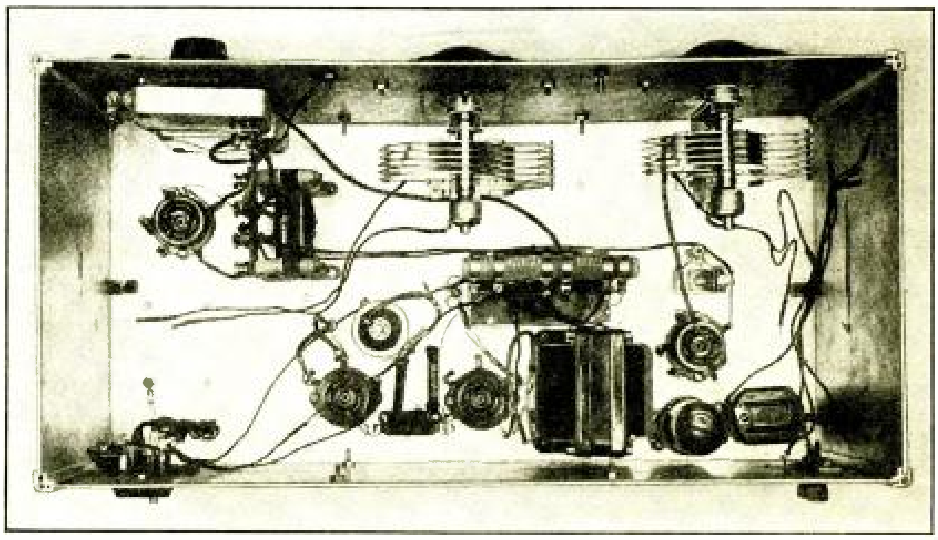
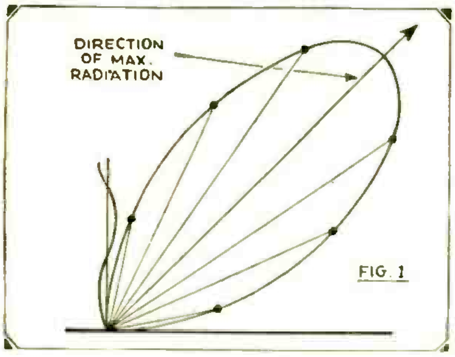


FIG. B

The interior of the A.C. Superregenode, which is easily constructed, having no compartments in the shield. The components may be readily identified by comparison with the schematic circuit above.

How ARE SHORT WAVES PROPAGATED?*



This diagram shows the direction of maximum radiation from a vertical antenna excited by harmonics.

By F. BÖDIGHEIMER

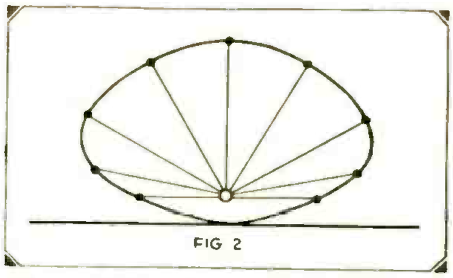
The author gives high credit to short wave amateurs who have contributed greatly to the data here presented on short wave phenomena. The question of whether short waves penetrate the Heaviside layer, thus making possible radio communication with other planets, is here considered.

BEFORE the extraordinary range of short waves was discovered by amateurs, it was held as *incontrovertible* that the electric waves followed the surface of the earth, and that the strength of the field decreased in proportion to the distance. It was assumed as simply natural without its causing any more surprise and attention, that for communication at a very great distance only long waves were serviceable, with the expenditure of correspondingly great energies. Operation was carried on with wavelengths of 2 to 3 kilometers (that is, with frequencies from 150,000 down to 100,000 cycles) and with energies of many hundred kilowatts.

The shorter the wave, the less suitable it seemed for distant communication. Waves of a few thousand meters were used in continental communication, but not in transoceanic. Waves of about 1,000 meters and less were intended for internal communication and for neighboring states. Finally came the waves of 600 and 300 meters for communication of ships with one another and with coast stations; that is, mostly for very short distances.

Waves Below 300 Meters Were Considered Useless

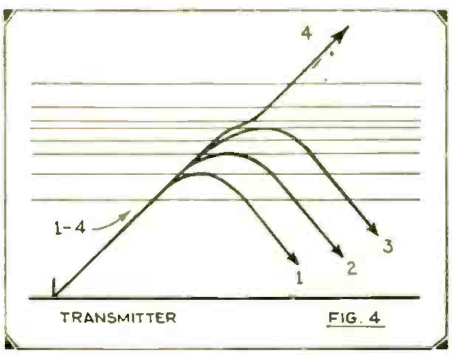
Waves of less than 300 meters were considered entirely useless, because they actually proved very unreliable in communication at short distances; for which at any rate, they appeared in question. It did not even cause thought that, during the war, weak German ship and field stations in Turkey were occasionally heard on the 300-meter wave by crystal receivers located in Germany. Likewise, the fact that the ships with their resounding transmitters disturbed or drowned out the first 300-meter radio stations at night from "impossibly" great distances, received no consideration. The fact was established: waves of 300 meters and less are absorbed by the influence of the sun's rays in their course along the surface of the earth. That they were more serviceable at night and, under certain circumstances, audible at very great distances, was attributed to the absence of the solar radiation.



The radiation from a horizontal antenna is evenly distributed over almost 180 degrees, as shown.

Amateurs Pioneers in Short Wave Work

Now, against considerable resistance, these views have fundamentally changed. The pioneers of the new conception were the amateurs, who even today have at their disposal the greatest experience and in part stand preëminent in the clarifying of still doubtful problems. Below is a brief outline of the now familiar laws for short waves, which touch on the new problems of propagation foremost in interest. The general laws here given rest on the personal investigations of the writer in the years 1926 and 1927; but, with reference to their general physical basis, on previously known facts or theories. The special data regarding the influence of the weather are based on independent researches performed by Dr. Karl Stoye and the writer, who have had occasional interchanges of ideas. These investigations are still going on.

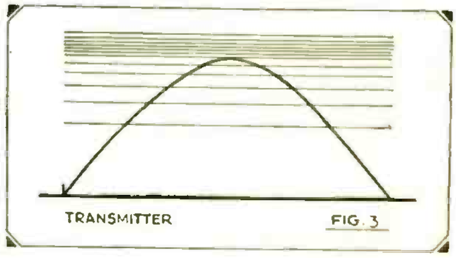


Radiation at various frequencies, 1 to 4, some of which are partly bent downward, some passing through the Heaviside layer with parallel deflection.

(1) The maximum radiation from a vertical antenna, especially if it is stimulated by harmonics, projects obliquely upward at an angle. (See Fig. 1.)

(2) A horizontal antenna radiates evenly, over an angle of nearly 180 degrees (Fig. 2),

(3) At a height of 50 to 100 kilometers (30 to 60 miles) above the surface of the earth, there is, according to Heaviside's theory, a stratum of atmosphere which, because of the sunlight and the electron radiation of the sun, is distinguished by a very large number of free negative electrons per unit of space and, because of the slight atmospheric density, by a very great number of heavy ions or positive particles. In view of the great open stretch, there takes place, by *impact ionization*, a further increase in the number of free electrons. The electron density gradually increases in a vertical direction and again decreases. The dielectric constant of the Heaviside layer is smallest where, in consequence of very great electron density, the electrical conductivity of the layer is greatest. This gradual change in the dielectric constant effects a refraction similar to astronomical refraction (also analogous to the formation of the "Fata Morgana" and mirages) and finally total reflection of the electromagnetic radiation (see Fig. 3). The space radiation is thus bent downward.

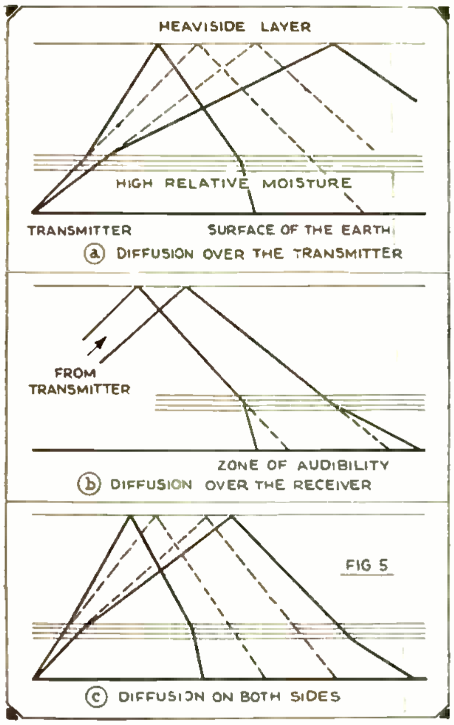


The space radiation is bent downward; more exactly it is refracted and totally reflected (at certain frequencies).

Ultra Short Waves Pierce Heaviside Layer

(4) The refraction is, as in the case of light, dependent on the frequency High

* The following is a section from the book "Radioamateurstation für kurze Wellen," by F. Bödigheimer. This should be of great interest to all short wave amateurs.



Assumed diffusion of energy by strata of high relative moisture; normal course of radiation in dotted lines. For the sake of simplicity, a straight course of radiation and reflection was drawn, instead of indicating refraction.

frequencies (short waves) are less strongly refracted than low frequencies (long waves). A pencil of electric waves of different frequency, increasing from I-IV (cf. white light) would behave as in Fig. 4. (This is similar to the production of rainbow colors in the refraction of white light.) The range is smaller in the case of long waves than in the case of short ones. Very high frequencies (ultra-short waves) are no longer refracted, *but pass, with a parallel deflection, through the Heaviside layer;* since, in consequence of the slight refraction, the limiting angle for total reflection is not reached. Rays striking the Heaviside layer perpendicularly pass through it unrefracted.

(5) The energy of ground radiation, whose proportion of the total radiation is great (especially with horizontal antennas) is quickly absorbed in consequence of the ion density being high near the ground, and because of other sources of loss. On the contrary, the space radiation moves along in the Heaviside layer almost without loss, because of the slight ionic density.

(6) The absorption in consequence of the greater ionic density near the ground is less, with high frequencies, than with the lower ones. The fact that the ground wave is nevertheless (as a rule) more quickly dissipated, with high frequencies, than with lower, is attributable to other sources of loss.

The Cause of "Dead Zones"

(7) Since the ground radiation is used up after a few miles, while the space radiation descends again to the earth only after a greater distance, there results a *silent zone*, in which there is no reception or only weak signals are heard.

(8) The height or make-up of the Heaviside layer, or perhaps both factors, changes with the time of day and of year and with the changing activity of the sun spots. Therefore these factors have a great influence on the propagation of the short waves.

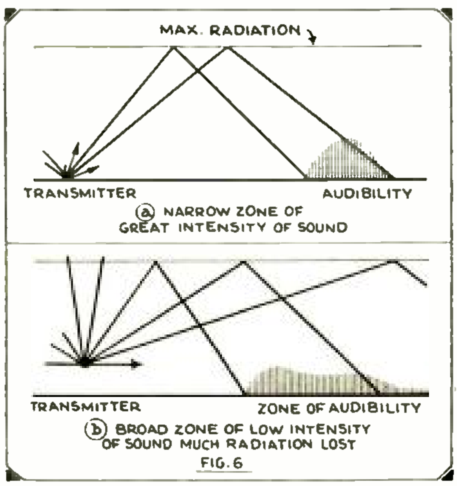
Best Frequency Varies With Seasons

With equal frequencies, the range is greater at night or in the winter than by day or in the summer; hence, for example, for these wavelengths:

20 meters by day in the summer: European communication,
by day in the winter: DX (distance) communication;

40 meters by night in the summer: still European communication,
by night in the winter: DX (distance) communication;

80 meters by day in the summer: almost useless,
by day in the winter: places very near at hand;
by night in the summer: European communication,
by night in the winter: also DX (distance) communication.



Vertical antenna (a) excited into harmonic oscillation and horizontal antenna (b) with its characteristic radiation.

(9) The shorter the wave (the higher the frequency), the better it is suited for communication by day and in the summer; but the less it is suited for communication at night and in the winter.

(10) Ultra-short waves are not deflected downward; with regard to their usefulness for communication, they behave almost like light waves. (*In so far as communication with other heavenly bodies might be considered, then ultra-short waves would be the most suitable.*) The limit between the ultra-short waves and those still serviceable for "DX" (distance) is not sharp, but varies with the time of day and of year. It lies at about 10 meters, as calculation and practical experiments have shown. The present experiments with 10-meter waves therefore lead toward "DX" communication in summer and by day, which should be noted.

Condition of Atmosphere Affects Short Waves

(11) Considerable influence seems to be exerted according to investigations not yet completed, by the weather or, more correctly, the condition of the atmosphere at the edge of the *stratosphere*. In fact, there evidently is a considerable significance in the "moisture content" in the higher strata of air; shorter waves show themselves most sensitive to these influences. The influence of the weather is therefore stronger on 20-meter waves than on those of 40 or 80 meters length.

(12) Uniformly dry air over transmitter and receiver seems to be the best condition for good "DX" (distance) radiation (by day there is strong interference by increased absorption).

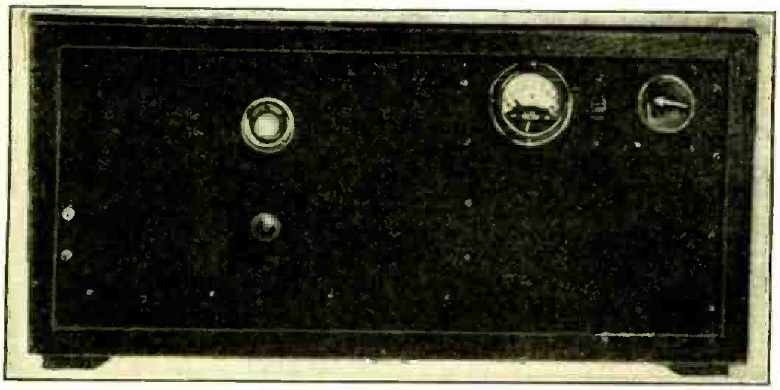
(13) Meteorological conditions, and probably also the Heaviside layer, are subject to marked changes (particularly the Heaviside layer) at twilight, and at times of disturbances in the earth's magnetism. The results are more or less rapid displacements of the zones and, therefore, changes in signal strength. This gives an explanation for "fading" which, according to the current explanation that it is caused by the difference in phase between *space* wave and *ground* wave, would be inexplicable in the case of short waves.

(14) At places in the middle of the zone of maximum sound intensity, the power of the transmitter received plays a small part. With favorable atmospheric conditions, one hears very slight energies (weak signals) with the sound intensity R9.

(15) The form of antenna, vertical or horizontal, is of distinct significance. From Fig. 6 it is evident that the horizontal antenna is more favorable for close communication (Europe); the vertical antenna, *excited on a harmonic*, is better for "DX" communication, though to be sure over a relatively narrow zone.

(16) From the viewpoint of short waves, it is also possible for us to look differently at long waves. Here too the *ground wave* is far from playing the part still assigned to it today. It does not reach far; with our chief German stations, in the autumn of 1930, not even 200 kilometers (125 miles).

Reception improvement in the local zone is a question of the *antenna*, likewise a question also of *frequency!* This effect should be studied carefully by those who are seeking the salvation of long-wave radio by utilizing tremendous transmitting powers.—*Funk Bastler.*



Front-panel appearance of the All Electric Super-Het of German design here described. Fig. 7.

All-Electric *SINGLE DIAL* Tuning SHORT WAVE *SUPER-HET*

Prize-winning receiver set entered in recent competition of the Reichs-Rundfunk-Gesellschaft; including details of the power supply. This set employs rectified A.C., for the heaters of the tubes, to minimize hum.

By K. KÖNIG

(Concluded from last issue)

The Construction

MOUNTING and wiring the set described are greatly simplified by the fact that the actual receiving chassis is completely separated from the power unit. Both can therefore be made almost entirely independent, before they are mounted together. The front panel, for which Fig. 1 gives the drilling plan, is common to the two parts; in order that there may be no hand capacity, it is made of 0.12-inch aluminum.

The Receiver Chassis

On the front panel of the receiver chassis (Figs. 2, 3, 4, and 5) there is only the variable condenser C3 of 100 mmf., a special short-wave condenser with median-line tuning curve. Condenser, graduated dial and vernier knob in this type form a unified whole. The friction disc F (Fig. 2), which is attached directly to the rotor, is here behind the front panel and at the same time represents the graduated dial. The scale is read through a window (Fig. 7) which, together with the vernier knob, serves for fastening the condenser to the front panel. The condenser is directly mounted (without insulation) on the front metal plate, and the rotor is thus *grounded.*

The individual parts are, mostly, mounted on the upper surface of a sufficiently stable bakelite sub-panel, which lies 1.4 inches above the lower edge of the front panel (see Fig. 1). The baseboard is screwed to the front panel as well as to the power unit with angle brackets (WS, Figs. 4 and 5).

On the outside, the baseboard is supported by a strip of bakelite 1.4 x 16 x 0.16 inches, to which it is screwed with three angle brackets W. This strip carries the connection terminals for antenna, ground, and loud speaker. The arrangement of the terminals may be seen from Fig. 4. At the upper side of the extra bottom the front panel is also supported by a hard-rubber bracket W (Fig. 2). All points where wire passes through are represented by small circles, each having a dot in it; and are uniformly marked on both sides by numbers (see Figs. 2 and 4). The six little double circles designated "—G," "+H," "—H," "+A," "+A," and "—A" (H=heater, A=anode or plate in German terminology) are terminal screws, which served for connecting the battery wires, when the receiver part was first tried out (by way of test, before the power unit

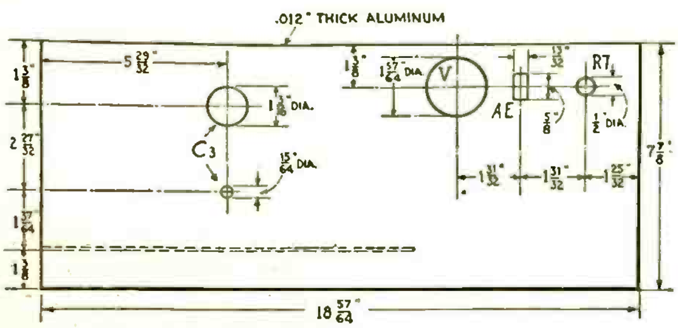


Fig. 1.

Above—Drilling plan for front panel used with the All-Electric German Super-Het here described.

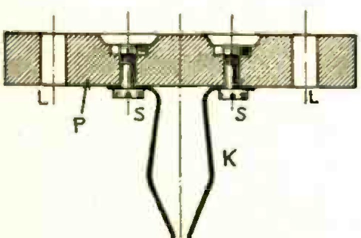
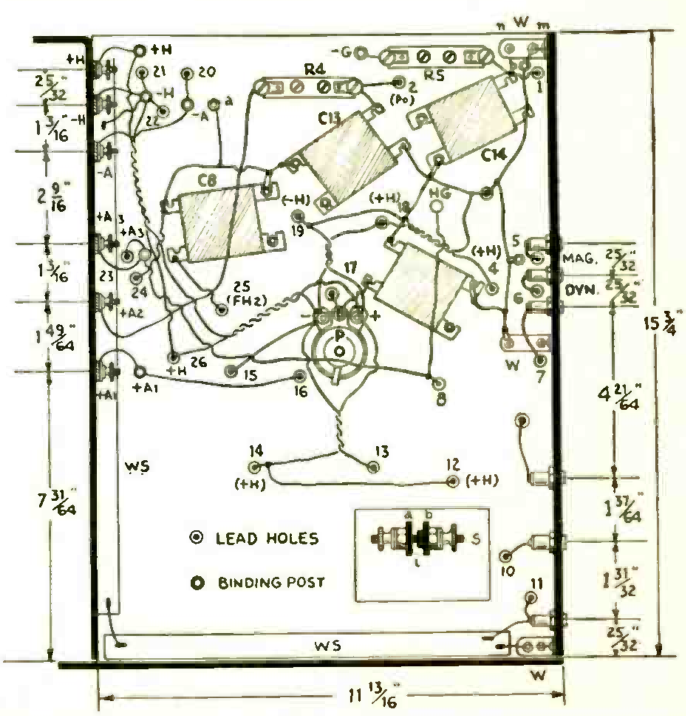


Fig. 6.

At Left—Automatic main switch operated by opening and closing cabinet.

Fig. 4.

Right—Mounting and wiring plan for the under-side of the short wave Super-Het.



was built in) with batteries or with "B" eliminator and storage battery, to be able to undertake any necessary changes in construction. At the same time this shows the way to amateurs who want to dispense with "building in" the power unit, and who wish to feed the receiver chassis from separate sources of current.

On the under-side of the baseboard, the wires are later run from the power unit to the above-mentioned terminal screws (Fig. 4). For receiving the resistors R1 and R2, as well as the fixed condensers C1, C6, C7, and C9, the resistor mountings are used on the upper side of the baseboard. The fixed condenser C2 stands vertically; it is fastened directly to the stator of C3 by its lower screw connection, while from the upper screw connection a flexible wire leads to the plate of the screen-grid tube 1. In this way the plate wire is kept as short as possible. Likewise from the upper connection screw of the R.F. choke HF1, a wire leads to the plate of screen-grid tube 1.

The grid resistor R3 is directly connected at one end to the grid prong of the tube socket of the vacuum tube 4; from the other end a lead runs at 17, through the subpanel to the center connection of the potentiometer P (Fig. 4). The potentiometer is not provided with a knob; but the shaft has a notch for adjustment by means of a screwdriver. The plate of the coil holder SPH lies 0.4-inch above the subpanel. This interval is produced by small insulating tubes through which the four fastening screws of the plate pass.

For retaining the grid battery, a small box of sheet aluminun is fastened on the subpanel; the box is grounded to one of the fastening screws on the under side of the subpanel (*d* in Fig. 4). At the right beside the grid battery is a tiny socket C with a plate ballast lamp; so that the connections "—H" and "—A" (— heater and — plate) are connected by its filament. This prevents the burning out of the tube filaments. The shielding hoods of the filter and the blocking circuit are grounded; the filter shielding has no special ground terminal since the terminal H, which is connected to "—H." (— heater) has metallic contact with the shield can.

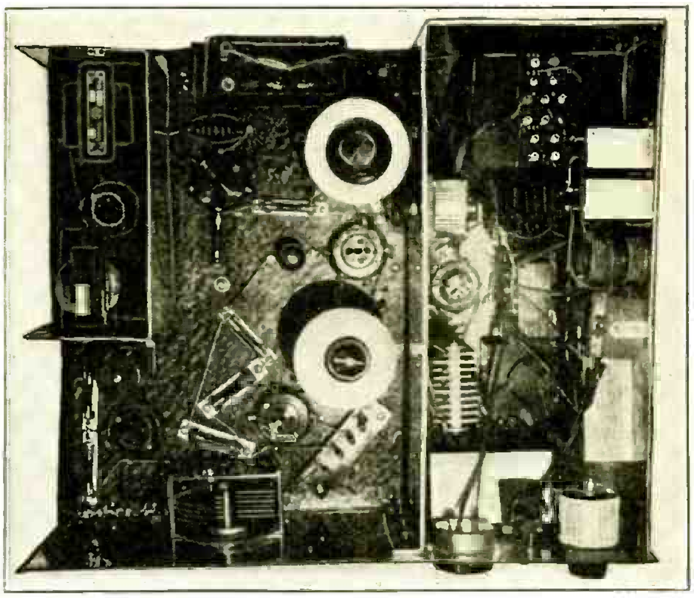


Fig. 3.
Top view, at right, of the complete short wave All-Electric Super-Het described in the accompanying article, and prize-winner in recent German contest.

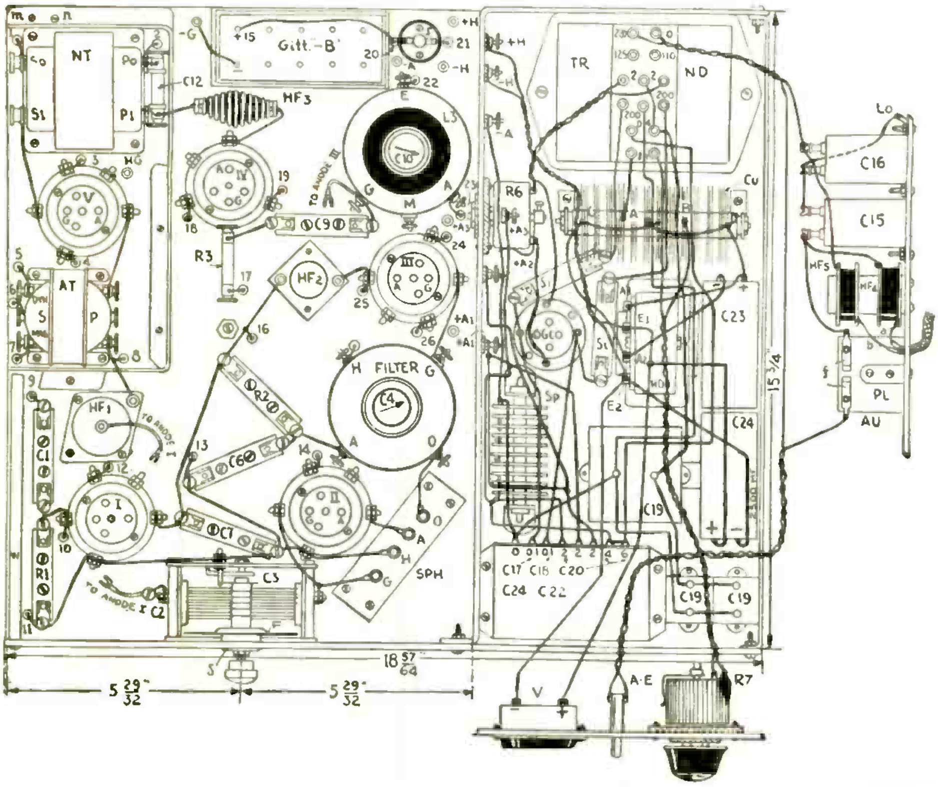


Fig. 2.
Above — General arrangement of parts in power supply unit and short wave super-het of the All-Electric type here described.

For the blocking circuit a special grounding terminal "E" is provided, which is connected through hole 22 to "— H" on the under side of the bottom. Beside the socket of the power tube 5, is an 0.16-inch terminal HG, for connecting the screen-grid (in this German tube, led to a screw on the side of the bakeite base). In the power tube used here, the screen-grid gets the same potential as the plate. If one employs a power tube in which the screen-grid is not connected to a side terminal, but to a fifth prong on the tube, then of course terminal HG is not used; and the middle terminal of the five-prong tube socket V is to be connected accordingly. The fixed condenser C12 is directly connected, suspended by the wiring, with the primary terminal of the audio-frequency transformer NT.

The iron cores and case of the audio-frequency transformer and the input transformer are each grounded on one of the fastening screws (*b* and *c* in Fig. 4). After the wiring is finished, on the upper side of the subpanel, the shielding of the audio-frequency part is at last fastened. It consists of .06-inch aluminum and is

(*Continued on page* 297)

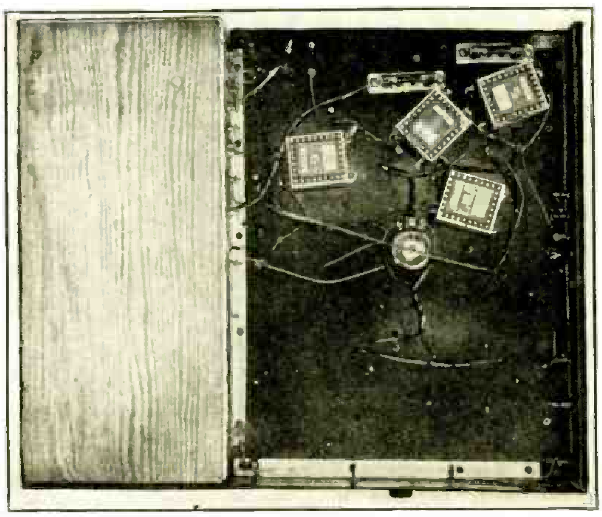


Fig. 5.
Right—Under-view of subpanel of the All-Electric short wave receiver.

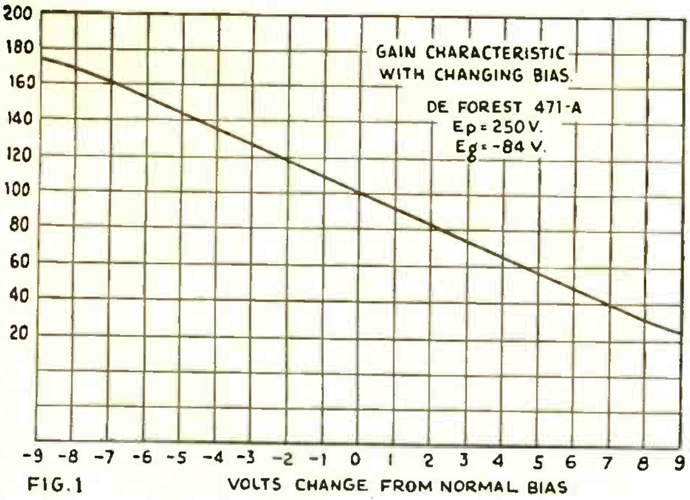


Fig. 1—Chart showing "gain" characteristic with changing bias on a '71-A tube, the normal bias being 84 volts.

ECONOMICAL MODULATORS *for* AMATEUR PHONE *Transmitters*

A common-sense article on modulation, explaining how to obtain the maximum results at the lowest cost.

By C. H. W. NASON

NOT long ago the writer discussed in these columns the theoretical aspects of modulation as applied to amateur transmission. While 100% modulation is a desirable feature in any station, there are few now on the air—commercial or otherwise—which can boast of truly 100% modulated waves. As pointed out in the article noted above, the complete modulation of a transmitter requires modulator tubes of no mean proportions; and this is certainly not economical from the standpoint of the amateur whose every penny must count to the best advantage.

What Modulation Is

Concentrated research in the field of television, undertaken by the writer a few months ago, lead him into the subject of modulation to a marked degree; and he retreated from that labor with some valuable information on this and other subjects.

Modulation itself consists *of any method of varying the amplitude of a modulated wave.* To be sure this variation must be *linear*, if high quality is to result; and the modulated and modulator tubes must be chosen with care as to their relative characteristics if high standards of operation are to be maintained.

As hinted above, there are few stations which can truly boast of completely-modulated carrier waves—but inasmuch as the full range of modulation is reserved for rare fortissimo passages, there is no real disadvantage in a percentage of modulation less than 100, provided economy in construction and in operation may be gained. In the transmitter described in the previous article, modulation was achieved by the Heising or constant-current method, wherein the power output of a highly-biased amplifier tube varies as the *square* of the applied plate voltage. Of all the potentials to be varied, the plate voltage places the greatest burden on the modulating equipment; and it was with this fact in view that the writer set out to find a simpler and more economical method, which will still give good quality and a fair degree of economy, with respect to the degree to which the carrier is varied under the influence of the voice currents. For reference to the various methods of operating vacuum-tube amplifiers ("Class A," "B" and "C") the reader should investigate the information contained in that previous article which appeared in the April-May issue (page 452) of SHORT WAVE CRAFT.

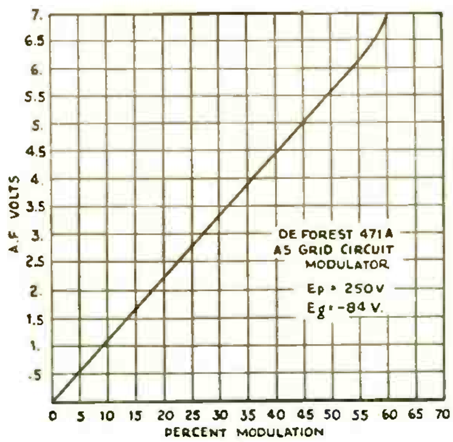


Fig. 2—Graphic representation of action occurring when De Forest 471-A tube is used as a grid circuit modulator.

One of the most effective methods of controlling the volume of a broadcast receiver lies in the use of a variable grid bias on the R.F. amplifier tubes—or, in the case of the screen-grid tube, by varying the screen-grid potential. We will describe here two methods of modulation based on this principle and capable of incorporation in small vacuum-tube "transmitters".

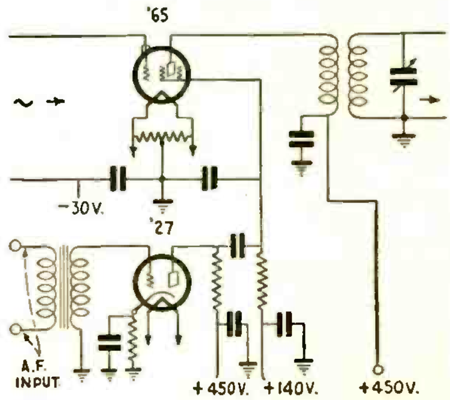


Fig. 4—A more powerful amplifier, using a De Forest 565, 7.5 watt S.G. tube, with '27 tube as modulator.

A Typical Example

If the grid bias of a '71A tube be varied over a range as shown in Fig. 1, the normal bias being—84 volts, the percent-

(*Continued on page* 295)

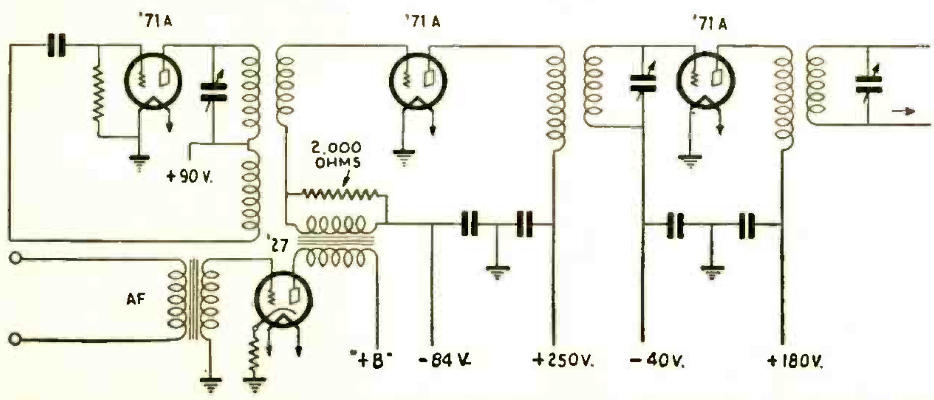


Fig. 3—Schematic diagram of a low-power transmitter, employing economical modulator with a '27 tube, fed by a single-button microphone or phonograph pick-up.

Checking the Short Wave Transmitter

By H. HARRISON

Mr. Harrison, a practical builder of short-wave apparatus, here tells you how to construct a simple wavemeter and monitor.

WITH the advent of the new regulations concerning amateur transmitting stations, better and more suitable tests of checking the transmitter were found to be an absolute necessity. Whereas, before, *off-frequency* was tolerated to a somewhat more or less degree, and raw A.C. notes were taken as a common and necessary evil, such a feeling no longer exists. Today, there must be an adequate filter system for every power supply in use; and off-frequency stations are first warned, and then their licenses are suspended or cancelled. No more does the Radio Inspector look with a broad grin of understanding at any complaints of interference or off-frequency. Today, the axe is applied—and plenty of it, too.

In the check-up of frequency and note transmission, the best practical tests are made with a calibrated wavemeter and a monitor which may or may not be calibrated. Both units are comparatively simple to construct, and must be sturdy to withstand hard service in the shack. The average amateur should experience no difficulty in building these instruments.

In the design of the wavemeter, a large scale coverage is most desirable for any particular frequency range, since it is necessary for accurate calibration and reading. Secondly, to secure accurate dial reading, a vernier dial as large as it is possible to obtain should be used. Thirdly, since the wavemeter must have an indicating device, a suitable bulb must be chosen. The choice lies between neon or flashlight bulbs.

There are advantages and disadvantages of both types of indicating bulbs. Flashlight bulbs below 3.8-volt rating cannot be used, since they burn out too easily. Neon tubes require a certain current before they will light, but are quite sharp in their operation. Flashlight bulbs do not require such a large amount of current, but are very broad in tuning. We believe that neon bulbs are more suitable for this reason alone; besides the fact that they will not burn out as will even the larger flashlight bulbs.

Selecting the Capacity for the Wavemeter

In procuring a variable condenser for the wavemeter, the following facts must be borne in mind: (1) minimum capacity of condenser; (2) capacity spread of condenser; (3) maximum capacity; (4) whether S.L.F. or S.L.C. curve. Since the graph is read in frequency against dial reading, the condenser must be an S.L.F. type if we wish to obtain as nearly a straight line as possible on the graph. In order to get a large dial spread, a condenser having a small capacity change must be used. It is quite obvious that a single condenser cannot be used for all frequencies. On the higher frequencies, a condenser may cover a dial reading of 70 for the complete 14,000-kc. band; while, on the 3,500-kc. band, the same instrument may cover only 200 kc. For the latter band, this would be quite inadequate as the band extends over 4000 kc.

The solution is the use of two condensers put in parallel. A 40-mmfd. condenser, shunted by a 25-mmfd. variable, has been found to give about the best all-around results. The minimum capacity is such that coils may be wound on tube bases. The maximum capacity allows the condensers to be used on all frequencies, and the variable condenser provides a good spread on all the bands.

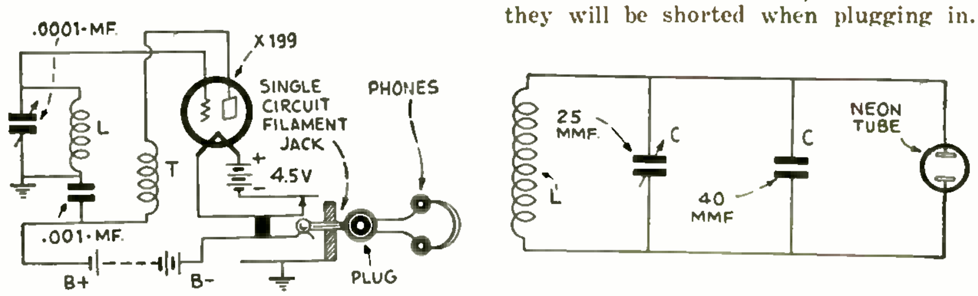
When wiring the wavemeter, make all connections as straight and permanent as possible.

Design of the Monitor Set

The listening monitor is a simple regenerative receiving set as may be gleaned by looking at the schematic diagram. Here the main problem was to design the coils so that the monitor would be as close to the regeneration point as possible, for it is most sensitive to C.W. at this point. The coil chart herewith gives the coil constants for the different frequencies. All coils were wound on tube bases, which simplifies the construction and greatly reduces the cost of building.

A 100-mmfd. variable was found to be suitable for all frequencies; the same large micro-vernier dial is necessary, because tuning is very sharp, and the note can be passed over without the operator being aware of the fact. It is very easy to pass by the note, unless great care is taken when tuning.

The "B" and "A" batteries may be mounted inside the aluminum case which houses the complete unit. A '99 tube is used because of its low current consumption. Some wiring hints may not be amiss. In wiring the single-circuit filament jack, be sure that the phone leads are wired as shown, for otherwise they will be shorted when plugging in.



Mr. Harrison's short-wave monitor circuit appears at left: the wavemeter circuit at the right. Mr. Harrison gives his reasons why he prefers neon tubes as "resonance indicators" for wavemeters. For one thing they are sharper than flashlight bulbs for this purpose.

Parts Required for Wavemeter

One micro-vernier dial;
One aluminum case, 6x6x6 inches;
One UX socket;
Three UX tube bases;
One 40-mmfd. fixed con.;
One 25-mmf. variable;
One neon bulb and socket.

Wavemeter Data

Frequency Covered in Kilocycles	Turns on Coil	Dial Spread, Degrees
14,100-14,000	4	15
7,300- 7,000	9	25
4,000- 3,500	22	55

All coils wound with No. 22 D.S.C. wire on tube bases.

Parts for Monitor

One micro-vernier dial;
One aluminum case 5x9x6 inches;
Two UX sockets;
Three UX tube bases;
One 22.5-volt battery;
One .001-mfd. fixed condenser;
One .0001-mf. variable condenser;
One single-circuit filament jack;
One 4.5-volt battery.

Coil Data for Monitor

Frequency Covered in Kilocycles	Coil Turns Grid	Coil Turns Plate	Dial Spread Degrees (App.)	Spacing of Windings
14,400-14,000	4	8	10	½ in.
7,300- 7,000	10	14	14	¼ in.
4,000- 3,500	22	30	25	¼ in.

All coils wound with No. 26 D.S.C. wire on tube bases.

How MANY Microhenrys *in* THAT COIL?

By JAMES K. CLAPP*

Every radio student should know how to calculate the inductance of a coil of given or known size. Here's a simplified method worked out by a leading engineer.

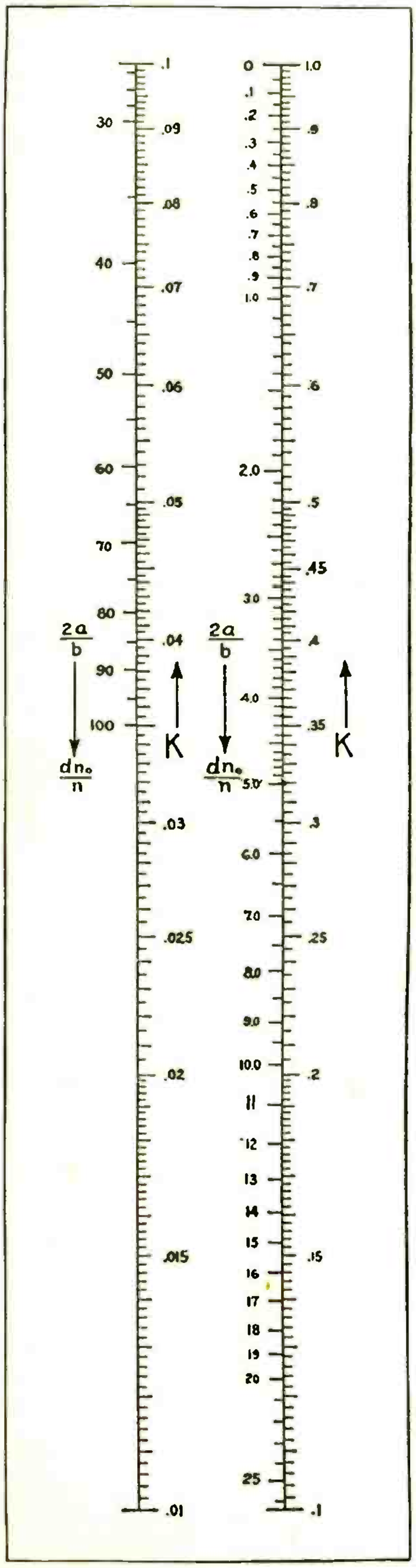


Fig. 3—The graph at left gives the values of Nagaoka's constant "K" for different values of $2a$ over $b = dn_0$ over n, on a logarithmic scale. This chart will prove very useful in calculating the inductance of coils.

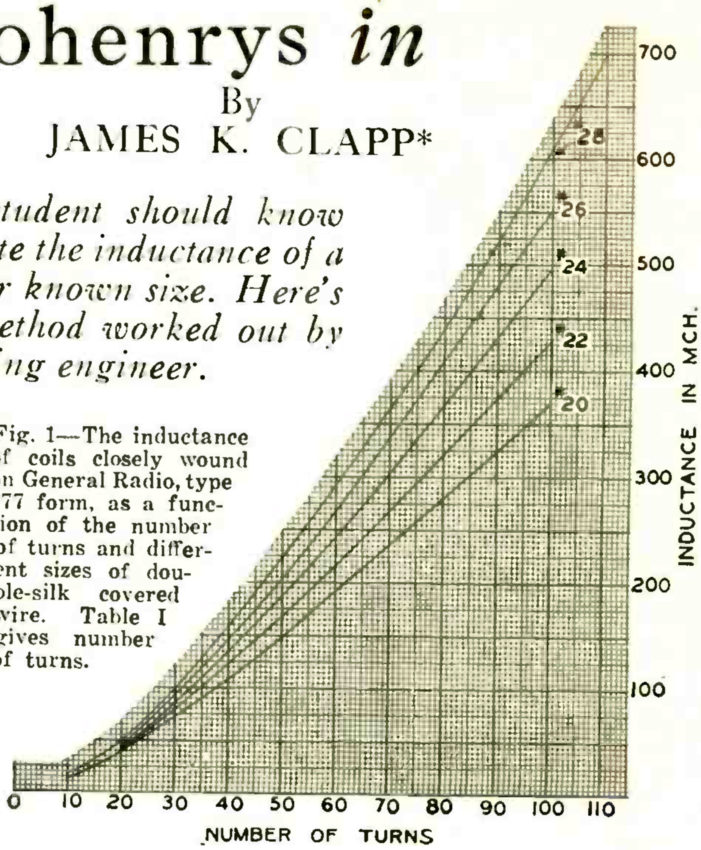


Fig. 1—The inductance of coils closely wound on General Radio, type 577 form, as a function of the number of turns and different sizes of double-silk covered wire. Table I gives number of turns.

WHILE much material has been published on the calculation of the inductance of coils,† the formulae given are in general not convenient for engineering use. Two difficulties are encountered in applying the results in engineering practice, one being the involved computations and the other the fact that differences in form and wire sizes and errors in the measurement of these factors introduce errors in the calculations which largely vitiate the utility of precise formulae.

For single-layer coils at radio frequencies (and, with slight modification, for bank-wound coils), Nagaoka's formula probably is the best for general engineering use. While neglecting the shape and size of the cross-section of the wire, the self-capacity of the winding and the variation of inductance due to skin-effect, it may be shown that the formula gives about as good results for high-frequency inductance as can be obtained.

Tables of the values of Nagaoka's correction factor have been prepared, but require considerable time to use due to the necessity for interpolations. The table values may be plotted in the form of a curve, but a more convenient interpolation is made possible by plotting these values on logarithmic scales, as has been done in Figure 3. Where much work of this type is done, the scales may be transferred to a slide-rule so that no reference to printed material is required.

The formulae given here, when carefully applied, give values of inductance to within about two per cent. for single-layer coils and to within about five per cent. for four-layer bank-wound coils for frequencies where the coils would serve as normal tuned-circuit elements.

The general formula is

$$L = \frac{0.1003a^2n^2K}{b}, \quad \text{microhenrys} \quad (1)$$

where a is radius of a mean turn in inches, n is the number of turns, b is the length of the winding in inches, and K is Nagaoka's correction factor which is a function of $\left(\frac{2a}{b}\right)$ or the ratio of diameter to length of the winding.

If n_0 is the number of turns per inch, the inductance and ratio of diameter to length are more conveniently given by:

$$L = 0.1003a^2nn_0K, \quad \text{microhenrys} \quad (2)$$

$$\text{or } L = 0.0251d^2nn_0K, \quad \text{microhenrys} \quad (3)$$

$$\text{where } \frac{2a}{b} = \frac{2an_0}{n} = \frac{dn_0}{n} \quad \text{numeric} \quad (4)$$

and d is the diameter of the mean turn in inches.

Given the size of wire and its insulation and the diameter of the coil form, n_0 as wound, is found from Table I and $\frac{dn_0}{n}$ is readily computed for any desired number of turns. Read the corresponding value of K from the scales at the left. The inductance is then easily computed by means of the slide-rule.

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* Engineer, General Radio Company.

† See in particular the publications of the U. S. Bureau of Standards and the Proceedings of the Institute of Radio Engineers.

For banked windings of not too great depth as compared with the diameter, a close approximation for the inductance is obtained by using Nn_0 for the turns per inch (where N is the number of banks) and $\frac{dNn_0}{n}$ for the ratio of diameter to length.

Then $\frac{2a}{b} = \frac{dNn_0}{n}$ numeric (5)

and $L = 0.0251 d^2 N n n_0 K$, microhenrys (6)

The number of turns required for a desired value of inductance cannot be directly calculated since K varies as n is varied. With given types of windings experience will indicate an approximate value for the number of turns. If the computations are carried out and the inductance obtained is near the desired value, the correct number of turns to give the desired value may be obtained by readjustment, since K does not vary rapidly with n. Where many values are required it is simpler to calculate a sufficient number of values for a curve. The required values may then be read off directly. (See Figures 1 and 2, for example.)

Examples of Calculations

Given: Form diameter = 2.75 inches (General Radio Company Type 577 Form). Wire size = No. 20 double-silk-covered. *Find:* The inductance for coil of 35 turns.

Procedure: In Table 1 find $n_0 = 25$

$$\frac{dn_0}{n} = \frac{\left(2.75 + \frac{1}{25}\right)25}{35} = 1.99$$

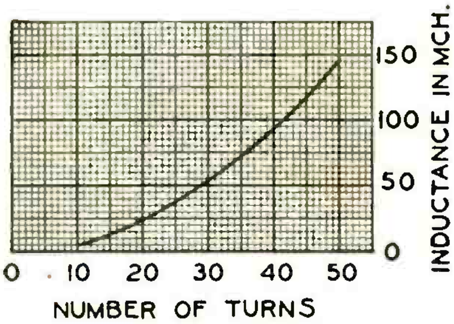


Fig. 2—Inductance of coils wound on General Radio, type 577 form, with double silk covered, copper wire, in which the turns have been equally spaced in order to fill the 2-inch winding space. Here $n_0 = ½ n$.

TABLE I

Winding Data for Closely Wound Coils

Size of Wire B & S	Turns per Inch					Total Turns for Full 2-Inch Form
	Enamel	Single Silk	Double Silk	Single Cotton	Double Cotton	Double Silk
20	29	27	25	27	25	50
22	36	34	30.5	34	30	61
24	45	43	38	41	35	76
26	57	52	45	50	41	90
28	71	64	53	60	48	106
30	88	80	66	71	55	132
32	120	95	76	84	62	152

From scales, opposite 1.99 for $\frac{dn_0}{n}$, read

$K = 0.526$

$L = 0.0251 \times (2.79)^2 \times 35 \times 25 \times 0.526 = 90.0$ microhenrys.

For a rough estimate, the diameter of the form may often be taken as the diameter of a turn. In the above example this procedure gives $\frac{dn_0}{n} = 1.965$, $K = 0.530$ and $L = 88$ microhenrys, which differs from the previous value by about 2.5 per cent.

For bank-wound coils an example is as follows:

Given: $d = 2.75$, $n_0 = 25$, $N = 4$, and $n = 200$

$$\text{Then, } \frac{dNn_0}{n} = \frac{\left(2.75 + \frac{4}{25}\right)25 \times 4}{200} = 1.455.$$

From Figure 3, $K = 0.604$

$$\text{Then } L = 0.0251 \times \left(2.75 + \frac{4}{25}\right)^2 \times 4 \times 25 \times 200 \times 0.604 = 2570 \text{ microhenrys.}$$

Many experimenters and many engineers "design" inductors by guessing at the number of turns, then peeling off wire until the correct value of inductance is obtained rather than go to the trouble of using the usual tables and formulas. Our experience with the method described here proves conclusively that much time and effort are saved by calculating the desired value of inductance before the coil is wound.—*Courtesy "General Radio Experimenter."*

How to Cure "Dead Spots" in Receivers

By Mander Barnett

NOTHING can be more annoying in a short-wave receiver than to find that the set refuses to operate at certain points of the tuning dial. Receivers of the type which use either a tuned or an untuned stage of R.F. amplification in front of the detector are not so liable to suffer from this defect as the plain regenerative receivers. Even here, however, the trouble is liable to occur to some degree, and is due to a number of causes which may be classed as being either mechanical or electrical.

In the former class we may place, for instance, a faulty tuning condenser, the plates of which short at certain points on the dial. Again, perhaps, some portion of the circuit was wired rather hurriedly and consequently, may be shorting somewhere; perhaps against the metal cabinet, if one is used. Condensers which use bare metal pigtails should be used with great caution in short-wave tuners. The turns of the pigtail are liable to catch and will cause bad crackling; and, possibly, render the condenser inoperative at certain points of the dial. In cases like this, it is best to scrap the condenser and use some other type, in which a different form of positive connection is made. Condensers which use a covered pigtail are, of course, quite O.K. for the job. Apart from other obvious mechanical defects in condensers, coils, tube sockets, etc., there are not many other directions in which trouble of this sort is to be found.

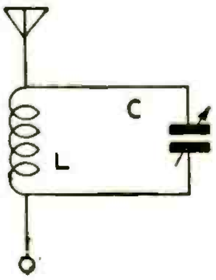


Fig. 1, at left, shows tunable circuit, placed in series with antenna for purpose of eliminating "dead spots."

The next section under discussion, *i.e.*, electrical causes, contains a large number of causes which may bring about these "dead spots". In short-wave tuners of the usual regenerative type, the most usual culprit is the antenna itself. When the receiver is tuned to the natural wavelength of the antenna, an absorption effect occurs and the set refuses to oscillate. It is not generally realized, however, that this effect can be easily got over by tuning the antenna itself, and thus placing the natural wavelength far out of the reach of the tuning dial. This can be done as shown in Fig. I.

The coil L may consist of six turns of fairly thick wire, such as No. 18 or 20 cotton-covered wire, wound on a form about 1 inch wide (an ordinary tube base will do—here is yet another use for the overworked tube-base!). The condenser C may be of any of the usual capacities, the .0005 mf. broadcast model will do quite well; or, better still, use one of the small compact adjustable condensers which are set to the correct value by means of a small screw on top of the case. If a metal cabinet is used, the coil and condenser should be placed inside the cabinet, if there is sufficient room.

The procedure for tuning out the dead spot is very simple. First of all, tune in the dead spot with the antenna connected in the usual manner; then connect the coil and condenser in circuit and adjust the condenser until the dead spot moves off the dial. It will, of course, appear again on some other wavelength; but it can be tuned right out of the usual short wavelengths.

Well, so much for one cause. The next most frequent culprit is the R.F. choke

(*Continued on page* 298)

The PROPAGATION of SHORT WAVES

By ROBERT MEYER,
(Hamburg, Germany)

The author describes his new theory of the effect of cosmic energy and change of season on the transmission and reception of short waves. The solar radiation of electrons in their effect on short waves is discussed.

IN the last few years, many radio listeners have tried to change over to the reception of short waves. much success has been attained but the interest in general waned very soon; because in the short-wave field there are peculiar propagation conditions which, so far, have not been understood in their basic principle. Even the set owner who is well up in the working conditions on the well-known broadcast wavebands, is confronted by puzzles in the case of the bands which have been investigated but little.

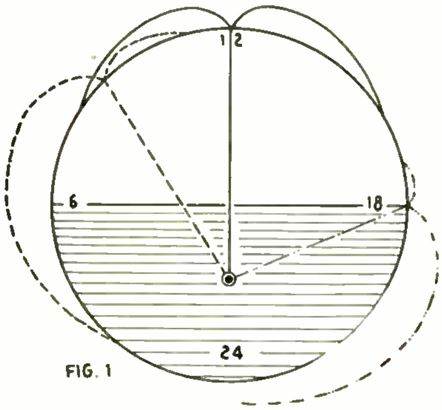


Fig. 1—Daily range-displacement of short waves.

It is a well-known fact that the working conditions or ranges of all the bands change once in the period of a day; but that this change is considerably modified by the season of the year. This observation led the writer to formulate the idea that the emission of the short-wave transmitter is something secondary; the influencing or modulation of a cosmic energy being probable. With this assumption, it becomes clear that even a nearby transmitter must remain inaudible, unless a flow of this cosmic energy is present between the sender and the receiver.

Now it is natural that we should, in view of the cosmic dependence of the earth on the sun, take into account the solar radiation of electrons, to explain the formation of lines of conductivity for short-wave transmitters. The solar electrons strike the earth and are partially reflected; after reflection, they must describe a curve which is determined by their own velocity and the attraction of the earth. Fundamentally, therefore, the reflected electrons must describe a path, through the atmosphere, from the point of rebound to the "night side" of the earth (the side away from the sun). The curve must always have the same form, since the two effective components (velocity and attraction) do not change their relation. If, nevertheless, the distance traversed by the electrons varies according to the time of day, then an important factor must have remained hitherto unconsidered.

It has been recognized, since Newton, that the reciprocal action of two bodies in space does not take place in the true centers of the bodies, but lies eccentrically according to the respective strengths of the bodies. From the reconstruction of many observed zones of reception, I now found the ideal or specific center of terrestrial attraction displaced about half the earth's radius or 1,980 miles, toward the north magnetic pole. The position of this center of attraction may be seen in Fig. 1; and from this diagram there also becomes clear its significance for the determination of reception zones.

The reflection curves of the solar electrons are represented for three different hours of the day. With vertically falling sunbeams, at 12 (noon), there is formed a *symmetrical "umbrella"* of conductive lines; for the imaginary axis of the reflection path passes through both the center of the earth and also through the theoretical center of attraction. The range formed at about 10 o'clock is unsymmetrical; the branch pointing to the south is *shortened*, and the effective path to the north is *lengthened*. Still greater is the distortion in the case of the *reflection umbrella* formed in the evening twilight. There the northerly-directed branch is so expanded that it does not touch the earth again; therefore this line of propagation is useless for practical communication. In both cases the influence of the ideal center of terrestrial attraction is plainly recognizable. Practical experience is accordingly confirmed and explained by the writer's theory.

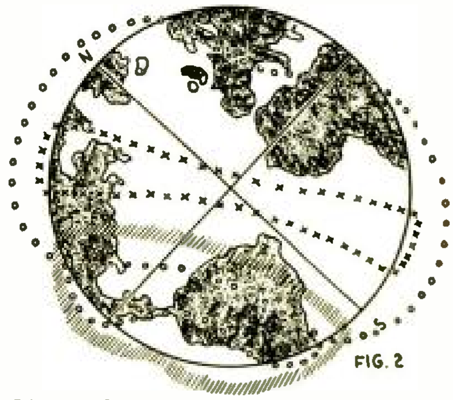


Fig. 2—Short wave lines of conduction over the earth in summer.

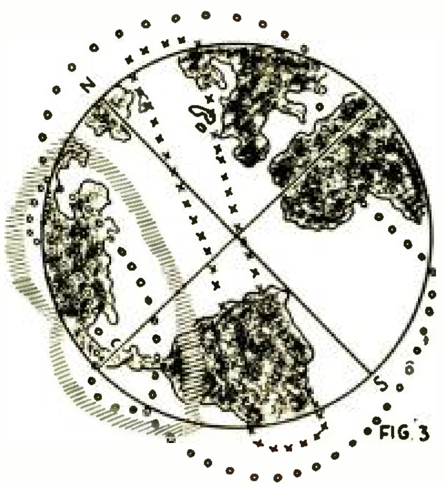


Fig. 3—Short wave lines of conduction in winter.

According to this assumption, there hangs over the earth on the *day side*, a multiple "umbrella," which contains, besides the lines shown, all the intermediate stages. At the same time there is a possibility of communication between any two places on the surface of the earth, which are touched by the same line of conductivity. The lines themselves are given continuous excitation from solar electrons.

In the course of a day, in view of the rotation of the earth, each point on the surface of the earth describes a fixed path in this "umbrella" structure, and finds operating conditions periodically changing. Besides the daily revolution, the earth annually completes a circuit about the sun; whereby there is caused a constantly changing angular inclination of the earth's axis to the sun. This second motion of the earth in the cosmically-located network of conductive lines (which are therefore fixed in space) is the cause of the changes in range which occur during annual periods, as may be seen from Figs. 2 and 3.

The ranges indicated in Fig. 1 may again be recognized over the earth, which

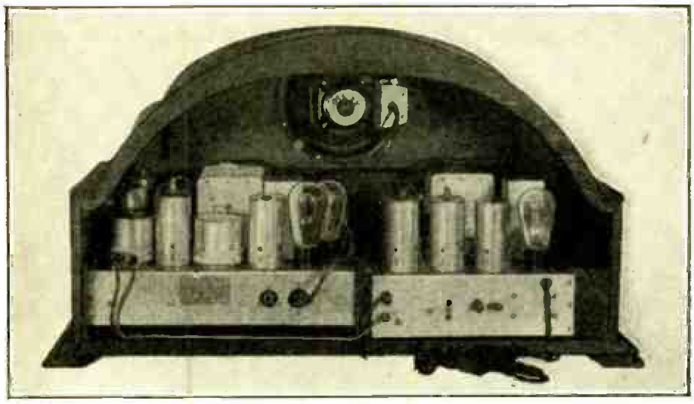
(*Continued on page* 298)

The New PILOT ALL-WAVE RECEIVER

By R. F. SHEA and EDGAR MESSING

The new "All-Wave" receiver covers a range of 10 to 550 meters, the set using eleven tubes in a double superheterodyne of high sensitivity and selectivity, with good tone quality. Has a wave change switch.

Above: The new Pilot "All-Wave" superhet with "wave-change" switch. Range 10 to 550 meters.



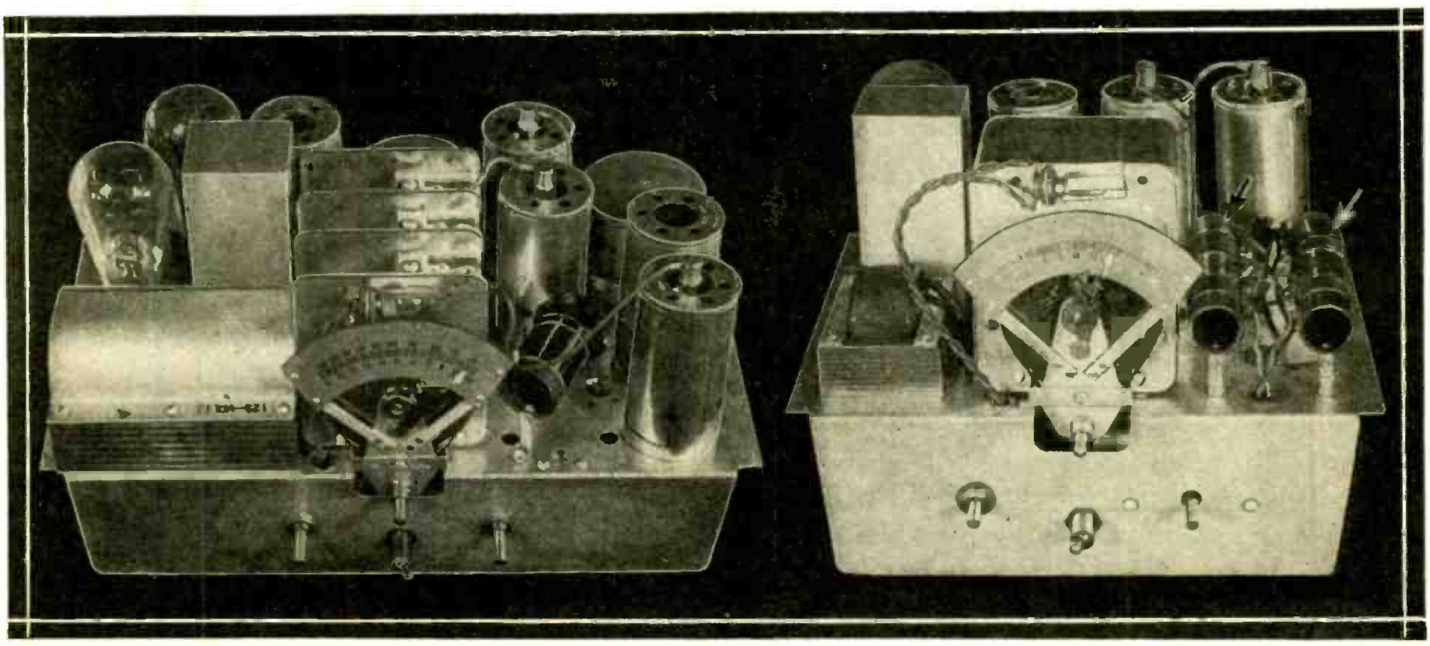
Left: Rear view of "All-Wave" superhet, showing dynamic speaker.

FROM the same laboratory that produced the Wasp, the Super-Wasp and the Universal Super-Wasp, there now emerges another short-wave receiver that promises to eclipse the world-wide fame achieved by its three predecessors. This is the new Pilot "All-Wave," an eleven-tube double super-heterodyne that has features of design and construction that were undreamed of only a year ago.

Covering a wavelength range from 10 to 550 meters at the turn of a knob, the "All-Wave" is a *real* combination receiver. Previous combination-wave sets were primarily short-wave receptors, and only incidentally broadcast receivers. They brought in the stations on the 200-550 meter band fairly well, but in this regard they admittedly were inferior to standard broadcast instruments. The new "All-Wave" does not suffer from this shortcoming. On the broadcast range it is an honest-to-goodness superheterodyne of the latest design; in fact, it uses the regular seven-tube chassis and dynamic loudspeaker of the new Pilot Midget, model No. S-148.

For the short-waves, a separate four-tube superheterodyne converter unit is brought into action. This feeds into the seven-tube unit, which is adjusted to 550 kc. and left there. The tremendous amplification of this chassis is brought into full use for short-wave reception, the set being employed as an intermediate-frequency amplifier at this frequency. This arrangement was devised for technical reasons, and not merely for mechanical convenience. The reason is that the optimum intermediate frequency for 200-550 meter operation is quite different

(*Continued on page* 296)



Broadcast chassis on left; short wave chassis at right. Arrows point to short wave coils—switch is directly below.

The New Tanner Audio System

ABOUT a year ago, while experimenting with short-wave receivers, it was found that audio howling and motorboating are far more serious than in regular broadcast sets, especially would be of equal magnitude when C equals C1. The potential at the mid-tap of the two capacities would then be zero, with respect to the preceding grid. Feedback to the grid will occur; positive spectrum. The resistance R is employed for the purpose of reducing the magnitude of the peak frequency to a satisfactory value.

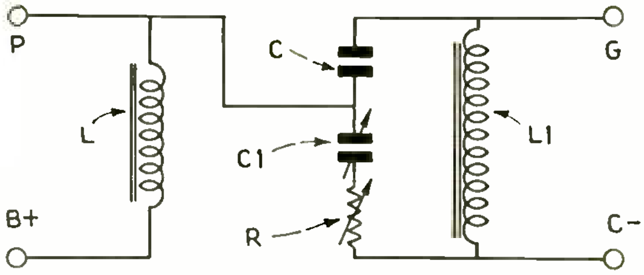


Fig. 1. New audio coupling transformer which eliminates howling and motorboating. The value of impedance L is dependent upon the type tube used. L1 is the grid impedance coil.

when operated from "B" battery substitutes. With transformer- or impedance-coupled audio amplifiers, these noises could generally be eliminated by shunting the grid of the first A. F. tube with a resistor under 100,000 ohms, or, in the case of resistance coupling, by reducing the resistance of the first A. F. grid leak to the same value. This is a very inefficient method, in view of the fact that most of the higher frequencies are shunted to ground, as well as of the large reduction in gain.

It was finally decided that a new system of amplifying the output of the detector, which would be practically free from howling and motorboating, was needed. Considerable research resulted in a new type of audio coupling transformer, details of which are given in Fig. 1.

The "B+" is led to the plate through an impedance L, the value of which depends upon the tube used; this may be replaced with a resistor, which is to be preferred in the case of a detector. L1 is the grid impedance coil. It will be observed that the plate tap is made at the juncture of two capacities connected in series across L1. If the resistance of L1 were zero, the potentials across C and C1 would be opposite in phase; in which case these opposite potentials

when C exceeds C1 and negative when C1 exceeds C. It is apparent, then, that by making C1 somewhat the larger of the two, audio howling, due to unavoidable magnetic coupling, may be compensated for.

As C and C1 are in series, the effective capacity across L1 is:

$$\text{Effective capacity} = \frac{1}{\frac{1}{C} + \frac{1}{C1}}$$

By properly proportioning C, C1 and L1, a rising characteristic may be obtained at any frequency within the audio

The voltage step-up is:

$$\text{Voltage step-up} = \frac{C + C1}{C}$$

By making C1 variable in steps (the minimum capacity should not be smaller than C) with a variable resistor at R, it is possible to peak an amplifier to suit the ear of the individual or to overcome any deficiencies in a loud speaker.

In Fig. 2 is a circuit for a two-stage Tanner audio amplifier for use with either a radio set or a magnetic pickup. The values for C1 and R may be fixed in the first stage, for simplicity, and variable in the second. In practice, the variables are adjusted when the amplifier is installed, and then they are left alone.

While this system was developed mainly for use in short-wave receivers, it may readily be employed wherever an audio amplifier is required, with greatly improved results.

The public is fast becoming tone-conscious. Some prefer a rising characteristic on the "lows," and some on the "highs." The Tanner system will give the listeners what they desire.

These audio transformers will soon be available on the market, as well as factory built amplifiers and kits of parts.

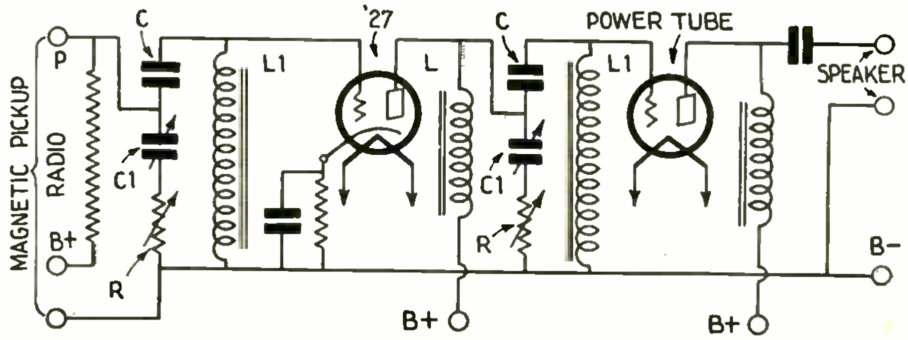


Fig. 2. Circuit of new Tanner audio amplifier with 2 stages, suitable for use with radio set or phonograph pick-up.

Enhanced Audio Amplification

MANY experimenters have found that, generally speaking, two audio stages in a short wave receiver create too much noise of a "mush" type for weak, long-distance signals. There is a very simple way to get over this, by means of auto-transformer coupling; and if this is arranged for parallel-plate feed, the heavy D.C. of the "B" battery is kept out of the loud speaker (or phones, as the case may be).

Fig. 1 is the conventional layout for a single transformer-coupled audio stage, while Fig. 2 is the suggested layout to obtain greater amplification from one audio transformer, which can, with advantage, be of high (7:1) ratio.

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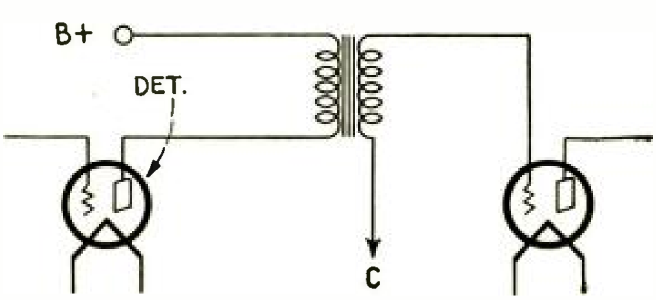


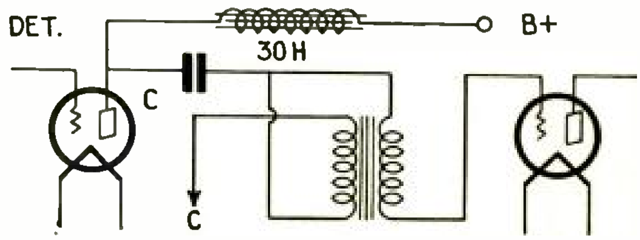


Fig. 1, at left, shows conventional hook-up of detector to audio stage; Fig. 2, above, improved auto-transformer hook-up, which eliminates "mushy" tone.

AMONG THE HAMS

THAT'S WHAT THEY ALL SAY

Editor, SHORT WAVE CRAFT:

I have been a constant reader of your magazine ever since the first one was published. I think it is the ideal magazine for an amateur.

I would appreciate an article on Monitors, as all stations need them.

I would appreciate it if you would publish this as I would like to hear from other Short Wave Fans; I will answer all mail.

Yours wid 73s,
F. M. WENTZ,
Amateur Radio W8EEQ,
211 Larkins St.,
Findlay, Ohio.
(Official Relay Station.)

(All right F. M. we take you at your word and remember that we have it in writing that you will answer "all" mail. The very first complaint we get that you have failed to answer each one, to the last word, we will promptly report you to the black-ball committee and your frequency will not be so "hot" hereafter. But we know that will not happen because real amateurs keep their word at all times. More power to you.—Editor.)

WHAT SAY, BOYS?

Editor, SHORT WAVE CRAFT:

This is to compliment you on your publication, SHORT WAVE CRAFT, and at the same time to offer my sincere suggestions as to a definite department that might be included in its pages.

Almost everything that the amateur, ham, *et al*, can wish for is included in your publication, save for one thing, which, in my opinion, would be a help to all concerned.

This "missing" item is that of a department in which some reliable amateur, engineer, or the like, publish his notes on short wave reception from day to day, or week to week, commenting on the kind of programs received, variety, signal conditions as to strength, etc.

These notes would be valuable to the amateur who has just started out, as well as to the "hard boiled," who could check their own reception from time to time. Of course there is a maze of stations, but these notes need only be on the more reliable sources of reception, so that a definite period may be set aside from day to day by amateurs who are eternally raking the "Heaviside" in the hope of hooking that elusive signal or signals, with very little idea whether or not the signals are there.

I own a battery model Super Wasp, and get plenty of practice with it, but too often reach out to bring in the signals that aren't there. Correspondence with anyone owning a Super Wasp is respectfully solicited. I will gladly answer all letters.

Radioally yours,
JOSEPH C. COLLINS,
1805 Breckenridge Ave.,
Austin, Texas.

(It is not a bad idea, Joe, but we really would like to put it up to the readers and if they want such a department, we will "shoot the works." It is easy enough to do it and the editor, as he has told you before, doesn't give a "rap" what he prints as long as he pleases you readers. But from the technical viewpoint, is such a department really worthwhile? The short wave enthusiast knows what is a good antenna circuit, and what is a good antenna circuit in one locality is a total "flop" in another. Have you thought of it in that way?—Editor.)

CHEERIO! O! O!

Editor, SHORT WAVE CRAFT:

I am a 100% reader of SHORT WAVE CRAFT and have gotten ten copies up to date. This magazine is the most interesting of all I have ever read. If you want to know anything about short waves, read SHORT WAVE CRAFT, to get new ideas. I am as proud of the SHORT WAVE CRAFT as I am of my seven-year-old Robert's three tube set. I hold a record of 3,800 miles one stretch. Alaska, California, Mexico, Alberta, as "runners up". Now I am in the short-wave class. I built a three tube, short-wave set of my own design, with 50% of help from SHORT WAVE CRAFT.

This set is at present one and one-half months old, holding the following record: Loud speaker reception every day—*not luck*—but every day occurrence. I have heard the following stations: FZG, Saigon, Indo-China every Friday, daylight saving time, at 7:30 P.M. to 8.00 on 24.85 meters. G5SW, XDA, W9XF, 7LO· 9frica, HRB, VE9CL, W8XK, W2XE, VE9GW, WAXM, W2SB, XFA, WGSY, WKBF, Minn KFKP, WEEB, Baltimore.

Please note every station is daily received except 7LO and FZG. I have only finished my low wave band; I mean it took me about two weeks to bring my set down to 6 meters. My set will now tune from 6 to 199 meters with 100% oscillation—*no dead spots on this set.* When I have perfected this set, I will send it to you so that some ham who has not had the pleasure of hearing Africa or England, can do so. We hear G5SW every evening, except Saturday and Sunday, signing off at 12, ringing Big Ben. We heard it every evening last week (week of May 10th), rain or shine. Again I say, Cheerio, to the SHORT WAVE CRAFT and to our good old friend the editor. I will answer all "hams". I have verified reception from XDA, HRB, VE9CL, G5SW, XFA. Yet to come from 7LO and FZG. **I would like to build sets if I had prospective customers.**

I wish to say to the radio hams of SHORT WAVE CRAFT that I can pick up G5SW, Chelmsford; VOR2, Austria; FZG, Saigon; FTN, Paris; 12RO, Rome; XDA, Mexico; WE9CL, Winn., *on the loud speaker!* No aerial, three tube receiver. Can be heard 40 feet from speaker.

What do I use in my aerial circuit? With an aerial, reception only 30% better. If I can receive 15 clippings with this on it, I will give the circuit and aerial circuit to the SHORT WAVE CRAFT, so that you may know the secret of how it's done. That's fair enough. I also wish to say that I have heard G5SW, twenty days in four weeks; that is five days a week. VOR2, Austria, seven days a week. I received my G5SW card. Weather conditions have no effect on this receiver. I pulled in Austria with no aerial on loud speaker, thermometer at 86° in the shade. If you want to know how good your receiver is on 25 meters, try between 5:30 to 7:00 P.M. to listen to G5SW as they sign off at 7:00, when they ring "Big Ben". SHORT WAVE CRAFT is 100% perfect. I have at present 14 copies and it's the only short wave magazine in my home; no other will do. I am very fussy about what magazine I read.

Cheerio,
OLIVER OMLIE,
56th City Line,
Overbrook, Phila., Pa.

P. S.:—I have only built radio seven years. I have a three tube receiver, long wave. Record—Alaska, California—this is one of my own make.

(This looks like good work to us, Oliver, particularly when you mention the seven year old Robert three tube set. It seems it is still a good circuit and your results would seem to justify it. You might send us some details of the hook-up for publication purposes. Good luck to you.

If we do not miss our guess, Oliver, we know you will be snowed under with letters and you are more apt to get 1,500 than 15. It serves you right and cheerio to yourself—Editor.)

ETHER FRICASSEE

SHORT WAVE CRAFT is certainly up to the standard of all the publications that you have ever had anything to do with.

I would like to see the readers of SHORT WAVE CRAFT join hands to see whether something cannot be done about the interference of W3XAL with VE9GW. Both are good stations and deserve to be heard without interference. My suggestion is this, the National Broadcasting Co. does not seem to be operating W9XF, since they took over WENR. Why not operate W3XAL on 6020 kilocycles?

In the past week (prior to March 30th) I have noticed several changes in the frequencies on which the ship-to-shore and trans-Atlantic stations are operating on. It ought to be easy for you to obtain these changes from the headquarters of these stations in New York. WND was working on 9,170 kilocycles yesterday afternoon, according to their own announcement of it when they signed off. WSBN was working on 4,175 kilocycles last evening. The stations at Rugby, England, have also changed some. Let us have the latest dope on them.

At 11:45 A. M. yesterday I picked up a strong carrier wave a little above 12,045 kilocycles, and at about 12:08 P. M. when they started to talk it was GBS. However, almost as soon as they started talking the signals and the carrier wave started to swing but before they started to talk everything had remained perfectly steady. GBU and GBW were hooked in the same circuit but the reception from them was worse than GBS.

My theory is that poor modulation causes a large part of the swinging so common to short wave stations. I receive VE9GW with no noticeable swinging although many of the stations that I hear are twice or three times as strong, they are all subject to more or less swinging.

Last night the operator at WOO, had the operator of WSBN busy trying to get a better signal into New York City, the operator on the shore told WSBN that their signals were so poor that they would be unable to put through a couple of commercial calls, that they had for the ship. WSBN's operator was adjusting and testing from 9 until 10 P. M. last night, and at the end of that time gave up trying. I don't think I missed understanding more than a dozen words of WSBN's operator all during the test, but the operator at WOO claimed that the signals were too poor to put through the calls. Maybe I could get a job building a good receiver for WOO??? My receiver uses 3 UY 224's and 1 UY 227. When I want to operate a loud speaker, I put the signals through the A.F. amplifier of my broadcast set and into the speaker.

The articles in SHORT WAVE CRAFT are fine. You may be sure that they are read and reread by me. While it may be possible that your magazine does not have a universal appeal to all short wave fans, nevertheless I do not see how an experimenter like myself can do without it.

I have never been lured to take any correspondence courses in radio. Although I have several good books on the theory of radio and secured no end of practical knowledge through experimenting and information gleaned from reading Gernsback publications. I am pretty sure that I know more about radio theory and practice, than at least half of these learn-by-mail graduates.

I don't know where I have ever ran across more real facts and less fancy than in RADIO-CRAFT. Although I am familiar with those who have been associated with you in publishing your magazines since 1922, you have never to my knowledge been surrounded with a more capable staff than at the present.

You keep up the good work in publishing these magazines and I'll keep on talking up your publications so that your subscription lists will continue to grow.

Yours sincerely,
CARROLL C. FOLTZ,
303 Central Avenue,
North Baltimore, Ohio.

(We fully agree with you, Carroll. This ether frequency and wave "hash" is getting pretty tough. We know exactly how you feel as every once in a while we ourselves blow up behind the loud speaker and become pretty much peeved. It would be a good idea to write to those stations which you think are the offending ones and tell them of the adverse results you are getting. It would seem to us that sooner or later this should bear good results.—Editor.)

Short-Wave Stations of the World

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

Meters / Kilocycles

5.00 60,000—W10XAY, portable. Licensed to 0.71-meter, 401,000 kc. Polin, Inc., New York.
4.97-5.35 60.000-56.000—Amateur Telephony and Television.
5.83 51,100—W2XBC, New Brunswick, N. J.
6.89 43,500—W9XD, Milwaukee, Wis. Television. Milwaukee Journal.
—W3XAD, Camden, N. J. Television. (Other experimental television permits: 48,500 to 50,300 k.c., 43,000-46,000 k.c.)
—W1XG, Boston, Mass.
—W2XBT, New York.
7.05 42,530—....Berlin, Germany. Tu. and Thu., 11:30-1:30 p.m. Telefunken Co.
7.32 41,000—W8XI, East Pittsburgh, Penna.
7.58 39,560—PCJ, Hilversum, Holland.
7.85 38,220—....Eindhoven, Holland.
—....Amsterdam, Holland. N. V. Philips Co. 4-7 p.m. Saturdays.
8.67 34,600—W2XBC, New Brunswick, N. J.
9.68 31,000—W8XI, Pittsburgh, Pa.
9.93 30,200—W6XD, M. R. T. Co.
9.96 30,105—....Golfo Aranci, Sardinia. Telephone to Rome.
10.51 29,190—PK313, Sourabaya, Java, Wed. and Sat., 5:50-7:50 a.m.
10.79 27,800—W6XD, Palo Alto, Calif. M. R. T. Co.
11.55 25,960—G5SW, Chelmsford, England Experimental.
11.67 25,700—W2XBC, New Brunswick, N. J.
—W3XA, Philadelphia, Pa. Norden-Hauck El. Mfg. Co.
12.48 24,000—W6AQ, San Mateo, Calif. (Several experimental stations are authorized to operate on non-exclusive waves of a series, both above this and down to 4 meters.)
—....Vienna, Austria. Mo., Wed., Sat.
13.04 23,000—W2XAW, Schenectady, N. Y.
13.92 21,540—W8XK, Pittsburgh, Pa.
13.97 21,469—W2XAL, New York.
13.99 21,429—XFA, Mexico City, Mex. (Authorized to broadcast at any higher frequency.)
14.00 21,420—W2XDJ, Deal, N. J. And other experimental stations.
14.01 21,400—WLO, Lawrence, N. J., transatlantic phone.
14.15 21,130—LSM, Monte Grande, Argentina.
—W2XAO, New Brunswick, N. J.
14.27 21,020—LSN (Hurlingham), Buenos Aires, Argentina.
14.28 21,000—OKI, Podebrady, Czechoslovakia.
14.47 20,710—LSY, Monte Grande, Argentina. Telephony.
14.50 20,680—LSN, Monte Grande, Argentina, after 10:30 p. m. Telephony with Europe.
—LSX, Buenos Aires. Telephony with U. S.
—FMB, Tamatave, Madagascar.
—FSR, Paris-Saigon phone.
14.54 20,620—PMB, Bandoeng, Java. After 4 a.m.
14.62 20,500—W9XF, Chicago, Ill. (WENR).
14.89 20,140—DWG, Nauen, Germany. Tests 10 a.m.—3 p.m.
15.03 19.950—LSG, Monte Grande, Argentina. From 7 a.m. to 1 p.m. Telephony to Paris and Nauen (Berlin).
—DIH, Nauen, Germany. Press (code) 6:15 a.m., English; 8:30 a.m. and 11 a.m., French, daily. 8:30 a.m. Sundays. French.
15.07 19,906—LSG, Monte Grande, Argentina. 8-10 a.m.
15.10 19,850—WMI, Deal, N. J.
15.12 19,830—FTD, St. Assise, France.
15.20 19,720—EAQ, Madrid, Spain.
15.25 19,600—....Santiago de Chile.
15.40 19,460—FZU, Tamatave, Madagascar.
15.45 19,400—FRO, FRE, St. Assise, France.
15.50 19,350—....Nancy, France, 4 to 5 p.m.
—VK2ME, Sydney, Australia.
15.51 19,340—W2XAC, And higher waves. Press wireless.
15.55 19,300—FTM, St. Assise, France. 10 a.m. to noon.
—PPU, Rio de Janeiro, Brazil.
15.58 19,240—DFA, Nauen, Germany.
15.60 19,220—WNC, Deal, N. J.
15.94 18,820—PLE, Bandoeng, Java. 5:40-6:40 a.m. and from 2:40 a.m. Tues. and Fri.; 8:40-10:40 a.m. Tues. Also telephony.
16.10 18,620—GBJ, Bodmin, England. Telephony with Montreal.
16.11 18,620—GBU, Rugby, England.
16.19 18,500—....Cottano, Italy. Telephone to ships.
16.30 18,400—PCK, Kootwijk, Holland. Daily from 1 to 6:30 a.m.
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. Canadian Marconi Co.
16.57 18,100—GBK, Bodmin, England.
—W9XAA, Chicago, Ill. Testing, mornings.
16.61 18,050—KQJ, Bolinas, Calif.
16.70 17,950—FZU, Tamatave, Madagascar.
16.80 17,850—PLF, Bandoeng, Java ("Radio Malabar").
—W2XAO, New Brunswick, N. J.
16.82 17,830—PCV, Kootwijk, Holland. 9:10 a.m. Sat.
16.87 17,780—W8XK, Pittsburgh, Pa.
16.90 17,750—HS1PJ, Bangkok, Siam. 7-9:30 a.m., 1-3 p.m. Sundays.
17.00 17,640—Ship Phones to Shore: WSBN, "Leviathan"; GFWV, "Majestic"; GLSQ, "Olympic"; GDLJ, "Homeric"; GMJQ, "Belgenland"; work on this and higher channels.
17.25 17,380—JIAA, Tokio, Japan.
17.34 17,300—W2XK, Schenectady, N. Y. Tues., Thurs., Sat. 12 to 5 p.m. General Electric Co.
—W8XL, Dayton, Ohio.
—W6XAJ, Oakland, Calif.
—W7XA, Portland, Ore.
—W7XC, Seattle, Wash.
—W2XCU, Ampere, N. J.
—W9XL, Anoka, Minn., and other experimental stations.
—VE9AD, Glace Bay, N. S., Canada.
17.52 17,110—WOO, Deal, N. J. Transatlantic phone.
—W2XDO, Ocean Gate, N. J., A. T. & T. Co.

Meters / Kilocycles

17.55 17,080—GBC, Rugby, England.
18.37 16,320—VLK, Sydney, Australia. Phone to England.
18.40 16,300—PCL, Kootwijk, Holland. Works with Bandoeng from 7 a.m. Netherland State Telegraphs.
—WLO, Lawrence, N. J.
18.50 16,200—FZR, Saigon, Indo-China.
18.56 16,150—GBX, Rugby England.
18.68 16,060—NAA, Arlington, Va. Time signals, 11:57 to noon.
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.
19.04 15,750—....Chi-Hoa, Saigon, Indo China. Telephony.
19.50 15,375—F8BZ, French phone to ships.
19.56 15,340—W2XAD, Schenectady, N. Y. Broadcasts 3-6 p.m.; Sun., 1-3 p.m.; relaying WGY.
19.60 15,300—OXY, Lyngby, Denmark, Experimental.
—....Konigswustarhausen, Germany. After 7 a.m.
19.63 15,280—W2XE, Jamaica, N. Y.
19.66 15,250—W2XAL, New York, N. Y.
—W6XAL, Westminster, Calif.
19.68 15,240—FYA, Pontoise (Paris), France. 9:30-11:30 a.m. Service de la Radiodiffusion, 103 Rue de Grenelle, Paris.
19.72 15,210—W8XK (KDKA), Pittsburgh, Pa. Tues., Thurs., Sat., Sun., 8 a.m. to noon.
19.83 15,120—HVJ1, Vatican City (Rome, Italy), 5-6 a.m.
—JIAA, Tokio, Japan.
19.99 15,000—CM6XJ, Central Tuinucu, Cuba.
—LSJ, Monte Grande, Argentina.
—VK6AG, Perth, West Australia.
20.20 14,850—HVJ1, Vatican City. Sunday, 5 a.m.; Tues. in English.
—CFA, Croydon, England.
20.50 14,620—WMI, Deal, N. J.
—XDA, Mexico City, 2:30-3 p.m.
20.65 14,530—LSA, Buenos Aires, Argentina.
20.70 14,480—W8XK, East Pittsburgh, Pa.
—GBW, Rugby, England.
—WNC, Deal, N. J.
20.80 14,420—VPD, Suva, Fiji Islands.
20.95 14,310—G2NM, Sonning-on-Thames, England. Saturdays, 3 a.m.; Sundays, 3 p.m.

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

20.97-21.26 14,300-14,100—Amateur Telephony.
21.17 14,150—KKZ, Bolinas, Calif.
21.50 13,940—.... Bucharest, Roumania. 2-5 p.m., Wed., Sat.
21.59 13,890—...., Mombasa, East Africa.
22.20 13,500—...., Vienna, Austria.
22.38 13,400—WND, Deal Beach, N. J. Transatlantic telephony.
22.68 13,220—Ship Phones.
23.00 13,043—OBE, La Punta, Peru. Time signals 2 p.m.
—TGCA, Guatemala City, Rep. Guatemala. 10 p.m.-midnight.
23.35 12,850—W2XD, Schenectady, N. Y. Antipodal program 9 p.m. Mon. to 3 a.m. Tues. Noon to 5 p.m. on Tues., Thurs. and Sat. General Electric Co.
—W2XCU, Ampere, N. J.
—WDD, Ocean Gate, N. J.
—W9XL, Anoka, Minn., and other experimental relay broadcasters.
23.38 12,820....Rabat, Morocco. Sun., 7:30-9 a.m. Daily 5-7 a.m. Telephony.
23.16 12,780—GBC, Rugby, England.
23.90 12,550—VBS, Glace Bay, Nova Scotia, Canada.
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.
24.63 12,280—Airplane.
24.68 12,150—GBS, Rugby, England. Transatlantic phone to Deal, N. J. (New York).
—FQD, FQE, Ste. Assise, France.
24.80 12,090—....Tokio, Japan, 5-8 a.m.
24.80 12,090—....Trieste, Italy.
24.95 12,020—VIY, Ballan, Australia.
24.89 12,045—NAA, Arlington, Va. Time signals, 11:57 to noon.
—NSS, Annapolis, Md. Time signals, 9:57-10 p.m.
24.98 12,000—FZG, Saigon, Indo-China. Time signals, 2-2:05 p.m.
—....Oporto, Portugal.

Meters / Kilocycles

25.10 11,945—KKQ, Bolinas, Calif.
25.16 11,920—FYA, Pontoise, France. Variable beams to French Colonies. 12:30-2 p.m.
25.24 11,884—W8XK (KDKA), Pittsburgh, Pa. Tues., Thurs., Sat., Sun., 11 a.m.-4 p.m., and Sat. night Arctic programs. Television, Mon. and Fri., 2:30 p.m., 60 lines, 1200 r.p.m.
—W9XF, Chicago (WENR).
—W2XAL, New York (WRNY).
25.26 11,870—VUC, Calcutta, India. 9:45-10:45 p.m.; 8-9 a.m.
25.30 11,860—VE9CA, Calgary, Alta.
25.34 11,840—W2XE, Jamaica, New York (WABC). 7:30 a.m. through to 2 a.m. Sundays 8 a.m. to midnight.
—W9XAA, Chicago, Ill. 7-8 a.m., 1-2, 4-5:30, 6-7:30 p.m.
25.42 11,800—W2XAL, New York.
—W9XF, Chicago.
—VE9GW, Bowmanville, Canada.
—PK6KZ, Macassar, Celebes.
—I2RO, Rome, Italy. Also relays Naples. 1:30-5:30 p.m.
25.47 11,780—VE9DR, Drummondville, Quebec, Canada.
—....Chi-Hoa, Saigon, Telephony.
25.50 11,760—XDA, Mexico City. 3-4 p.m.
11,750—G5SW, Chelmsford, England. 7:30-8::30 a.m.; 2 p.m. to 7 p.m.
25.58 11,720—CJRX, Middlechurch, Man., Canada.
—PPU, Rio de Janeiro, Brazil.
25.63 11,690—FYA, Pontoise, France, Intercolonial broadcasting, 4-6 p.m.
25.65 11,680—YVQ, Maracay, Venezuela.
25.68 11,670—KIO, Kahuhu, 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.
26.60 11,280—ON4BDK, Brussels, Belgium.
27.30 10,980—ZLW, Wellington, N. Z. Tests 3-8 a.m.
27.75 10,800—GBX, Rugby, England.
28.00 10,710—CT1BO, Lisbon, Portugal.
—....Casablanca, Morocco.
—TGW, Guatemala City, Guatemala.
28.20 10,630—PLR, Bandoeng, Java. Works with Holland and France weekdays from 7 a.m.; sometimes after 9:30.
28.44 10,540—WLO, Lawrence, N. J.
28.50 10,510—RDRL, Leningrad, U.S.S.R. (Russia).
—VLK, Sydney, Australia. 1-7 a.m.
28.80 10,410—PDK, Kootwijk, Holland.
—KEZ, Bolinas, Calif.
—LSY, Buenos Aires, Argentina.
28.86 10,390—GBX, Rugby, England.
29.30 10,250—TI4, Heredia, Costa Rica. Mo.-Wed. 7:30-8:30 p.m.; Thu., Sat., 9-10 p.m.
29.54 10,150—DIS, Nauen, Germany. Press (code) daily: 6 p.m., Spanish; 7 p.m., English; 7:50 p.m., German; 2:30 p.m., English; 5 p.m., German. Sundays: 6 p.m., Spanish; 7:50 p.m., German; 9:30 p.m., Spanish.
29.98 10,000—CM2LA, Havana, Cuba.
—....Belgrade, Jugoslavia. Monday 3-4 p.m.
30.15 9,950—GBU, Rugby, England.
30.20 9,930—W2XU, Long Island City, New York.
—....Posen, Poland.
30.30 9,890—LSN, Buenos Aires, phone to Europe.
—LSA, Buenos Aires.
—EAQ, Madrid, Spain.
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.
31.10 9,640—....Monte Grande, Argentina, works Nauen irregularly after 10:30 p.m.
—VVB, Bombay, India. Testing.
—RVRI, Leningrad, U.S.S.R. (Russia), 2-3 p.m.
31.23 9,600—LGN, Bergen, Norway.
31.26 9,590—PCJ, Hilversum (Eindhoven), Holland. Wed. 11 a.m.-3 p.m., Thurs. 9 a.m.-1 p.m., 5-9 p.m., Fri. 1-3, 8 p.m., Sat. 2 a.m. Philips Radio.
—VK2ME, Sydney, Australia. Sundays, midnight to 2 a.m.; 4:30-8:30, 2-4 p.m.
31.30 9,580—W3XAU, Byberry, Pa., relays WCAU daily.
—VPD, Suva, Fiji Islands.
31.33 9,570—W1XAZ, Springfield, Mass. (WBZ). 6 a.m.-10 p.m. daily. Westinghouse Elec. & Mfg. Co.
—SR1, Poznan, Poland. Tues. 1:45-4:45 p.m., Thurs. 1:30-8 p.m.
31.36 9,560—....Konigswusterhausen, Germany. 10 to 11 a.m., 11:30 a.m. to 2:30 p.m., and 3 to 7:30 or 8:30 p.m. Relays Berlin.
—NAA, Arlington, Va.
—ZL2XX, Wellington, New Zealand.
31.48 9,530—W2XAF, Schenectady, New York. 5-11 p.m.
—W9XA, Denver, Colorado. Relays KOA.
—....Helsingfors, Finland.
—W10XAI, S.S. "Malolo," Nat. Broadcasting Co.
31.49 9,520—OXY, Skamleboek, Denmark. 1 p.m. daily. Relays Copenhagen. Sunday 2-3. (Medical ship telephone service, also from Thorshavn, Faroe Islands, and Julianehaab, Greenland.
31.56 9,500—VK3ME, Melbourne, Australia. Wed. and Sat. 5-7:30 a.m. Amalgamated Wireless, 47 York St., Sydney, Australia.
31.70 9,460—...Radio Club of Buenos Aires, Argentina.
31.75 9,450—....Rio de Janeiro, Brazil. 5:30-7:30 p.m.
32.00 9,375—EH9OC, Berne, Switzerland. 3-5:30 p.m.
—OZ7MK, Copenhagen, Denmark. Irregular after 7 p.m.
32.00 9,375—3UZ, Melbourne, Australia.
—W8XAO, Detroit, Mich.
—TGX, Guatemala City, Guatemala. 10 p.m.-midnight.

(Continued on opposite page)

Short-Wave Stations — When to Listen

(Continued from opposite page)

Meters Kilo-cycles

32.06 9,350—**CM2MK**, Havana, Cuba.
32.13 9,330—**CGA**, Drummondville, Canada.
32.21 9,310—**GBC**, Rugby, England. Sundays, 2:30-5 p.m.
32.26 9,290—....Rabat, Morocco. 3-5 p.m. Sunday, and irregularly weekdays.
32.40 9,250—**GBK**, Bodmin, England.
32.50 9,230—**FL**, Paris, France (Eiffel Tower). Time signals 4:56 a.m. and 4:56 p.m.
—**VK2BL**, Sydney, Australia.
32.59 9,200—**GBS**, Rugby, England. Transatlantic phone.
32.80 9,110—**SUS**, Cairo, Egypt.
32.85 9,100—**HB9OC**, Zurich, Switzerland.
33.00 9,091—**XFD**, Mexico City, Mex.
33.26 9,010—**GBS**, Rugby, England.
33.81 8,872—**NPO**, Cavite (Manila), Philippine Islands. Time signals 9:55-10 p.m.
—**NAA**, Arlington, Va. Time signals 9:57-10 p.m., 2:57-3 p.m.
33.95 8,830—**Ship Phones.**
33.98 8,810—**WSBN**, S.S. "Leviathan."
34.00 8,820—**VK3UZ**, Melbourne, Australia. Mon., Thu., 8:00-8:30 a.m.; Mon., 11-11:30 p.m.
34.50 8,690—**W2XAC**, Schenectady, New York.
—**ZPZ**, Asuncion, Paraguay.
34.68 8,650—**W2XCU**, Ampere, N. J.
—**W9XL**, Chicago.
34.68 8,650—**W3XE**, Baltimore, Md. 12:15-1:15 p.m., 10:15-11:15 p.m.
—**W2XV**, Long Island City, N. Y.
—**W8XAG**, Dayton, Ohio.
—**W6XN**, Oakland.
—**W4XG**, Miami, Fla.
—**W3XX**, Washington, D. C.
—And other experimental stations.
34.74 8,630—**WOO**, Deal, N. J.
—**W2XDO**, Ocean Gate, N. J.
35.00 8,570—**RB15**, Khabarovsk, Siberia. 5-7:30 a.m.
—**HC2JM**, Guayaquil, Ecuador.
35.02 8,550—**WOO**, Ocean Gate, N. J.
35.50 8,450—**PRAG**, Porto Alegre, Brazil. 8:30-9:00 a.m.
35.70 8,400—**VBS**, Glace Bay, N. S., Canada.
35.80 8,380—....Cottano, Italy. Telephone to ships.
36.00 8,330—**3KAA**, Leningrad, Russia. 2-6 a.m., Mon., Tues., Thurs., Fri.
36.74 8,160—....Mombasa, East Africa.
36.92 8,120—**PLW**, Bandoeng, Java.
37.02 8,100—**EATH**, Vienna, Austria. Mon. and Thurs., 5:30 to 7 p.m.
—**JIAA**, Tokyo, Japan. Tests 5-8 a.m.
37.43 8,015—**Airplanes.**
37.65 7,980—**VK2ME**, Sydney, Australia.
37.80 7,930—**DOA**, Doeberitz, Germany. 1 to 3 p.m. Reichpostzentralamt, Berlin.
38.00 7,890—**VPD**, Suva, Fiji Islands.
—**JIAA**, Tokio, Japan (Testing).
38.14 7,860—**CMS**, Camaguey, Cuba.
38.30 7,830—**PDV**, Kootwijk, Holland, after 9 a.m.
38.60 7,770—**FTF**, Ste. Assise, France.
—**PCK**, Kootwijk, Holland. 9 a.m. to 7 p.m.
39.15 7,660—**FTL**, Ste. Assise.
39.40 7,610—**HKF**, Bogota, Colombia. 6-10 p.m.
39.58 7,560—**XGO**, Shanghai, China.
39.74 7,520—**CGE**, Calgary, Canada. Testing, Tues., Thu.
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.
—**ZTD**, Durban, So. Africa.
40.70 7,370—**X26A**, Nuevo Laredo, Mexico. 9-10 a.m.; 11 a.m.-noon; 1-2; 4-5; 7-8 p.m. Tests after midnight. I.S.W.C. programs 11 p.m. Wed. A.P. 31.
40.90 7,320—**ZTJ**, Johannesburg, So. Africa. 9:30-a.m.-2:30 p.m.
41.00 7,310—....Paris, France ("Radio Vitus") Tests.
—....Moscow, USSR. 7-7:45 a.m.
—**HSP2**, Bangkok, Siam. 8-11 a.m. Mondays.
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., Thur., Sat. Budapest Technical School. M.R.C., Budapest, Müegyetem.
41.58 7,210—**EAR58**, Canary Islands (Spain). 7-9 p.m.
41.67 7,195—**VSIAB**, Singapore, S. S. Mo., Wed. and Fri., 9:30-11 a.m.
42.00 7,140—**HKX**, Bogota, Colombia.
42.12 7,120—**OZ7RL**, Copenhagen, Denmark. Irregular. Around 7 p.m.
42.50 7,060—....Liakov Islands (north of Siberia).
—**XFA**, Mexico City, Mex.
42.70 7,020—**EAR125**, Madrid, Spain. 6-7 p.m.
42.90 6,990—**CTIAA**, Lisbon, Portugal. Fridays, 5-7 p.m.
43.00 6,980—**EAR110**, Madrid, Spain. Tues. and Sat., 5:30 to 7 p.m.; Fri., 7 to 8 p.m.
—....Binche, Belgium. 2-4 p.m.
43.50 6,900—**IMA**, Rome, Italy. Sun., noon to 2:30 p.m.
43.60 6,875—**F8MC**, Casablanca, Morocco. Sun., Tues., Wed., Sat.
—**D4AFF**, Coethen, Germany. Sundays, 4-6 a.m.; Tuesdays, Fridays, noon to 2 p.m.; Thursdays, 4-6 p.m.
43.70 6,860—**KEL**, Rolinas, Calif.
—Radio Vitus, Paris, France. 4-11 a.m., 3 p.m.
43.80 6,840—**CFA**, Drummondville, Canada.
44.40 6,753—**WND**, Deal, N. J.
—**XFD**, Mexico City, Mex.
44.90 6,675—**TGW**, Guatemala City, Guatemala. 9-11:30 p.m.
44.99 6,660—**F8KR**, Constantine, Algeria. Mo., Fri., 5 p.m.
—**HKM**, Bogota, Colombia. 9-11 p.m.
45.00 6,600—....Berlin, Germany.
45.50 6,560—**RFN**, Moscow, U.S.S.R. (Russia). 8 a.m.-4 p.m.
46.05 6,515—**WOO**, Deal, N. J.
—**W4XG**, Miami, Fla.
46.40 6,480—**TGW**, Guatemala City, Guat. 9-11 p.m.

46.60 6,430—**REN**, Moscow, U.S.S.R. Tues., Thurs. and Sat., 6-7 a.m.
46.70 6,425—**W2XCU**, Ampere, N. J.
—**W9XL**, Anoka, Minn.
46.70 6,425—**W3XL**, Bound Brook, N. J. Relays WJZ. Fri., 5-6:15 p.m.; 11 p.m.-1 a.m.; Sat., 1:30-6:15 p.m.; 11 p.m.-1 a.m.
47.00 6,380—**HCIDR**, Quito, Ecuador. 8-11 p.m.
—**XIF**, Mexico City, Mex. 7-9 p.m.; 11 p.m.-1 a.m.
47.35 6,335—**W10XZ**, Airplane Television.
—**VE9AP**, Drummondville, Canada.
—**CN8MC**, Casablanca, Morocco. Mon. 3-4 p.m., Tues. 7-8 a.m., 3-4 p.m. Relays Rabat.
47.77 6,280—....Strasbourg, France (?)
—**WWV**, Bureau of Standards, Washington, D. C. Tuesdays, 2-4, 10-12 p.m. Standard Frequency Code.
47.81 6,270—**HKC**, Bogota, Colombia. 8:30-11:30 p.m.
48.00 6,250—**HKA**, Barranquilla, Colombia. 8-10 p.m. ex. Mo., Wed., Fri.
48.62 6,170—**HRB**, Tegucigalpa, Honduras. 5-6, 9-12 p.m., Mon., Wed., Fri., Sat. Int. S. W. Club program. Sat., 11:30-12 p.m.
—**XIF**, Mexico City, Mex.
48.74 6,155—**W9XAL**, Chicago, Ill. (WMAC), and Airplanes.
—**VE9CL**, Winnipeg, Canada. 5:30-11 p.m.
—**W2XDE**, Bell Telephone Laboratories, New York.
48.83 6,140—**W8XK**, East Pittsburgh, Pa. Tues., Thurs., Sat., Sun., 5 p.m. to midnight.
48.99 6,120—....Motala, Sweden, "Rundradio." 6:30-7 a.m., 11-4:30 p.m. Holidays, 5 a.m. to 5 p.m.
—**F3ICD**, Chi-Hoa (Saigon), Indo-China. 6:30-10 a.m.
—....Moscow, U.S.S.R., 4-5 p.m.
—**W2XE**, New York City. Relays WABC.
—**FL**, Eiffel Tower, Paris. 5:30-5:45 a.m., 5:45-12:30, 4:15-4:45 p.m.
—....Toulouse, France. Sunday 2:30-4 p.m.
—**EAR25**, Barcelona, Spain. 3-4 p.m.
49.10 6,110—**VE9CG**, Calgary, Alta., Canada.
49.15 6,100—**W3XAL**, Bound Brook, N. J.
—**VE9CF**, Halifax, N. S., Canada. 6-10 p.m., Tu., Thu., Fri.
49.17 6,095—**VE9GW**, Bowmanville, Ontario, Canada.
49.26 6,090—....Copenhagen, Denmark.
49.31 6,080—**W2XCX**, Newark, N. J. Relays WOR.
—**W9XAA**, Chicago, Ill. (WCFL). 6-7 a.m., 7-8 p.m., 9:30-10:15, 11-12 p.m. Int. S.-W. Club programs. From 10 p.m. Saturday to 6 a.m. Sunday.
—**W6XAL**, Westminster, Calif.
49.40 6,070—**VE9CS**, Vancouver, B. C., Canada. Fridays before 1:30 a.m. Sundays, 2 and 10:30 p.m.
—....Johannesburg, So. Africa, 10:30 a.m.-3:30 p.m.
49.46 6,065—**SAJ**, Motala, Sweden. 6:30-7 a.m., 11 a.m. to 1:30 p.m.
49.50 6,060—**W8XAL**, Cincinnati, Ohio. Relays WLW. 6:30-10 a.m., 1-3 p.m., 6 p.m. to 2 a.m., daily. Sunday after 1 p.m.
—**ONVA**, Brussels, Belgium.
—**7LD**, Nairobi, Kenya, Africa. Mon., Wed., Fri., 10 a.m. to 1:30 p.m. From 10:30 Tuesday, Thursday, Sunday.
—**W3XAU**, Byberry, Pa. Relays WCAU.
49.59 6,050—**VE9CF**, Halifax, N. S., Canada. 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—**W9XAQ**, Chicago, Ill. (WMAQ).
—**W2XAL**, New York.
—**PK3AN**, Sourabaya, Java. 6-9 a.m.
—**VK2ZW**, Wellington, N. Z. Nimmo & Sons, 89 Willis St.
49.75 6,030—**VE9CA**, Calgary, Alta., Canada.
49.80 6,020—**W9XF**, Chicago, Ill.
—**W2XBR**, New York, N. Y. (WBNY).
—**W10XAI**, S.S. "Malolo".
49.97 6,000—**ZL3ZC**, Christchurch, New Zealand. 10 p.m. to midnight, Tuesdays, Thursdays and Fridays.
—**HRB**, Tegucigalpa, Honduras. 9:15 p.m. to midnight. Mon., Wed., Fri. From 11 p.m. to midnight, Sat. Int. S. W. Club programs.
—**EAJ25**, Barcelona, Spain. Sat., 3-4 p.m.
—**REN**, Moscow, Russia. 10 a.m.-5 p.m. English on Su., Mo., Thur.
—**YV2BC**, Caracas, Venezuela. 7:45-11 p.m. daily ex. Monday.
—**Eiffel Tower**, Paris, France. Testing, 6:30 to 6:45 a.m., 1:15 to 1:30, 5:15 to 5:45 p.m., around this wave.
—**PK2AF**, Djokjakarta, Java.
—**VE9CU**, Calgary, Canada.
—....Bucharest, Rumania.
49.97 6,000—....Tananarive, Madagascar. Noon to 2 p.m.; 1 to 5 p.m., Sat.
50.10 5,985—....Eindhoven, Holland.
50.23 5,970—**HVJ**, Vatican City (Rome). 1-1:30 p.m. Sundays and holidays, 4-5 a.m.

50.80 5,900—**HKE**, Medellin, Colombia, 8-11 p.m.
51.22 5,860—**XDA**, Mexico City. 10-11 p.m.
51.40 5,835—**HKD**, Barranquilla, Colombia. 7:45-10:30 p.m. Mon., Wed., Sat.; 2-4, 7:45-8:30 p.m. Sunday. Elias J. Pellet.
52.00 5,770—**AFL**, Bergedorf, Germany.
—**HIX**, Santo Domingo, R. D. 9 a.m. Sundays.
52.50 5,710—**VE9CL**, Winnipeg, Canada.
52.72-54.44 5,600-5,510—**Aircraft.**
54.02 5,550—**W8XJ**, Columbus, Ohio.
54.51 5,500—**W2XBH**, Brooklyn, New York City (WBBC, WCGU).
58.00 5,170—**OKIMPT**, Prague, Czechoslovakia. 1-3:30 p.m., Tues. and Fri.
—**PMY**, Bandoeng, Java.
—**PMB**, Sourabaya, Java.
59.96 5,000—....Bratislava, Czechoslovakia.
—....Kuala Lampur, Straits Settlements.
60.26 4,975—**GBC**, Rugby, England.
60.30 4,975—**W2XAV**, Long Island City, N. Y.
60.90 4,920—**LL**, Paris, France.
61.22-62.50 4,800-4,900—**Television.**
—**W8XK**, Pittsburgh, Pa.
—**W1XAY**, Lexington, Mass.
—**W2XBU**, Beacon, N. Y.
—**WENR**, Chicago, Ill.
62.50 4,800—**W2XV**, Long Island City, N. Y.
62.56 4,795—**W9XAM**, Elgin, Ill. (Time signals.)
—**W3XZ**, Washington, D. C.
—**WSXDD**, portable. Bell Telephone Laboratories, New York.
—**W9XL**, Chicago, Ill.
62.69 4,785—**Aircraft.**
—And other experimental stations.
—**VZA**, Drummondville, Canada.
62.80 4,770—**ZL2XX**, Wellington, New Zealand.
63.00 4,760—**Radio LL**, Paris, France.
63.13 4,750—**WOD**, Ocean Gate, N. J.
63.79 4,700—**W1XAB**, Portland, Me.
65.00 4,610—**HIX**, Santo Domingo, R. D.
65.22-66.67 4,500-4,600—**Television.**
—**W6XC**, Los Angeles, Calif.
67.65 4,430—**DOA**, Doeberitz, Germany. 6-7 p.m., 2-3 p.m., Mon., Wed., Fri.
70.00 4,280—**OHK2**, Vienna, Austria. Sundays, first 15 minutes of hour from 1 to 7 p.m.
—**HC2JM**, Guayaquil, Ecuador.
70.20 4,273—**RB15**, Khabarovsk, Siberia. 4-7 a.m.
—**GDLJ**, S.S. "Homeric."
71.77-72.98 4,180-4,100—**Aircraft.**
71.82 4,175—**Ship Phones.**
72.87 4,116—**WOO**, Deal, N. J.
74.72 4,105—**NAA**, Arlington, Va. Time signals, 9:57-10 p.m., 11:57 a.m. to noon.
—**PKIAA**, Weltevraden, Java.
80.00 3,750—**F8KR**, Constantine, Tunis, Africa. Mon. and Fri.
—**I3RO** (Prato Smeraldo), Rome, Italy.
—....Turin, Italy.
—**VK2TW**, Sydney, Australia, 7:30-8:30 a.m. Wed.
82.90 3,620—**DOA**, Doeberitz, Germany. (Television.)
83.73 3,583—**G2NM**, Sonning-on-Thames, England. 5 a.m. Sunday.
84.24 3,560—**OZ7RL**, Copenhagen, Denmark. Tues. and Fri., after 6 p.m.
84.46-85.66 3,550-3,500—**Amateur Telephony.**
86.50-86.00 3,490-3,460—**Aircraft.**
92.50 3,256—**W9XL**, Chicago, Ill.
—**W2XDD**, portable.
—And other experimental stations.
92.5-94.9 3,241-3,160—**KFR, WJE**, City of Seattle, Wash., Light Dept.
94.20 3,184—**KQS, KQT**, City of Los Angeles, Calif., Water Dept.
95.00 3,156—**PK2AG**, Samarang, Java.
95.48-97.71 3,142-3,070—**Aircraft.**
96.03 3,124—**WOO**, Deal, N. J.
97.15 3,088—**W10XZ**, Airplane Television.
97.53 3,076—**W9XL**, Chicago, Ill.
98.95 3,030—....Motala, Sweden. 11:30 a.m.-noon, 4-10 p.m.
—**VE9AR**, Saskatoon, Sask., Canada.
101.7 to 105.3 meters—2,850 to 2,950 kc. **Television.**
—**W1XAV**, Boston, Mass. 1-2, 7:30 to 10:30 p.m. daily ex. Sun. Works with W1XAU 10-11 p.m. Shortwave & Television Corp.
—**W2XR**, Long Island City, N. Y. 4 to 10 p.m. exc. Sundays. Silent 7-7:30 Sat. Radio Pictures, Inc.
—**W9XR**, Chicago, Ill.
—**VE9AR**, Saskatoon, Sask., Canada.
104.4 2,870—....Milan, Italy. After 2 p.m.
105.0 2,855—**W1XY**, Tilton, N. H.
105.9 2,833—**W6XAN**, Los Angeles, Calif.
—**W7XAB**, Spokane, Wash.
—**W2XAO**, Yacht "MU-1," New York.
—**VE9AK**, Red Deer, Alberta, Canada.
105.3 to 109.1 meters—2,750 to 2,850 kc. **Television.**
—**W2XAB**, New York City. Columbia Broadcasting System. 2-6, 8-11 p.m. On Sat. and Sunday to 10 p.m. Works with W2XE on 48.99 meters.
—**W2XBO**, Long Island City, N. Y.
—**W9XAA**, Chicago, Ill.
—**W9XG**, West Lafayette, Ind.
—**VE9BZ**, Vancouver, B. C., Canada.
108.8 2,758—**VE9CI**, London, Ont., Canada.
110.2 2,725—**Aircraft.**
112.1 2,938—**W6XAF**, Sacramento, Calif. State Dept. of Agriculture.
121.5 2,470—**Police and Fire Departments.**
—**KGOZ**, Cedar Rapids, Ia. — **WRDQ**, Toledo, Ohio.
122.0 2,458—**WPDG**, Youngstown, Ohio.
122.3 2,452—**WRBH**, Cleveland, O. — **KGPP**, Portland, Ore.
—**WPDK**, Milwaukee, Wis. — **KGPH**, Oklahoma City, Okla.
123.0 2,440—**WPDF**, Flint, Mich. — **WNDA**, Miami, Fla. — **WPDP**, Philadelphia, Pa. Lansing, Mich.
—**W3XB**, Portable.
123.9 2,422—**WMJ**, Buffalo, N. Y. — **KGPE**, Kansas City, Mo. (Mo. State).

(Continued on page 300)

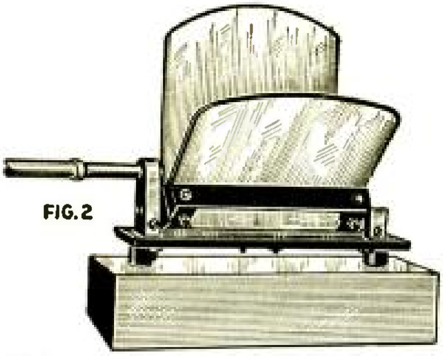
"HAMS" PLEASE NOTE

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

ULTRA SHORT WAVE CONDENSERS

By DR. KARL STOYE

FIG. 2



This variable condenser was made from a honeycomb coil coupler and brass plates of desired size.

THE condensers described here have stood the test, both with transmitters and with receivers. The German short-wave amateur is compelled to make serviceable parts with slight means. Often one can put old parts together to make a new unit. A source of all kinds of serviceable parts is provided, for instance, by dismantled electric meters. Likewise, in the condenser shown in Fig. 1, the side-piece came from a meter.

The condenser consists of two brass cylinders with a sheet thickness of .04-inch and a length of 2 inches. The upper cylinder (Fig. 3) has an outer diameter of 0.8-inch and an inner one of 0.72-inch. At both ends are put in threaded pieces .24-inch thick. The lower cylinder has an outer diameter of 1 inch and an inner one of 0.90-inch. The brass axle (with a thread) has a diameter of 0.2-inch and a length of 4.8 inches. It is fastened on an insulating plate 0.16-inch thick, by two hollow screws. The fastening must be secure, so that the inner cylinder will not strike the other in its rotation. Likewise the cylinder must, of course, so move up and down on the axle without wobbling; *i.e.*, the thread must be cut very accurately. The connection of the condenser with the other parts of the apparatus is made, on the one hand, through the side-piece, by means of which also the outer cylinder is screwed tightly to the plate; and on the other hand, by passing the axle through the plate and connecting it to the screw visible in Fig. 1. The up and down motion of the middle cylinder can be arranged in various ways; the author used a sort of hard-rubber fork for turning this cylinder.

The second condenser (Fig. 2) was produced from a honeycomb coil coupler with friction-hinge adjustment. Only the movable part is used; it was cut through in the middle. Two holes were bored through each part, in order to hold the movable plate tightly. The movable plate can be given different dimensions, according to conditions (3-, 5-, 8-meters wavelength). The writer used the following plate dimensions: movable, 3.2 inches high, 2.8 inches wide; fixed, 3.48 inches high, 2.8 inches wide. Fig. 4 shows the condenser as seen from the front. The plates consist of sheet aluminum 60 mils thick.—*Funk Bastler.*

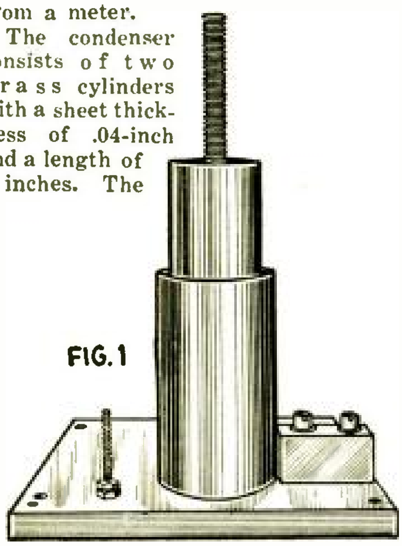


FIG. 1

The short-wave condenser at Fig. 1 was made from parts of an electric meter.

Fig. 3 illustrates section of variable condenser shown in Fig. 1; the upper cylinder moves up and down on a threaded rod.

Fig. 4 shows hinged type variable condenser.

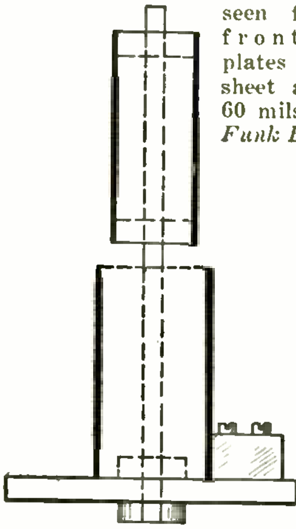


FIG. 3

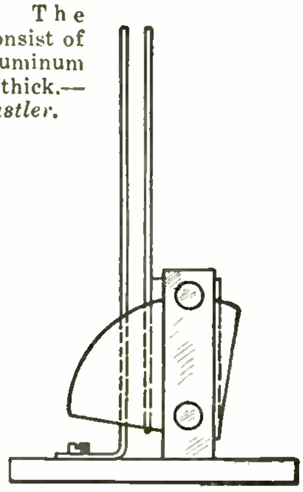


FIG. 4

Marvellous Reception by Coupling 2 Supers

By BURT H. TAYLOR, W1KB

(*Continued from page 261*)

phones on 20 and 80 meter bands from California with the volume of "locals" on the ordinary short wave receiver; also amateur phone signals from various other countries.

Now, to get back to code, all that is necessary to do is to pull the cord out of the second-detector socket and replace the tube and the grid leak, then put on the phones. The "HY-7" is coupled to the phones through one stage of audio.

Regarding this arrangement (using a local oscillator on the Graybar) I demonstrated to engineers of the Haverhill Electric Company by moving the Graybar to the other side of the room (where it was connected to another antenna) and then, with cord plugged to the second-detector socket of the "HY-7" and thrown up over the desk, I actually rebroadcast "Radio Roma" across the room to the Graybar with no connection, and still had good house volume.

The accompanying diagram of the second detector socket of the "HY-7" shows how it is connected to the Graybar Superhet (or any receiver); making an automatic short-wave and regular-band receiver, and still being the "Rolls Royce" as a *code* receiver.

The Grid Leak shown is to be removed from clips when using the combination; or, as an alternative, the test cord is plugged into the plate connection of the same socket and connected to the Graybar's antenna post through a small fixed condenser. This probably gives a little more wallop, but I used the arrangement as shown the past year.

Now, as stated before, the "HY-7" I.F. is tuned to just above 1,500 kc. to allow the Graybar to tune just off the edge of the regular broadcast band. You will note by that I have three stages of I.F. in this "HY-7" and that the detector stage is inductively instead of impedance coupled (all this was explained by Mr. Hatry in *Radio-Craft* last year, with diagrams).

With both sets switched on to receive short-wave broadcast or phone, the Graybar is dialed to just above 1,500 kc., and the short-wave tuning dial of the "HY-7" takes care of the rest, with the volume control on the Graybar. Now, to change to WEAF regular, all that is done is to reach over and turn the Graybar dial to that wave; and, ten to one, no further adjustment of volume control is necessary. With the Short-Wave dial left tuned to "Radio Roma" or any other, you can listen to WEAF on the test cord between the two sets.

Short Wave Question Box

Edited by R. William Tanner, W8AD

Push-Pull Transmitter Hook-up

Paul A. Johnson, Jamestown, N. Y., wants to know:

(Q.) A circuit of a good push-pull transmitter for use on 40 meters, using a plate voltage of 135 to 180.

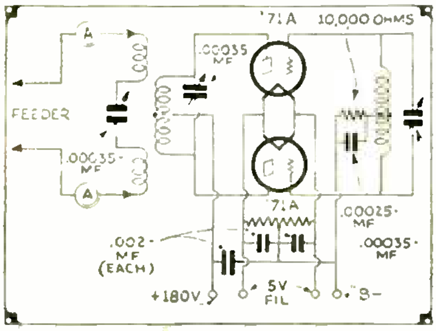


Diagram requested by Mr. Johnson, showing push-pull transmitter for use on 40 meters, using plate voltage of 135 to 180.

(A.) The circuit is given in these columns.

(Q.) What is the proper value of resistance to use across an audio transformer?

(A.) I assume that you mean the value of the resistor to shunt across the secondary, to eliminate "fringe howl." This will be somewhere between 100,000 and 250,000 ohms.

Wants Single Control Super-Het

Harold Berkman, Toledo, Ohio, wants to know:

(Q.) If it is possible to single-control the oscillator and first detector tuning condensers of a short-wave super-het?

(A.) Yes, it is easily possible to gang the condensers; but it is also necessary to shunt a vernier condenser across the first detector coil, and vary this at the same time the main dial is varied—and then, where is the single-control feature? There is none, of course.

(Q.) What size of fixed condensers to connect in *series* with each section of a two-gang .00035-mf. broadcast condenser, in order to tune the R.F. and detector stages of a short-wave receiver?

(A.) Fixed condensers of .00015-mf. capacity will be about right.

Best S.W. Converter

Jack Namaroff, Philadelphia, Pa., wants to know:

(Q.) What is the best type of converter to use with a broadcast set, to bring in short waves?

(A.) The type of converter using a screen-grid detector and '27 oscillator, utilizing the broadcast R.F. amplifiers as the I.F. amplifiers of a superhet, will afford the best sensitivity and selectivity.

Transmitter Inquiry

Orion Derick, Dennis Port, Mass., inquires:

(Q.) Regarding the "Low Cost P-P Transmitter" (P. 129 Aug.-Sept. issue)—can '10 tubes be used instead of '45's?

(A.) The '10 tubes may be employed; but this will require a power supply capable of delivering the proper filament and plate voltages.

(Q.) Can the coils be wound with solid copper wire, instead of tubing?

(A.) Yes, solid wire about the same size as the tubing can be used, with no decrease in output. Of course, for high power transmitter circuits, tubing would be far better; but, for transmitters of low power—using up to two 210 tubes—tubing is no better than solid wire, say No. 4 or 6.

(Q.) Can a Readrite ammeter be used to measure antenna current?

(A.) No, only a hot-wire or thermocouple meter may be used here.

Super-Converter

J. L. Frisman, St. Louis, Mo., asks:

(Q.) Can you give a circuit of a one-tube super converter?

(A.) When are the short-wave fans going to do as the amateurs have done, and give up using an autodyne first detector in their super converters or superhets? Such a converter can only cause needless interference, to other short-wave listeners, of a type exactly like that caused by the old single-circuit regenerative broadcast receivers of a few years ago. This is, however, not the only disadvantage. It is necessary to tune the grid circuit to a frequency differing from the signal frequency; the difference being the frequency of the I.F. amplifier. This *greatly* decreases the sensitivity. Also there are *always* two points on the dial for each station; no amount of pre-selector tuning eliminating this annoyance.

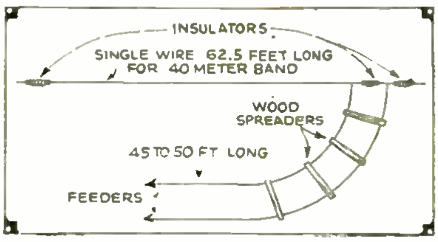
Transmitting Antenna

B. W. Ball, Houston, Texas, asks the following:

(Q.) Will you print a diagram of a suitable antenna for use with the transmitter (Page 129 Aug.-Sept. issue)?

(A.) The diagram is shown here.

(Q.) Can this transmitter be used for phone transmission?



Data for constructing a short wave transmitting antenna with "feeder" line.

(A.) Modulating an oscillator directly is very unsatisfactory, and can only be accomplished at low percentages of modulation. Frequency modulation results, if the degree of modulation is much above 15 to 20 per cent.

Power Amplifier for Receiver

Charles Leininger, Venice, Calif., writes:

(Q.) Can you print a diagram of a power amplifier to use with a short wave receiver, using a '27 push-pull stage, followed by a push-pull pentode power stage?

(A.) The circuit is given here.

(Q.) Would shielding eliminate hum, and what material should be used?

(A.) If the entire power supply is enclosed within a box made of sheet iron, hum due to induction should cause no trouble.

Circuit Query

Norton Smith, London, Ontario, Canada, asks:

(Q.) With reference to the circuit (page 23 June-July issue) what are the values of the condensers, resistors and audio transformers; and also what tubes are used?

(A.) The suggested values are as follows: .00014-mf. for the tuning and regeneration condensers; .00015-mf. for the grid condenser; and .00025 mf. for the antenna coupling condenser. The grid leak will be from 2 to 10 megohms, depending upon the characteristics of the detector tube. Using '01A tubes and a 6-volt "A" battery, the filament rheostats may be approximately 6 ohms.

Impedance and Choke Data

C. H. Bennet, Fall River, Mass., wants to know:

(Q.) What is the value of the impedance in Fig. 2 (Page 473 April-May issue)?

(A.) This may be a regular type of 30-henry filter choke.

(Q.) What is the value of the R.F. choke in Fig. 1?

(A.) The article states that this choke consists of 40 turns of bell wire. However, a single-layer choke of, say, 150 turns of No. 36 wire on a ½" form would be preferable, on account of its lower self-capacity.

Two Tube Set

O. Long, Moose Jaw, Sask., Canada, inquires:

(Q.) What are the constants of the circuit of the two-tube set (Page 56 June-July issue)?

(A.) The constants follow:

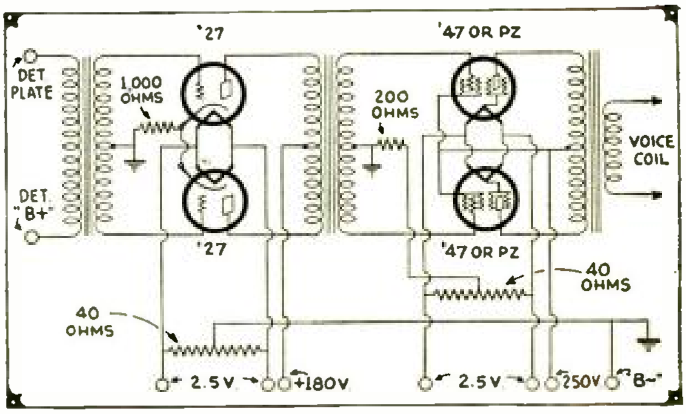
- L1, L2—any good set of plug-in coils;
- C—.00015-mf.;
- C1—.0005-mf.;
- C2—.0001-mf.;
- C4—.000025 mf.;
- C5—.00015-mf.;
- R1—2 to 10 megohms;
- R2—50,000 ohms;
- R3—0.1- to 0.25-megohm.

Coil Size

Edward Camp, San Francisco, Calif., desires the following data:

(Q.) What are the sizes of coils (Page 474 April-May issue)?

(A.) For 12 meters, the grid coil would have approximately 4 turns and the tickler about 3 or 4 turns, when wound on a tube base. The turns should be spaced slightly. Any size wire from No. 30 to No. 24 will do.



Power amplifier for short wave receiver, using a '27 push-pull stage, followed by a push-pull "pentode" power stage.

The Delft wavemeter for measuring length of transmitted or received short waves.

How to Use a Wavemeter

By A. BINNEWEG, JR.*

DID you ever look over a list of shortwave stations and then decide to see if you couldn't tune in some of the most distant (or "strange") ones? Undoubtedly you have done exactly that. You probably looked at the desired station's wavelength, then made a sort of a longing look at the dial on your receiver, and guessed where it would come in on your set. Chances are, you heard several possibilities near the place where you wanted to listen, and spent a lot of time tuning each one in and waiting for it to "sign." Well, all that is a lot of trouble and there's a way out! A wavemeter removes all of this guesswork and saves *considerable* time.

In fact, a wavemeter is an absolute necessity for every shortwave fan and experimenter. Dealers ought to use one to demonstrate their sets. It will help the fan tune in his stations and, to the experimenter, a wavemeter has numerous uses besides; such as checking receivers, getting the exact ranges that any coil you want to test will cover with a given condenser, checking the ranges that condensers cover with the same coil, testing oscillators and transmitters. Why, there is really no end to the uses of a wavemeter! No radio station or experimenter's laboratory is complete without one. Certainly, a wavemeter is much more essential than many of the useless "gadgets" one finds around the usual shortwave receivers. A popular, inexpensive wavemeter is shown in the photo herewith.

WHAT IS A WAVEMETER?

In its simplest form, a wavemeter is an accurate, calibrated tuned circuit. To use one, couple it closely to the secondary coil (tuned circuit) of the detector; be sure that the detector tube is oscillating. And be sure that the detector coil is being coupled to; it would be of no use to couple a wavemeter to a coil in the R.F. amplifier stages, because the sensitive condition does not obtain there. The detector tube should be just barely oscillating for best results. But be sure it *is* oscillating!

Be careful to use the proper plug-in coil, so that the wavemeter will tune to the wavelength that the receiver is tuned to. When thus coupled, and the dial of the wavemeter is varied, the detector tube will stop oscillating when the wavemeter-dial is tuned past the wavelength to which the receiver is tuned. By varying the coupling between receiver and wavemeter, a very sensitive condition is soon found which yields very accurate results.

As soon as the point at which the wavemeter causes a click in the receiver (as heard in the headphones or loudspeaker) is found, the dial of the wavemeter is read and the wavelength to which the receiver is tuned is thus accurately found.

If an accurate wavemeter is desired, such as is necessary for general short wave tuning and test work, it must be calibrated from accurate standards. To design one of these instruments to cover the range of 14 to 250 meters, with the required overlap between coils, and such that the calibration remains constant, is a problem for shortwave specialists with the required laboratory apparatus. Careful shielding is also necessary to prevent hand-capacity effects.

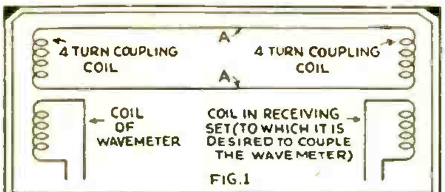


FIG. 1

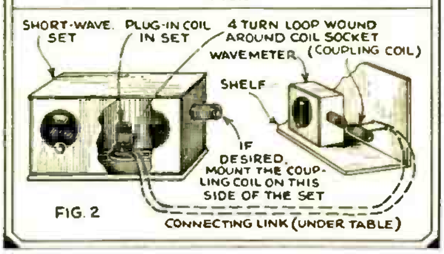


FIG. 2

How wavemeter can be coupled to receiver by "link" circuit.

INTERESTING TESTS WITH A WAVEMETER

Suppose you wanted to locate a certain receiver dial-setting so that you could hear a certain station when it came on. First look up the wavelength of the desired station in SHORT WAVE CRAFT. Next select the particular coil which, when plugged into the wavemeter, will allow the wavemeter to tune to this wavelength. Then set the dial of the wavemeter to that wavelength. Bring the wavemeter close to the secondary of the receiver and vary the receiver dial until you get the familiar click. When obtained, your receiver is tuned exactly to the proper wavelength and the desired station is then heard at once. It sounds long, perhaps, but it's all very easy, especially when you have a good wavemeter to start with and all the necessary instructions.

SPECIAL WAVEMETER CONNECTIONS

There are certain special cases where it is difficult to couple the coil of the wavemeter to the secondary (detector) coil in the set. The reason is that no plug-in coils are used in the short-wave receiver, making it unnecessary to have the coils readily accessible. Some sort of a switch is used in these sets, instead of loose plug-in coils. In cases like this, the idea shown in Fig. 1 can be used. This consists of two small coils of about 4 turns each and a pair of wires serving as a connecting link. The connecting link is simply a closed loop with two 4-turn coils at each end of the line; each of these small coils is coupled to the desired coil in the usual way.

In this way, a wavemeter can be used with any set, no matter how far away the set is, if the leads A-A shown in Fig. 1 are made of sufficient length; the exact length makes no difference. The leads A-A can even be twisted together if desired, although results are a little better when they are kept apart about one-half inch. The line may be permanently installed, and the coil, which is coupled to the wavemeter, located at some convenient point near and outside of the set itself.

It is suggested that the small coupling-coil in the set be wound round the socket into which the set's plug-in coils are plugged, or coupled to the coils in some convenient way. One of the coupling coils can be wound on a tube-base if desired. Use about No. 18 wire for the coils and about No. 20 wire or so for the coupling line or connecting link. Couple one of the coils to the secondary of the set (just as you would couple the wavemeter coil itself) and couple the other coil to the wavemeter coil as shown in Fig. 1. The proper selection of coupling between wavemeter and coil to which it is coupled, will give the necessary fine adjustments.

The installation of one of these connecting links in a shortwave set is show in Fig. 2. Of course, the coils used in the coupling link need never be changed, as they are of the correct dimensions for any wavelengths. The line with its coils remains permanently installed. It is better to use too-close coupling between the coil in the line, and the one in the set, than too loose; although the exact value to use is not at all critical.

* Engineer, Delft Radio.

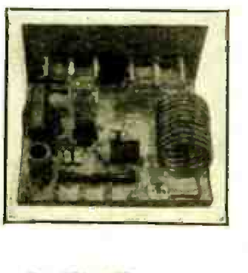
New S-W Transmitters and Receivers

DELFT Radio has placed an entirely new and modern line of short-wave receivers and transmitters on the market for their large winter business. These sets include all modern features.

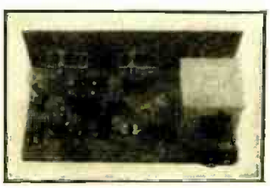
The receiving sets are designed for maximum distance at the lowest possible first cost. The new pentode tubes, costing little more than ordinary tubes, give results equal to two ordinary tubes and thus give loudspeaker volume where other sets, with the same number of tubes, give only results loud enough for headphones.

The Receiver Kits include a coil winder which makes the latest low-loss coils. In addition, each kit employs a pentode tube, which itself gives the amplification of two tubes. All in all, the loud volume obtained from these new kits is really surprising. In addition, the Kits are specially designed so that Television signals can be picked up. The reader is perhaps familiar with the fact that ordinary receivers cannot be used for television. Therefore, these kits can not only receive everything that goes on at short waves, but also television broadcasts as well.

The new Transmitter Kits are especially worthy of note. These kits include absolutely all transmitting parts so that any combination of tubes and batteries can be used up to and including 2, Type '45 or often 2, Type '10 tubes in parallel. No new parts need be purchased when larger power is used, because they will stand the higher voltage. Instructions are furnished so that AC tubes can be used, so no batteries at all are necessary if you are near, or have access to, light lines. The sets are for either AC or DC operation and will operate with batteries, "B" eliminators, power packs or any home-made power supplies you may make or purchase later. They are designed to operate in any short-wave band at high power if desired. Best of all, *no license is required* to experiment with one of these sets, so long as you do not connect a transmitting aerial to it. Thus, you can learn to adjust and operate these sets, and be prepared to pass the examination. Of course, these sets can be used on the air by even the *most experienced of amateurs* as well, as they are very pleasing to the eye. You can now have international communication by either code or voice for a very low price indeed!



Above: New Delft S.W. transmitter kit assembled.



Right: Delft short wave receiver kit assembled.

The total amplification of the receiver need not be used for the majority of long-distance reception, and for that reason there are two regulations for power; allowing the use of low amplification for the nearby more powerful stations. In fact, a range up to 2,000 miles in the broadcast band can be brought in with very good volume on low power, and only when extreme distance or short-wave reception is desired need the high power position be used.

How to Use Volume Control

Never advance the volume control past the point of stability. Tremendous amplification is available before oscillation will occur. The strength of the incoming signal is directly proportional to the amount of amplification required; and when a signal is so weak, due to atmospheric conditions, that same cannot be heard with a reasonable amount of amplification being used, nothing can be gained by advancing the volume control further.

Selecting Wave Bands By Switch

The range of the Lincoln De Luxe "32" equipment is from 15-550 meters. This range is divided into five groups to be selected by switch at left side of control panel and the range is divided as follows:

15— 30 meters 30— 50 meters
50—100 meters 100—200 meters
200—550 meters.

Each group will register from 0 to 100

The Lincoln All-Wave Super-Het

By H. WINFIELD SECOR.

(*Continued from page* 251)

on the dial. For instance, in the 15—30 meter band the 15 meters will register at low end of dial and the 30 meters at upper end of dial, and likewise throughout all of the group. The De Luxe "10" and "32" models tune very sharp and dial must be accurately set in resonance with the station as it is very easy to

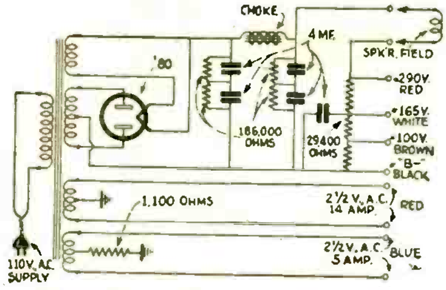


Diagram of Lincoln power supply.

pass over a short-wave station, especially in the higher frequencies. Also, it is very essential that the left-hand antenna trimming knob should be kept in resonance to bring in the signals.

Now assume that you wish to tune in G5SW (Chelmsford, England); from your log book you note that this station uses a wavelength of 25.53 meters which falls in the 15-30 meter group. So merely turn the selector switch to the 15-30 meter position; turn your dial to about 65; bring the antenna trimmer to resonance; and tune slowly both sides of this position until G5SW is located. When W8XK is broadcasting on 25.25 meters, G5SW can be quickly located about one dial division above them.

The above procedure is followed for all short-wave reception. Stations in the 31-meter band are found on the lower portion of the dial when selector switch is set on the 30-50 meter position. The 49-meter band stations will then be found around 70 on the dial. The 85-meter band will be found near 60, with switch in the 50-100 meter position. One group of police calls will be found near 30 and another group near 70, with switch in the 100-200 meter position.

Tuning In the Broadcast Range

In placing the selector switch in position from 200-550 meters, you can tune the complete broadcast range; 200 meters coming in around the neighborhood of 5 on the dial. Where there is only one station to a channel, this station can be brought in if signal is available. Where more than one station is operating on the channel at the same time, a heterodyne will be found which is beyond the power of any receiver to separate. Many such channels will be found in the low- or wavelengths in the broadcast band, where from two to ten stations are allowed to operate at the same time.

This switch should always be in "*radio*" position when radio is used. When phonograph pick-up is used, place switch in *phono* position and turn volume control to point just above the position where switch shuts off.

The oscillator coil assembly is composed of four short-wave oscillator coils, and one broadcast oscillator coil, with the ranges mentioned in the previous data. Each oscillator coil acts independently and is selected by a special selector switch; the switch being of the double-wiper type, with a rotor not common to the shaft.

A 2-Tube Receiver—12,500 Mile Range

By WALTER C. DOERLE

(*Continued from page 258*)

doubtedly call for home-made plug-in coils, because of their convenience, we follow up our diagram with a discussion of this type of coil for the oscillating circuit. To hold the wire in place on the tube-base, the author has found orange shellac to have small loss, and it gives a shiny finish to the form. As to the condensers for use in this receiver, select those that have the smallest amount of dielectric in supporting the stator plates.

Have you ever experimented with various values of grid condensers and leaks in the detector circuit? Well, get about twelve leaks (½ to 10 megs), and twelve different sizes of grid condensers (.006- to .0001-mf.), but first of all figure out the possible number of combinations.

Use a 5-megohm leak and .0001-mf. grid-condenser. These values will make the receiver very sensitive.

Now, in our discussion we are near the audio-frequency transformer and our eyes immediately behold an R.F. choke. Gee, what a mean thing for the temper; but, at any rate, 300 turns of No. 36 D.S.C., magnet wire, close-wound on a ½" wooden dowel, will choke the R.F. current out of the transformer primary, even at 20 meters.

As to the audio transformer, we can't boast for any type; but a good 5 to 1 ratio and a hefty type, will be good.

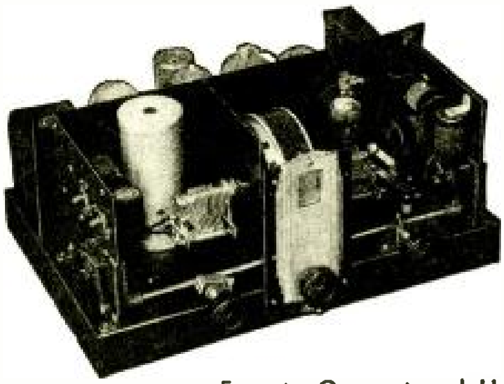
The following is a list of parts for the set proper:

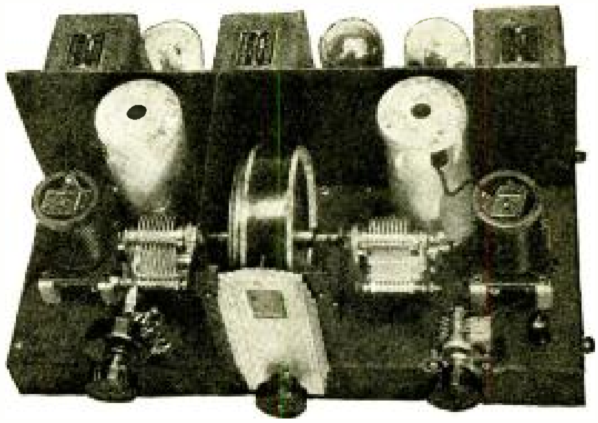
1—Bakelite panel 7"x10";
1—Baseboard 9x11";
3—UX Sockets;
1—Tuning Condenser .00014-mf.
1—Throttle Condenser .00025-mf.;
2—Condenser Plates 1½" square;
7—Terminal Post-strip;
7—Binding Posts;
5—Megohm Grid-leak;
1—.0001-mf. Grid Condenser;
1—5:1 Transformer;
2—Telephone Binding Posts;
2—3" Dials;
1—20-Ohm Rheostat;
Hook-up wire, screws, etc.

COIL DATA

Range (meters)	Turns S	Turns T
15-45	5	6
35-75	9	5
60-125	16	6

All coils are close-wound with No. 24 enamelled copper wire, and with no spacing between S and T.





Locating Ore Deposits By Ultra Short Waves

By A. BINNEWEG, JR.

(*Continued from page* 255)

transmissions of any nature whatsoever! It is readily seen, therefore, that ¾-meter operation results in greater portability of the apparatus and more satisfactory licensing conditions.

Construction of ¾-Meter Apparatus

There are a number of precautions which must be taken in the construction of apparatus for operation below one meter. It is not difficult to make most tubes operate at 1.5 meters, or so, but the operation of a ¾-meter oscillator is much more difficult.

Fig. 3 shows the essential connections for a ¾-meter oscillator. The radio-frequency chokes and grid-leak can be constructed like those already described for the 1.5-meter oscillator. The condenser, C, in Fig. 3 should be about 100 mmf. Undoubtedly, the experimenter will bring about many improvements in the design and circuit constants of Fig. 3, but the values shown should be used for first trial. The coil, L, of Fig. 1 has now been reduced to simply two parallel wires, and one of the condensers of Fig. 1 has been omitted. It is extremely important that the internal capacities of the tube used should be small. It is suggested that the work be carried out with a tube designed especially for operation at these frequencies.

The operation of any transmitter, at frequencies of the order of one meter, is such that modulation of the carrier is desirable. The wave transmitter, especially when batteries are used, is so sharp that it is often lost in receivers commonly used. For this reason, the wave must be broadened so that it can be easily picked up. The wave can be easily broadened by coupling the output of an audio-frequency oscillator into the grid circuit of the transmitter; such a complete arrangement is shown in Fig. 5. The oscillating circuit of the audio-frequency oscillator consists of an audio transformer. The audio oscillator is coupled through an amplifying tube connected across the grid-leak of the transmitter. Other arrangements than Fig. 5 are possible, but this circuit has worked out well. The dotted lines in Fig. 5 suggest that both transmitter and amplifier tubes can be operated from the same plate battery if desired.

75-Centimeter Receivers

The ultra-short-wave receiver has the circuit shown in the accompanying drawing. Its response will be found quite broad; nevertheless, it should be tuned for a maximum effect. It is suggested that the reader try a crystal detector also, since the loading effects of ordinary tubes can be overcome. This can be judged near enough, perhaps, by listening in on the receiver at a distance from the transmitter, and sliding the fixed condenser (in the receiver's input circuit) along the parallel wires. If a power tube is used in the transmitter, it will be found that the tuning of the receiver will be quite different, because of the smaller tube (and consequently smaller internal constants) used. Use an extension handle to adjust the set; otherwise the presence of the body will have a detuning effect.

It is perhaps not necessary to state that there is much experimental and developmental work to be done yet on ¾-meter waves. The superheterodyne, in which a harmonic of the oscillator beats with the incoming signal to produce a low intermediate frequency seems, offhand, to be a solution. The arrangement suggested here is not to be considered a final arrangement but as a good beginning. If you want to use an aerial on the ¾-meter receiver, for greater signal, take a piece of No. 14 wire (or even a piece of copper tubing, for rigidity) about 30 inches long, or so, and run about half an inch of it near the grid of the detector tube. Maybe you can show us a better arrangement, after *you* have tried it! Better get the transmitter blasting first!

A very novel supporting frame for a parabolic reflector is shown in accompanying sketches. By a hinged arrange-

VOTING COUPON
For Proposed Radio 'Phone League

I have read Mr. Gernsback's article on the proposed amateur Radio 'Phone League, and I approve of the movement.

I believe I can secure ______ members for the new League.

I think I can organize a local chapter of the League in my own town.

I understand that signing this blank obligates me in no way whatsoever.

Name ....

Address ....

City .... State ....

ment, the reflector can be tipped and properly "aimed" at the hidden ore-bed; in order to obtain a maximum response at the receiver. By noting responses over different kinds of ground (the surface of the earth also reflects waves), one can "calibrate" the instrument, and know exactly what the outlines of the deposit, or underground lake, are. Gold, of course, or even buried treasure, if you are looking for it. (Who wouldn't be, if they knew where it was?) Anyhow, this ¾-meter stuff will make it easier to locate!) will have its own characteristic reflections, as noted by the responses received at the receiver. The reflector should be fitted with a degree-reading scale (such as a protractor) so that more accurate results will be secured.

The reader is warned not to expect too much at first from experimental apparatus of this nature. *Do not* build up a set in a hurry, rush out into the field, and expect to get immediate results. Experiment with it. Try out the transmitter first at some wavelength near 3 meters or so, then reduce the wave as low as you please; and go easy, or you'll get lost!

You can use a small aerial on the receiver, or even arrange a more complicated arrangement with a reflector, as at the transmitter. The receiving aerial will then be the aerial at the focus of the parabola. Couple this aerial to the set by running a length of wire parallel to the aerial, and from there to a point near the grid of the tube.

For ¾-meter operation, tubes are a problem. (For details see October-November SHORT WAVE CRAFT for an article on this subject by this writer.) For preliminary experiments, use a type '10 tube. For considerable power, use a UX-852 or a De Forest "H" tube. By using an R.F. transmision line, the power supply can be located at a considerable distance from the place where one is actually exploring. However, for work in the field, smaller tubes such as the type '30 dry-cell tubes must sometimes be used, although the results will not be so satisfactory. The most practical arrangement would be to use a gasoline engine driving a generator, for field work; in this way, the desired power could be obtained for the larger tubes.

To the man with small means, it is suggested that extensive experiments be carried out in some convenient location, in order to determine just "how little one can get by with" when the apparatus is to be carried into the field. Try out the preliminary work described in the October-November issue, before writing me.

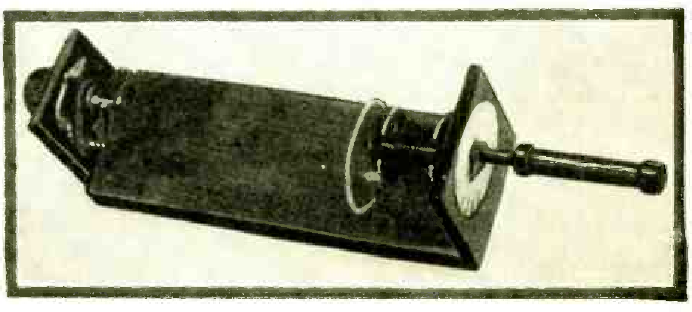
A METER FOR ULTRA WAVES

If a sufficient number of requests are received for this wavemeter, Mr. Binneweg, Jr., will supply them at cost price ($5.95 postpaid) to the readers of SHORT WAVE CRAFT. Mail your orders to the editor and if a sufficient number are received to warrant Mr. Binneweg carrying out his liberal offer, he will do so; otherwise the money will be returned to the readers.

The wavelength range covered (range 3 to 5.5 meters) by this ultra-short-wave meter will include the amateur 5 meter band. Mr. Binneweg states in his letter to the editor, "don't ask for any other ranges." The wavelength embraced by the instrument will permit the readers to become sufficiently acquainted with these frequencies to carry out experimental work with reflectors, and to apply such experiments to prospecting apparatus, etc.

The wavemeter will look approximately like the one shown on the enclosed illustration herewith.

If you are interested in obtaining one of these special ultra-short-wave meters, please send your check, or money order, together with your order to the Editor of this magazine.



3 to 5.5 meter wavemeter.

Planes Can Land in Fog

By LIEUT. MYRON EDDY

(Continued from page 249)

any desired angle above the horizon to the projected beam.

The transmitter projecting the localizing beam along the runway operates on about 1,200 meters. It is a 200-watt set and uses small loop antennas. When signals from this beacon are picked up, the landing beam receiver aboard the plane is immediately switched on.

There is a horizontal doublet type antenna about five feet long on the plane, employed for the short-wave landing receiver. The regular *airways beacon* receiver, either visual or aural, takes care of the airways beacon, the airport *boundary marker* beacon along the runway.

The boundary beacon consists of a 50-watt transmitter feeding a loop-type antenna. Modulation of the radiated wave to the desired frequency, 1,000 cycles per second, is obtained by supplying the transmitting tube with a plate voltage of 1,000 cycles frequency. On the airplane, earphones connected in series with the *main course* indicator are employed with a special filter circuit. The boundary line is defined by a zero, as the plane passes over the boundary line; then an increasing signal as he comes within the landing-field area,

On the airplane, the signal current in the output circuit of the special short-wave receiving set employed to receive the landing beam is first rectified and then passed through a *landing beam* "indicator". This "indicator" is mounted on the instrument board of the plane.

To help in maneuvering onto the field a "rough distance indicator" has been developed which is also automatic. It works like the ordinary tuning meter, found on any receiver which has automatic volume control, and constantly indicates to the pilot the approximate distance of the

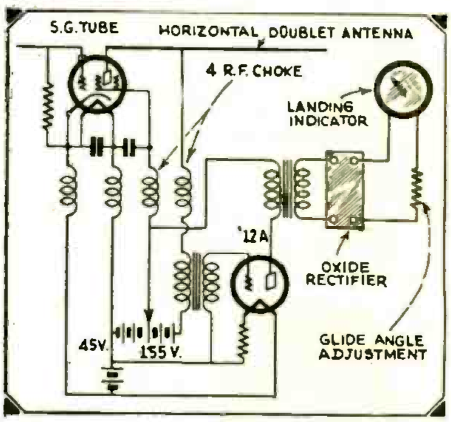


Diagram showing elements of landing beam receiver and indicator carried on plane.

plane from the *localizing-beam* transmitter. This transmitter is usually just back of the landing beam transmitter; and so the pilot usually "sets her down" just before the *rough distance indicator* registers zero—whether he feels like it or not! Otherwise he piles up on the transmitter antennas—if he does not see them at the last instant.

New All-Wave Receiver Using Auto Tubes

By BERYL B. BRYANT

(Continued from page 253)

The only other additional part to be made is the plate for the ground and antenna binding posts; this is made of bakelite. The bakelite is laid out, and drilled in accordance with Fig. 1D; and the parts mounted. At this time the binding-post panel may be wired completely, mounting the antenna resistor underneath. After doing this, the binding-post panel is mounted on the top panel, immediately behind the radio-frequency tube. The panel is mounted and spaced from the metal base with long 6/32 brass screws and nuts; the height of the panel being made sufficient to clear the antenna resistor, R1.

Wiring the Receiver

In wiring this receiver, as well as any other, in which metal is employed for the chassis, it is excellent practice to wire in the same manner as if the chassis were made of some insulating material. In this way the ground circuit will be of the same radio frequency potential; whereas, if the metal chassis is used for the common connection, various points of the chassis will be at different radio-frequency potentials, which will give rise to oscillations, broad tuning, and a multitude of other troubles.

The filaments are first wired, beginning with the radio-frequency tube; then across at the front to the detector, and lastly to the pentode. The negative of the filament is also grounded to the chassis at this point. A lead then runs to the filament switch and then out of the box. The supply lead for the positive filament should be of the same length as the negative lead from the switch; both should be about two feet in length or longer if desired.

Following the circuit diagram, Fig. 2, the Sprague bypass condensers are soldered directly to the socket prongs, with the ground ends soldered to the same point at which the bias resistors are grounded to the negative filament. A long lead is provided for the screen grid of the R.F. socket V1, of such a length to reach the volume control R7 when the top and the front panels are placed together. A lead is connected from the ground binding post B2 on the bakelite panel through the metal panel and connected to the grounded end of the 500-ohm R.F. biasing resistor R2. The plate of the R.F. tube is connected to the "G" of the coil socket; and a long lead is provided from this point, to reach the stator of the tuning condenser when the panels are assembled. The condenser C6, which bypasses the secondary to ground, is soldered to the filament of the coil socket on the same side of the "G." This prong is also the plus "B" of the R.F. tube. The plate of the detector tube is next connected to the "P" prong of the coil socket, and the "F" prong of the coil socket is then provided with a lead, to connect to the stator of the regenerative condenser.

The grid leak R3 and condenser C7 are next connected by soldering the condenser to the "G" post of the coil socket, and the resistor to a ground point. A lead is run from the junction of the condenser and resistor to the grid post of the detector socket V2. The R.F. choke is next fastened into position, as shown, at a sufficient height from the bottom of the top panel to clear the .02-mf. coupling condenser C8.

The plate resistor R4, of 100,000 ohms, is soldered to one terminal of the choke, while a lead from the detector "P" prong of the socket V2 is soldered to the other terminal of the choke. The grid leak R5 of the power tube is soldered to one end of the condenser C8, and its other end to a ground point. The 1500-ohm biasing resistor of the pentode, R6, and its bypass condenser C9 are next soldered to the cathode terminal of the pentode socket V3, and their other ends to a ground point. A lead is next soldered to the junction of the condenser C8 and the gridleak R5, and passed up through the metal panel to the control-grid of the pentode. The free end of the detector plate resistor R4 is next connected to the "F" prong of the secondary of the coil socket, and then to the screen grid of the pentode socket V3. A lead is soldered to the plate prong of the pentode socket V3, and is later connected to the binding post B3 on the back panel.

The corner posts are next fastened to the corners of the top panel, and the front panel slipped into place. The leads from the "G" prong of the coil socket and from the "F" side of the tickler are connected to the tuning and regeneration condensers respectively. Next the side panel with the switch is placed in position. A lead from the screen-grid prong of the R.F. socket V1, which is bypassed by the condenser C5, is connected to the center terminal of the 50,000-ohm volume control R7. One side of R7 is connected to one of the terminals of the switch at position 1; the negative filament lead from the pentode socket is connected to the switch terminal 2, with the long lead provided on the common terminal of the switch running out. A long lead for the current supply of the R.F. screen-grid is soldered to the remaining terminal of the volume control.

The back panel is next put into position, soldering the lead from the plate of the pentode to the binding post B3. The plus "B" lead of the R.F., from the detector, and the pentode screen-grid are next soldered to the other binding post B4. A long supply lead is also soldered to this post.

The receiver is now turned over, and a lead soldered to the junction of the antenna series condenser C3 and the antenna resistor R1. This lead should be of sufficient length to reach the control grid of the R.F. tube, and provided with a control grid-clip. The lead for the control-grid of the pentode also gets a clip.

The coils are of simple construction, and are wound on tube bases; three are employed for the short-wave band. The tabulated data are given in Fig. 3, along with the proper connections of the windings. For those who desire operation of the receiver from the A.C. line, a simple power supply unit is given in Fig. 4.

Parts List

- One—Hammarlund Type ML 5 short-wave condenser (C1)
- One—Hammarlund Type ML 11 short-wave condenser (C2)
- One—Hammarlund Equalizer condenser, 32 mmf. (C3)
- Two—Sprague or Aerovox tubular bypass condensers, 0.1 mf. capacity (C4, C5)
- Two—Sprague or Aerovox tubular bypass condensers, 0.5 mf. capacity (C6, C9)
- One—Aerovox moulded mica condenser midget type, .00015-mf. (C7)
- One—Aerovox moulded mica condenser, .02-mf. capacity (C8)
- Two—Lynch metallized resistors with pigtails, 1 watt, 100,000 ohms (R1, R4)
- One—Lynch metallized resistor with pigtails, 1 megohm, 1 watt (R5)
- One—Lynch metallized resistor with pigtails, 6 megohm, 1 watt (R3)
- One—Lynch metallized resistor with pigtails, 1500 ohms, 2 watt (R6)
- One—Electrad 500-ohm pigtail grid-suppressor resistor (R2)
- One—Electrad 0-50,000 ohm bakelite shell Supertonatrol (R7)
- One—Bryant Electric switch, power type, single pole single throw two position (obtainable from Blan the Radio Man, Cortlandt St., N. Y. C.)
- One—Eby wafer socket, type 236 (V1)
- One—Eby wafer socket, type 237 (V2)
- One—Eby wafer socket, type 238 (V3)
- One—Pilot moulded bakelite socket, type 216 (V4)
- One—Pilot 80-millihenry R.F. choke
- Four—Pilot binding posts (B1, B2, B3, B4)
- Two—Sheets aluminum 4¼ inches long by 3¾ inches wide by 3/64 inches.
- Two—Sheets aluminum 8¼ inches long by 5¼ inches wide by 3/64 inches.
- Two—Sheets aluminum 5¼ inches long by 4 inches wide by 3/64 inches thick
- Four—Aluminum Corp. of America aluminum corner posts 5¼ inches long tapped for 6/32 screws.
- Three—Hammarlund screen-grid tube shields (V1, V2, V3)
- One—Coil shield can 3 inches diameter by 4 inches high
- One—Bakelite or hard-rubber panel 1¼ inches by 2 inches by 3/16 inches.
- Two—National type C vernier dials (C1, C2)
- One—236—One 237—One 238 automobile tubes. (Arcturus used in tests.)

The A.C. Superregenode

By CLIFFORD E. DENTON

(*Continued from Page* 265)

their respective coils. The upper right-hand knob controls R2, which is insulated from the panel and varies the voltage on the oscillator's plate; the lower knob, governing R1, which is also insulated from the panel, controls the screen-grid voltage of V1.

Varying the Suppressor-Frequency

The switch Sw. which cuts in or out the condenser C3 shunting L3, changes the frequency of the local oscillation. With the parts utilized, the oscillating circuit works at the natural frequency of the transformer (30 kilocycles) when C3 is out of circuit; when it is cut in, its capacity of .001-mf. tunes the oscillations to 21 kilocycles. In Table I, the values of C3 corresponding to various suppressor frequencies, and the signal frequencies to which they are best adapted, are shown as computed on this basis. With other specifications of L3, of course, capacity values will change in inverse proportion to the inductance comprised. (See "How to Figure the R.F. Coil Secondary," by the author, beginning on page 37 of the July, 1931, issue of *Radio-Craft*.)

It is even possible for the ingenious constructor to use a fan switch, or condensers fitted with plug-in terminals, to approximate most closely the optimum suppressor-frequency over the whole range of the receiver's tuning.

The base is drilled for the 5-prong detector socket V1; the 250-millihenry R.F. choke RFC; the equalizing condenser C4; the bypass condenser C5; the A.F. transformer T; the oscillator socket, V2; the A.F. socket, V3; the pentode socket, V4.

The A.F. coupling condenser C10 is bolted to the base. The condenser bank with five 1-mf. units, C6, C7, C8, C9, C12, is placed in the center; with the voltage divider resistor R8 held in place, by busbar connections to the condenser bank. Mounting C11 near socket V4, and the oscillator coil L3 near V2, completes the layout.

Wiring and Operation

The filaments are wired in first, running the twisted leads under the chassis. All other leads are run in the most direct manner, depending upon the design of the parts used, and their placement. The center-tapped resistor R6 is soldered to socket V4, and the resistors R3, R4, R5, R7 are soldered to their respective terminals, becoming self-supporting.

Little more need be said; as the illustrations show the simplicity of the whole design and wiring.

The leads to the plug-in R.F. coils should be left just long enough so that the metal cover can be removed to replace tubes, when required. *Do not* depend upon the metallic connection between shields at this point for grounding. Run wires to all grounded parts, especially between tuning coils and condensers.

Hum and other local disturbances seem low in comparison with the signal level, and the high signal-noise ratio is an excellent condition in a short-wave receiver.

More letters covering experiences with the super-regenerative circuit are invited; and, if questions do not come too fast, and are accompanied by stamped and self-addressed envelopes, the author will endeavor to answer them.

List of Parts Used

Two Hammarlund "MLW-125" 125-mmf. short-wave condensers, C1-C2, and two Kurz-Kasch vernier dials;
One Hammarlund 14-to-110 meter "Model LWT-4" short-wave kit, L1;
One Hammarlund 14-to-110 meter "Model LWI-4" short-wave kit, L2;
One Hammarlund "Type RFC 250" 250-mh. R.F. Choke, RFC1;
One Hammarlund "Type EC 80" 80 mmf. equalizing condenser, C4;
One Flechtheim filter block (five 1-mf. units), C6-C7-C8-C9-C12;
One Ferranti "Type AF-5." 3.75-to-1 ratio audio transformer, T;
One Sangamo .002-mf. double fixed condenser unit, C5-C13;
One Aerovox .001-mf. fixed condenser, C3;
One Sangamo .006-mf. fixed condenser, C10;
One Aerovox 25-mf., 25-volt dry electrolytic condenser, C11;
Two Electrad 50,000-ohm "Super-Tonatrols," R1-R2;
Two Electrad 20-ohm V-type resistors, R6-R9;
One Electrad 500 ohm wire-wound grid resistor, R3;
Two Durham ½ meg. 7-watt resistors, R4-R5;
One Electrad 400-ohm wire-wound grid resistor, R7;
One Electrad "R 71" 13.000-ohm voltage divider, R8;
One Carter battery switch;
One Acme 30 kc. I. F. transformer or equivalent (see preceding article for other options), L3;
Four Pilot UY (5-prong) sockets, V1-V2-V3-V4;
One Yaxley 7-wire cable, 3-4-5-6-7-8;
Two Eby lettered binding posts, 1 and 2;
One output connection block, 9-10;
One aluminum cabinet 7x9x18x3/32" thick;
Miscellaneous hardware (two National screen-grid clips; screws, nuts, lock-washers, wire, etc.).

Data for the coils L1 and L2 were also given in the Oct.-Nov. issue of SHORT WAVE CRAFT.

Another alternative is therefore given here. Take a Silver-Marshall "130 T" coil form (1 inch in diameter, 2½ inches long, with 98 threads in the winding space) and wind on it 630 turns, in seven layers, of No. 32 D.C.C. wire, for the secondary or grid coil. Over this, at the lower end, the pickup coil L3 is wound—100 turns of No. 38 enamelled wire. Do not bank-wind.

The tickler or plate coil is 300 turns of No. 38 enamelled, wound into the small slot which is cut into the base of the coil form for the purpose. The form is made to plug into a regular UY socket, for ease in connection.

With a shunt capacity of .001-mf., the secondary will then tune to about 45 kilocycles, suitable to an ultra-short wavelength; and higher capacities will lower the frequency in proportion to the square roots of their value—as indicated in the table, which was made for a transformer of much higher inductance. For the coil just described, the capacities needed will be in the order of .01-mf. at 20 meters; .05 at 40, and 0.2 at 80 meters.

How High Is That Balloon?

By CAPT. JAMES A. CODE, JR.

(*Continued from page 248*)

The transmitter is so attached to the balloon that the supporting and trailing wires constitute an antenna and counterpoise, and act as two legs of an ideal dipole radiator. The frequency radiated depends on the length of the legs chosen in conjunction with the circuit inductance, and the length of these legs is arbitrarily chosen as 40 feet; which determines the wavelength at about 125 meters. The length is not critical, however, and the legs may be shortened or lengthened as desired. One leg may even be omitted entirely; and then the frequency, as determined by the capacity of a single wire, is sufficient to maintain effective oscillations at a much shorter wavelength.

Signals Heard Eleven Miles

The transmitter signals are readable up to 11 miles and, with a fresh battery, the transmitter will operate from 3 to 5 hours.

When actual balloon tests are made, the transmitter is first adjusted on a test stand, immediately before the balloons are released, and it is kept operating until it is removed for attachment to the upper antenna leg which holds the balloons captive. The transmitted signal is a clear, musical note, of a tone-modulated continuous wave. The entire signal energy is confined to a narrow frequency-band and, since no carrier wave exists in the system, heterodyne reception is resorted to after the balloons have travelled two or three miles and the signal has become weak. The result gives the signal a hissing sound which is readily distinguished.

The direction-finding receiver is portable. It covers a band of frequencies higher than the broadcast band and employs tuned, single-control radio amplification; the controlled regeneration is confined to the detector, so that C.W. signals may be received. The input employs capacity neutralization to eliminate the antenna effect, and an aperiodic loop is used.

Consideration was given to the problem of constructing three-dimensional direction finders; since this would permit direct determination of the angle of elevation of the balloons, which is obtained with the visual theodolite method. It would appear that a combination loop and dipole, rotatable about a vertical and horizontal axis, would solve the problem; but, since the capacity to ground of the dipole is more difficult to correct than that of the loop, the idea has been dismissed for the present. Instead, it was decided to rely upon giving the balloons the proper inflation to determine the elevation by their ascensional rate, and to construct a simple direction finder. The finder as developed serves the purpose extremely well, and is correct to within one-half a degree.

A Short-Wave Super-Converter That's Different

(*Continued from page* 260)

"self-contained" power supply. (This converter is supplied in kit form; and also completely wired, at small additional cost.

The converter consists of a tuned detector, using a '24 tube, in conjunction with a '27 tube in a specially-designed oscillator circuit, and an '80 type rectifying tube. The power supply operates from any 100-120 volt, 25-60 cycle circuit or (by quick change of two power-transformer leads) from any 200-240 volt, 25-60 cycle alternating current lighting circuit; and provides all "A," "B," and "C" power for the converter. The converter comes wired for operation on 100-120 volt 25-60 cycle current.

Performance of this "Super-Het" Converter

The converter designed by Mr. Silver, operated in combination with any standard broadcast receiver (either of the T.R.F. or the super-heterodyne type) which has a normal amount of sensitivity, makes a short wave super-heterodyne which will give *loud-speaker reception* of short-wave phone and short-wave broadcast programs of practically all American short wave stations and most foreign ones.

The antenna lead should be removed from the broadcast receiver and connected to the antenna binding post at the rear of the converter. The shielded wire coming out of the converter should be connected to the antenna binding post of the broadcast receiver, and the wire connected to the shielding on this lead connected to the ground post on the broadcast receiver. Insert the power cord of the converter in the nearest light socket, and the converter is ready for operation.

No "Squeal" Heard—A New Feature!

In tuning the converter, care should be taken to see that a short-wave station is not passed without noticing it. The short-wave detector is of the non-regenerative type, and no regenerative squeal will be heard. The dial should be rotated very slowly, and the compensating knob to the right of the dial knob frequently adjusted, to be sure that the receiver is operating at maximum sensitivity.

Correction Notice

In the last issue of SHORT WAVE CRAFT we published a table entitled "Don't's for the Short Wave Listener" and we credited this to Philip's Radio, operators of station "PCJ", Eindhoven, Holland. We have been informed by Mr. A. J. Green, President of the International Short Wave Club of Klondyke, Ohio, that this list of "Don't's" was originally prepared by them and we are glad to give them due credit.

A New Converter of Novel Design

By JAMES MILLEN

(Continued from page 257)

when using the two '35 variable-mu tubes in the circuit, is of some advantage.

The filter comprises a small choke coil which, because of the low value of current drawn through it, can have an exceedingly small air gap and, consequently, high inductance without danger of saturation. On both sides of the choke are located 8-mf. electrolytic filter condensers. The power pack is entirely shielded from the detector and the oscillator circuits, by means of the welded-steel partition, running lengthwise along the chassis. The power transformer also supplies the necessary heater voltages to all five tubes.

The I. F. Amplifier

In order that the converter might be universal in its application to any type of broadcast receiver, a stage of high-gain I. F. has been incorporated as an integral part of the converter. Such an arrangement is the outgrowth of an idea originally suggested by L. W. Hatry, who will be remembered as the developer of the "HY-7" superheterodyne, described last year in SHORT WAVE CRAFT.

In addition to furnishing a voltage gain of approximately 100, this stage of amplification also serves as a low-impedance output, or coupling-network; so that the output lead from the converter may be connected directly to the antenna post of the broadcast receiver, without either making the set oscillate, or having the antenna coupling system of the set act as such an extremely low-impedance "load" on the output circuit of the first detector as to prevent an appreciable signal getting into the broadcast receiver.

The output lead, from the plate circuit of this I. F. tube to the antenna post of the broadcast receiver, is shielded in order to prevent pick-up of any local interference or low-frequency transmitting station. To further minimize the possibility of any such pick-up troubles, where the converter is used with an unshielded R. F. chassis, an I. F. frequency of 575 kc. has been selected.

Coils Selected by New Switches

Numerous methods have been suggested for eliminating plug-in coils for short-wave receivers and converters but, in the final analysis, it must be admitted that nothing has yet been recommended that approaches in effectiveness the 6-prong plug-in system. For purely converter use, however, where the number of coils to be switched in any one circuit are few, the system developed for the new "NC-5," illustrated herewith, has been found decidedly satisfactory. Perhaps one of the main reasons is the use of the new "R-39" molding material; which permits the many mechanical design tricks without the introduction of prohibitive electrical losses, which would be incurred should ordinary bakelite be used for this purpose.

The coupling transformers, working between the high-frequency pre-amplifier and the first detector, are truly transformers, with the primary interwound between the secondary in the fashion developed in connection with the "SW-5" short-wave receiver.

A mechanically-operated *color screen* on the drum-dial illuminator is driven by the same knob that drives the frequency-changing switch, indicates which coil is in use.

Economical Modulators for Amateur Transmitters

(*Continued from page* 270)

age of the normal gain through the tube will vary as shown in the curve. From this information we may calculate the percentage of modulation corresponding to a given modulation voltage. This latter curve, shown as Fig. 2, indicates that a signal voltage of only seven volts will provide for a modulation percentage of over 60, at which point the curvature of the characteristic becomes excessive. Now 60% modulation in an amateur transmitter, with little or no distortion, is nothing to be sneezed at; and the fact that a mere seven volts is required from the A.F. amplifier for maximum modulation means that a '27 or an '01A with a good impedance-matching transformer is all the modulator tube we require.

Fig. 3 is a schematic diagram of a small transmitter employing this system of modulation. The plate supply for such a transmitter will require but a single '80 rectifier, as employed in receivers using a '45 output tube. Where higher power is required, additional tubes may be added; or two '45s as "Class B" amplifiers may be employed in the output stage.

For the Advanced Amateur

For those advanced amateurs, for whom the power involved in the system above is too meager, the writer has a second message involving the DeForest 565 7.5-watt screen-grid tube used as a modulated R.F. amplifier. Curves involving the changing gain of the 565 tube (when it is provided with a screen-grid potential varying about a fixed value of 140 volts, a control grid bias of —30 volts, and a plate voltage of 450) indicate that linear modulation over a range of some 65 to 70% may be obtained with an A.F. signal of 45 volts.

For a modulator a '27 tube, resistance-coupled to the screen-grid lead of the 565 in the manner shown in Fig. 4, will serve our purpose admirably. In this case it will be necessary to work the '27 very close to its maximum capabilities, with a full 180 volts on the plate and a grid bias of 13.5 volts. The plate current of the '27 under these conditions is 5 milliamperes; a terminal voltage of 450 will be required to compensate for the drop through the 50,000-ohm coupling resistor and for the fact that the grid bias is taken through a 2,700-ohm resistor. The 565 screen-grid tube must be followed by "Class A" or linear amplifiers, or by "Class B" amplifiers in push-pull, if quality is to be maintained.

The New Pilot All-Wave Receiver

(*Continued from page* 275)

from the ideal intermediate frequency for waves below 200 meters. The "All-Wave" was designed to use two I.F.'s so as to give maximum efficiency on both spectra. When the short wave section is used the antenna is coupled to the detector tuned circuit through a fixed condenser. The oscillator and detector circuits are magnetically coupled. Both circuits are tuned by a two-gang variable condenser with a small additional vernier across the detector tuning condenser to provide accurate tuning. This is especially necessary on shart-wave sets where antenna constants and large frequency coverage make it almost impossible to absolutely align both detector and oscillator circuits with a ganged condenser.

The induced voltage from the oscillator mixes with the incoming signal in the grid circuit of the detector and the resulting beat, which is about 550 kc., is impressed across a circuit tuned to that frequency and transferred from there to the grid of the second '24 tube. This tube, which is a very efficient amplifier, is coupled to the broadcast section of the set through a fixed condenser.

A tuned plate oscillator is used in this section to secure maximum frequency stability.

The coils are located about the wave-changing switch so that the effect of any one coil upon any other coil is negligible. The forms are so situated that three are mounted directly on the switch and two, covering the fourth and fifth bands, are mounted on top of the chassis, which thereby acts as a shield between the two sets of coils.

Switch Is Reliable

The switch itself is absolutely fool-proof and represents a very ingenious extension of the most common form of switch—the knife-blade type, the detector grid, the oscillator plate and the oscillator grid are the points that are switched.

Separate Power Supplies

Each section has its own power system and is adequately filtered so that there is no possibility of hum troubles. This separation of power systems allows for easiest serving and makes for greater simplification. Each section can be removed and inspected separately.

The spectrum between 10-200 meters is divided into five bands which allow for an unusually wide coverage. These bands are 10 to 19 meters, 19 to 35 meters, 35 to 65 meters, 65 to 110 meters, and 110 to 200 meters. There is, of course, generous overlap between bands.—*Radio Design*.

All-Electric Single Dial Tuning, S-W Super-Het

By K. KONIG

(Continued from page 269)

screwed to the bottom with properly bent flanges; see Fig. 2.

On the under side of the subpanel (Figs. 4 and 5) we find the potentiometer P, whose center connection is bridged by the condenser C11, also the lead-off condenser C8 and the decoupling devices—R4 with C13, and R5 with C14. In fastening these parts one can often make use of the fastening screws of the parts mounted on the upper side of the subpanel. The metal cans of the block condensers are, as is seen in Fig. 4, grounded by a lug placed under the fastening screws; likewise the mounting angles W, and the already mentioned angle strips WS. The heater wires have holes drilled for them, so far as possible. On the side wall of the power unit we find six insulated terminals mounted. In Fig. 4 one of these practical terminals is drawn separately in an extra illustration. On the threaded part "*s*" are two insulating discs "*a*" and "*b*"; of which "*b*" extends into a corresponding hole in the metal plate with a cylindrical projection "*i*." According to the thickness of the metal plate used, one can adapt projection "*i*" to the thickness of the plate, using a file. The two hexagonal nuts hold "*a*" and "*b*" firmly against the plate; and the lead wire is put under the terminal screws.

The terminals of the A.C. power transformer marked "8 V" furnish an A.C. potential of 11.5 volts. The copper-oxide system Cu operates in bridge hookup as a full-wave rectifier, and is of suitable dimensions for an A.C. potential of about 12 volts, and a D.C. output of about 6 volts, at 1 ampere. "A" and "B" are the connections for the secondary side of the A.C. power transformer (8 V); C and D are the terminals for the direct current. An automatic switching device is AU, which, on the opening of the cover, cuts off the A.C. supply current. The device consists of two springs "*f*," which were taken from a commercial switch. The two springs are mounted on an insulating plate P1, which is fastened to the side wall by an angle mounting.

The second part of the switching device (Fig. 6), the contact closer, is fastened to the lid of the case at the right spot. It consists of an insulating plate P, on which there has been fastened by two screws S a properly bent strip K of spring sheet metal. Through holes L, in plate P, it is fastened on the lid of the case.

The receiver and power unit represent together a very stable chassis. Finally, the parts on the front panel have to be connected; the voltmeter V, the switch A-E, and the resistance R7, likewise the terminal screws on the receiver side. The final result is shown in Fig. 7.—*Funk Bastler.*

The Propagation of Short Waves

By ROBERT MEYER

(*Continued from page* 274)

is shown in its summer and winter positions. Although both illustrations show the same time position of 18 o'clock (*i.e.*, 6 P. M.) Greenwich time, the continents differ greatly in their positions to the network of conductive lines. For instance, the course of radio waves from Europe to South America is considerably longer in winter than in summer, and the operating conditions are worse.—*Wissen und Fortschritt.*

How to Cure "Dead Spots"

(*Continued from page* 273)

and the writer has designed one in which no serious dead spots occur over the whole of the short-wave tuning range. This consists of a ½-inch ebonite or bakelite tube, 4 inches long, on which is wound one layer of No. 36 wire.

Dead spots will also sometimes occur when a tickler coil of too many turns is used. *Always use a tickler coil as small as possible, consistent with steady regeneration effects.*—(EDITOR'S NOTE: *Wire sizes are British Wire Gauge.*)

Enhanced Audio Amplification

(*Continued from page* 276)

But this is not all; accentuation, or the reverse of the low-note reproduction can (within limits) be varied by changing the value of condenser "C." If its capacity is 0.5-mf., a rising characteristic of 1.4 times that with a 1-mf. condenser can be obtained at 40 cycles; whereas, if its capacity is 2 mf., a falling characteristic of 0.875 times that of the 1-mf. capacity is obtained.

Therefore, if your speaker is deficient in its bass response, the value of "C" should be altered to 0.3 or 0.5 mf.—*E. T., Somerset, G2DT (England).*

Simple Sending Antennas for Amateurs

(*Continued from page* 259)

wire is to be a multiple of half the wavelength. A length of 40 meters is especially favorable; since with it 20-, 40-, and 80-meter waves can be sent.

The tuning is done in this way; first, the absorption circuit is brought in resonance with the sender, as determined by the hot-wire ammeter. The antenna is connected at the side opposite the meter which, with correct adjustment, should not be affected by this. In practice, however, current changes of 15 to 20% play no important part; and operation is possible even with fluctuations of over 30%.—*From "Radiowelt."*

When to Listen In

By "BOB" HERTZBERG

(*Continued from page 263*)

Holland

One of the less-frequently heard Dutch stations is PCV, located at Kootwijk, Holland. This uses a wave of 16.85 meters, and, like its brother station PCJ, announces in several languages. It is on the air Saturdays at about 10:30 in the morning, EST.

California

The west coast station that has been working with Bangkok, Siam, is KER, Bolinas, California, on approximately 29 meters. There is a whole flock of KE- stations at this place likely to be heard on a number of wavelengths at all hours of the day and night.

Australia

Following is the complete schedule of station VK2ME, Sydney, Australia: Midnight to 2 a. m., E.S.T., for American countries bordering the Pacific. 4:30 to 6:30 a. m. for New Zealand, Fiji, New Caledonia, New Guinea, and Islands of the Pacific and Eastern Australia. 6:30 to 8:30 a. m. for West Australia, Java, Japan, China, Straits Settlement, Burma, Ceylon and India. 2:00 to 4 p. m. for Great Britain, Western Europe, South Africa, British East African possessions, Egypt and other African countries. All programs include as a sort of identifying signal the laugh of the Kookaburra, an Australian bird (sometimes called the "laughing jackass").

Melbourne, Australia, VK3ME, transmits on the same wavelength from 5:00 to 6:30 a. m. every Wednesday and Saturday.

More Time Signals

Mr. Ernest Madison, of Scranton, Iowa, sends in some dope on station NPO, the U. S. Naval Radio Station at Cavite, P. I. He has received a letter from them, part of which follows:

"NPO broadcasts time signals for the Manila Observatory twice a day at 11:00 a. m. and 10:00 p. m., 120th East Meridian Time. NPO uses the following frequencies, one of which you can hear any hour of the day: 17744, 13575, 13308, 9050, 8892 and 18100 kilocycles. Transpacific traffic is handled on 13575 and 9050 kc. with a 25-kw. crystal-controlled transmitter.

Arlington Time Signals

The Naval radio station at Arlington, Virginia, is undoubtedly the best known of all stations transmitting time signals. We have been able to obtain the operating schedule, which is published herewith in full.

NAA Daily Time Signals

Hours, E.S.T.	Kilocycles	Meters	Power
	17.8 (arc) A1	16850	350 K.W.
3:00 a. m.	113 A2	2840	5 K.W.
	4015 A1	74.72	10 K.W.
	8030 A1	33.98	10 K.W.
	113 A2	2840	5 K.W.
	690 A3	434.5	1 K.W.
11:55-12:00	4015 A1	74.72	10 K.W.
Noon	8870 A1	33.82	10 K.W.
	12045 A1	24.91	10 K.W.
	16060 A1	18.68	10 K.W.
	17.8 (arc) A1	16850	350 K.W.

A New Console Receiver for S. and B.C. Waves

(*Continued from page 263*)

A big advantage of the Stewart-Warner converter is that in changing from the broadcast band to short waves—and vice versa—it is not necessary to disconnect the converter and attach the antenna to the broadcast receiver. This, as well as the change from one short-wave range to another, is accomplished by the "range switch".

S-W Stations of the World

(Continued from page 279)

124.2 2,416—**WPDI**, Columbus, O. — **WPDE**, Louisville, Kentucky.
—**KGPB**, Minneapolis, Minn. — **WPDJ**, Passaic, N. J.
—**WPDS**, St. Paul, Minn. — **WPDA**, Tulare, Calif.

124.5 2,410—**WCK**, **WRDR**, **WMO**, Detroit (Belle Isle, Grosse Pointe, Highland Park, Mich.
—**WPDW**, Washington, D. C.
—**KGPD**, San Francisco, Calif.
—**KGPG**, Vallejo, Calif. Police Dept.
—**W3XAG**, Baltimore, Md., Police Dept.

125.1 2,398—**W9XL**, Chicago, Ill.—**W2XCU**, Ampere, N. J.—And other experimental stations.
—**W2XAD**, **W2XAF**, Schenectady. — **WPDT**, Kokomo, Ind. Police Dept.

125.4 2,392—**W10XAL** and **W10XAO**, Portable. National Broadcasting Co.—**W2XCZ**, Portable, N.B.C.

128.0-129.0 —Aircraft.

129.0 2,325—**W10XZ**, Airplane Television.

130.0 2,306—**DDOX**, S.S. "Bremen" and "Europa" testing.

135.0 2,220—....Stockholm, Sweden.
—....Oslo, Norway.

136.4 to 142.9 meters—2,100 to 2,200 kc. **Television.**
—**W2XBS**, New York, N. Y., 1,200 R.P.M., 60 lines deep, 72 wide, 2-5 p.m., 7-10 p.m. ex. Sundays. National Broadcasting Co.
—**W2XR**, Long Island City, N. Y. 48 and 60 line. 5-7 p.m. Radio Pictures, Inc.
—**W3XAD**, Camden, N. J.
—**W2XCW**, Schenectady, N. Y.
—**W3XAK**, Bound Brook, N. J. (Portable, 60 lines).
—**W8XAV**, Pittsburgh, Pa. 1,200 R.P.M., 60 holes, 1:30-2:30 p.m., Mon., Wed., Fri.
—**W9XAP**, Chicago, Ill.
—**W6XS**, Gardena, Calif. Don Lee, Inc., Los Angeles.

142.9 to 150 meters—2,000 to 2,100 kc. **Television.**
—**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.
—**W2XBU**, No. Beacon, N. Y. (1-2 p.m.)
—**W2XCD**, Passaic, N. J. 2-3 p.m. Tu., Thur., Sat.
—**W9XAO**, Chicago, Ill.
—**W9XAA**, Chicago, Ill.
—**W10XG**, portable. De Forest Radio Co.
—**VE9AU**, London, Ont., Canada.
—**VE9RM**, Toronto, Ont., Canada.

150 2,000—**RA72**, Smolensk, USSR.

149.9-174.8—2,000-1,715—**Amateur Telephony and Television.**

160 1,875—....Cuxhaven, Germany, Elbe-Weser Radio.

174.0 1,723—**ZL2XS**, Wellington, New Zealand.

175 1,715—**W9XAN**, Elgin, Ill.
—**W6XK**, Los Angeles, Calif. And other experimental stations.

175.2 1,712—**Municipal, Police and Fire.**
—**KGKM**, Beaumont, Texas. — **WKDT**, Detroit, Mich. — **WEY**, Boston, Mass.
—**WPDB**, **WPDC**, **WPDD**, Chicago, Ill. — **WKDU**, Cincinnati, O.
—**KSW**, Berkeley, Calif. — **WKDU**, Cincinnati, Ohio.
—**KUP**, Dallas, Texas. — **WMDZ**, Indianapolis, Ind.
—**KGPC**, St. Louis, Mo. — **KGOY**, San Antonio, Texas.
—**KGJX**—Pasadena, Calif. (Police Dept.).
—....St. Quentin, France.
—**F8FY**, Cannes, France. 5 p.m. Wed.; 4 a.m. Sunday.

176.5 1,700—....Orly, France.

178.1 1,681—**WKDX**, New York, N. Y., Dept. Plant & Structures.
—**KOX**, Honolulu, T. H. Mutual Telephone Company.

180.0 1,662—**WMP**, Framingham, Mass. (State Police).
—**WRDS**, Lansing, Mich. (State Police).

186.6 1,608—**W9XAL**, Chicago, Ill. (WMAC) and Aircraft Television.
—**W2XY**, Newark, N. J.

187.0 1,604—**W2XCU**, Wired Radio, Ampere, N. J.
—**W2XCD**, DeForest Radio Co., Passaic, N. J. 8-10 p.m., synchronized with television broadcasts.
—**W1XAU**, Boston, Mass.
—**W3XJ**, Wheaton, Md.
—**W2XAD—W2XAF**, Schenectady.
—**W9XX**, Cartersville, Mo.
—**W5XN**, Dallas, Texas.
—**W2XDD**, Portable.
—And other experimental stations.
—....Omskeldvik, Sweden.

187.9 1,596—**WCF**, New York, N. Y. (Fire Dept.)
—**WKDT**, Detroit, Mich. (Fire Dept.)
—**KGKM**, Beaumont, Texas.
—**KGPA**, Seattle, Wash., Fire & Police Depts.

189.4 1,584—**W10XAL**, **W10XAO**, Portable (N. B. C.)

192.3 1,560—....Scheveningen, Holland.

194.3 1,544—**W2XDA**, New York.

196 1,530—....Karlskrona, Sweden.

The Workrite Converter

(Continued from page 257)

—2-'24 screen grid, 1-'27, and 1-'80 tubes. The wavelength range covered is 14 to 200 meters; the popular band from 23 to 50 meters is tuned without changing the coils.

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

Of SHORT WAVE CRAFT, published BI-MONTHLY at Mt. Morris, Ill., for Oct.-Nov., 1931.

State of New York: County of New York, ss.

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, 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, 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.; D. 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 trustee, 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.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is —. (This information is required from daily publications only.)

H. GERNSBACK.

Sworn to and subscribed before me this 29th day of September, 1931.

MANNIE COYNE.

(My commission expires March 30, 1932.)

New York Chapter of International Short Wave Club

This club, which has been meeting regularly at Peter's Banquet Hall, 217 Fulton Street, Brooklyn, New York, has had a steady growth in membership, which is now over the 300 mark, and the club has commenced to hold meetings in New York City. The office of the secretary of the club is located at 1622-44th Street, Brooklyn, N. Y. The club has held many successful meetings and is promising some extremely interesting attractions for the coming meetings.

SWAPPERS

SWAPPERS are swappers of correspondence. During the past few years we have noted that Short-Wave enthusiasts love to get acquainted with each other by mail in order to swap experiences.

Rules: Use a postcard only. Never write a letter. Address postcard as follows:

SWAPPERS
c/o SHORT WAVE CRAFT
96-98 PARK PLACE
NEW YORK, N. Y.

On the blank side of the postal PRINT clearly your name, address, city and State. Don't write anything else on card. We will then understand that this is your request to publish your name and address and that you wish to enter into correspondence with other short-wave readers. There is no charge for this service.

—EDITOR.

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412 Seneca St., Oil City, Pennsylvania
GEORGE J. BARMAN
232 W. Second St., Chillicothe, Ohio
ARCHIE BENNETT
1st Bn. 8th F. A., Schofield Bks., T. H.
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HERE'S a NEW plan, which saves you money. *Stop shopping—the lowest prices are right on this page.* Yes, lower than in our own catalog. Why? Because no house can get out a new catalog every month, but by advertising in this magazine we can bring you the latest and lowest prices *up to the time this ad is printed.* We watch our competitors and *do not allow anyone to undersell* us. We meet ANY price on NEW merchandise. *Order direct from this page and save money. 100% satisfaction on every transaction.*

Pacent "250" Power Auditorium Amplifier

One of the Most Powerful Super Power Amplifiers ever made.

Now $8.75

CONTAINS 2 STAGES SUPER POWER A.F. AMPLIFICATION

This famous amplifier is provided with input and output transformers for working from a phonograph pick-up into a 2000-ohm transmission line or into the coupling transformer furnished with most dynamic reproducers. The tubes required are one '26, one '50 and one '81 rectifier. Where maximum output is not required a '10 may be substituted for the '50 in the output. Automatic adjustment takes care of the discrepancy in voltages. The undistorted power output is 2.5 watts—**enough for four small dynamic reproducers.** This degree of power output provides satisfactory coverage for auditoriums having a volume of 25,000 cubic feet. The input voltage necessary to provide maximum output is but .025 volts.

Ideal for theatres seating approximately 3,000 people, dance halls, schools, lectures, hospitals, auditoriums, outdoor gatherings, etc., etc. The gigantic power is at all times within control—for that matter, it can be used in any home, as the volume can be regulated down to a whisper!

A PHONOGRAPH AMPLIFIER—PUBLIC ADDRESS AMPLIFIER SYSTEM, ETC.

Use of the '26 tube in the input stage makes the long "warming up" period unnecessary. Shipping weight, 30 lbs. Overall size, 16 x 9½ x 6¾" high. **List Price, $90.00.**

No. 1925—Pacent Model 250 Power Amplifier (less tubes). Your Price $8.75

RADIO MIRROR PENLITE

The Latest and Cleverest Tool for Radio Serviceman. The only device that enables you to LOOK AROUND CORNERS or UNDERNEATH inaccessible spots. Your vision is ONLY in a straight line, but with the Mirror-Penlite you can look around a 45 degree angle. You can now look under the whole chassis and see every nut, every wire, every socket, behind condensers, transformers, etc. This is made possible by the powerful pocket flashlight to which is attached a **GENUINE DENTAL MAGNIFYING MIRROR.** Mirror clips on or off so flashlight can be used alone if desired. The cleverest device yet. Complete with battery and bulb. Shipping weight 6 ozs.

No. 1695—Mirror-Penlite. List Price $2.50. YOUR PRICE.............. 85c

NEW! "LITTLE GIANT" DYNAMIC SPEAKER

Absolutely the smallest dynamic speaker that will withstand the strain of modern output power tubes ever manufactured. Suitable for use on midget, portable and automobile receivers. Measures but 6½ in. long overall, having a 4½ in. diaphragm and weighing but 4 lbs. The "Little Giant" has, under test, actually flooded a ten-room apartment with faithfully reproduced music of virtually original tone quality. Field winding has a resistance of 2500 ohms and may therefore be energized by using it as a filter choke in the power pack, thereby serving a double purpose. This last feature makes the "Little Giant" excellently suited for portable A.C. sets, since it does away with filter chokes and thus with considerable weight. Equipped with built-in output transformer to work from any standard output power tube arrangement. Specify the power tube or tubes used when ordering. Shipping weight 5 lbs. **List Price $6.50.**

No. 1549. LITTLE GIANT DYNAMIC SPEAKER..Your Price $2.50

Baldwin RIVAL Speaker Unit

A loud speaker unit bearing the world famous Baldwin mark. Designed for use with horn type speakers or with old style phonographs. Complete with cord. Shipping weight 1 lb. **POSITIVELY LOWEST PRICE THIS UNIT HAS EVER BEEN SOLD.**

No. 1520—Baldwin "Rival" Unit. YOUR PRICE 45c

NEW READRITE Analyzer

This three-meter analyzer has selector switch for checking all parts of tube circuits by connecting to the set sockets. Selection for testing voltages of plate, grid, cathode and screen-grid done quickly and accurately. Plate current, filament volts, line and power supply volts are measured. Grid swing test for tubes used. Just push one button for screen-grid and other button for other tubes. **Makes testing of all type tubes simple and thorough. 4½-volt grid battery is furnished. Battery is used for grid test and** continuity testing of transformers, chokes, etc. Capacity and resistance charts furnished showing use of instruments for testing condensers, also measuring resistances up to 100,000 ohms. Eight scale readings of meters may be used separately with the jack terminals provided. Scale readings are 0-60-300-600 D.C. volts, 0-10-140-700 A.C. volts and 0-20-120 milliamperes. A.C. and D.C. filament voltages are accurately measured on the one meter. Strong case with leatherette covering. Attractive. Compact. Size 10¾x3½x8 inches. Shipping weight 15 lbs. **List Price $25.00.**

No. 700—READRITE ANALYZER. YOUR PRICE.......................... $14.70

Free 36 page Radio Treatise No. 23

75 New Hook-Ups, etc. 350 Illustrations.

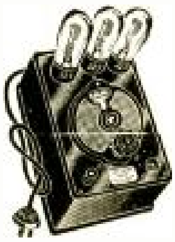
The new Summer Edition of our greatly enlarged RADIO SERVICE TREATISE has just come off the press. If you liked the Winter issue, you will like this one a hundred-fold. It contains some 75 new hook-ups, circuit diagrams; and some 350 illustrations. **POSITIVELY THE GREATEST BOOK EVER PUT OUT BY ANYONE.** Among the new matters listed are:

VACUUM TUBE TREATISE, with many illustrations; full page Vacuum Tube Average Characteristic Chart; How to Take Care of Your Tubes; How to Connect Phonograph Pick-ups; Improving the Tone Quality of Old Sets; Connecting Additional Loud Speakers; all fully illustrated with diagrams.

Other articles: Modernizing Old Radio Sets; How to Convert Battery to Power Sets; Selection of Tubes; Push-Pull Amplifiers; Replacing Audio Transformers; Phono Attachments; How to Choose Power Transformers; Voltage Dividers; Wattage of Power Transformers; Selecting and Installing Replacement Parts in Radio Sets; Filter Condensers; Repairing Eliminators.

WRITE TODAY. Enclose 2 cents for postage. Treatise sent by return mail.

NEW! NEW!! Superheterodyne S-W Converter



At last a short-wave converter that converts any broadcast set into a superheterodyne short-wave receiver. Employs three 227 tubes and covers from 20 to 115 meters. No plug-in coils! Coil switch is used to cover all wavelengths. Single dial control, no body capacity, no squeals. This converter has built-in filament transformer to heat the three 227's. All you need to obtain from your receiver is a positive B voltage anywhere from 45 to 180 volts. Voltage is not critical; no noiseless operation of the receiver. So simple a child can operate it. Size 7 x 10 x 5 inches. Shipping weight, 8 lbs. **List Price $25.00.**

No. 1614—Super Converter (less tubes). YOUR PRICE......... $14.69

World-Wide Short-Wave Set

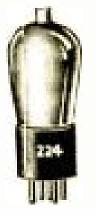
NOT A CONVERTER

NEW

A perfect radio short-wave receiver for use between 18 and 200 meters. To put into operation, connect antenna, ground, 45-volt "B" and two No. 6 dry cell "A" batteries, and headphones to the posts provided. Plug in a type '30 tube, and tune in! An ingenious circuit makes possible a 4-coil single-winding plug-in design. This little instrument has the same sensitivity as many big, shielded short-wave receivers costing ten times as much. A power amplifier may be added for any degree of volume. Complete with 4 plug-in coils. Has fine vernier dial for precision tuning. **Never has a first class short-wave set sold for so little money.** This short-wave set measures 5¼x7x4 in. high, over all. Ship. weight, 3 lbs. List price, $12.50.

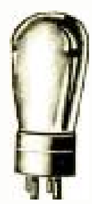
No. 1666—World-Wide S.-W. Set. Your price.................. $6.25

6 MONTHS GUARANTEED NEONTRON TUBES



Sold on a **6 MONTHS FREE REPLACEMENT GUARANTEE BASIS, PROVIDING TUBE LIGHTS! All tubes are carefully** meter-tested before shipment, and carefully packed. Do not confuse these HIGH QUALITY tubes with any other "low priced" tubes—our low prices are possible because we do a VOLUME business!

Choice	Choice of	Choice	Choice	NEW Choice	NEW Choice
226	112A	245	222	230	235
227	200A-199X	280	210	231	247
171A	199UV-120	171	250	232	238
201A	224		281		236-37
					551
63c ea.	69c ea.	79c ea.	1.58 ea.	1.08 ea.	1.50 ea.



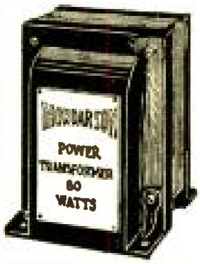
R.C.A. LICENSED TRIAD AND PERRYMAN TUBES

These nationally advertised tubes are guaranteed UNCONDITIONALLY for six months. The prices are slightly higher than our NEONTRONS because these tubes are of much better quality. See listing above for tube numbers.

Choice Price	Choice Price	Choice Price	Choice Price	Choice Price	Choice Price
76c	96c	86c	$1.76	$1.46	$2.09

THORDARSON "245" Power Transformer

A Miniature Power Plant — Supplies All ABC Voltages — 80 Watts



In addition to supplying a full 250 volts to the plates and 50 volts to the grids of two type '45 tubes in push-pull, this transformer may be used to light the filaments of seven or eight 2.5-volt filament tubes; and by connecting in series two of the three 2.5-volt filament secondaries it is possible to light 5-volt filaments too. Five secondaries: S1—5 V., 2 Amp.; S2—310 V. Cent. T.; S3—2½ V., 3 Amp. Cent. T.; S4—2½ V., 10½ Amp.; S5—2½ V., 3 Amp. Cent. T. **Just the power transformer for building up a high-grade public address amplifier to use a screen-grid A.F. amplifier to boost the output of a microphone or phonograph pick-up;** following this with two stages of push-pull amplification consisting of two '27's in the first stage and two '45's in the second. Bottom of transformer has bakelite panel on which are mounted all taps. **It outperforms ANY similar transformer. Many Service Men** keep this model transformer on hand for emergency replacements in hundreds of makes of radio sets. For 110-120 volts, 50-60 cycles. **Size: 5 in. high x 4 x 3¼ in. Shipping weight, 8 lbs. List Price, $15.00.**

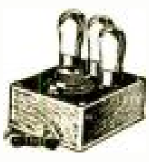
No. 1450—Thordarson Power Transformer. YOUR PRICE....... $3.84

Flewelling-Dayton SW Adapter

This wonderful instrument connects to any A.C. radio set by putting into tube socket in place of the tube (which must be a type '27, or "heater" tube) the plug which is on the end of its 2 ft. cable; then put tube into tube-socket of adapter. Remove aerial from broadcast set and connect to antenna post on adapter. Special plug-in coil No. 1 covers a wavelength band of 17 to 29 meters; coil No. 2, 27-28 meters; coil No. 3, 47-84 meters. Plug-in coil inductances come with the adapter. 5¼x7¼x4" high, overall. Ship. weight 4 lbs.

No. 1613 — Dayton Flewelling Short-Wave Adapter. List Price, $15.00. YOUR PRICE (without tube).... $4.93

Short-Wave Converter



Build a short wave converter at lowest price on record, but with which excellent results are obtainable nevertheless. The voltage for the three 227 tubes used may be obtained from an external filament transformer or from a secondary winding of 2½ volts in a power pack. Wavelength from 30 to 110 meters. No plug-in coils; coil switch is used to cover wave band. Single dial tuning; no grunting, no body capacity, no squeals. Leak condenser modulation. Converter consisting of all parts (less filament transformer) including cabinet, panel, diagram and 1-page instruction sheet (less tubes).

No. 1619—YOUR PRICE $4.85

No. 1615—6-Volt Battery Model, same price.

High-Voltage Condenser Units

We guarantee these condensers unconditionally. They are ideal for general replacement purposes and can be installed in any new power-pack. All condensers are furnished with 8-inch lengths of tinned "push-back" wire.

800 VOLTS Cat. No.	Mfd. Capac.	Your Price	800 VOLTS Cat. No.	Mfd. Capac.	Your Price
1702	½	$0.25	1706	1	$0.40
1703	1	.30	1707	2	.70
1704	2	.40	1708	4	1.05
1705	4	.60			

WE ARE A WHOLESALE HOUSE AND CANNOT ACCEPT ORDERS FOR LESS THAN $3.00.

If C. O. D. shipment is desired, please remit 20% remittance, which must accompany all orders.

If full cash accompanies order, deduct 2% discount. Send money order—certified check—U. S. stamps.

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Should you wish goods shipped by parcel post, be sure to include sufficient extra remittance for same. Any excess will be refunded.

NOW You Can Do It!

LIST PRICE $25.00

less microphone

Microphone as illustrated. $10 additional

AT LAST it has become possible for every Short Wave enthusiast to actually record his messages be they code or phone.

How often have you boasted that you have received a far distant phone station, 12,000 miles away, so loud that it "rattled the gaskets of your loud speaker." But frequently your friends were highly skeptical.

Now with the PACENT RECORDOVOX, recording of any foreign program becomes child's play. And, of course, the RECORDOVOX is supreme as well for home recording, because it faithfully records and keeps for posterity the voices of the entire family.

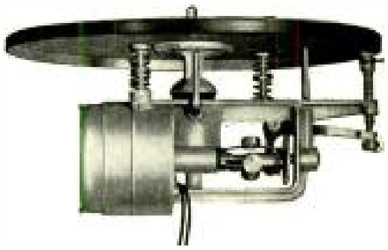
The special blank records cost only a few cents and can be secured anywhere.

Electrically and mechanically, the PACENT RECORDOVOX is as fine an instrument as you could find even in the professional recording laboratories.

Every possible angle has been taken into consideration in the design of the RECORDOVOX. Supplied with 3 adjustable weights, it can be used with motors that lack sufficient torque to operate the turntable when the head is fully weighted. Like the well-known PHONOVOX, the RECORDOVOX, as the result of careful design, possesses excellent frequency characteristics.

Designed for pre-grooved type of records only. List Price $25.00. Microphone $10.00 list extra.

Write for information on special types and models to meet your specifications



Electric Phonograph Motor, Catalog No. 140

Meets every requirement of radio-phonograph use. Has sufficient torque to cut even 10" records.

List Price $25.00

Manufacturers

PACENT ELECTRIC CO., INC., 158 W. 16TH ST., NEW YORK, N. Y.

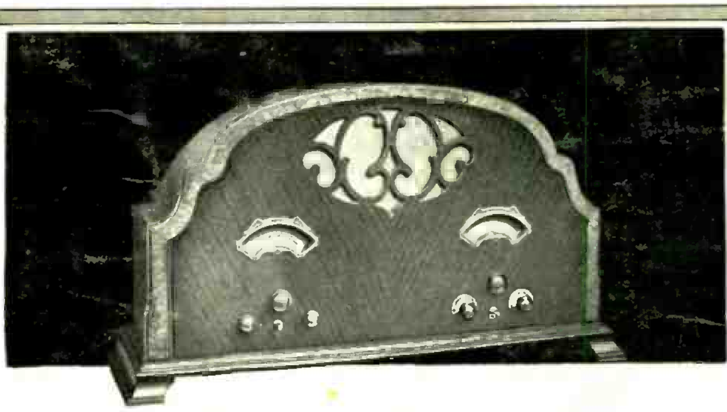
Pioneers in Radio and Electric Reproduction for Over 20 Years. Licensee for Canada: White Radio, Ltd., Hamilton, Ont.

PACENT

RECAPTURE the THRILL of EARLY RADIO RECEPTION

Hear the Short-Wave Stations of the World: direct With the NEW PILOT

SUPER-WASP

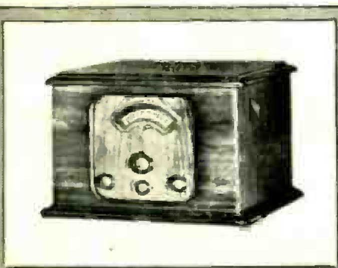


This 4-tube Short-Wave Converter transforms any modern radio receiver into a short-wave set instantly. Complete with newest type tubes, including rectifier.

$39.50

Day or night, Pilot's marvelous SUPER-WASP brings in all kinds of new and startling things—airplane-to-ground conversations, transoceanic telephone calls, foreign broadcasting stations and, most exciting of all, police headquarters in a dozen cities talking to their radio-equipped "emergency cruisers." This 11-tube Super-heterodyne has separate controls for the broadcast band, with special high quality, high selectivity circuit. Including newest type tubes and built-in dynamic speaker.

$99.50



Pilot Radio & Tube Corporation
Lawrence, Mass.

Please send me complete information about:

- ☐ The new SUPER-WASP
- ☐ The 4-tube Converter

☐ I enclose 50c for one year's subscription to Radio Design beginning with the current issue.

Name .... City .... State ....