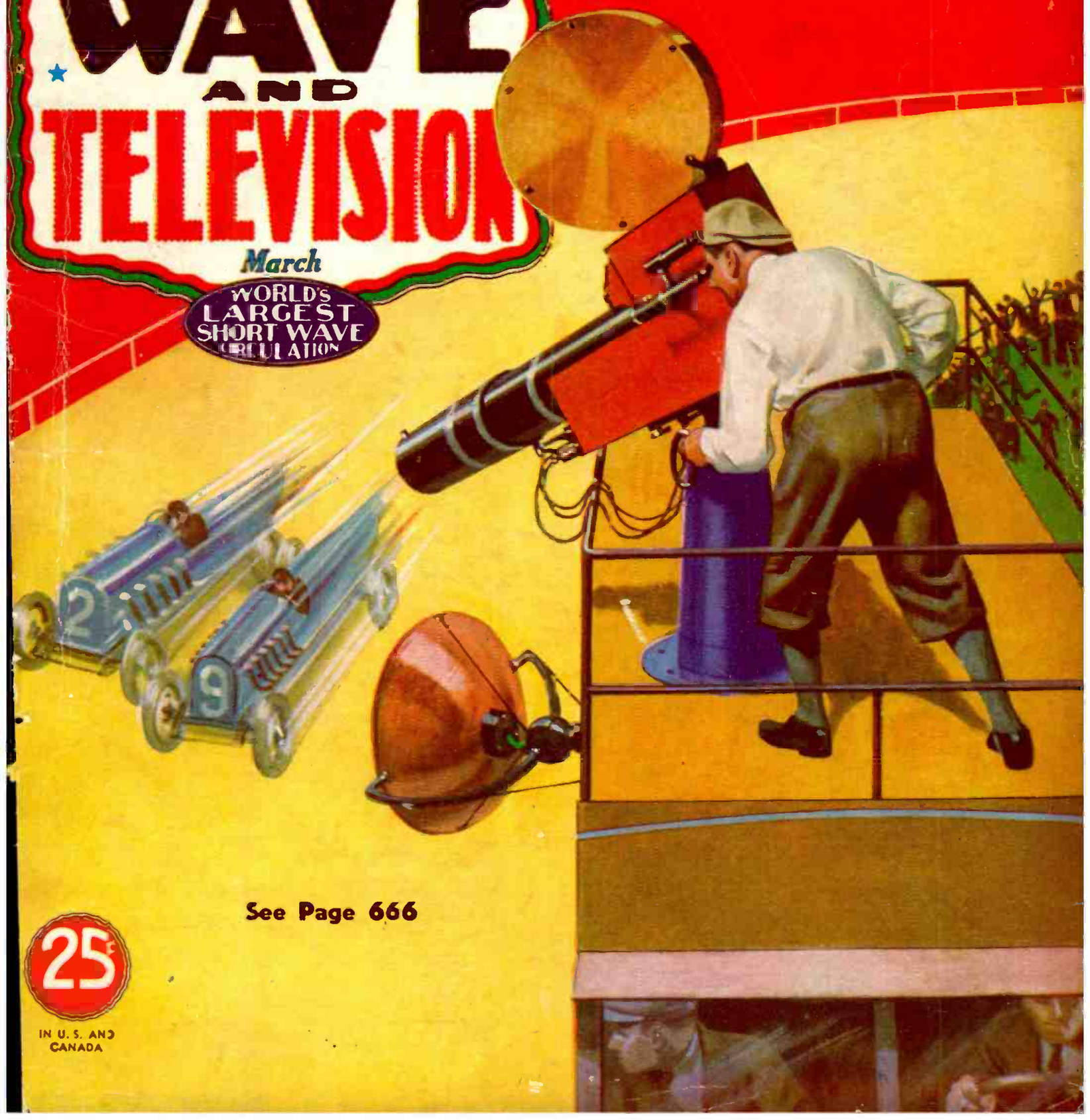
THE RADIO EXPERIMENTER'S MAGAZINE

HUGO GERNSBACK
Editor

SHORT WAVE AND TELEVISION

March

WORLD'S LARGEST SHORT WAVE CIRCULATION



See Page 666

25¢

IN U. S. AND CANADA

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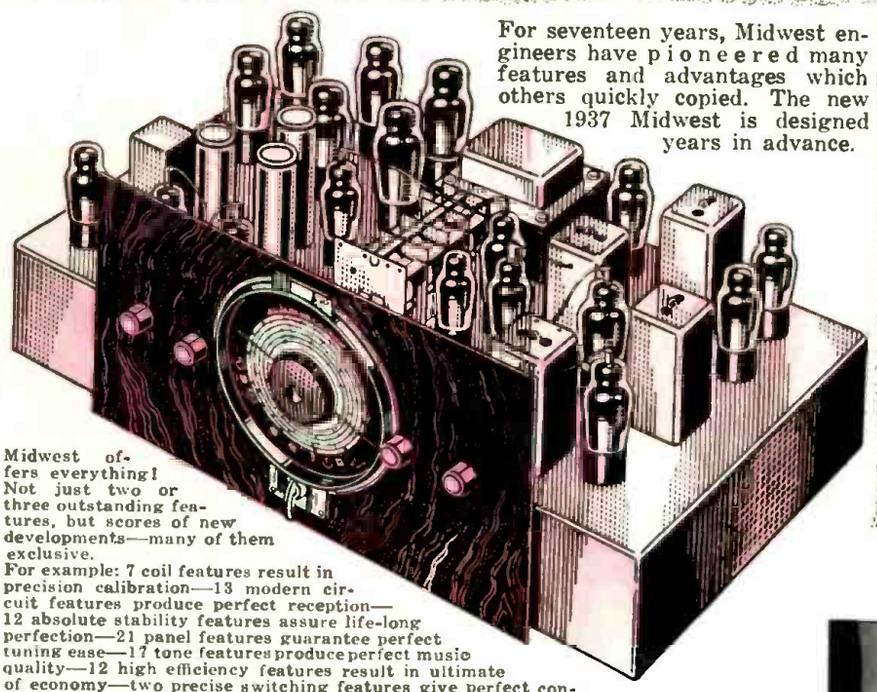

For seventeen years, Midwest engineers have pioneered many features and advantages which others quickly copied. The new 1937 Midwest is designed years in advance.

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The birdseye view above shows how the newest type "radio beacon" guides planes to the airport at Stettin, Germany.

Landing Planes "BLIND"— Thanks to Short Waves

The newest short-wave system employed at the Stettin Airport in Germany, for guiding planes to a "blind" landing in fog or at night. Simple indicating instruments on the plane enable the pilot to know when he is approaching the landing field.

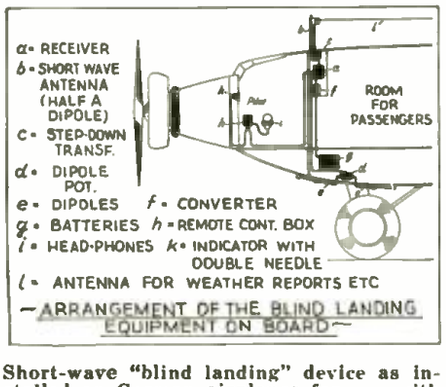
● SHORT WAVES are finding many new applications daily and one of the very newest is that for landing airplanes *blind*. The particular installation here illustrated is that at the Stettin Airport in Germany. It is said that this new system is a decided improvement over those of similar type used heretofore. The diagrams show how a radio beacon transmitter is installed at the airport, and this transmitter radiates a horizontal directional beam into the air. This short-wave beam actuates an indicating instrument on the plane and serves to guide the pilot toward the airport. Two auxiliary beams on both sides of the main directional beam (consisting of *dot* and *dash* signals), may be checked with the other radio indications by the pilot. When the plane drifts from the central beam, a double needle instrument indicates the direction of the drift.

In the upper left-hand corner of the diagram at the right below, we see the indicating instrument which is installed in front of the pilot on the plane. The letter "L" means plane off to the left side, and the letter "R" means that the plane is off to the right side of the central *guide* beam.

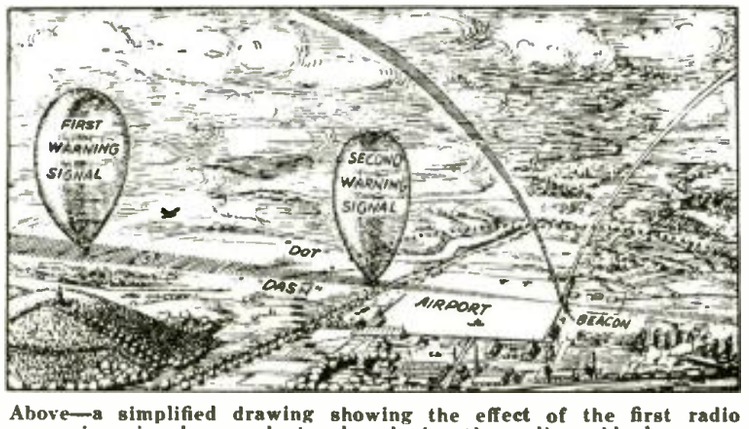
In addition to the main directional radio beam radiated from the airport, two radio warning signal transmitters are installed at distances of 1,000 and 10,000 feet respectively from the border-line of the airport. They operate on 7.9 meters and radiate their beams vertically, as the illustration clearly shows.

A second indicating needle on the instrument before the pilot, moving between the words *near* and *far* on the dial, shows the pilot when he approaches the first "warning signal" beacon. It

(*Continued on page* 710)



Short-wave "blind landing" device as installed on German airplanes for use with the latest type of radio-direction beam.



Above—a simplified drawing showing the effect of the first radio warning signal, second signal and also the radio guide beacon.

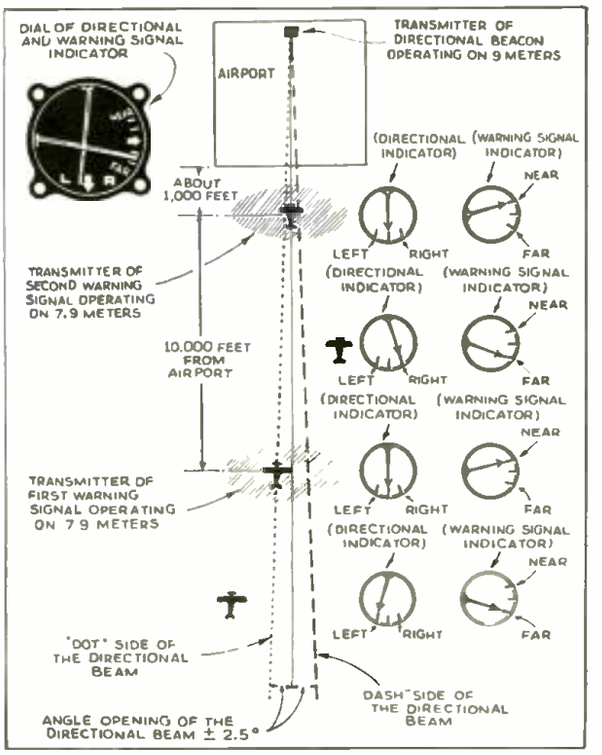
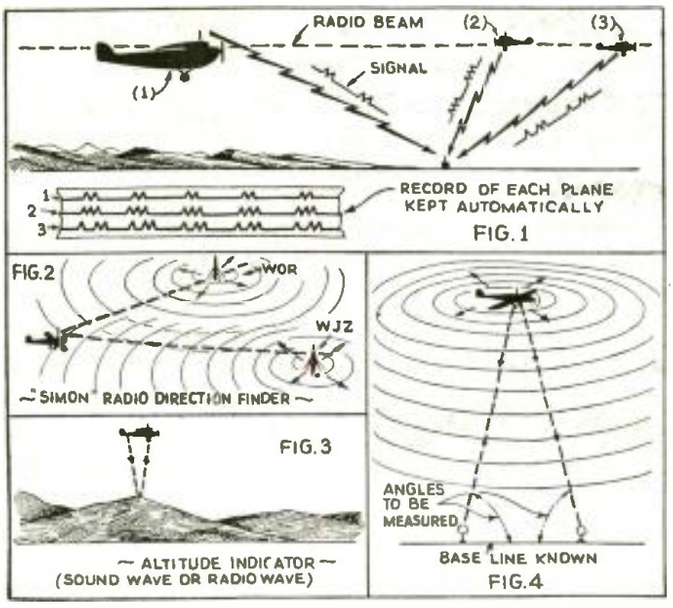


Diagram above shows the simple indicating instruments which warn the pilot as he approaches the airport, also successive indications of the "direction" as well as the "warning signal" indicator.



Several radio schemes are illustrated above which may add considerably to the safety of our commercial airlines. Some form of radio "direction finder" should be used for the purpose of accurately locating the position of a plane.

Can SHORT WAVES Prevent *"Lost" Planes?*

By H. W. Secor

● THREE airplanes lost in one week is not a very good record for American Aviation, and even with the high degree of perfection of radio beacons now in use by the principal airlines, every now and then a plane gets lost.

One case in point was that of a plane which crashed on a mountain, at Port Jervis, New York. Newspaper reports state that *sleet and snow static* interfered with the proper reception of the radio beacon signals by the pilot; in the first place the signals were greatly weakened due to the fact that high winds had apparently forced him off the main path of the beacon signals from Washington, D.C., to Newark.

With one plane and its four passengers and crew of three still lost, at the time this article was written, it seems that we are not checking the position of our planes as accurately as we might.

At present, the pilot may talk to the ground station by radio phone and he reports at regular intervals. After what has happened recently, however, and in view of the fact that one plane is lost *somewhere in Utah*, it would seem that one of the first steps that should be taken by the aviation operating companies would be to inaugurate a new system, whereby the pilots would have to check back to the *ground* stations at much shorter intervals, say every ten minutes. This is so for the simple reason that planes today frequently fly at speeds of three to four miles per minute. If a plane does not report except at thirty minute intervals, imagine where a plane may be if it strikes a mountain during a storm and he is at the end of a thirty minute reporting period! If the plane had flown at 200 miles an hour, he would have been 100 miles or (*Continued on page* 717)

Television Images Seen 70 Mi. from Transmitter

● RECENTLY a very interesting report was received from engineers at Riverhead, Long Island, who were successful in picking up television images broadcast from the transmitter atop the Empire State building, in New York City. Theoretically, the radius of NBC's radio transmitter, even though it is elevated approximately 1300 feet above sea level, is about 25 to 30 miles. The report from the Riverhead engineers is, therefore, of unusual interest, and here is the way the images were picked up.

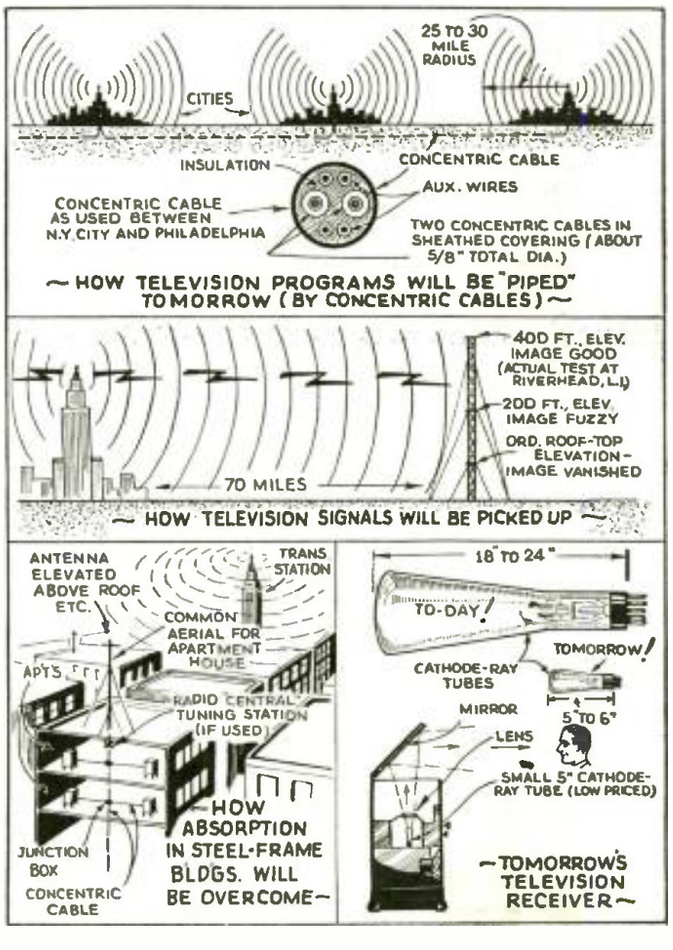
It would seem from the theory of radio wave propagation that if we went high enough, we would probably be able to intercept the 6-meter television waves, and this is exactly what the engineers at Riverhead, L.I., did. In other words, they used a small antenna elevated on a 400-foot tower. The report stated that the pictures detected by this antenna

Will concentric cables carry television programs from city to city? How can the range of ultra short-wave television signals be increased? What new tube bids fair to reduce the cost of the "home" television receiver?

at 400-feet elevation, and 75-miles distant from the transmitter, were as clear as those intercepted 15-miles from the transmitter. When the receiving antenna was moved to a lower elevation, or 200-feet, the images became fuzzy, and when the receiving antenna was lowered still further, to an elevation equivalent to an ordinary roof-top, then the images disappeared altogether.

At least two new developments may hinge on this reception test. First, television images may be relayed in the future or wherever necessary, by picking up the images at a distance of 75 to 100 miles from the transmitter on a *high-elevation* antenna, then piping the image signals over a concentric cable to a *relay* transmitter. In this fashion, television images may be transmitted on ultra-short waves of the six-meter variety over great distances, or to points far beyond the line of vision.

A study of the signal strength on such short waves as six meters has shown that considerable variation occurs in the strength of the signals when the receiver is moved around to different locations on a floor in a steel-frame building, such as we find by the hundreds in (*Continued on page* 718)



How will television programs be broadcast tomorrow? The diagrams above show probable arrangement of receiving aerial on a typical apartment house and also small, low-priced cathode-ray tube receiver.

5-Meter Tests Made from "Above the Clouds"!

By Charles W. Carter, W3EZL–W3FXL

Remarkably successful long-distance tests in both *transmitting* and *receiving* were accomplished in the 5-meter band, from a station located atop the Blue Ridge Mountains in Va., at an elevation of 3595 feet. Distances of about 200 miles were negotiated; a description of the apparatus is given.

The 5-meter antenna and "Long-lines" oscillator atop pole, as used for portable station atop the Blue Ridge Mts., 3,600 feet above sea-level. The mast is lashed to the car so that the whole station is mobile.

● SINCE the early part of 1930 several friends and I have been actively engaged in experimentation with ultra-high frequency waves.

During the early tests many things were learned which resulted in the successful operation of a 35 mile circuit in the latter part of 1930. Many of the conclusions reached at that time have remained unchanged. One of the most important of these concluded that in order to consistently work greater than a distance of 10 miles, the transmitter must have an elevation of 35 feet for every mile of transmission distance. This rule, is of course, subject to topographical variations. It does not apply to *directional arrays* excited by high-power transmitters.

In 1932 there was much speculation on the possible results in transmitting from a point near Skyland, Virginia, a small resort on top of the Blue Ridge mountains. A test from the mountain had often been postponed because of the difficulty in getting a car to the top of the mountain. The opening of *Skyline Drive* last year made accessible many attractive points for ultra-high frequency research.

Remarkable Receiving Tests

During the spring, in preparation for the long delayed tests, topographical maps were studied. Armed with a good mental picture of the "lay of the land," a sensitive receiver and a compass we were ready on the night of July 19th to make a *receiving* test. By far the best receiving location was found at *White Oak Canyon*, elevation 3595 feet above sea level.

On this particular night during a "listening period" from 10 p.m. to 11 p.m. Est., signals were heard in the following order: W3DQO—R5—ICW—Millville, N. J., 191 miles; W3DNX—R8—Phone—Vineland, N. J., 193 miles; W3CUT—R9—Phone—Wildwood Villas, N. J., 194 miles; W3FFX — R3 — Phoenxville, Pa., 191 miles; W3DBC — R2 — Washington, D. C., 78 miles. My portable, operated at Bremo, Virginia, was R9 plus (60 miles).

The 5-meter antenna and "L.L." oscillator erected on a chimney.

It was calculated that this reception was freakish and predicted that with normal conditions reestablished, the range would drop off sharply with an attendant increase in Washington (D. C.) signals, with a possibility of Baltimore showing up with at least moderate signals.

5-Meter Transmitter Data

A *transmitter* was designed to be used in "transmitting and receiving" tests to be made from the aforementioned location. A parallel rod system was used because of its ruggedness, stability and high efficiency. Type 12A tubes were used and operated at 180 volts, 60 milliamperes. A type 42 was used as a modulator. This tube will give ample modulation to a pair of 12A's and does not require a speech-amplifier. The transmitter power was obtained from a dynamotor. A most novel and original idea, accounting largely for the fine results of this system, is the method of radiation. One-quarter wave radiators are attached directly to the plate tank rods at a point where the plate current doubles the no-load current.

Photo at left shows author tuning 5-meter receiver of the portable automobile station used in the mountain-top tests made on the famous Skyline Drive in Va. Photo below shows young lady inspecting the 5-meter portable set; dynamotor and filter in bottom case, modulator in center case, and receiver on top.

The radiator length is a length which does not cause the frequency to shift from the no-load frequency. This system eliminates feeder losses, it is stable and will "stay put" indefinitely.

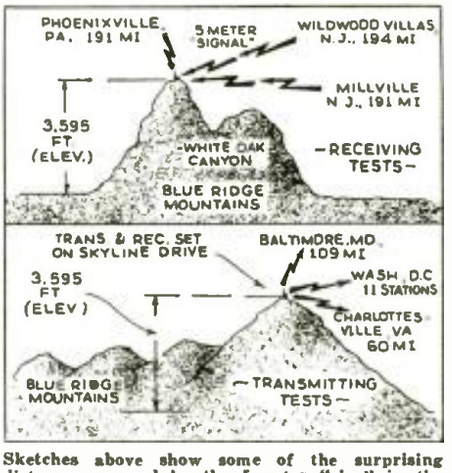
Transmitter Mounting

The transmitter is mounted on a 2" by 2" stick, 12 feet long. For portable use the stick is strapped to the door frame of the car. For fixed use it is lashed to the chimney shown in the photograph. As a fixed station the type 12A tubes are replaced by type 10's which are operated at 480 volts, 100 milliamperes. They are modulated by a pair of type 50 tubes in parallel.

In portable use the filament and modulated plate voltages are fed through a 14 foot shielded two-wire cable, the F— and B— being common to the sheath. As a fixed station the feed is through two twisted pair lines each 55 feet long.

Weather seems to have no effect on the transmitter and it may be operated through a heavy rain with no change in characteristics.

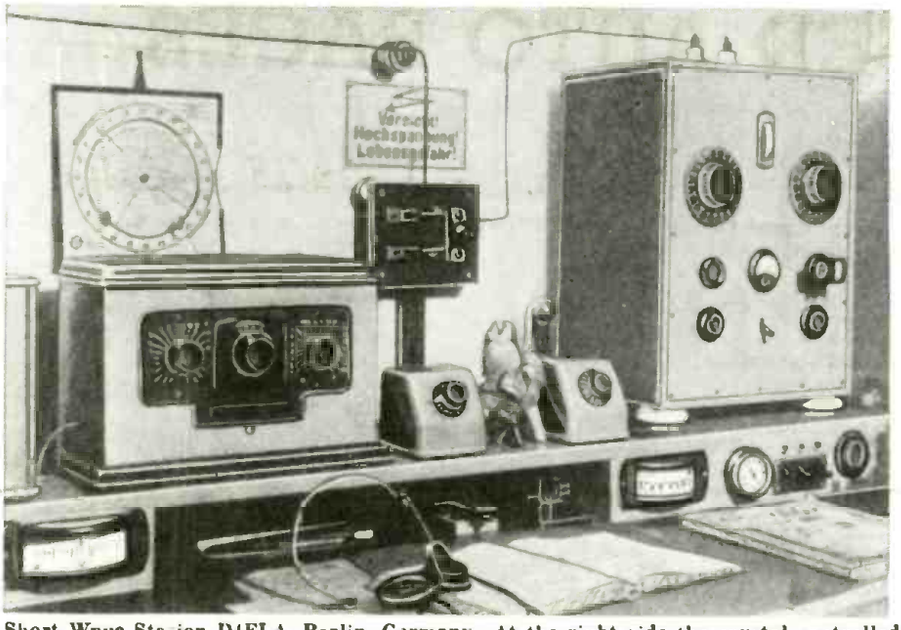
(*Continued on page* 694)



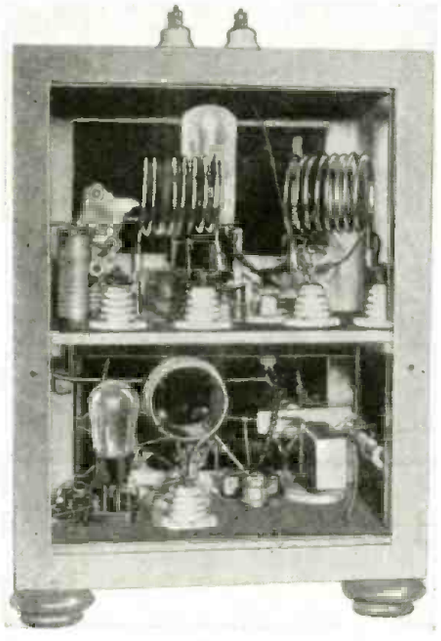
Sketches above show some of the surprising distances covered by the 5-meter "sigs" in the mountain-top tests.

A Crack German Ham Station and Its "CQ" Machine

A "CQ" or automatic calling machine is not so well known to American amateurs. Here's one, built by a German "Ham," that will "fill the bill"—and it's simple and cheap to build. An old phonograph motor supplies the necessary motive power, and a hand-perforated paper tape sends out the signals automatically.



Short Wave Station D4FLA, Berlin, Germany. At the right side the crystal controlled 10 watt transmitter. The small cabinets in the center are trap circuits to be used when necessary. The box at the left is the Telefunken all-wave communication receiver, type 1930, but still in excellent operating condition.



Rear view of crystal-controlled 10 watts transmitter of D4FLA, owned and operated by W. L. Baumgarten, Berlin, Germany.

● W. L. BAUMGARTEN, owner of the German amateur station, D4FLA, has constructed a very novel and efficient "CQ" machine which only cost him about $1.25 to build.

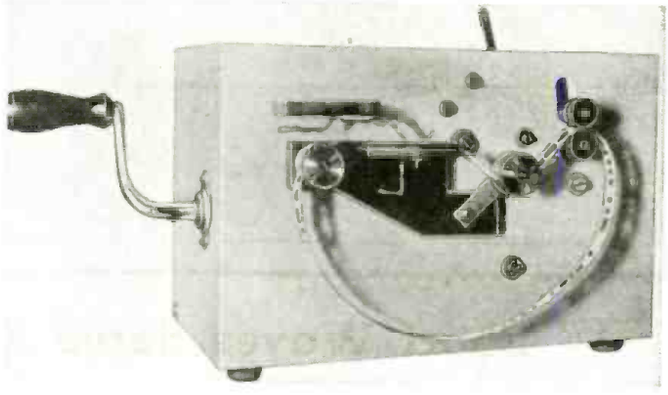
This gadget is a very simple CQ machine, which he constructed of an old wooden box, a much older spring motor taken from a discarded portable phonograph, and some pieces of brass and hard rubber such as we may find in every amateur's scrap box.

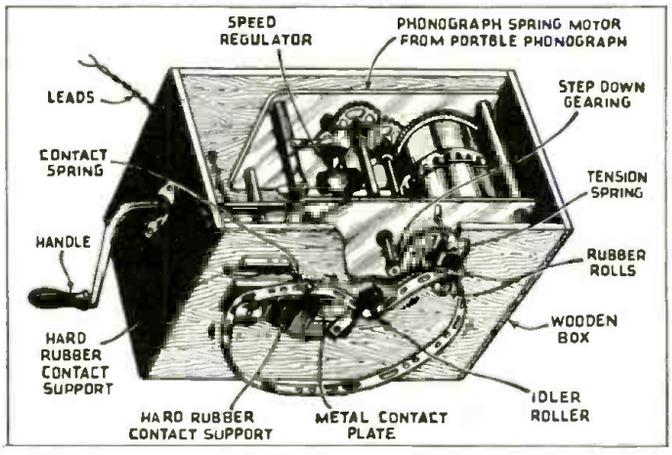
Mr. Baumgarten calls this gadget his "auto" and how he constructed it is shown in one of the photos. Atop the main axis of the spring motor a small-toothed wheel has been fixed, which is a part of a step-down gearing. The driving force of the gadget, a small soft rubber roll, has been attached at the axis of the larger toothed wheel. A second roll, made of medium soft rubber, presses the paper tape tight against the soft rubber roll. The pressure required is created by means of a small steel spring, installed between the axes of the two rolls. Since it is necessary to lift the upper roll in case the paper tape is to be inserted, slots have been provided in the front plate of the spring motor and in the front wall of the wooden box. The upper roll has been made moveable by resting its axis into a strip of brass. This strip has been attached by means of a screw behind the front plate of the spring motor.

The speed of the paper tape is controlled by a zero-adjustment lever atop the box, which is also used as stopping device. This lever operates upon the tiny leather brake used to control the speed regulator. Sometimes, other stopping and speed regulating devices are to be found in spring motors as applied in portable phonographs. In such cases it is necessary to arrange these control devices in a little bit different way. But since the main principle in the method of speed control is about the same, no difficulties may be created for the home-builder of such an "auto-caller." A fitting place for the two idler rolls required is quite simple to find. However, some trouble may occur in connection with the design of the spring contact.

While any piece of metal can be used for the contact plate, which is fixed

(*Continued on page* 695)





Mr. W. L. Baumgarten who is the owner of the well known amateur short-wave station D4FLA, Berlin, Germany, designed a helpful gadget to call other amateur stations to which he often "speaks" via code. He took the spring motor from an old portable phonograph, a wooden box, some pieces of hardrubber and brass, and a few screws, and constructed an automatically operated "caller," which helps him to gather verification cards from all parts of the globe. The holes are punched into the paper tape by means of steel punches after the signals have been written upon the tape. Paper is used as the signal tape.

TELEVISED AUTO RACES

Front Cover Feature

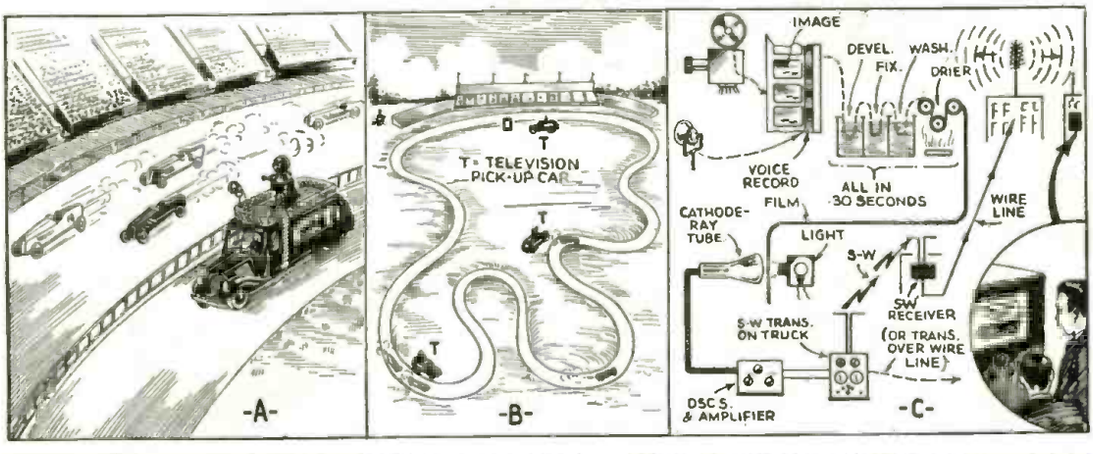
● THE front cover picture shows how mobile television units can be utilized to pick-up exciting scenes and the accompanying sounds at different points along an automobile race course. The photo at the right shows one of the mobile television units in actual use in Germany, where television programs are being broadcast daily as well as in England.

The television truck shown in the accompanying photo was used by the German television system for the purpose of picking-up the images and sounds of some of the events in the recent Olmpic Games held in that country. The truck followed some of the running and jumping teams and recorded the image, as well as the sound, upon a photographic film similar to that used for motion picture work. The images are photographed with a machine placed on top of a truck, while a microphone picks up the sound which is recorded on the *sound-track* of the film.

The next interesting point in the present method of picking up *"spot"* news shots by television in Europe, is the *intermediate-film* process. "Believe It Or Not"—as Ripley says—the film for an average scene or event, is developed, fixed, washed, and dried in the remarkably short space of thirty seconds! The finished film is shot through the television pick-up and scanned. The scanning covers both the image and the voice tracks on the film; in this way both components can be transmitted on a single wavelength.

The television short-wave signals are pick-up at a local receiving point and then relayed over a *wire* line, preferably a concentric cable, to the main television (*Continued on page* 696)

Above—television truck in actual use in Germany and of similar type to that shown in our front cover illustration.



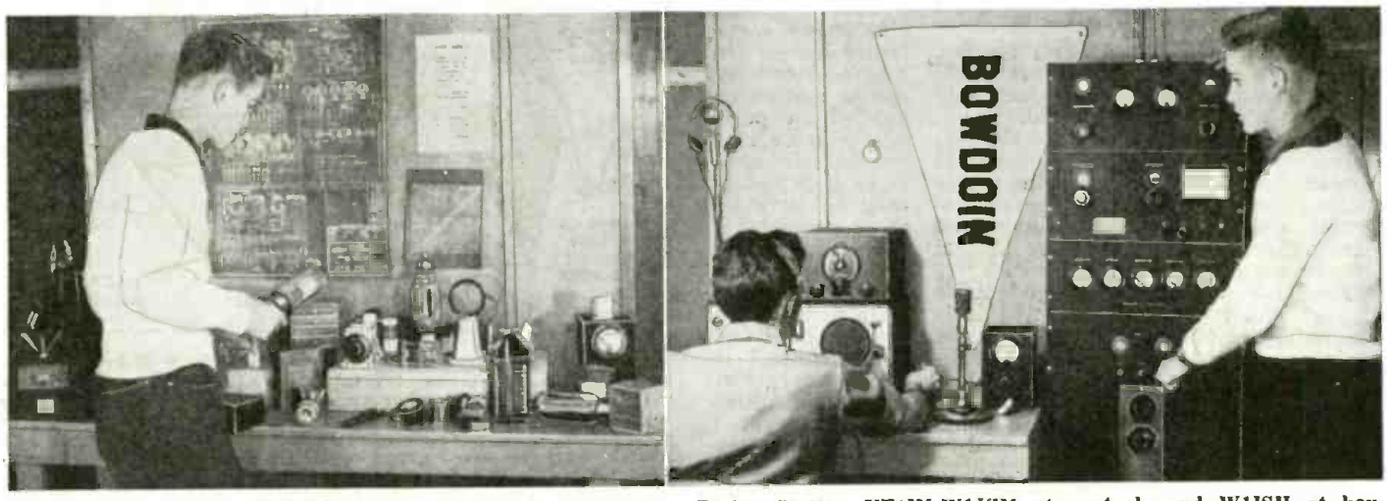
Left—this picture shows how several television mobile units may be employed to pick-up scenes at various points around an auto race course. The method of transmitting the image and sound by short waves is also shown.

Short Waves Serve Kent's Island Expedition

● THE Bowdoin-Kent's Island Expedition operated in the "Bay of Fundy" which is located between the coast of Nova Scotia and that of New Brunswick, Canada. The transmitting facilities of VE1IN was located upon a very small island, Kent's Island, which is 2 miles long and one thousand feet wide. This island, which served as a base for the expedition, was recently given to Bowdoin College by J. S. Rockefeller.

Kent's Island is located at the mouth of the bay half way between the coasts of Nova Scotia and New Brunswick.

The expedition consisted almost wholly of college undergraduates who were carefully (*Continued on page* 696)

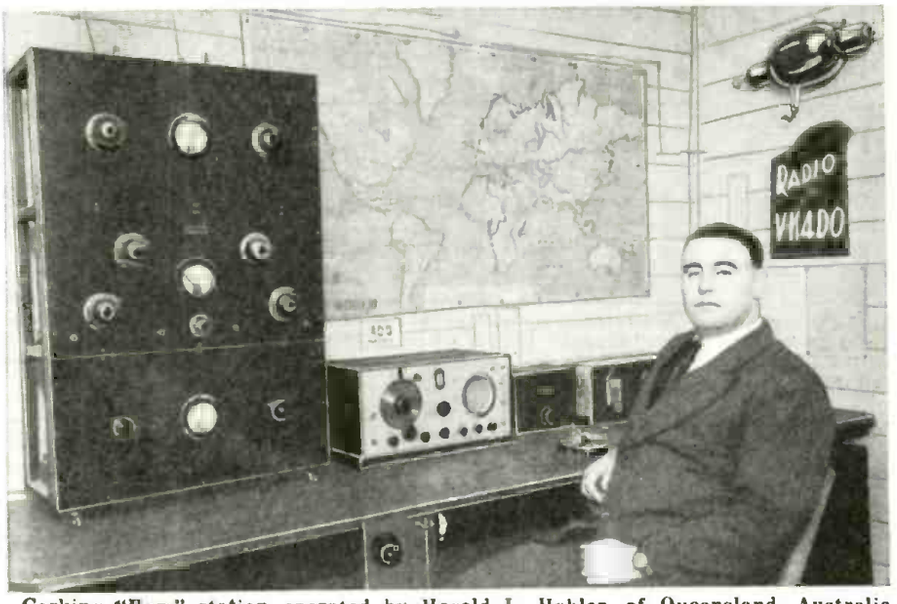


Left—Thomas Gross (W1JZM) and experimental apparatus. Right—Station VE1IN-W1JZM at controls and W1ISH at key. Bowdoin-Kent's Island Expedition. This transmitter was heard four times in New Zealand and over 35 times in England. Power was furnished by gasoline-driven engine-dynamo unit.

SHORT WAVES and LONG RAVES

Our Readers Forum

Prize Winner, Harold L. Hobler, VK4DO, Australia



Corking "Ham" station operated by Harold L. Hobler, of Queensland, Australia. Call letters VK4DO. Awarded "Best Photo" prize of 1 year's subscription offered each month.

● Radio VK4DO was one of the first licensed stations in Queensland, and transmitted 240 meter broadcasts first in 1923, and was also the first licensed receiving station in Rockhampton after the Great War. From 1923 up to the present time it has never been "off the air" very long and of late years the "log" shows an entry for practically every day. The station has progressed from 140 volts on a UV202 in a self-excited Meissner and Hartley up to the present gear, namely a 4 stage "rack" (crystal-control) with 47,46,46, and 210 in the final on 20 meters, where the station is practically always operated.

VK4DO has never in the 13 years used a greater input than 45 watts, always being on low power. The 4 stage crystal "rig" has switching for change to 40 meters by cutting out a 46 doubler. The transmitter is followed by a 1936 model SX9 *Super Skyrider* with crystal, just brought out from Chicago. Next is a *Gross* Monitor which keeps a check on frequency and signal, then a faithful *Super Wasp* which served well for several years until the *Super Skyrider* arrived.

A map of the world in front of the operator is used to show the stations and countries worked. It is mounted on a sheet of Celotex, and a pin is inserted at the exact spot a station is worked. The pin has a small flag at the top on which is the station call. It only takes a glance to see just where QSOs have been made.

Crystal-control has been installed just over a year. Prior to that the station went through all the old "time-trying" stunts to get a good note—including the old slop-jar rectifiers, Amrad "S" tubes and an Esco Generator giving 500 volts.

In 1926 VK4DO was the winner of the Queensland-Jewell *"Miles Per Watt"* Contest, communicating with Hawaii, California and Oregon (U.S.A.) using 140 volts (poorly rectified) on a UV202. In this year the station was also successful for Queensland in the Trans-Pacific Tests conducted by the A.R.R.L. and W.L.A. In 1925 the station pushed 200 meter phone to New Zealand (2,000 miles) using 160 volts on a *receiving* tube in the transmitter.

Despite the low input of 40 watts, 5 con-

(*Continued on page* 719)

A Flash from South Africa

Editor, SHORT WAVE & TELEVISION:

I submit a photo of my short-wave "listening post"—all the way from "Sunny South Africa."

The receiver I use is a "Pilot" Model 63, all-wave 6-tube superhet, covering from 16 to 550 meters. I use two antennas—one is a 40 ft., vertical non-directional antenna, and the other an inverted "V" directional, N.W. to S.E. This antenna is the "real goods" for receiving stations from America and Australia. There is about 40 per cent gain when receiving stations from these countries, as compared when using the ordinary vertical. I find the 40 ft. vertical antenna better for ordinary broadcast reception, and also for receiving stations from Daventry, Germany, Brussels, and other stations in Europe.

Mike Kruger's "Listening Post" in Johannesburg, South Africa.

I have been a very keen short-wave listener for 12 years now, and I have been appointed official "Radio News" short wave listening post observer for South Africa. In April 1934 I won the "Argus" contest, for logging the most short-wave stations from this country, as you will see from the illuminated address clearly shown in my photo. In January of this year, I was runner-up, having had 230 stations verified over a period of six months. My total number of verifications actually verified to date are 420, which easily holds the record for South Africa.

I have heard every continent on several occasions. My best veris are TI4NRH, Costa Rica, when that station was using only 7½ watts; VK3ZX, an Australian amateur broadcasting records and using only 20 watts; TFK, Iceland; HAS3-HAS4, Budapest; CT2AJ, Ponta Delgada, Azores; Colombo, JVM; H-P-JYS, Japan; VP3MR, Georgetown, using 50 watts; ZHJ, Penang, Malaya; Fiji Islands; Honolulu, and many others too numerous to mention.

I have been reading *Short Wave & Television* ever since its inception, and it sure is a great magazine. In my opinion *Short Wave & Television* is one of the best magazines in the world. Please carry on with the good work and good luck.

Mike Kruger,
17 St. Georges Street,
Yeoville,
Johannesburg, South Africa.

Built Set from Our Book

Editor, SHORT WAVE & TELEVISION:

I have been a reader of *Short Wave & Television* for some time and I think there is no better magazine on the subject. I have been interested in the pictures of Amateur stations and Listening Posts.

On the right-hand side of the table is a small set which I seldom use. On the left-hand side is my regular receiver, a Doerle using a 56 and a 57. This set was made from plans in your book, "How to Build Four Doerle Short Wave Sets." I have not had any unusual DX on this set, but I have heard all districts in the United States and Canada (verified). Also, I have heard stations in Cuba, Canal Zone, South America, and Alaska. Altogether, I am well satisfied with the results.

Stan Sacks,
1701 S. 26 St.,
Lincoln, Nebr.

Back in the U. S. A.—SW Listening Post of Stan Sacks, Lincoln, Nebr.

Ultra-Short Waves and "Blind Landing" in Europe

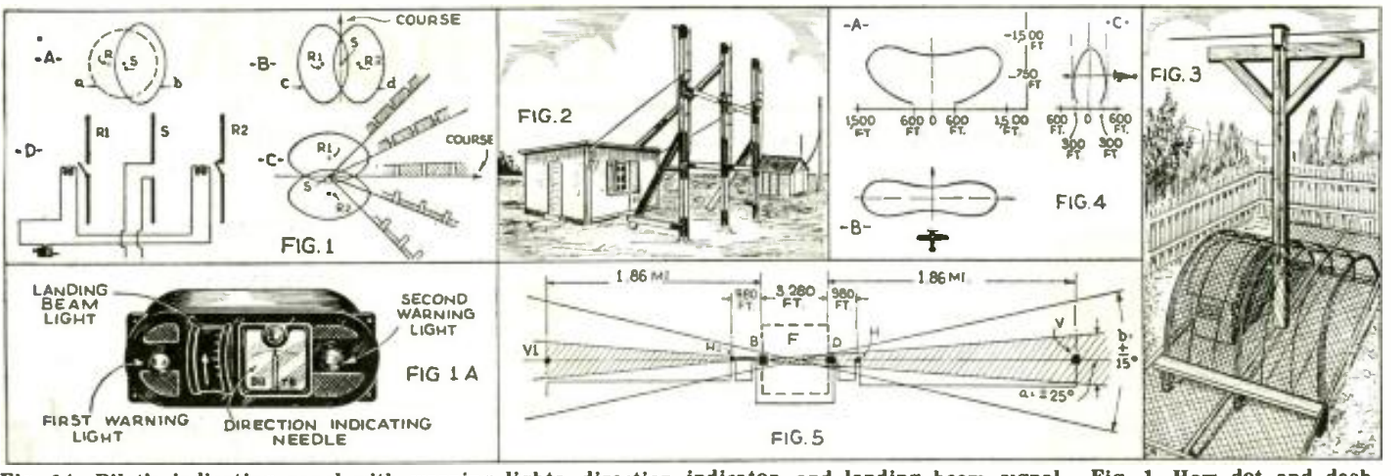


Fig. 1A, Pilot's indicating panel with warning lights, direction indicator, and landing beam signal. Fig. 1, How dot and dash signals are arranged so that they produce a continuous "on course" signal. Fig. 2, Ultra short-wave aerial and the two reflectors. Fig. 3, Dipole antenna of 5-watt transmitter and auxiliary reflector. Fig. 4, Diagram showing the shape of the radiated waves. Fig. 5, Plan of the complete ground antenna set-up.

By C. W. Palmer

● RADIO has been instrumental in improving many industries during the past few years, and aviation is certainly not the least important of these. The radio beams and beacons which have made flying from one landing field to another safe have revolutionized flying methods.

During the past year or two, much activity has taken place regarding the safe landing of planes when the landing field is completely obscured—or in flying terms, when the ceiling is zero!

In Europe, the Lorenz Co., of Germany, has developed a radio system operating on ultra short waves, which is being installed in all the important cities, to make *blind-landing* safe.

This system operates in a general way as follows: When the pilot who is riding the radio beam toward his point of destination arrives at a point some 2¾ miles from the airport, a tiny lamp on the instrument panel of the plane lights and he then descends until an audible signal is heard. The lamp tells him that he has reached the outer extremity of the landing beam and when he picks up the audible signal he is on this beam which is focused at a point some 650 ft. above ground at this point.

The landing beam is composed of three parts, a continuous signal for "on course," a series of dots for one side and a series of dashes for the other, so that the pilot simply keeps his plane at the point of loudest continuous signal, and he is then riding in on the landing beam.

When the plane has reached a point about 1,000 ft, from the center of the field, just before touching the ground, a second light (*Continued on page* 713)

Micro-Ray Communication

By W. L. McPherson, B.Sc. (Eng.), A.M.I.E.E., and E. H. Ullrich, M.A., A.M.I.E.E.

● IN a recent important paper entitled, "Micro-Wave Communication," read before the *Institution of Electrical Engineers*, London, some very interesting and little-known facts concerning micro-wave transmission and reception were given.

Credit is given for some of the earliest micro-ray work to Hertz, whose classic experiments in "wireless" were performed with centimeter waves in 1887. Radio development in the next few years drifted away from the short-waves to the longer waves, but after the War, research slowly but surely started again in the short-wave part of the radio spectrum.

Barkhausen and Kurz in 1919 discovered that centimeter waves could be generated by tubes with highly positive grids, and in March, 1931, the first public demonstration of modern micro-wave telephone communication was given across the Straits of Dover, with waves only 18 centimeters (7.2 inches) long. Later, a micro-ray link was placed in operation between Lympne and St. Inglevert, in which essentially the same principles were involved. The same ultra short-wave link of 18 cm., as used in the Dover experiments, were used, but this time the distance was much greater, or 56 Km. (33.6 miles.) (*Continued on page* 711)

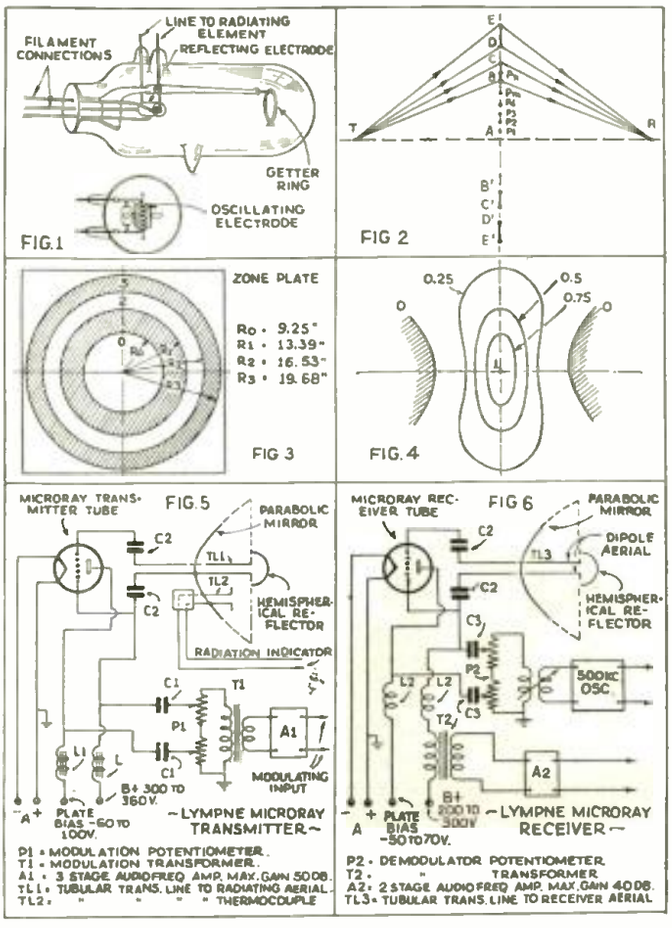


Fig. 1, Appearance of the micro-ray tube. Fig. 2, Diagram showing radiation from a zone plate consisting of a number of concentric metal rings. Fig. 3, Lay-out of typical zone plate. Fig. 4, Showing that points in line with the doublet are sometimes not excited at all, or else weakly. Fig. 5, Micro-ray transmitter. Fig. 6, Receiver. →

TELEVISION COURSE

Mechanical Scanning—How It Works

Lesson 2

By George H. Eckhardt,

Author, "Electronic Television"

● PROBABLY the first important problem in television is to break up a picture having *length* and *breadth* into *length* alone, and then transmit this by some means, and—at a receiver—again assemble length into length and breadth again. This, of course, is the problem of *scanning*.

Nipkow's Scanning Disc

Paul Nipkow, a German of Slavic extraction, invented the scanning disc in 1884. Until as late as six years ago Nipkow's invention was the "heart" of experimental television. True enough Nipkow, and his successors, for many years did not have the modern thermionic tubes, used for radio frequency amplification, but the *basic principle* of *mechanical scanning* was there!

Nipkow's invention is as ingenious as it is simple. It consists of a rotating disc (see figure 1) in which a number of apertures, arranged in a *spiral* manner, have been cut. Each aperture, or hole, is its own width nearer the center. A "mask" is supplied as in figure 1. It will be seen that if a source of light is placed behind the disc (as shown in figure 2) as the first hole in figure 1 moves from A to B, there will be a horizontal sweep of light. Then there will be a second sweep of light from C to D (figure 1), as the second hole moves across the opening in the mask, and so on the light from the source will be broken down in a series of *parallel lines of light*.

How Action of Eye Helps Television

The *persistence of vision* of the human eye is such that if the disc is revolved fast enough, there will appear to be always a complete light picture in the opening of the mask. Thus if there are *twelve holes* in the disc, there would be *twelve strips of light*. Of course, to obtain any worth-while results at all, there would have to be more than twelve holes; however, this is the *basic* principle.

How then could the Nipkow disc be used in making up a television set, both "pick-up" and "receiver"? Figure 3 shows how this is done. Again it must be remembered that this is an extremely elemental diagram, and that amplifiers, and other most essential parts, are not shown for simplicity's sake.

The light reflected from the subject (figure 3) passes through the apertures or holes in the revolving disc. By means of the holes in the disc the "picture" is broken up into strips. These strips themselves vary in *intensity of light and shade* as the "picture" being picked up varies itself. As each strip passes across the mask opening it falls upon a photo-electric cell, and this causes variations in the photo-electric current.

Thus it is seen that the picture is broken up into *length* and *intensity*. The disc is revolved by means of a (synchronous) motor. The varying signals from the photo-electric cell are sent out after amplification.

Scanning Discs Must Be Synchronized

At the receiver there is a similar disc with a similar number of holes, identically arranged as in the disc at the pick-up. This second disc is revolved by a motor in *perfect synchronization* with the motor at the pick-up disc. Thus it will be seen that the revolutions of the receiver disc are synchronized with the revolutions of the pick-up disc. The source of light at the receiver is a neon glow tube which varies in brilliancy, *accurately* and *instantaneously*, with the signal coming from the photo-electric cell at the receiver. The *persistence of vision* of the human eye is such that, if the disc is revolved fast enough, and there are enough holes or apertures, a recognizable picture or image appears in the mask opening.

Many well-known inventors have used the scanning disc in television research, and among them were the Bell Laboratories and Jenkins in America, and Baird in England.

375 Line Mechanical Scanning Achieved

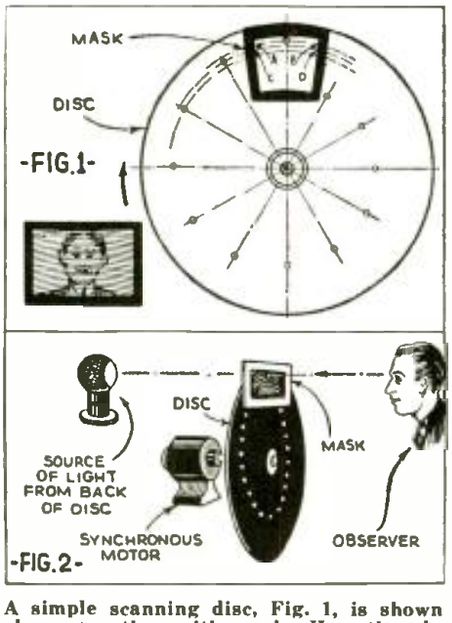
In Germany, Fernseh A. G., has built *mechanical* scanning transmitters that have achieved a definition of 375 lines interlaced. These require a disc revolving at 6000 revolutions per minute. The discs revolve in a vacuum.

Television has always, it seems, presented both great difficulties and great hopes. In 1908, in the English scientific magazine *Nature*, appeared the following, "M. Armengaud, president of the *French Society of Aerial Navigation*, firmly believes that within a year, as a consequence of the advance already made by his apparatus, we shall be watching one another across a distance of hundreds of miles."

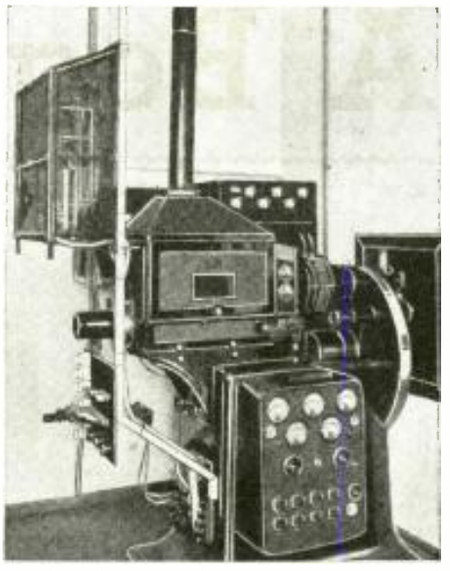
The editor of *Nature* added, "It may be doubted whether those who are bold enough to attempt any such feat adequately realize the difficulties which confront them."

Without going into details regarding the apparatus of M. Armengaud, his hopes, and the comment of the editor of *Nature*, seem to apply very well to mechanical scanning.

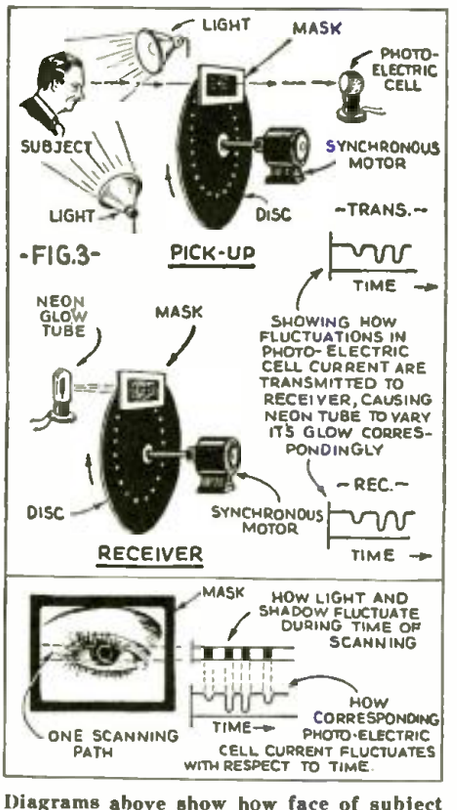
Synchronization is one of the most important things in television, there must be *per-* (*Continued on page* 701)



A simple scanning disc, Fig. 1, is shown above, together with mask. How the observer sees successive strips of light, which eventually cover the whole opening in the mask as the spiral of holes rotates behind the mask, is made clear by the drawing above.

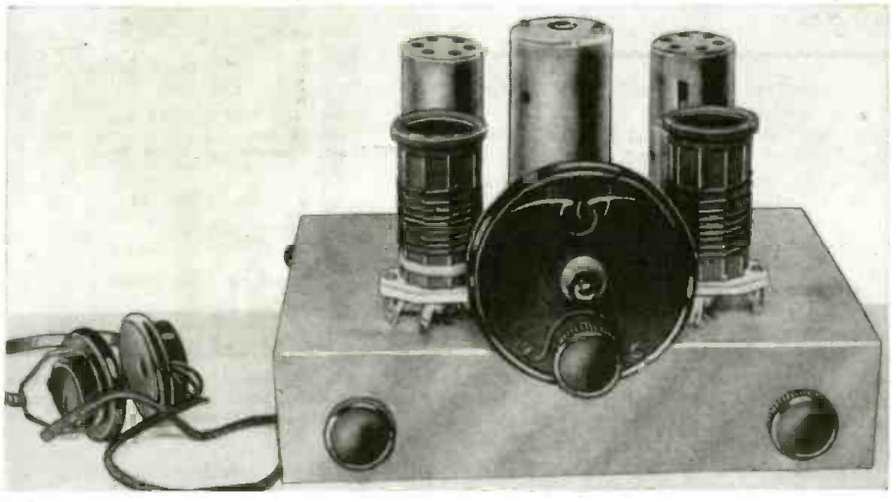


Light-spot transmitter with high-speed scanning disc, built by the Fernseh Company in Germany. Fig. 4.



Diagrams above show how face of subject is scanned by spiral hole disc, successive variations in light and shadow being projected onto photo-cell. The fluctuations in the photo-cell current, when transmitted to the receiver, cause corresponding variations in the glow of a neon tube mounted behind a second revolving scanner.

A Beginner's Super



Front view of a clever 2-tube super-het for the Beginner. With the new type tubes now available it is possible to perform all of the functions in a superheterodyne with only two tubes.

● THE urge to build a real honest-to-*goodness superheterodyne* receiver is "in the blood" of every true short-wave experimenter. Unfortunately, however, the ambition of many "fans," especially the younger ones, only too often exceeds the contents of their pocketbook and the great day must be indefinitely postponed. To make the situation still worse, it seems that no designer of short-wave supers can resist the temptation to add that "one more" feature which will make the circuit "just a little better." This is all very well and highly commendable but it doesn't help the fellow who has only a limited amount of money to spend for parts and who has had no practical experience in superheterodyne construction and adjustment.

The little "beginner's super" shown in the photographs and described in this article is designed especially as a "first" superheterodyne for the experimenter who has built the regenerative or tuned-radio-frequency circuits, and is looking for something slightly more complicated. This receiver has all of the characteristics of the standard superheterodyne circuit and is ideal for the fellow who is studying radio or who would like to "get the feel" of a super before tackling the job of building a larger set. If built of good quality parts and according to the specifications as laid down here, the *selectivity* and the *sensitivity* will be very good and no difficulty whatever should be encountered in getting the circuits into proper alignment.

How 2 Tubes Do All the Work

As the schematic diagram, Fig. 1, shows, the circuit consists of a 1C6 as *combined mixer and oscillator* and a 19 as *regenerative detector* and *one stage of audio frequency amplification!*

The single I.F. transformer used in this receiver is of the "airtuned" type, which gives maximum gain and stability, and is tuned to approximately 465 kc.

The tuning condenser is a standard two-gang unit of 140 mmf. per section maximum capacity, the two sections being made to "track" by means of the 20 mmf. trimmer condenser *in parallel* with the mixer tuned circuit and the .001 mf. mica condenser *in series* with the fixed plates of the oscillator tuning condenser.

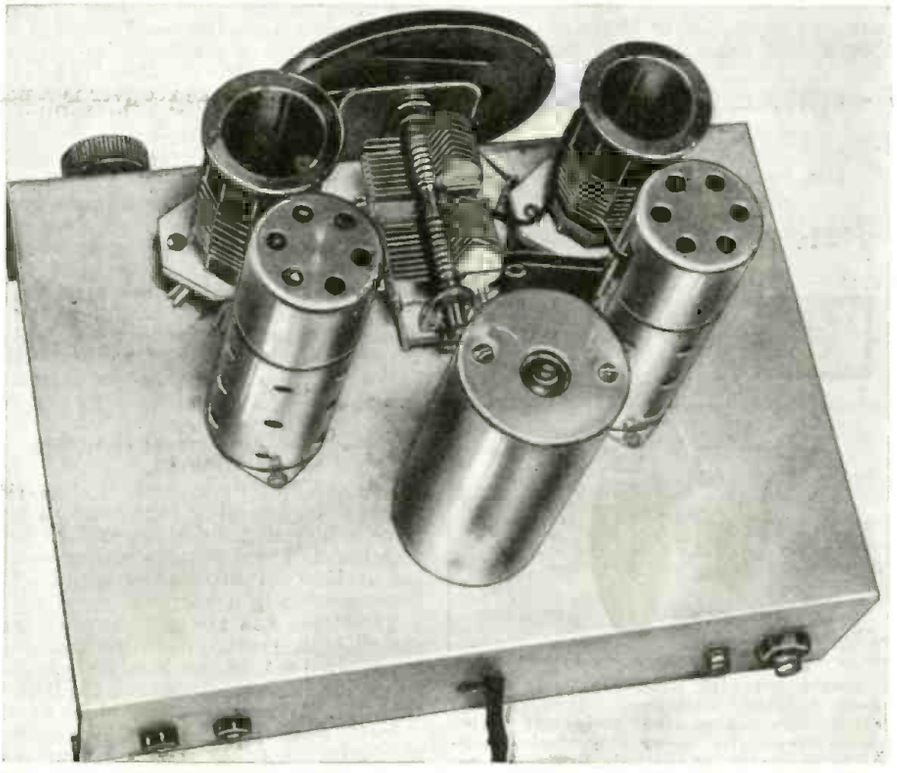
The eight coils necessary for complete coverage of the range from 15 to 200 meters, are of the plug-in type, wound on 6-prong forms, and may be purchased "ready-wound," or else made by the experimenter himself, according to the data which will be found in the coil table at the end of this article. In general, the circuit is probably the most simple that will pass under the superheterodyne name and, in this particular model, all of the parts have been selected for the highest possible gain and lowest losses.

Construction Extremely Simple!

The construction of the receiver is not at all difficult. As the photographs and drawings show, it is built up on a 7x11x2½ inch steel chassis, no front panel being used. The control at the left of the tuning dial is the regeneration control; the knob at the right turns the 20 mmf. trimmer mentioned above. This arrangement is the most logical one as it is *not* necessary to readjust the trimmer every time the receiver is tuned to a different station.

Drill and cut the chassis as outlined in Fig. 3 and mount the various parts as shown in the photographs, fastening them in place by means of machine screws. Place the tube and coil sockets and the I.F. transformer in the position that will give the shortest and the most direct wiring between them.

Beginning with the filament circuit, connect the parts together with either the usual stranded or solid tinned hook-up wire or bus wire. Solder each joint with a clean, hot and well-tinned iron and rosin-core solder and make sure that the connections are *really soldered* and not merely stuck together. Do not allow the melted solder or rosin to run down over the insulation of the sockets,



Here is how the Beginner's 2-Tube Super-het constructed by Mr. Hooton looks from the rear.

By
Harry D. Hooton
W8KPX

This beginner's super-het uses but 2 tubes to accomplish surprising results. A "19" and "1C6" are used to do all the work. The set may be operated from batteries such as a couple of dry cells and 135 volts for the plate taken from either a "B" battery or a plate supply unit. The wavelength range is 15 to 200 meters.

the coil forms or the tuning condensers. Wipe each joint with a clean cloth moistened in alcohol.

How to Wind the Coils

We are now ready to construct the plug-in coils, if these are to be home-made. Wind the grid coils to the proper amount of turns, as specified in the coil table, and make sure that the tickler is in the same direction as the grid winding of the oscillator coil and that the *connections are exactly as shown in the picture diagram.* Otherwise, no oscillation will be obtained which means, of course, that no signal can be passed to the detector. If commercial coils are to be used, it will be necessary to remove a portion of the oscillator grid winding in order to obtain even "tracking" between the two tuned circuits.

In case the ready-made coils do not correspond exactly with the data given for the standard (mixer) coil, merely remove approximately ⅛ of the turns from one set, leaving the other alone, and disregard the data given in the coil table. (*Continued on page 703*)

List of Parts for Beginner's Super

FIXED COND. & RESISTORS
2 Mica condensers, .001 mf., type 1460
2 Mica condensers, .00025 mf., type 1467
One Mica condenser, .0005 mf., type 1460
One Paper condenser, 0.05 mf., 400 volts, type 484
One Paper condenser, 0.01 mf., 400 volts, type 484
One Paper condenser, 0.25 mf., 400 volts, type 484
One Paper condenser, 0.1 mf., 400 volts, type 484
2 Paper condensers, 0.1 mf., 600 volts, type 684
One Carbon resistor, 50,000 ohms, ¼ watt, type 1096
One Carbon resistor, 50,000 ohms, 1 watt, type 1094
One Carbon resistor, 1 megohm, ¼ watt, type 1096
One Carbon resistor, 3 megohms, ¼ watt, type 1096
Name of above manufacturer on request.

HAMMARLUND MFG. CO.
One "air tuned" I.F. transformer, 465 kc., type ATT-465-CT
8 (two sets) 6-prong coils, type SWK-6, or 8 6-prong forms. See text.
4 Isolantite sockets, 6-prong, type S-6
2 Aluminum tube shields, type TS-50
One split-stator tuning condenser, 140 mmf., type MCD-140-S
One midget tuning condenser, 20 mmf., type MC-20-S
One midget trimmer condenser, mica, 35 mmf., type MEX

ELECTRAD INC.
One Potentiometer, 50,000 ohms, with d.p.s.t. switch, type 205
One Filament rheostat, 10 ohms, type 204-W

ICA
One Electralloy chassis, 7½x11x2½ inches (No. 1531)
One Vernier dial, type 2212
Two Knobs (for regeneration and trimmer controls)
One "Ant-Gnd" binding post assembly
Two Insulated tip jacks

EVEREADY
Two or three (90 or 135 volts) type 772, 45-volt "B" blocks
One type 761, 4½-volt "C" battery
Two type 7111 1½-volt "A" batteries (dry cells)

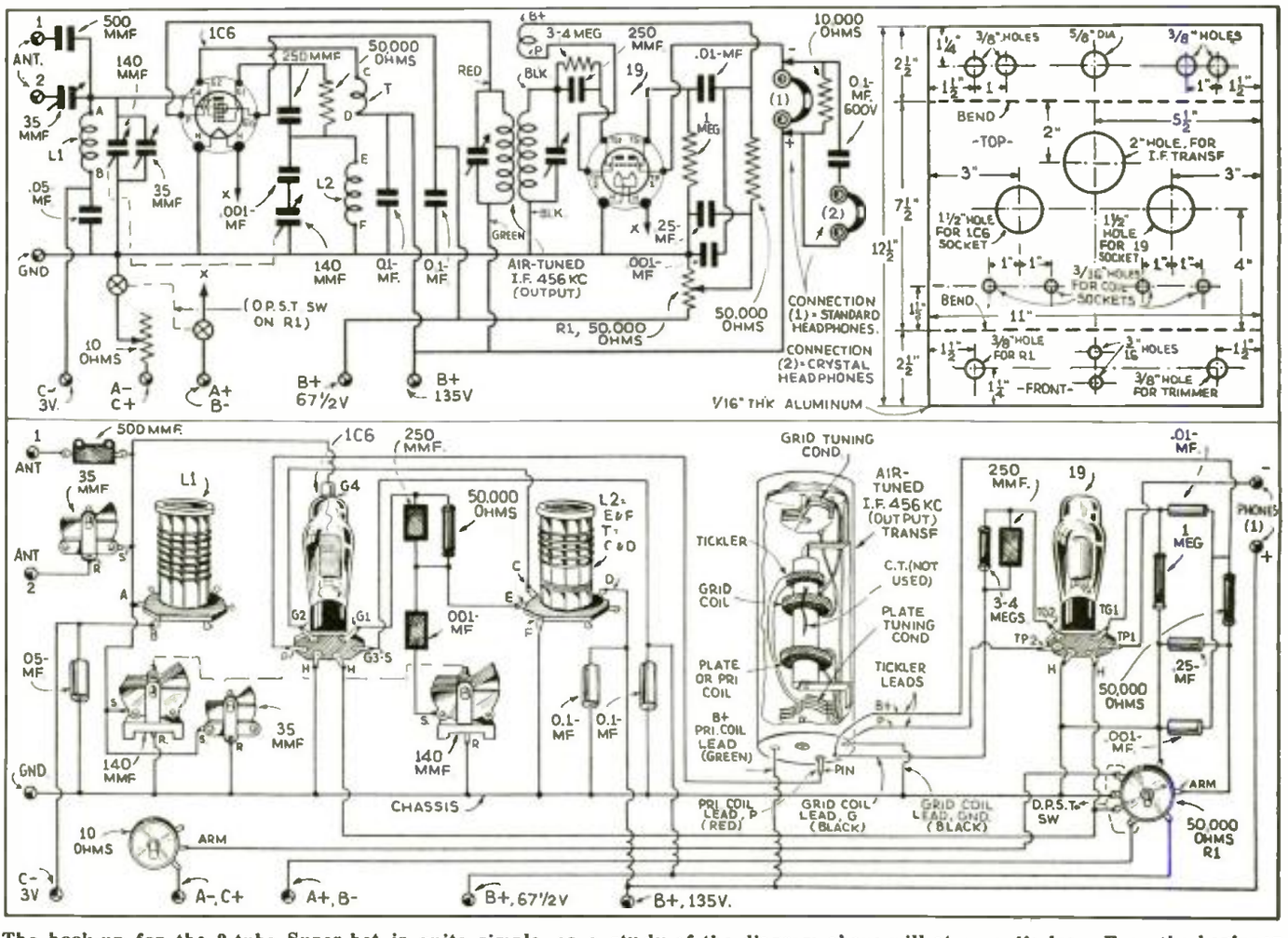
RAYTHEON
One type 19 tube
One type 1C6 tube

MISCELLANEOUS
One supply solder, machine screws, nuts, wire, etc.

Coil Data

Range	Mixer Grid	Osc. Grid	Spacing*	Wire	Tickler
17-41	8	6½	1⅜"	No. 18	3⅜
33-75	17¾	15½	1½"	No. 20	7¾
66-150	38	31	1⅝"	No. 22	10¾
135-270	82	65	1⅞"	No. 26	17¾

All coils wound on Hammarlund XP-53 forms (1½" diameter), 6-prong type. Range given is in meters. *Spacing refers to the distance between the grid and filament ends of the coil, not the space between the turns. Tickler is wound in the same direction as that of the oscillator grid winding and coupled to the grounded (filament) end of that coil.



The hook-up for the 2-tube Super-het is quite simple, as a study of the diagram above will at once disclose. Even the beginner will experience no difficulty in aligning the I.F. transformers.

The "McEntee-6"—A Super-Het

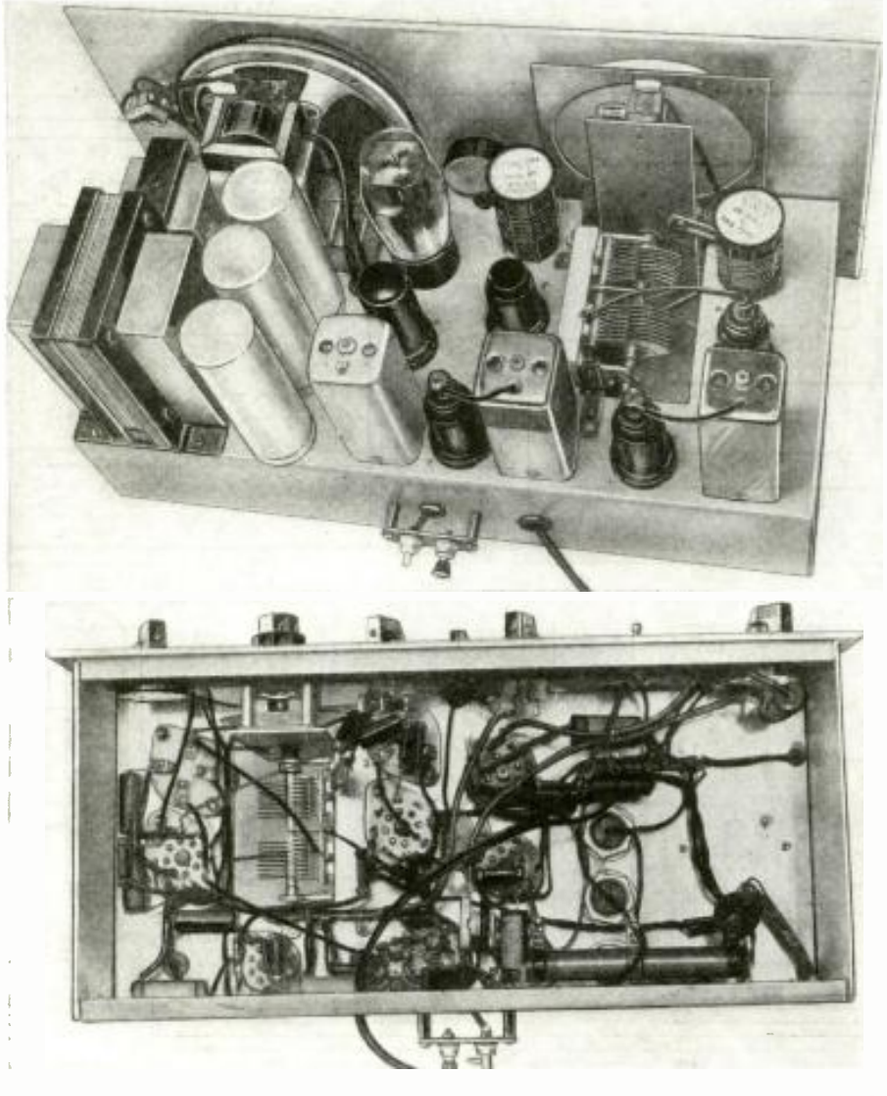
This Month's $20.00 Prize Winner
By Howard McEntee, W2FHP

In this all-wave superhet 6 tubes perform 8 functions. This set was especially designed for *Short Wave & Television* and is an exclusive feature. Outstanding points which will please both the "Fan" and the "Ham" are—Band-Spread, Beat Oscillator, Regeneration, Head-Phone Jack, Plug-in Coils and the latest Iron-Core "High-Gain" I.F. Transformers.

● THE average short-wave *beginner*, after he has mastered the simple regenerative receiver, begins to feel a need for something more efficient and capable of a higher type of performance. With the short-wave bands becoming increasingly crowded as time passes this means that the only style of receiver to consider is the *superhet*. Such a receiver, with its high order of sensitivity and sharp tuning capabilities is truly the receiver of today. The amateur *must* have a superhet to do really good work, except possibly those fortunates situated in locations such as we all dream of.

The receiver to be described is as simple as is consistent with good *high frequency* performance. It is built of low cost parts—nothing hard to obtain or high in price. Several of the tubes perform *dual functions* making it possible to keep the total down to six, including the rectifier. The whole outfit is self-contained, making it an excellent set to take away in the summer or for general portable use.

A separate first detector and oscillator is used, as the 6A8 is not noted for exceptional efficiency on the higher frequencies. The 6L7 makes a fine first detector as it has high overall gain and is easy to control. This tube is made regenerative, and we thereby gain several important advantages. The regeneration of course adds greatly to the gain of the mixer, but, more important, it adds considerably to its *selectivity*. We are thus enabled to dispense with an R.F. stage, and while we have the regeneration control to operate, an R.F. stage would have added many more parts, and another tube, to say nothing of the attendant tracking difficulties such a stage would necessarily bring about. As it is, we are able to use a ready made coil-set, which saves a great deal of time and bother in construction.



Above—rear and bottom views of the 6-tube superhet which "sports" many valuable features. It has Band-Spread, Beat Oscillator and "built-in" Loud-speaker.

Plug-in Coils Used

Plug-in coils are used for efficiency and simplicity. It is admittedly much easier to turn a switch than to change plug-in coils, but the band-switching system adds so much to both mechanical and electrical complications that it is not justified in a set of this type. The coils have to be slightly modified as they were designed for use with a 6A7 first detector and oscillator. The work is very simple, however, and consists only of removing primary turns as specified in the coil table.

The I.F. system consists of a single 6K7, with two *iron-core* transformers and the *overall gain is very high!* The second detector is rather unusual and consists of a type 6A8. This is used so that no separate tube is needed for the beat oscillator. With or without the beat oscillator in action, the tube functions as an efficient detector similar to a pentode or screen-grid tube, and is quite satisfactory for our purpose.

Head-Phone Jack Provided

A jack is provided for the use of head-phones, and when these are not in use the circuit is closed to the output tube, a 6N6G, which is really two direct-coupled triodes in one bottle. This tube gives fine audio quality and in addition makes unnecessary the usual cathode resistor with its large bypass condenser.

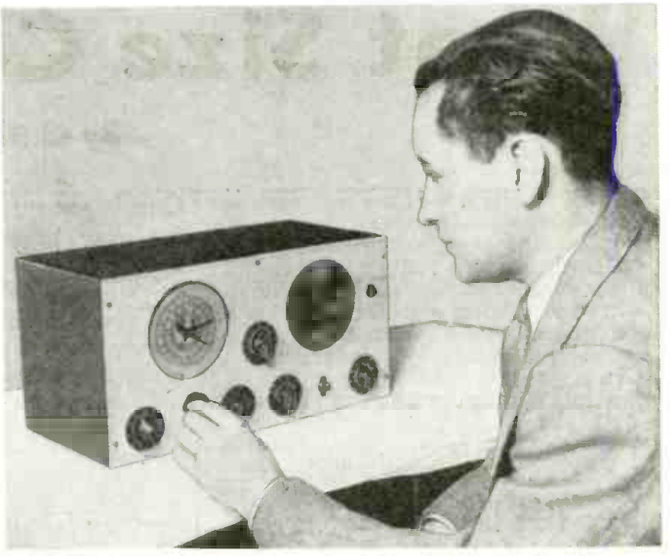
Construction is started by cutting a hole for mounting the tuning condenser and the large dial. Once this is done the rest of the parts may be spotted and set in place.

The 5 inch loud speaker is not mounted directly on the chassis, but is *acoustically insulated* therefrom by a small piece of ½ inch thick celotex. Also a ¼ inch thick pad of felt is glued around the front of the speaker to hold it away from the panel. This insulation prevents the speaker vibrations from being transmitted through the panel and chassis to tubes and other parts which would cause a microphonic howl to be set up. The set may therefore be run at considerably higher audio volume than would otherwise be permissible.

Painted Panel Enriches Appearance

After all parts are fitted in place to make sure they are properly spaced, they should be removed and the front

for Fan and HAM



David Kreisman taking a twirl at the "McEntee-6"—a superhet which really "steps out and goes places."

of the panel, and also the chassis top, given a smooth coat of *French Grey* enamel, first giving the parts a good cleaning to remove all traces of dirt and grease. The paint will dry thoroughly if left over-night.

All parts may now be permanently mounted and the wiring started. It is best to start first with the filament circuits and the power supply. With these out of the way, the rest of the work should proceed at a fast pace.

Certain of the leads in the receiver should be shielded as shown on the diagram. This is necessary to avoid feedback or undesirable radiation to other components. The shielding may be the ordinary small size used for automobile low tension work.

The connections to the tuning condenser and the coils and also the oscillator grid circuit wiring is preferably done with heavy tinned copper wire of about No. 14 gauge. This will insure stability so that you won't get a "warble" if the set or table is accidentally tapped while receiving C. W. on the higher frequencies. For the same reason these leads should be made as short and direct as possible, omitting all fancy curves and angles.

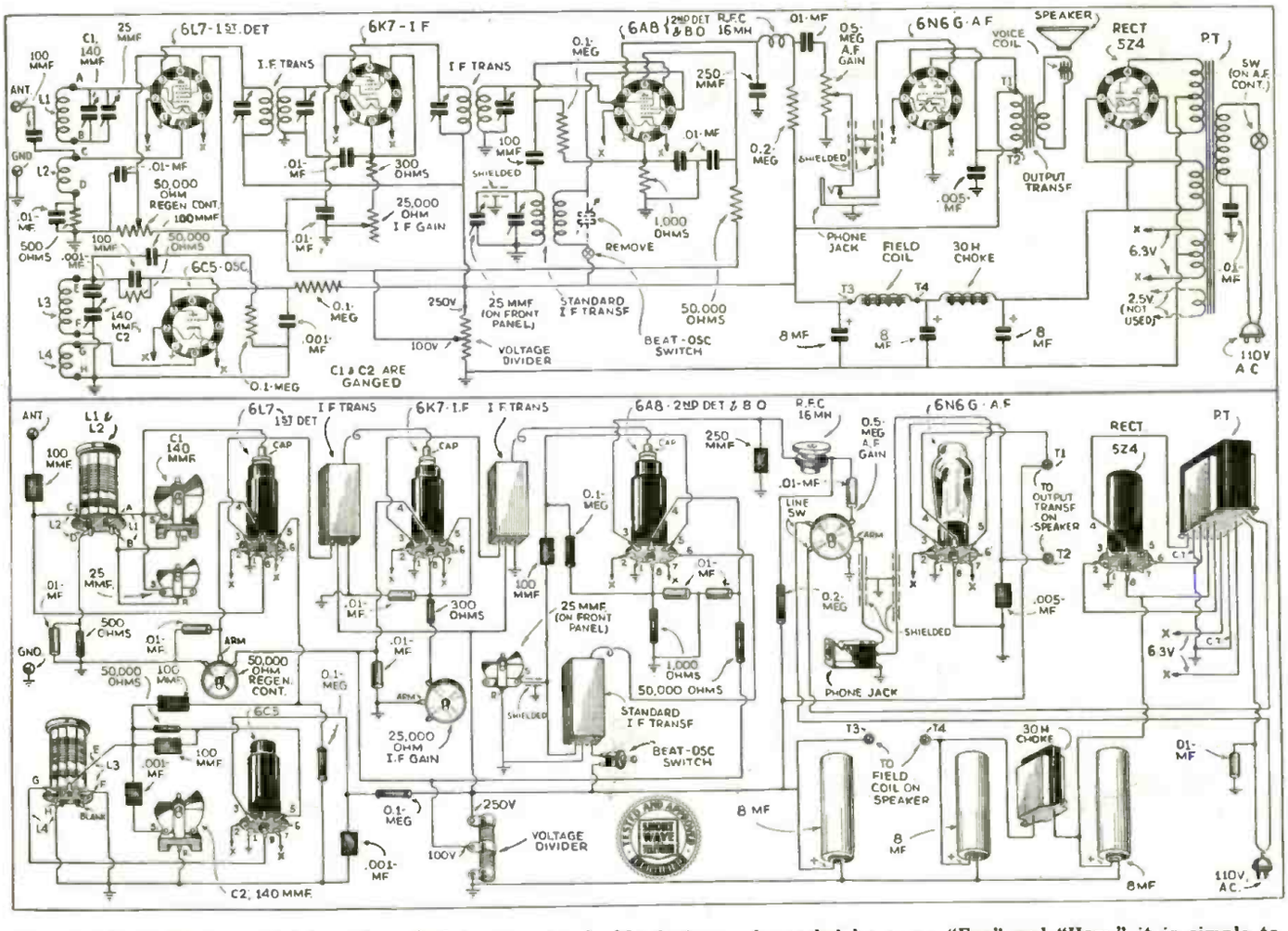
"Lining-Up" the Set

Lining up the receiver is quite simple, but the services of an all wave oscillator, or at least an I.F. oscillator are almost a necessity. By use of such an instrument the I. F. may be lined up in a couple of minutes. The output of the oscillator should be connected to the cap of the 6L7 and the four I.F. trimmers adjusted for maximum output. With the oscillator still connected adjust the trimmer in the I.F. transformer that is used for the beat oscillator until the beat note is obtained. This should be done with the beat oscillator switch on and the condenser at mid-scale.

Regenerator Boosts "Sigs"

The test oscillator may now be removed and with an antenna and ground connected to the binding posts signals should be heard. The *regeneration control* will be found to give a tremendous increase in signal strength as it is advanced, and possibly a point will be reached where the signals abruptly drop and become distorted. This means that the first detector is oscillating and the receiver should naturally never be operated in this condition.

It will be (*Continued on page* 706)



Although the 6-tube superhet here described has many valuable features, demanded by every "Fan" and "Ham," it is simple to build and operate. Of course high-quality parts will help to spell "success."

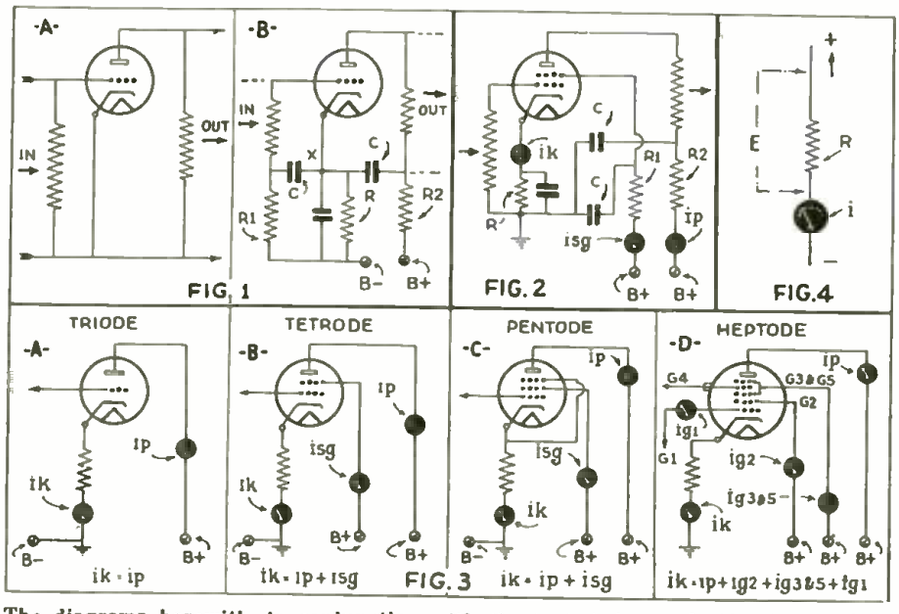
What Size Condenser or Resistor?

By Clifford E. Denton

One important question uppermost in the mind of the average set-builder and designer is: "What size condenser or resistor should I use?" Mr. Denton has endeavored to give the answer as clearly as possible, with the aid of an elaborate table and the simple diagrams presented herewith.

● THE widespread use of resistor-capacity combinations for circuit isolation and the prevention of degeneration in modern radio and audio amplifier design practice has brought many letters requesting more information on the proper application and selection of the above mentioned components.

In a perfect amplifying circuit, as illustrated in figure 1A, the signal applied to the grid would be amplified in the tube and appear across the output load in the conventional manner, at the same time the normal D.C. operating voltages would not affect the operation of the tube. In fact, in figure 1A no consideration is given to the necessity of using a *positive* potential on the *plate* from a *direct current* source, nor the use of a *negative bias* on the *grid* of the tube which is essential, especially in class A circuits. Thus the circuit of figure 1A is shown to illustrate an ideal condition as far as the A.C. signal is concerned in a tube circuit, and represents the point towards which the designer strives in order to obtain the maximum efficiency from a given tube. A practical amplifier circuit is shown in figure 1B. Here, the use of resistors and condensers "decouples" the grid from the plate circuit, prevents *degeneration* in the cathode circuit and "decouples" the plate circuit of this particular amplifier stage from the *common* power-supply found in modern radio receivers.



The diagrams herewith, in conjunction with the text, help to clarify the problem as to the proper size of condenser or resistor to be used in a given case.

Capacity in Cathode Circuit

The use of resistors in the cathode, screen and plate circuits of a Tetrode is shown in figure 2, with their associated bypass condensers. The capacity in the cathode circuit not only prevents *degeneration*, but also decreases the effective cathode-ground impedance to the signal applied to the grid. Resistor R1 "decouples" the screen circuit, and can also be used as a *voltage-dropping* resistor, i.e., drop the plate voltage of 250 volts down to the required screen voltage of 100 volts. The same function holds in the case of resistor R2, where the isolation effect is more important, as greater signal voltages are present in the plate circuit. It can be generally stated that the resistors in the plate circuit of a tube will be low in ohmic value and that fairly high values of capacity will be necessary for satisfactory isolation. This can be deducted from the fact that it is seldom desirable to waste plate voltage, which may result in a loss of gain and tube efficiency.

Table Helps the Designer

To assist in designing resistance-capacity filters the table below has been included. This table gives the *capacitive-reactance* in ohms at various frequencies commonly used. A representative listing of standard capacities ranging from .00005 to 15 mf. gives ample scope to the chart so that most problems can be solved at once.

The capacity and reactance values can be extended very simply in multiples of 10 or 100 if so desired. For example, having a capacity of 100 mf. operating at 50 cycles, what is the reactance? Look in the column under capacity in mf. The second column from the bottom of the chart is the 10 mf. listing. Multiply this 10 mf. by 10, giving 100 mf. Divide the figure along the 10 mf. line in the 50 cycle column 318 by 10. Thus, the reactance of a 100 mf. condenser at 50 cycles is 31.8 ohms. In general it will not be necessary to extend the capacity or reactance values beyond the chart but the above indicates how it can be done if desired.

Design of Resistance-Capacity Filters

In designing *resistance-capacity* filters, always select the capacity having a reactance at the LOWEST frequency encountered in the circuit, equal to at least 1/50 of the value of the isolating resistor in ohms. For example, a broadcast receiver tunes over the range of 1,500 to 550 kc. Therefore, any condenser used in the R.F. portion of this

(*Continued on page* 714)

FREQUENCY IN CYCLES PER SECOND

CAPACITIVE REACTANCE IN OHMS

	CAPACITY IN MF	ULTRA H F			AMATEUR				BROADCAST		INTERMEDIATE	POWER SUPPLY			AUDIO	
		300 MC 1M	60 MC 5M	30 MC 10M	15 MC 20M	7.5 MC 40M	3.7 MC 80M	1.8 MC 160M	1,500 KC 200M	500 KC 600M	175 KC.	25 CYCLES	60 CYCLES	120 CYCLES	50 CYCLES	10,000 CYCLES
MICA	.00005	10 6	53	106	212	416	833	1,666	2,123	6,369	18,240	127,388,534	53,078,503	26,539,252	63,694,767	318,471
MICA	.0001	5.3	26.5	53	106	208	4165	833	1,061	3,184	9,120	63,694,767	26,539,252	13,269,626	31,847,133	159,235
MICA	.00025	2.1	10.6	21 2	42.4	83.2	166.3	333	424.6	1,273	3,648	25,477,706	10,615,600	5,307,850	12,738,853	63,694
MICA	.0005	1.0	5.3	10.6	21.2	41 6	83.3	166 6	212. 3	636.9	1,824	12,738,853	5,307,850	2,653,925	6,369,426	31,847
MICA	.001	0.5	2 6	5.3	10.6	20 8	41 6	83.2	106.2	318.5	912	6,369,427	2,653,975	1,326,963	3,184,713	15,924
MICA	.005	0.1	0.5	1	2 12	4 16	8.3	16.6	21.2	63.7	182.4	1,273,885	530,785	265,393	636,943	3,185
PAPER	.01	.05	.26	.53	1.06	2.08	4.1	8.2	10 6	31 8	91 2	636,943	265,393	132,696	318,471	1,592
PAPER	.015	036	.18	.36	.53	1.39	2.8	5.6	7.1	21.2	60.4	424,629	176,929	88,464	212,314	1,061
PAPER	.02	.02	0.1	0.2	.35	1 04	2.0	4.0	5.3	15.9	45 6	318,471	132,697	66,348	159,235	796
PAPER	.05	.01	.05	0.1	.21	.41	.83	1.66	2.1	6 4	18 2	127,389	53,078	26,539	63,694	318
PAPER	0.1	.005	.026	.053	0.1	.2	.41	.82	1.1	3.2	9.7	63,694	26,539	13,270	31,847	159
PAPER	0.25	.001	.01	.021	.042	.083	.16	.32	.42	1.2	3 6	25,478	10,616	5,308	12,739	64
PAPER	0.5	0005	.005	.01	.021	.041	.08	.16	.21	.64	1.8	12,739	5,308	2,654	6,369	32
PAPER	1	.00025	.0025	.005	.01	.02	.04	.08	.11	.32	.9	6,369	2,654	1,327	3,184	159
PAPER	2								.05	.16	.45	3,184	1,327	663	1,592	79
ELECTROLYTIC	4								.03	.08	.2	1,592	664	332	796	3.9
ELECTROLYTIC	6								.02	.05	.14	1,062	442	221	531	2.6
ELECTROLYTIC	8										.11	796	332	166	398	2.0
ELECTROLYTIC	10										.085	637	265	133	318	1.6
ELECTROLYTIC	15										.057	425	177	88	212	1.1

FULL WAVE 25 CYCLE RECTIFICATION IS EQUIVALENT TO 50 CYCLE COLUMN UNDER "AUDIO". FOR "I.F." OF 456, 465, 252, 507 ETC. USE 175 KC. COLUMN

WORLD-WIDE SHORT-WAVE REVIEW

–Edited By C. W. PALMER

High Quality in Super-Regenerative Set

● A DESCRIPTION of a new English patent covering a means for eliminating distortion in the reception of broadcast signals on ultra-short wavelengths when using the super-regenerative methods of reception was recently published in *Wireless World* (London).

It was explained that while the super-regenerative type of circuit is particularly

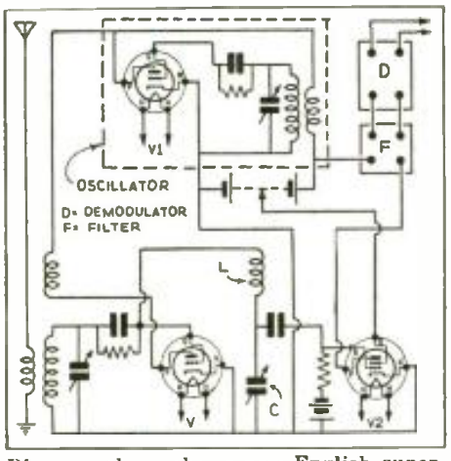


Diagram above shows new English super-regenerator receiver hook-up.

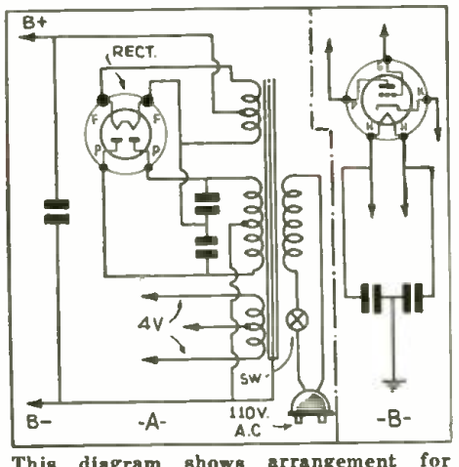
suitable for reception of ultra-high frequencies it is often difficult to prevent the "quenching" oscillator from affecting the quality of the received signals. This is due to the fact that both the quenching frequency and the A.F. signals share the same path, and that the "tone" or frequency characteristic of the latter is impaired in the process of separation.

The inventor found that when a signal is received the quenching oscillations are modulated by it and develop corresponding side-bands. He accordingly amplifies the local frequency and derives the required signals from it by *demodulation*.

As shown in the circuit, the local or quenching frequency is supplied from tube V1 to the plate circuit of the regenerative tube V. The grid of the latter is coupled to the next amplifier, V2, through a circuit, LC, tuned to the quenching frequency, which is then passed on for subsequent amplification and detection.

Eliminating Modulation Hum

● IN the construction of A.C. operated



This diagram shows arrangement for eliminating a modulating hum in an A.C. operated high-frequency receiver.

high-frequency receivers difficulty is often encountered in eliminating the "modulation hum" or as it is sometimes called "tunable hum."

Wireless World (London) recently contained some useful hints on the elimination of this troublesome disturbance and we are reprinting the data for our readers.

"A complete cure can generally be effected by joining two condensers of .001 to .005 mf. in series across the high potential secondary winding of the power transformer.

"The junction point between these two condensers is normally taken to the center tap of the rectifier filament winding, but recent experiments with *high-gain* all-wave receivers have shown that more complete hum elimination can be secured by connecting it to one end of the winding, it being immaterial which end is chosen.

"A further precaution which is advisable is the addition of two condensers of about .005 mf. connected in similar manner across the heater leads, with their center-point grounded. They should preferably be mounted as close as possible to the second detector tube socket."

Ultra-Short-Wave Converter

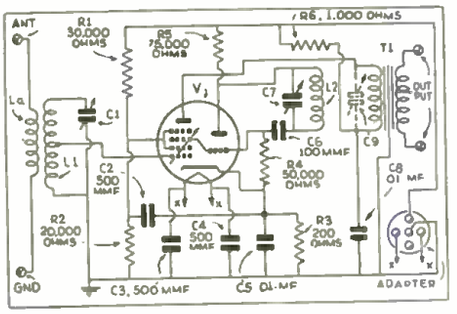
● THE 5-meter amateur stations and the television transmissions (that is, the sound accompaniment to the images) can be picked up on a standard broadcast receiver by using an ultra-short-wave converter.

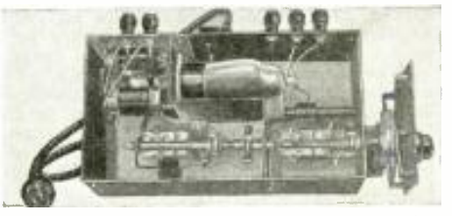
This resembling the usual shortwave converter in its circuit, the main difference being in the size of the coils and tuning condensers. The circuit here is reproduced from *Wireless World* (London) in which it was originally published to permit the reception of the sound accompaniment of the Alexandria Palace *television* signals.

The converter consists of a single tube of the triode-pentode type, such as the 6F7 and similar types. The pentode section is used as the first detector while the triode section acts as the oscillator.

The output of the first detector is fed into an "I.F." coil which is really a regular broadcast band T.R.F. coil. This is tuned to a wavelength at which no broadcast station is operating, preferably at the high-frequency end of the band covered by the radio receiver, The tuning is then accomplished entirely by the condensers in the converter. These may be ganged together if desired although the construction of the unit will be much simpler if separate controls are used (since no tracking of the two condensers will be needed).

The tuning condensers have a capacity of about 30 mmf. at maximum position and the coils consist of 8 turns of No. 14 enameled wire wound to a diameter of ⅝ in. and spaced to ¾ in. long. The aerial coil consists of 8 turns of No. 28 D.S.C. wire wound on a ⅜-in. bakelite rod inserted in the detector grid coil. The detector grid coil is tapped at the center of the winding.





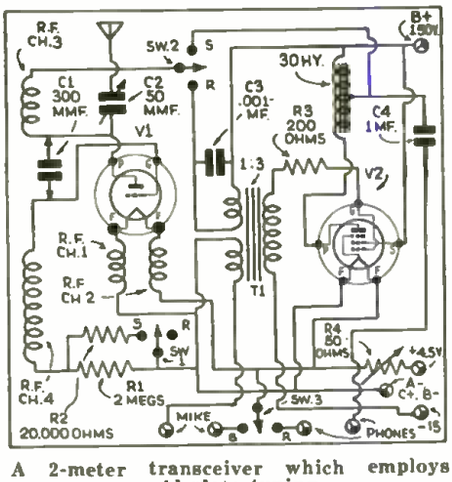
Appearance of ultra-short wave converter and also wiring diagram for the converter.

The power for the converter is obtained either from the receiver itself, by tapping off plate and filament voltage from the power tube socket in the set, or a separate small power-supply is made for it.

A Danish 2-Meter Transceiver

● A RECENT issue of *Popular Radio* (Copenhagen) a Danish radio magazine contained a transceiver for operation on wavelengths down to 2 meters.

The second tube, which is used as the modulator tube for phone transmission and as audio amplifier for reception, is a battery type output pentode. The switches S1, S2 and S3 are actually one switch which is a three-pole double throw unit. Tuning is accomplished by sliding the condenser C1 along the wires (tubes) between the grid and plate of V1 and the R.F. chokes Ch3 and Ch4. The chokes Ch1, Ch2, Ch3 and Ch4 are wound with 30 turns of No. 20 wire on ½-in. diameter forms.



A 2-meter transceiver which employs grid-plate tuning.

SHORT WAVE LEAGUE

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Executive Secretary

Here's Your Button

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

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

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

WHEN TO LISTEN IN

By M. Harvey Gernsback

All Schedules Eastern Standard Time

DAVENTRY

● DAVENTRY hopes to have its 3 new transmitters in operation some time this spring. In addition a new and improved aerial system, the result of 4 years experience with the old transmitters and aerials, will be placed in use simultaneously. The new transmitters will each be of about 50 kw. power output as compared with the 10-15 kw. rating of each of the present transmitters. The new system is expected to give greatly improved service. The old transmitters will continue in use, employing the new antennas and instead of broadcasting simultaneously on 3 waves, the station will use 5 or 6 in some transmissions, each directed to a different part of the world. By this means all parts of the world will be given a good daytime service as well as a good night-time service. At present each area is given only a good night time service. Daytime service is only the result of listeners picking up signals directed to some part of the world where it is night. Thus at present the only transmissions specifically aimed at America are those from 4-5.45, 6-8 and 9-11 p.m.

The schedule for February is as follows: 3-5 a.m. on GSB, GSO and either GSP or GSG-**** 6-8.45 a.m. on GSG, GSB and either GSH or GSF.** 9 a.m.-12 n. on GSF, GSB and either GSH or GSG** 12:15-3:45 p.m. on GSI, GSD and GSB.** 4-5:45 p.m. on GSB, GSC and GSD **** 6-8 p.m. on GSC, GSB and either GSA or GSD.*** 9-111 p.m. on GSC, GSB and either GSL or GSD.

CZECHOSLOVAKIA

Prague has been jumping from one frequency to another recently, so it is impossible to predict what frequencies they will use this month. OLR can operate on the following frequencies. 6010, 6030, 6055, 6115, 9504, 11745, 11760, 11840, 11875, 15230, 15320 and 21450 kc. It is possible that others are available also. The only ones used to date are: 15230, 11875, 11840, 11760, 6115, 6030 and 6010 kc. At present 11875 is used during the hours from 1 a.m.-2 p.m. irregularly. Occasionally 11840 is heard during these hours. A regular program is broadcast daily from 2:45-4:30 p.m. generally on 6030 or 6010 kc. The American program is broadcast on Mon. and Thur. from 7-9 p.m. This was heard on 11875 but is probably on 6030 kc. now.

JAPAN

In addition to the frequencies of the new Tokyo station mentioned last month the following are also available for use: JZH, 6095 kc and JZL, 17785 kc.

JVN, 10660 kc, and JZJ, 11800 are heard on Mon. and Thur. from 4-5 p.m. with a program for the East Coast of N. America. JZJ is especially well heard being an R7-8 signal. JZJ is on daily now from 12 m.-1 a.m., instead of JZH. However, a bad echo causes the announcements to be garbled. On Wed. and Fri. JZI and JZJ are on from 2-3 p.m. for Europe.

JAVA

The NIROM stations are on daily except Sat. from 6-7:30 p.m., 10:30 p.m.-2 a.m., 5:30-10:30 a.m. On Sat. 3:30-11:30 a.m. and from 6 p.m.-2 a.m. (Sun.). The stations used are YDB, Soerabaja, 9650; YDC, Bandoeng, 15150; PLP, Bandoeng, 11000; PMN; Bandoeng, 10260 kc. In addition YDA at Batavia operates on 6040 kc. Daily except Sat. from 6-7:30 p.m., 10:30 p.m.-2 a.m., Sat. from 6 p.m.-2 a.m. (Sun.) and on 3040 kc. daily except Sat. from 5:30-10:30 a.m. and on Sat. till 11:30 a.m. All these stations relay the YDA program. PMH at Bandoeng on 6720 kc. sends the NIROM Bandoeng program daily from 5:30-9:30 a.m. and Sat. from 9:30 p.m.-1:30 a.m. (Sun.) All reports should be addressed to J. H. A. Hardeman, NIROM Short-Wave Editor, Batavia, Java.

AUSTRALIA

In February VK2ME at Sydney, 9590 kc. operates on Sun. from 1-3, 5-11 a.m. Contrary to reports VK6ME at Perth is not yet on the air. The Australian ship *"Althea"* has a short-wave telephone on board using the call ZFBJ and is heard calling VLZ Sydney, 13340 kc. and ZLT Wellington, New Zealand, 11050 kc. around 5 a.m. ZFBJ is on 8900 kc. The Sydney phone station works with New Zealand, London, Java and ships. When calling New Zealand and ships the call VLZ is used, when calling England the call VLK is used, and when calling Java VLJ is used. VK2ME is the call used when testing. These are all one station, however. Frequencies generally used are 10520 and 9760 kc. They are generally heard from 12 m. to 8 a.m. irregularly.

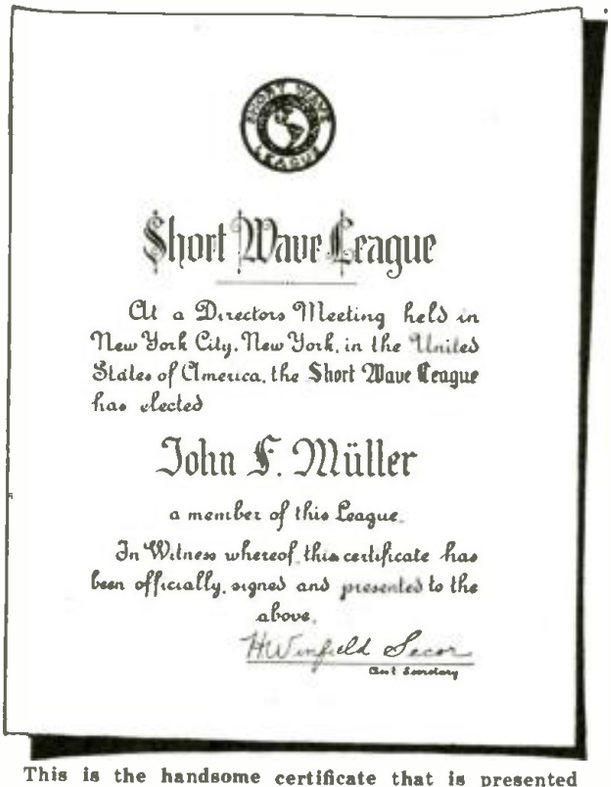
MOSCOW

The programs from RNE daily from 12:30-6 p.m. are now on 6000 kc instead of 12000 kc. RAN on 9600 broadcasts daily now from 6-8 p.m. RW96 on 15180 kc. is off the air for the winter.

USA

W3XAL at Bound Brook on 6100 kc. now broadcasts special programs in Spanish with typical Spanish entertainment daily at 8 p.m. They are specially intended for S. America. A new beam antenna for S. America is employed. The programs generally last for a half hour but they will be extended. These programs originate in the NBC studios in Radio City. W2XAF at Schenectady on 9530 kc. now broadcasts only NBC programs. It no longer relays the WGY, Schenectady program. This station also has special Spanish programs several nights a week.

Thanks to our listeners who write us reception reports each month. They are a great aid in keeping the lists and this column up to date. In the future we shall try to mention by name outstanding contributors when space permits. Reports should be in our hands by the 20th of each month *at the latest.*



This is the handsome certificate that is presented FREE to all members of the SHORT WAVE LEAGUE. The full size is 7¼"x9½".

(See page 720)

SHORT WAVE . THIRTY-SIXTH TROPHY . SCOUTS

Presented to

SHORT WAVE SCOUT

WALTER E. BUTTS
629 Hartford Street
Worthington, Ohio

For his contribution toward the advancement of the art of Radio

by

SHORT WAVE AND TELEVISION

Magazine

Honorable Mention

Li Chi Chiang
St. Johns, Quebec

Harry Eppinger
Norton, Kansas

Henry Sroka
Chicago, Ill.

Stanley Wojnarski
Chicago, Ill.

36th TROPHY WINNER

67 Stations—54 Foreign

● THE Thirty-sixth Trophy is awarded to Walter E. Butts of Worthington, Ohio, for his contribution toward radio DXing. Mr. Butts had a total of 67 verification cards or letters which came within the rules of the contest. Fifty-four of these were from stations outside of the United States. The receiver used by Mr. Butts was a 16-tube Midwest receiver, employing a single wire antenna. Mr. Butts further states that on all occasions these stations were received on the loudspeaker.

There was quite a bit of activity in the contest this month, and all of the contestants except one had a very sizeable number of verifications. We noticed in checking the verifications that a number of stations verify, but fail to give the particular date of reception, therefore disqualifying the card. It is impossible for us to determine whether or not they were verifying reception for the particular period chosen by the contestant.

We therefore suggest all contestants mention in their *requests for veris*, that the *date of reception* be *clearly indicated* in the reply.

The list of stations received by Mr. Butts follows:

United States Stations

Call	Freq.	Station Name and Location
W9XAA,	6,080	kc., Chicago, Ill.
W3XAL,	6,100	kc., Bound Brook, N.J.
W3XAL,	17,780	kc., Same as above.
W2XAD,	15,330	kc., Schenectady, N.Y.
W2XAF,	9,530	kc., Same as above.
W4XB,	6,040	kc., Miami Beach, Fla.
W3XAU,	9,590	kc., Newton Square, Pa.

(Continued on page 699)

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

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

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

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

W. R. GUENTHER LIKES TROPHY

© By Milwaukee Journal

Above—W. R. Guenther, of Milwaukee, Wis., winner of thirty-third "Scout" Trophy. He used a homemade superhet.

Trophy Contest Entry Rules

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

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

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

The winner each month will be the person sending in the greatest number of verifications. Unverified stations should not be sent in as they will not count in the selection of the winner. At least 50 percent of the verifications sent in by each listener must be for stations located outside of the country in which he resides! In other words if the contestant lives in the United States at least 50 percent of his "veries" must be from stations outside of the United States. Letters or cards which do not specifically verify reception, such as those sent by the Daventry stations and, also by commercial telephone stations will not be accepted as verifications. **Only letters or cards which "specifically" verify reception of a "given station," on a given wave length and on a given day, will be accepted!** In other words it is useless to send in cards from commercial telephone stations or the Daventry stations, which state that specific verifications will not be given. Therefore do not put such stations on your list for entry in the trophy contest!

SHORT WAVE SCOUTS are allowed the use of any receiving set, from a one-tuber up to one of sixteen tubes or upwards, if they so desire.

(Continued on page 699)

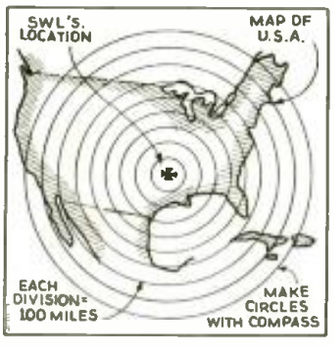
$5.00 FOR BEST SHORT-WAVE KINK

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

$5.00 PRIZE

IMPROVING MAP

Here is a kink that I find very useful and so will many other Amateurs & Fans. Procure a map of the United States, then with a compass, draw a circle with a radius of



100 miles with the Amateurs or SWL'S location as the center. The next circle will then have a radius of 200 miles, the next 300 miles, and so on until the map is covered. The circles can be marked as 100 miles, 200 miles, etc., then the amateur or SWL can tell at a glance how far away the station to which he is listening is. I also have a map of the world fixed this way, with circles swung with a radius of every 1000 miles.—Kenneth Tyler.

▼ ▼ ▼

WORKSHOP KINK

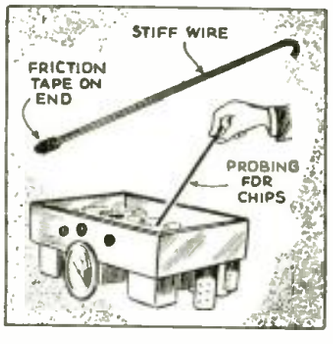
It is always a problem, finding a place for jars and containers of screws, bolts, lugs, and many other items found around the work bench. I use a small jar with a

metal screw-top and fasten it to the underside of the shelf as shown in the drawing. In this way they're always kept in place and out of the way.—Eugene Paputz.

▼ ▼ ▼

A RETRIEVER

One sometimes tries in vain to remove stray pieces of solder from the chassis with either a sharp pick or a pair of long-nose

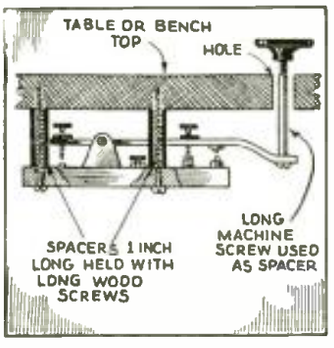


pliers. Especially is this a nuisance when the solder is hardly visible through a network of wires. He finally may have to resort to turning the chassis upside down and shaking it. A short length of friction tape wrapped around the tip of a stiff wire will do the work better and faster.—M. C. Ledesma.

▼ ▼ ▼

CLEVER KEY MOUNTING

In answer to your call for kinks I submit the following which I have used with success. First, adjust key to exact position wanted, then secure two one-inch spacers and place between under sides of bench and key screw key in place with wood screws through both mounting holes. Remove bakelite knob on key and screw threaded spacer to key arm with single machine screw. The knob can be turned off after operation is complete. The diagram will explain more fully.—Ralph Pressman.



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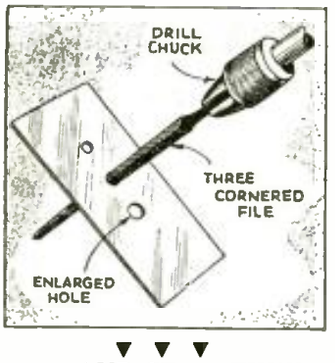
FILE AS REAMER

Here is a kink for all who often have use for a hole enlarger. After you have drilled the hole to be enlarged, replace the drill with a three-cornered or round file. Then continue to drill with the file until the desired hole has been made. The size of the file will depend upon the hole to be enlarged.—Richard McIntyre.



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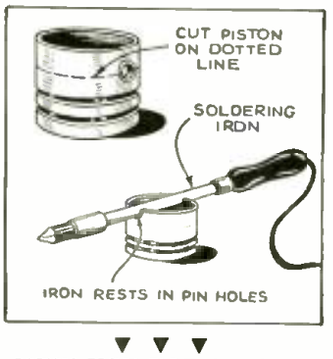
. . . AND STILL THEY COME!

I noticed that you have printed a number of iron holders in past issues of the Kink Department and feel that mine would undoubtedly be as valuable as any of those appearing heretofor. The idea is very simple. A piston from a gasoline motor is cut in half at the center of the wrist-pin holes. The illustration clearly shows how it is employed.—Jesse M. Large.



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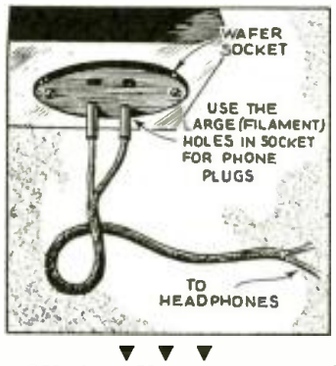
NEW USE FOR SOCKET

I am submitting a kink which I have found very useful when building sets. The parts consist of a tube wafer socket and two nuts and bolts. This will serve as a headphone jack and costs only a few cents. The sockets may be either 4, 6 or 7 prong. I am sure that many set-builders and "Hams" can use this little kink.—Morton Gottlieb.



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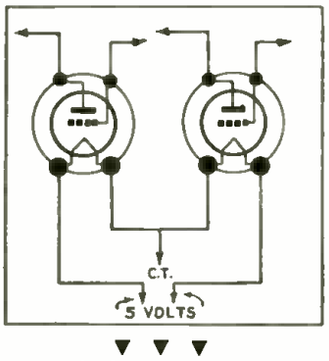
SUBSTITUTE FOR C.T. RESISTOR

A 5-volt filament transformer may be used with two 2.5 volt tubes with the filaments in series. The center-tap filament resistor may be eliminated as illustrated. The drawing clearly shows how this is done.—Melvin Herlin, W6NNZ.



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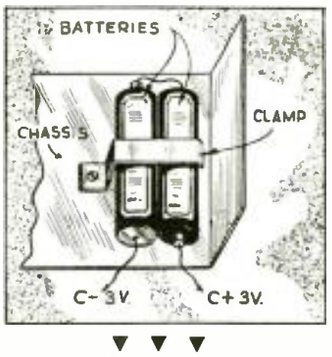
A GOOD IDEA

In battery-operated radios, I use the pencil-type flashlight cells as "C" batteries. These are mounted underneath the chassis with suitable clamps to hold them in place; this method eliminates extra battery leads. The ends of the batteries should be taped so as to avoid unwanted contact with the metal chassis. I am enclosing diagram showing how they can be fastened to the chassis.—Frank Anderson.



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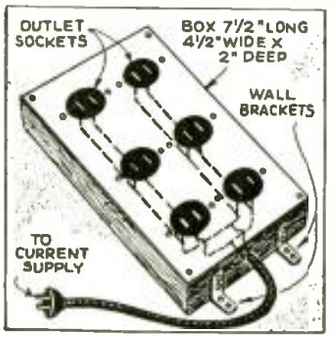
HOME-MADE LUG

In the construction of transmitters and receivers where it is necessary to use a soldering lug, I found the following kink economical and extremely handy, especially when the "Tailor-made" variety were not on hand. The drawing clearly shows that a short electric wire is wrapped around the binding post and twisted for a length of about ½-inch. This makes a very convenient soldering lug.—Duane Carr.

▼ ▼ ▼

MULTIPLE OUTLET PANEL

Herewith you will find a kink which I have found to be most valuable. It consists of a box with six outlet sockets in order to provide a convenient amount of outlet sockets. I trust many experimenters and fans will find this idea most convenient.—Arthur Wischebrink.



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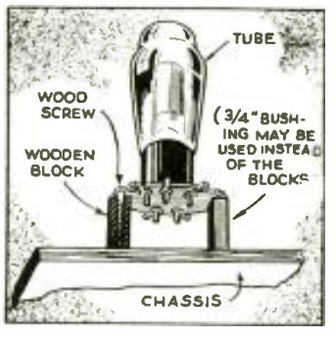
CONSTRUCTION HINT

Recently while constructing a set with a breadboard chassis, I did not have the right type of tube sockets, only the wafer socket. In order to use them, I cut small blocks of wood about one inch long and mounted the socket with a screw through these blocks to the board.—Walter Perelman.



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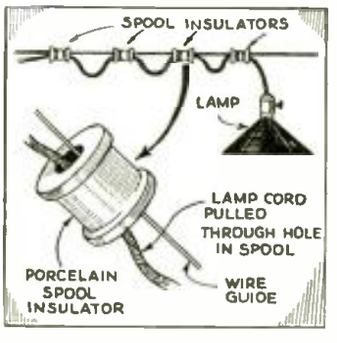
BENCH-LIGHT KINK

Those experimenters confronted with the problem of lighting a large work-bench will find this kink the solution to their problem. While the drawing shows porcelain spool insulators, ordinary thread-spools may be used, of course. The arrangement is extremely simple and the drawing illustrates just how the extension cord is arranged. After you have once used an adjustable light of this kind you'll never be without it.—H. W. Crowder.



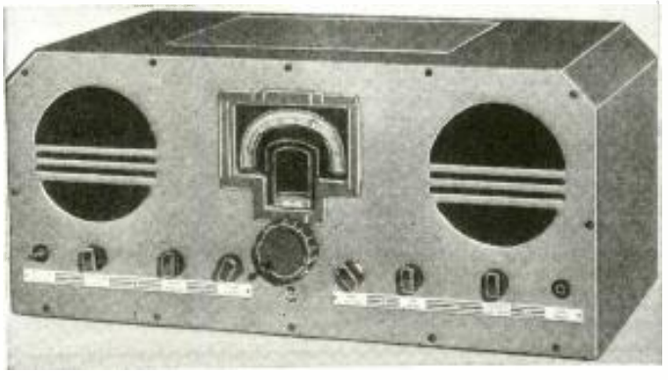
WHAT'S NEW In Short-Wave Apparatus

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

The ACR-155 . . A New Amateur Communication Receiver

One of the very latest communication type sets, fitted with very smooth working controls and employing 9-tubes. It has a range of 520 to 22,000 kc.

● THIS new moderately-priced amateur receiver employs 9 tubes and covers a range from 520 to 22,000 kilocycles. It employs the most up-to-date circuits and constructional features. All the equipment necessary for satisfactory amateur communication is included. These are beat oscillator, standby switch, AVC, sensitivity control, headphone jack and band-switching.



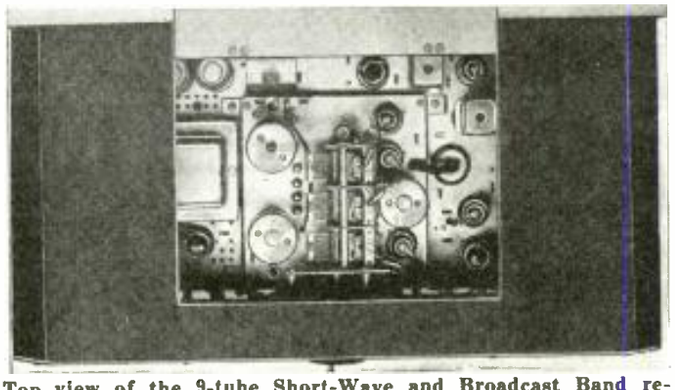
Front view of the new ACR-155 communication type receiver—A dandy set for both the short-wave Fan and the Ham. (No. 598)

Two dials are employed; one is a *master*, and the other a *vernier*. The vernier dial is controlled by a large knob some 2½ inches in diameter, which can be cranked around at great speed, with a small handle, when rapid frequency changing is desirable.

The photographs clearly show the modernistic lines of this new receiver; the speaker is behind the right-hand grill. The left-hand grill is merely a dummy to lend symmetry to the appearance of the receiver and also has something to do with the tonal response.

The various tubes used and their functions are as follows: 6K7-radio frequency amplifier, 6L7-first detector, 6J7-oscillator, 6K7-intermediate frequency amplifier, 6H6-second detector and AVC, 6F5-audio voltage amplifier, 6F6-power output, 5W4 full-wave rectifier and 6J7-beat oscillator. The intermediate frequency of the receiver is 460 kilocycles. The power output is 2-watt undistorted and 4.5-watt maximum. The loudspeaker is a dustproof electro-dynamic speaker, 6 inches in diameter.

The editors had an opportunity to try this receiver in a very poor location and with only a few feet of wire, and were able to pull in stations from all (*Continued on page* 702)



Top view of the 9-tuhe Short-Wave and Broadcast Band receiver with lid of metal cabinet open, showing the tubes and main tuning condenser. It has a "band-switch," thus eliminating plug-in coils.

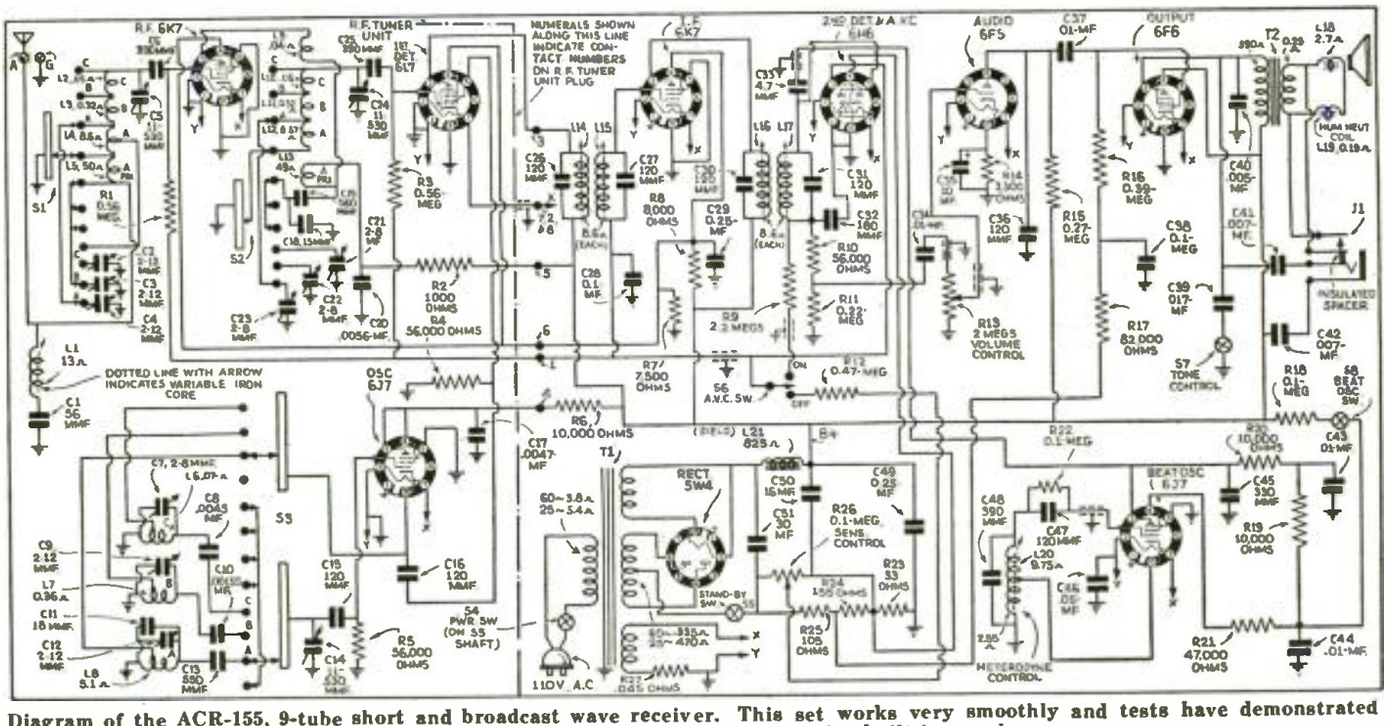
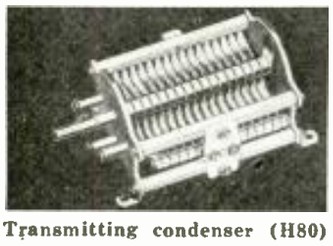


Diagram of the ACR-155, 9-tube short and broadcast wave receiver. This set works very smoothly and tests have demonstrated superior quality and excellent volume on the built-in speaker.

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

NEW APPARATUS FOR THE "HAM"

New microphone (H79)



Transmitting condenser (H80)

NEW MICROPHONE H79

● THE crystal microphone shown in the photograph has a number of outstanding features. Prominent among them is the method of mounting. The microphone is secured to the stand by the ball and socket arrangement which permits it to be turned at almost any angle. By setting it horizontally, as shown in the photo, it can be made to pick up sounds in practically all directions.

The microphone itself is an excellent crystal unit with a gain of minus 55DB. A special anti-resonant cable is employed which is 100 per cent shielded, together with a completely shielded plug of machined brass, chrome finished. No feed-back troubles will therefore result due to the cord picking up R.F. from the transmitter.

XMITTING CONDENSER H80

● A NEW popular series of transmitting condensers for high frequency and ultra-high frequency, medium and low-powered transmitters.

Although low in price, these condensers include all constructional features necessary in quality transmitters of all kinds. High operating efficiency has been attained by extensive research in materials and design plus careful workmanship.

These condensers are made in both single and split-stator styles, with end-frames of heavy aluminum. Rotor and stator plates are heavy aluminum and firmly anchored in place by wedging them into deep slots. An accurately ground stainless-steel shaft is carefully fitted to a long bronze front-bearing, mounted on a beryllium cushion disc. This free floating action affords a perfect bearing and consistently smooth operation.

The rear bearing is of the steel ball and cup type. Isolantite insulation and silver-plated beryllium contact wiper assures lowest losses. Noiseless operation and complete stability under all conditions are assured, according to its maker. These condensers are produced in 19 different sizes—20 to 530 mmf. 1000 to 6000 volts—panel or base mounting. This is a Hammarlund product.

VOLT-OHM MILLIAMMETER—H81

● SERVICING engineers will appreciate the testing capabilities and handy portability of Model 740 Volt-Ohm-Milliammeter, one of the new Ranger-Examiner single testers.

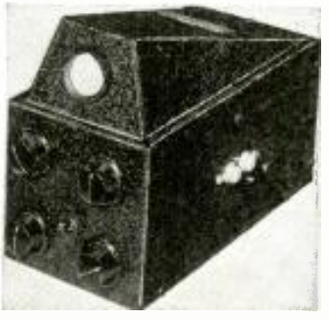
The unit has a Triplett precision instrument with scales reading: 10-50-250-500-1000 A.C. and D.C. volts at 1000 ohms per volt; (D.C. Accuracy 2%, A.C. 5%) 1-10-50-250 D.C. milliamperes; 0-300 low ohms; high ohms to 250,000 at 1½ volts. Provision for higher resistance readings by addition of external batteries.

Sturdy metal case with black electro-enamel finish is 5⅞"x7⅞"x 4⅛". Built-in compartment with snap-on cover holds all accessories. Panel is silver and black. Carrying handle folds against the side of the case when not in use. Model 740 Volt-Ohm-Milliammeter.

MINIATURE OSCILLOSCOPE H82

● The Amateur, particularly the phone man, should by all means possess an instrument of this type in order to be within the scope of the government regulations. This

Compact testing unit (H81)



Miniature oscilloscope (H82)

National oscilloscope makes use of the new 913-cathode ray tube.
(*Continued on page* 696)

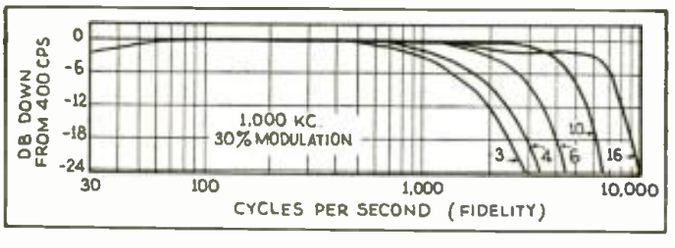
New "Super Pro" Developed Skillfully

By Donald Lewis

Rear View of Hammarlund "Super Pro" and Power-Supply

● A RECEIVER with laboratory calibrated controls, such as the new "Super Pro" demands extremely skillful design and construction to achieve the necessary perfect circuit and mechanical synchrony. How many difficult problems were solved to permit the production of such a precision instrument are explained in this article.

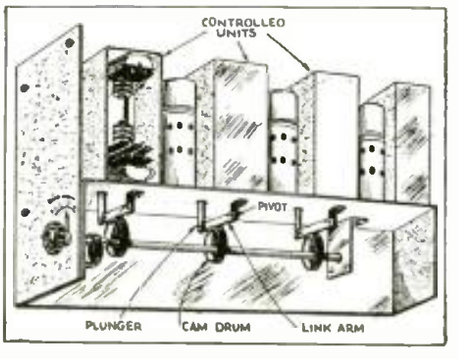
The selectivity of the intermediate frequency amplifier of the new "Super Pro" is continuously variable by means of a control in the front panel. This control simultaneously varies the coupling between the primaries and the secondaries of the first three I.F. transformers. Since both the primary and secondary of each transformer are tuned, this variation of coupling changes the response characteristic from a single sharp peak in the *minimum* coupling position, to a wide double-humped curve in the position of the *maximum* coupling. The total range of the coupling provided by this panel control is from approximately ⅓ optimum in the narrow position, to about three times optimum in the wide position. The control being continuously variable, any intermediate value between these two extremes is readily obtainable. Thus with the aid of a carefully engineered group of transformers and a special measuring instrument, the selectivity or band widths were both calibrated and the calibrations noted directly on the panel as 3, 4, 6, 10, 16 kc. The accuracy of this control is evident from curve "A". This curve was made with the input at reasonance of one micro-volt, 30% modulated 400 CPS, with a 50 ohm resistor in series with each "A" post. The sensitivity was adjusted to produce a six milli-watt output with one microvolt input at resonance. The *bandwidth* control was set as indicated on the curve. The signal frequency was set at 6 megacycles, and the A.F. gain at 10. The band widths at two times the input or 6 db down, are actually 2.6, 5.6, 9.9, and 15.6 kc., with (*Continued on page* 712)

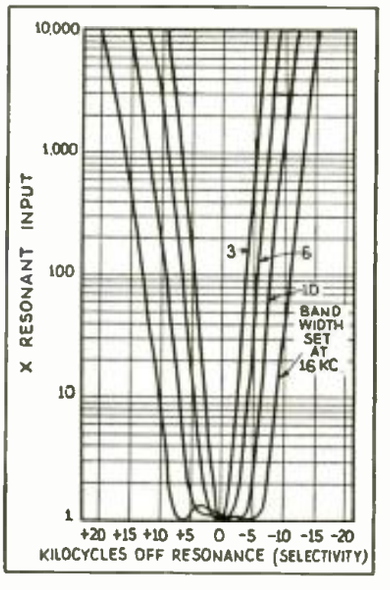


"Fidelity" Curves for Super Pro receiver (B) ←

"Selectivity" Curves for the New "Super Pro" (A) →

Band-Width Control Mechanism

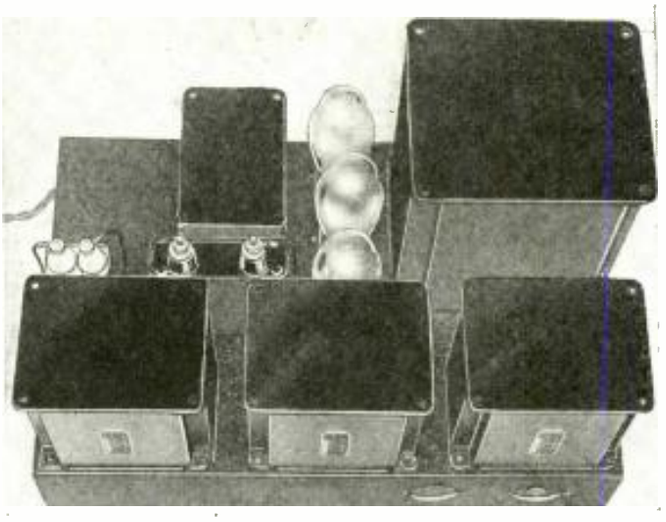




Universal POWER SUPPLY for the HAM

By George W. Shuart, W2AMN

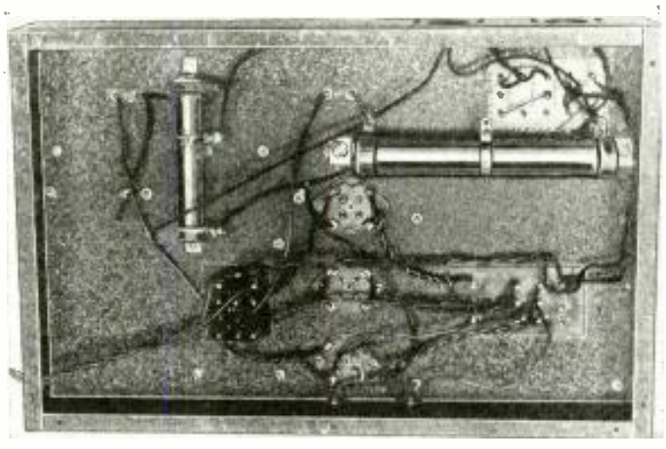
Here is a Power-Supply that every Ham has been waiting for. It furnishes both low and high voltages, with excellent regulation, and makes possible the operation of a complete transmitter using only a single power supply.



Top view of the Multi-purpose power-supply.

● THE problem of supplying voltages to a transmitter is constantly confronting the average amateur.

In most cases two separate power-supplies were used; one furnishing low voltage, that is around 500; another supplying the high voltage, usually around 1,000 to 1,500 volts. It is also possible to obtain the same results with a single power-supply by using a tapped voltage divider.



Bottom view showing the wiring.

However, this latter method is electrically unsound because of the poor regulation afforded and power wasted. The low-power stages suffer when the high-voltage amplifier is keyed.

The new Kenyon triple-winding transformer which is described in this article, and shown in the photographs, permits the entire problem to be solved economically and in an electrically sound manner.

In most of the amateur stations where the average power output is around 100 to 250 watts, two voltages are required, 500 and 1,000. The 500 volt potential is usually applied to the oscillator and buffer stages, while the 1,000 volt supply furnishes power for the final amplifier alone, and it was for this particular purpose and arrangement that this power-supply was designed.

Here we have in effect, two power-supplies employing only one transformer for the high voltages and using three type 83 rectifiers. A switch is also provided so that a single output of some 1,600 volts may be obtained if needed; however, this does away with the low voltage supply. In the last issue of this magazine, we described a 10 and 20 meter transmitter; and elsewhere in this issue we describe a transmitter, both of which can satisfactorily employ this particular power-supply. The transformer which supplies the various filament voltages contains two 6.3, 7.5 and a 5-volt winding. For the 10 and 20-meter described last month, one 6.3 and the 7.5 windings are both employed; for the transmitter described in this issue using the H.F. 100's, and 7½-volt winding, and half of the one 6.3 winding is used to supply the 10-volts for the filament

By employing a rather long filament cable, the voltage is dropped to around 10¼-volts, which is entirely satisfactory. The HF-100 being rated at 10 to 10½-volts. The remaining 6.3 volt winding is employed for the low-power stages. Each output section of the power supply will provide the voltages indicated in the diagram at 250 milliamperes, this is entirely satisfactory for almost any medium power amateur transmitter.

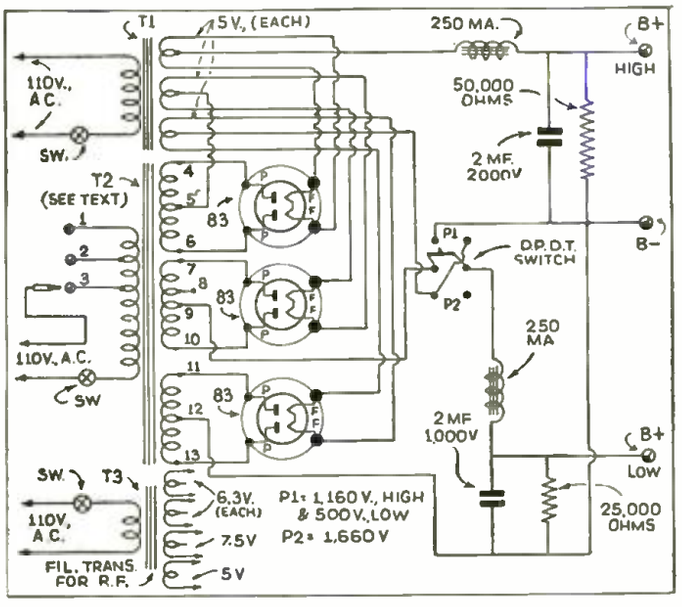
Numerous other combinations may be employed aside from those shown in the diagram. The only variations we found necessary were the double-pole, double-throw switch for switching from one single output, at 1,600 volts, to two delivering 500 and 1,100 volts, together with the three taps on the primary. The voltages shown in the diagram are obtained by employing tap *No. three* on the primary. Taps *one* and *two* will give correspondingly lower voltages.

Other variations, of course, have been explained in previous articles describing this transformer. (See Feb. issue, page 616). T-1 in the diagram is a triple-winding, 5-volt filament transformer, and permits the many combination hook-ups available with this power-supply. The filter section of the supply may seem rather meager; however, careful examination has shown that a single choke and condenser is entirely sufficient to provide an absolutely *pure note* from an efficiently designed transmitter.

Of course, the *crystal* when used in the oscillator circuit goes a long way toward ironing out any ripple that might be caused by the power-supply.

Tests on the air with a number of transmitters have proved that this power-supply gives a perfect note, and one need not incorporate additional chokes or condensers in the filter section.

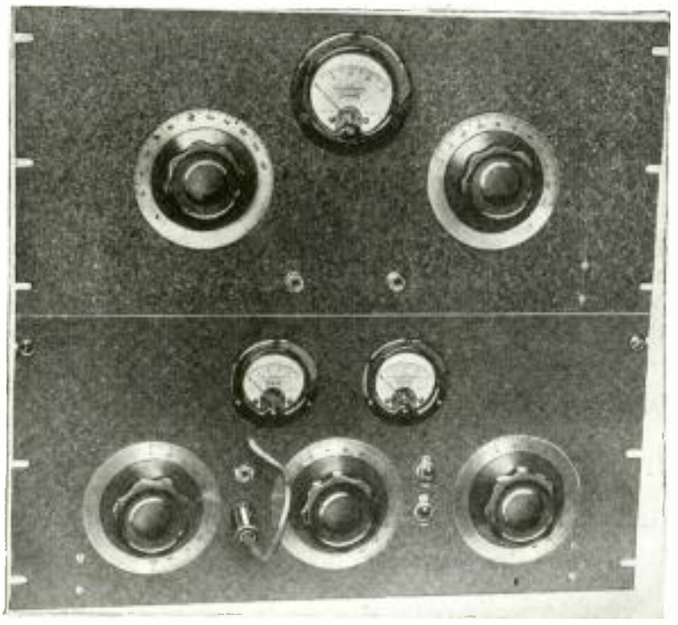
(*Continued on page* 707)



Circuit diagram showing the various connections.

200 Watt Xmitter

By George



Front view of the complete transmitter; note its professional appearance.

Aside from describing a complete 200 or 300-watt transmitter, this article deals extensively with various *trick* circuits and points out their shortcomings. The crystal oscillator and multiplier combination, termed the PEN-TET, is described and eliminates the numerous headaches commonly associated with many of the crystal oscillator circuits.

● THE two main objectives in the design of this transmitter were compactness and the use of a circuit and tube combination which would permit at least three- and possibly four-band operation, with a *single* crystal.

The first thought, of course, was to use one of the new-fangled "Tet" circuits such as the *Tri-Tet*, or *Les-Tet*. However, each time we produce one of these circuits employing *trick* oscillator circuits, we have always had our fingers crossed in the hopes that the exact specifications in the article would be followed, and thus no difficulty would arise due to overheating or fractured crystals. However, it seems almost impossible for anyone to follow instructions down to the last turn of the coil, and many of our over-enthusiastic readers have fractured one crystal after another. Of course, the difficulty in crystal oscillator circuits comes about only when frequency multiplication in the oscillator is employed, and the real danger is in endeavoring to quadruple the frequency in the oscillator plate circuit.

If one doubts this, a simple check can easily be performed with a pentode-tube and a ¼-watt Neon tube; or a 60 ma. pilot light connected in series with the crystal. In the straight pentode oscillator circuit, it will be found practically impossible to light the Neon tube or the small bulb on the *hot* side of the crystal, even with as high as 500 or 600 volts on the plate; pentode tubes such as the 2A5 and 59 are excellent pentode oscillators. Now if we change to either the *Tri-Tet* or *Les-Tet* circuits and tune the plate circuit to the second harmonic, we will note that the Neon bulb can be lighted to fair brilliancy on the grid side of the crystal holder, and if we continue to adjust the plate circuits to either the third or fourth harmonic, we immediately find that the R.F. crystal current has increased tremendously. This is where the crystal begins to heat violently and is subject to fracture, because the less R.F. in the plate circuit or, we may say, the less R.F. absorbed by the multiplying plate circuit from the crystal circuit, or the crystal oscillator circuit, the higher the R.F. crystal current.

This will even be found true with a triode crystal oscillator. A moderately heavy plate load will decrease the crystal current to a very small value, while a lightly-loaded crystal oscillator plate circuit will run a very high crystal current. So it would seem that the ideal proposition would be a crystal oscillator of the ordinary plate-grid feed-back type, employing a tube with very low plate-to-grid capacity.

It will generally be found that the lower the feed-back within the tube, the lower the crystal current, until we get to the point where there is insufficient feed-back to cause crystal activity. This ideal situation will then be, as we mentioned before, a pentode oscillator having a very low plate-to-grid or feed-back capacity and with the plate circuit heavily loaded.

After a great amount of experimenting, we found that the metal 6F6 tube proved to be the ideal one for this circuit. You will notice, by referring to the diagram, that the 6F6 pentode runs with a very high grid bias, obtained via the cathode circuit, and is directly coupled to the multiplier tube.

In the diagram we have a 6L6 which is also heavily biased with a large cathode resistor. It will be seen that one tuned circuit is employed for the grid and plate circuits for the amplifier and oscillator respectively. With this arrangement it is possible to tune the output of the

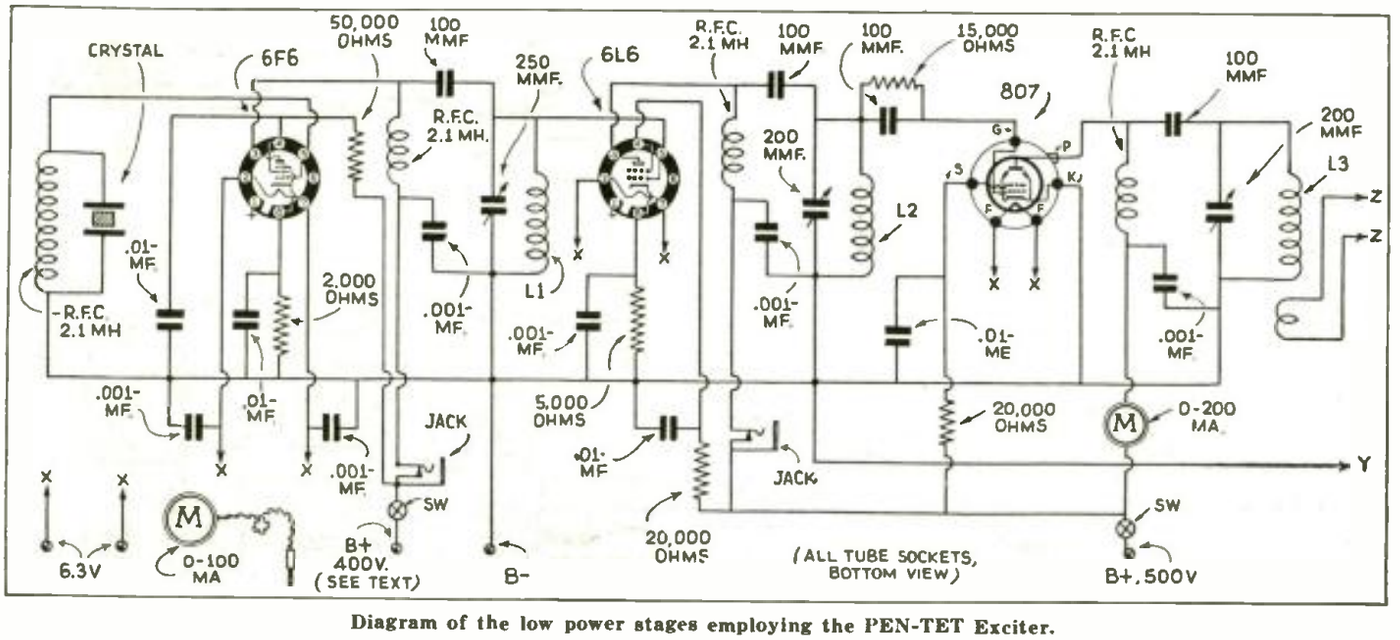
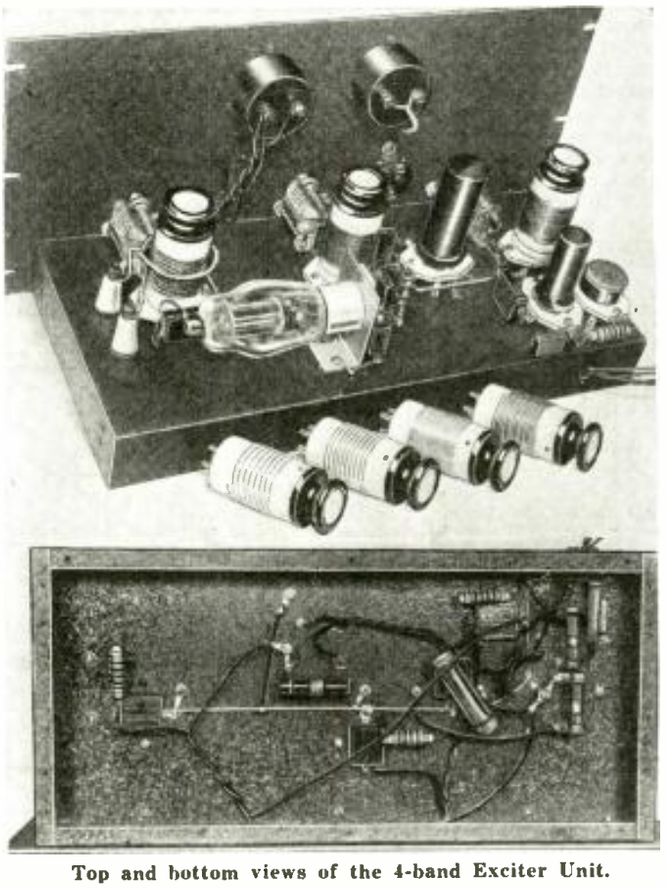


Diagram of the low power stages employing the PEN-TET Exciter.

Features New PEN-TET EXCITER

W. Shuart, W2AMN



Top and bottom views of the 4-band Exciter Unit.

6L6 to the fourth harmonic and obtain more R.F. and better plate efficiency than can possibly be obtained with either the *Tri-Tet* or *Les-Tet* circuits, and at the same time the crystal remains *absolutely cold* and there is no sign of *creeping*, because there is no crystal heating. Another advantage is that the crystal current remains constant or nearly so, regardless of the frequency of the 6L6 multiplier tube. Here we have a set-up with the same number of controls and tubes as the *Les-Tet* circuit, and the same number of controls as the *Tri-Tet* with the addition of only one extra tube.

We have nicknamed this combination the *Pen-Tet*, meaning a pentode-oscillator tetrode - multiplier. It is necessary that the 6L6 metal tube be used in this multiplier circuit, or some other tube having as effective *shielding*.

If the 807 is used in this position, an external shield must be used to prevent reaction when this tube is tuned to the crystal frequency. The 6L6 performs satisfactorily and is more convenient to use than other types of tubes. The third tube in this transmitter is an 807, and is used as a screen-grid amplifier and is capable, with 500-volts applied to the plate, of about 25 to 30 watts power output.

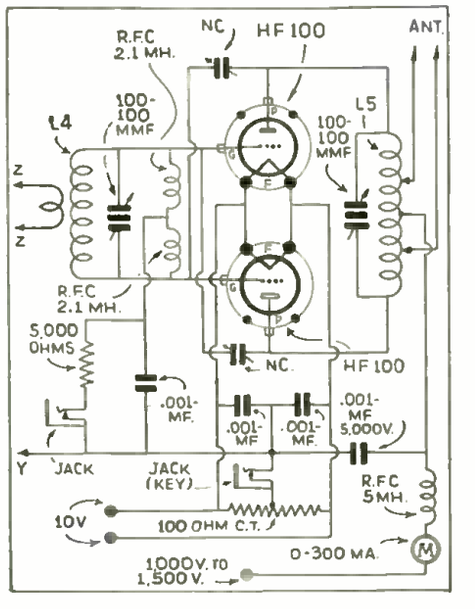
A single tuned circuit is also used for the plate circuit of the 6L6 multiplier and the grid circuit of the 807, necessitating parallel plate feed. The grid bias for the 807 is obtained with a grid-leak and condenser inserted in series with the grid-lead.

FIRST!

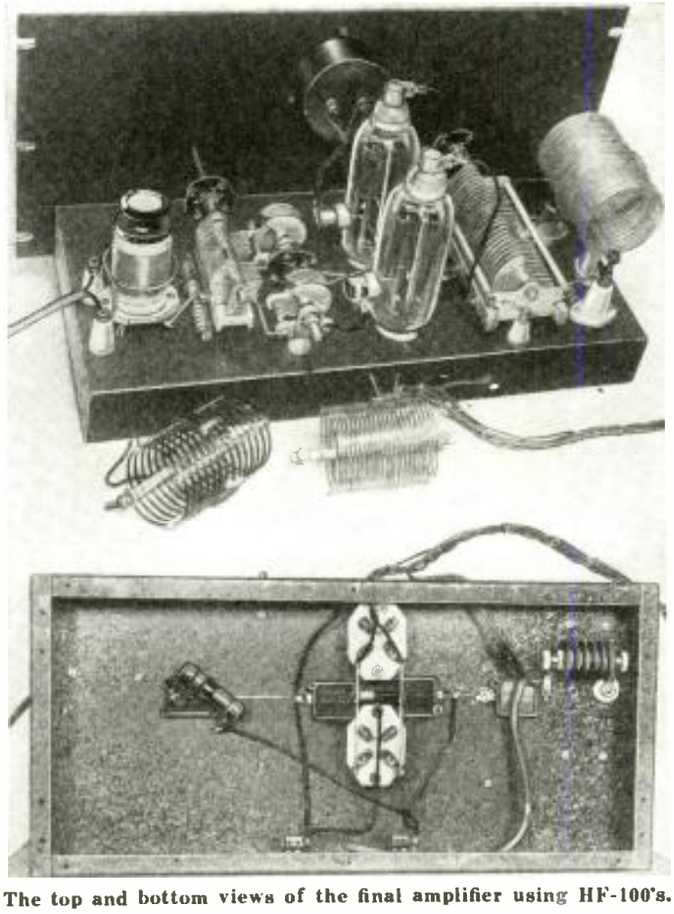
The PEN-TET crystal oscillator and frequency multiplier circuit here described for the first time outdoes all other arrangements and has none of their shortcomings. No more cracked crystals!

In order to be consistent and so that no insulation was necessary between the rotors of the plate tuning condensers, and the metal chassis, we have employed parallel plate-feed with the 807. We have used plug-in coils in this exciter unit and they are so arranged that it is possible to work on the first two bands (80, 40) without changing coils. First, for instance, for 80 meter operation the plate circuits are all tuned to that wavelength or band.

With the coil data given it is only necessary to tune the plate circuits of the 6L6 and 807 (*Continued on page* 704)



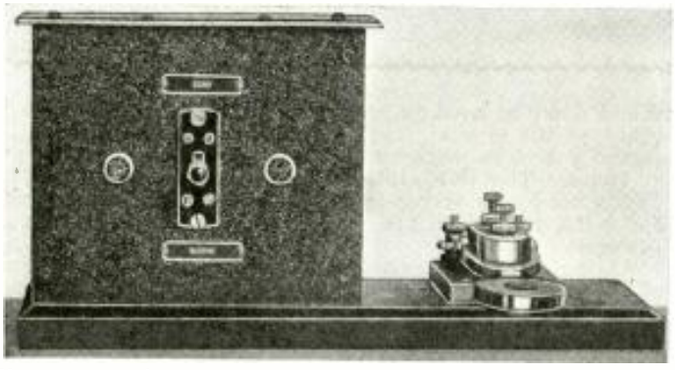
Final amplifier hook-up diagram.



The top and bottom views of the final amplifier using HF-100's.

A Control Unit for the Ham Operator

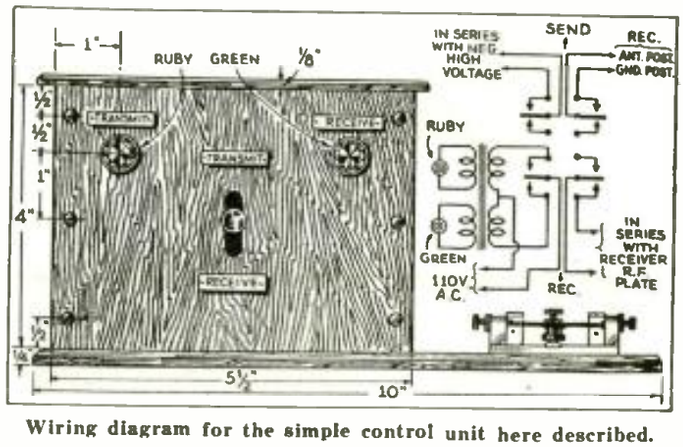
By Howard S. Pyle, W7ASL



Very neat and useful control unit designed and built by Mr. Pyle. Every "Ham" station needs one of these.

● DID you ever watch an amateur change over from transmitter to receiver, which operation consisted in throwing a myriad of switches, pulling of plugs and acrobatic activities similar to that of a plump hen who has just had her machinery department neatly severed from her body? Of course you have—nine chances in ten you have to do it yourself! And why all this fuss in changing over? Many stations are, of course, equipping for *break-in* operation, which is the ideal set-up, requiring nothing further than pushing the key to transmit, and leaning back for a smoke to receive. But there are countless amateurs still having to depend upon some manual means of accomplishing the "change-over," and it is for them that the described unit has been designed. It provides a simple, inexpensive method of accomplishing the various switching required, through the medium of but one handle, and at the same time indicates in just which position the equipment is at all times.

Consult the dimension drawing reproduced here. These dimensions do not, of course, have to be adhered to, but were found to be about the right size and are accordingly suggested. The base is made up from a piece of the material variously known as "Masonite." Prestwood or Hardboard—an excellent, hard, smooth-surface wood-base material suitable for many uses around the "ham shack." It can be had in either a nut-brown finish or in black, or it may be purchased finished in black crackle lacquer, in small standard panel sizes, for very little cash, under various trade names. Never mind what they call it—you get the idea, and a "rose by any other name is just as sweet." Plain black was used for the base, 10" long by 5" wide, and of ¼" thickness. A small bevel was planed around all four top edges for appearance sake—this stuff works easily with carpenter tools. The control cabinet itself was made up of ½" soft wood for the back and *(Continued on page 707)*



Wiring diagram for the simple control unit here described.

Low Cost Oscilloscope

By Howard G. McEntee, W2FHP

Easily built by the radio amateur around the new 913 Cathode Ray Tube.

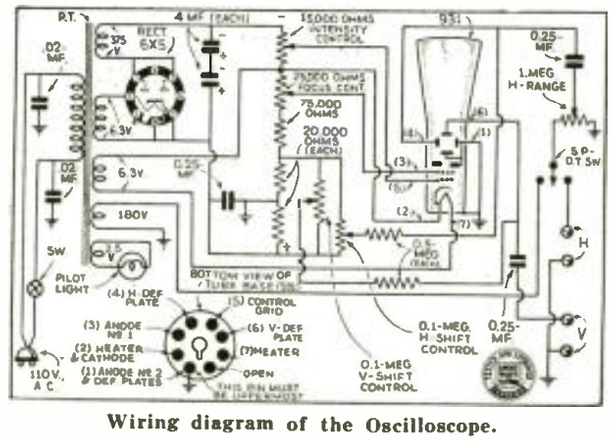
Front View of the Oscilloscope.

● THE serious amateur or experimenter has often felt the need for a simple oscilloscope, but the cost has many times proven to be a barrier.

However, with the advent of the new 913 tube, a complete cathode ray tube which will do anything its larger brothers will do, the picture has suddenly changed, and we now find it possible to build a highly useful piece of equipment with tubes and all for around $15.00 starting from scratch. Aside from the actual cathode ray tube, *all* other parts are of the ordinary receiver type, many of which the prospective builder will already have on hand.

This instrument is built as a basic unit, and is the simplest type of cathode ray oscilloscope. It is capable of many uses, not the least of which is its use as a transmitter output monitor, the so-called "trapezoid" figures thus furnished being invaluable in securing proper operation. This use is all the more important in view of the F.C.C. rulings regarding constant monitoring of phone transmitters, as improper operating conditions can be instantly noted. Since many excellent articles have been written on the actual patterns for various conditions and since the actual theory of action in the cathode ray tube is either known or is easily available, this will not be touched upon.

A brief study of the circuit is deemed necessary before starting construction. The power transformer is one made expressly for this purpose. The diagram shows that it has 5 secondaries, 2 high voltage, and 3 for filament. The one marked 375 V. actually furnished a voltage about 450 to the *bleeder* (resistance) due to the use of condenser imput and the low current drain. This 450 volts is split up by the voltage divider for the various tube elements. The two 20,000 ohm sections of the *(Continued on page 697)*



Wiring diagram of the Oscilloscope.

CORRECTED AND REVISED Monthly

World S-W Station List

Complete List of Broadcast, and Telephone Stations

All the stations in this list use telephone transmission of some kind. Note: Stations marked with a star ★ are the most active and easily heard stations and transmit at fairly regular times.

Please write to us about any new stations or other important data that you learn through announcements over the air or correspondence with the stations.

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

Around-the-Clock Listening Guide

It is a good idea to follow a general schedule as far as wavelength in relation to the time of the day is concerned. The observance of these simple rules will save time.

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

To the east of the listener, from about 11 a.m.-5 a.m., the 19-35 meter will be found very productive. To the west of the listener this same band is generally found best from about 12 m. until 7 a.m. (After dark, results above 35 meters are usually much better than during daylight.) These general rules hold for any location in the Northern Hemisphere.

Short-Wave Broadcasting, Experimental and Commercial Radiophone Stations

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

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

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

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

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

31600 kc. W6XKG
-BX- 9.494 meters
LOS ANGELES, CAL.
Relays KGFJ Mon. 11:30 a.m.-1:30 p.m.

31600 kc. W9XPD
-BX- 9.494 meters
ST. LOUIS, MO.
Relays KSD daily

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

17790 kc. ★GSG
-B- 16.86 meters
DAVENTRY,
B.B.C., BROADCASTING HOUSE, LONDON, ENGLAND
3-5, 6-8:45 a.m.

17785 kc JZL
-B- 16.87 meters
TOKIO, JAPAN
Tests irregularly

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

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

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

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

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

17755 kc. ZBW5
-B- 16.9 meters
P.O. Box 200
HONGKONG, CHINA
Irregular 11:30 p.m.-1:15 a.m., 4-10 a.m.

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

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

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

17480 kc. VWY2
-C- 17.16 meters
KIRKEE, INDIA
Works Rugby 7:30-8:15 a.m.

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

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

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

16385 kc. ITK
-C- 18.31 meters
MOGADISCIO, ITAL. SOM-ALILAND
Calls IAC around 9:30 a.m.

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

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

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

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

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

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

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

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

15660 kc. JVE
-C- 19.16 meters
NAZAKI, JAPAN
Phones Java 3-5 a.m.

15620 kc. JVF
-C- 19.2 meters
NAZAKI, JAPAN
Phones U.S., 5 a.m. & 4 p.m.

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

15450 kc. IUG
-C- 19.41 meters
ADDIS ABABA, ETHIOPIA
Calls IAC 9:15-10:30 a.m.

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

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

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

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

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

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

15310 kc. GSP
-B- 19.6 meters
DAVENTRY
B.B.C., BROADCASTING HOUSE,
LONDON, ENGLAND
3-5 a.m.

15290 kc. LRU
-B- 19.62 meters
"EL MUNDO"
BUENOS AIRES, ARGENTINA, S. A.
Daily 6 a.m.-5:50 p.m.

(All Schedules Eastern Standard Time)

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

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

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

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

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

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

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

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

15220 kc. ★PCJ
-B- 19.71 meters
N.V. PHILIPS' RADIO
EINDHOVEN, HOLLAND
Tues. 4:30-6 a.m.
Wed. 8-11 a.m.
Sun. 7:30-8:30 a.m.

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

15200 kc. ★DJB
-B- 19.74 meters
BROADCASTING HOUSE
BERLIN, GERMANY
12:05-5:15, 5:55-11 a.m.
Sun. also 11:10 a.m.-12:25 p.m.

15190 kc. ZBW4
-B- 19.75 meters
HONGKONG, CHINA
P. O. Box 200
Irregular 11:30 p.m.-1:15 a.m., 4-10 p.m.

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

15180 kc. RW96
-B- 19.76 meters
MOSCOW, U.S.S.R.
Irregular

15160 kc. JZK
-B- 19.79 meters
TOKIO, JAPAN
4-5 p.m. Mon. and Thurs. and 2-3 p.m. Tues. and Fri.

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

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

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

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

15090 kc. RKI
-B, C- 19.88 meters
MOSCOW, U.S.S.R.
Phones Tashkent near 7 a.m.

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

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

14970 kc. LZA
-B,C- 20.04 meters
RADIO GARATA,
SOFIA, BULGARIA
Broadcasts Sun. 12:30-8 a.m., 10 a.m.- 4:30 p.m., Daily 5-6:30 a.m., 12 n-2:45 p.m.

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

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

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

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

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

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

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

14600 kc. JVH
-B,C- 20.55 meters.
NAZAKI, JAPAN
Irregular 5-11:30 p.m.
Phones Europe 4-8 a.m.

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

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

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

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

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

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

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

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

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

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

14470 kc. WMF
-C- 20.73 meters
LAWRENCEVILLE, N. J.
Phones England in daytime

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

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

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

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

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

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

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

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

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

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

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

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

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

13075 kc. VPD
-X- 22.94 meters
SUVA, FIJI ISLANDS
Daily exs. Sun. 12:30-1:30 a.m.

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

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

12800 kc. IAC
-C- 23.45 meters
PISA, ITALY
Calls Italian ships, meralago

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

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

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

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

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

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

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

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

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

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

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

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

11955 kc. IUC
-C- 25.09 meters
ADDIS ABABA, ETHIOPIA
Calls IAC around 12 m.

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

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

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

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

11875 kc. OLR
-B- 25.24 meters
PRAGUE, CZECHOSLOVAKIA
Irregular Mornings

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

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

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

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

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

11830 kc. ★W2XE
-B- 25.38 meters
ATLANTIC BROADCASTING CORP.
485 MADISON AVE., N. Y. C.
Relays WABC 6-10 p.m.

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

11810 kc. ★2RO
-B- 25.4 meters
E.I.A.R.
Via Montello 5
ROME, ITALY
Daily 6:43-10:30, 11:30 a.m.-12:40 p.m.; Sun. 6:43-9, 11:30 a.m.- 12:40 p.m.

11800 kc. ★JZJ
-B- 25.42 meters
TOKIO, JAPAN
Mon. and Thur. 4-5 p.m.
Tues. and Fri. 2-3 p.m.
Daily 12m.-1 A.M.

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

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

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

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

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

11730 kc.
-B- 25.57 meters
"RADIO PHILCO"
SAIGON, INDO-CHINA
Irregular 3:30-8:30 a.m.

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

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

11715 kc. ★TPA4
-B- 25.61 meters
"RADIO COLONIAL"
PARIS, FRANCE
8:15-10:15 p.m.
10:45 p.m.-1 a.m.

11710 kc. SM5SX
-B- 25.63 meters
STOCKHOLM, SWEDEN
Daily 11 a.m.-5 p.m.
Wed. till 6 p.m.

11680 kc. KIO
-B. X- 25.68 meters
KAHUKU, HAWAII
Broadcasts Tues. 12:30-1 a.m. Irregular, Wed. 8-8:30 p.m. and tests irregularly

11600 kc. ★COCX
-B- 25.86 meters
HAVANA, CUBA
Relays CMX
8 a.m.-1 a.m.

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

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

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

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

11280 kc. HIN
-B- 26 meters
LA VOZ DEL PARTIDO DOMINICANO, CIUDAD TRUJILLO, D.R.
4:40-5:40 p.m.

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

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

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

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

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

(All Schedules Eastern Standard Time)

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

10740 kc. JVM
-B,C- 27.93 meters
NAZAKI, JAPAN
Phones U.S. 2-7 a.m.

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

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

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

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

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

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

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

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

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

10370 kc. EHZ
-C.-B- 28.93 meters
TENERIFFE, CANARY ISL.
Relays EAJ43, 2-4, 6-7 p.m.

10350 kc. LSX
-C- 28.98 meters
MONTE GRANDE, ARGENTINA
Tests irregularly 8 p.m.-12 midnight. Broadcasts Mon. and Fri. 5-6 p.m.

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

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

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

10260 kc. PMN
-B, C- 29.24 meters
BANDOENG, JAVA
Relays YDB 5:30-10:30 or 11 a.m.

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

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

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

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

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

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

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

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

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

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

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

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

9930 kc. ★CSW
-B- 30.21 meters
NATL. BROAD. STATION
LISBON, PORTUGAL
4-6 or 7 p.m.

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

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

9860 kc. ★EAQ
-B- 30.43 meters
P. O. Box 951
MADRID, SPAIN
Daily 5:15-9:30 p.m.;
Saturday also 12 n.-2 p.m.

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

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

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

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

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

9740 kc. ★COCQ
-B- 30.78 meters
HAVANA, CUBA
6:50 a.m.- 1 a.m.

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

9680 kc. ★CT1AA
-B- 31 meters
"RADIO COLONIAL"
LISBON, PORTUGAL
Tues., Thurs., Sat. 4-7 p.m.

9675 kc. DZA
31.01 meters
ZEESEN, GERMANY
Irregular

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

9660 kc. ★LRX
-B- 31.06 meters
"EL MUNDO"
BUENDS AIRES, ARGENTINA
6-10 or 11 p.m.

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

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

9645 kc. HH3W
-B- 31.1 meters
P.O. BOX A117,
PORT-AU-PRINCE, HAITI
1-2, 7-8 p.m.

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

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

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

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

9600 kc. RAN
-B- 31.25 meters
MOSCOW, U.S.S.R.
Daily 6-8 p.m.

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

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

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

9590 kc. ★VK2ME
-B- 31.28 meters
AMALGAMATED WIRELESS, LTD., 47 YORK ST.
SYDNEY, AUSTRALIA
Sun. 1-3, 5-9, 9:30-11:30 a.m.

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

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

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

9575 kc. HJ2ABC
-B- 31.34 meters
CUCUTA, COL.
8 p.m.-12 n.

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

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

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

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

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

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

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

9530 kc. JZI
-B- 31.48 meters
TOKIO, JAPAN
Tests 2-3 p.m., Tues. and Fri., and at other times

9525 kc. ZBW3
-B- 31.49 meters
HONGKONG, CHINA
P.O. Box 200
11:30 p.m.-1:15 a.m., 4-10 a.m.

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

9520 kc. HJ4ABH
-B- 31.51 meters
ARMENIA, COLOMBIA
Irregular 5 p.m.-12 m.

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

9510 kc. ★GSB
-B- 31.55 meters
DAVENTRY,
B.B.C., BRDADCASTING HOUSE, LONDON, ENGLAND
3-5 a.m., 6 a.m.-12 n. 12:15-5:45, 6-8, 9-11 p.m.

9505 kc. HJ1ABE
-B- 31.57 meters
P.O. BOX 31,
CARTAGENA, COLOMBIA
Daily 7:30-9 p.m.,
Mon. also 9:30-10:30 p.m.

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

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

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

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

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

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

9330 kc. CGA4
-C- 32.15 meters
DRUMMONDVILLE, CANADA
Phones England irregularly

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

8400 kc. HC2CW
-B- 35.71 meters
GUAYAQUIL, ECUADOR
11:30 a.m.-12:30 p.m., 8-11 p.m.

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

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

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

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

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

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

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

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

7854 kc. HC2JSB
-B- 38.2 meters
GUAYAQUIL, ECUADOR
Evenings

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

(All Schedules Eastern Standard Time)

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

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

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

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

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

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

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

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

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

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

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

7100 kc. FO8AA
-B- 42.25 meters
PAPEETE, TAHITI
Tues. and Fri. 11 p.m.-12 m.

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

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

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

6996 kc. PZH
-B- 42.88 meters
P. O. BOX 16,
PARAMIRABO, DUTCH GUIANA
Daily 6:06-6:36 a.m.
Sun. 9:36-11:36 a.m.
Daily 5:36-8:36 p.m.

6977 kc. XBA
-B- 43 meters
TACUBAYA, D.F., MEX.
9:30 a.m.-1 p.m., 7-8:30 p.m.

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

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

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

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

6850 kc. XGOX
-B- 43.8 meters
NANKING, CHINA
Daily 6:40-8:40 a.m.
Sun. 4:40-6:05 a.m.

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

6770 kc. HIH
-B- 44.26 meters
SAN PEDRO de MACORIS
DOMINICAN REP.
12:10-1:40 p.m., 7:30-9 p.m., Sun. 3-4 a.m., 4:15-6 p.m.; 4:40-7:40 p.m.

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

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

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

6720 kc. PMH
-B,C- 44.64 meters
BANDOENG, JAVA
Relays NIROM programs
5:30-10:30 or 11 a.m.

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

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

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

6635 kc. ★HC2RL
-B- 45.21 meters
P. O. BOX 759, GUAYAQUIL, ECUADOR, S. A.
Sunday, 5:45-7:45 p. m.
Tues., 8:15-11:15 p. m.

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

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

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

6550 kc. XBC
-B- 45.8 meters
VERA CRUZ, MEX.
8:15-9 a.m.

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

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

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

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

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

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

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

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

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

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

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

6355 kc . YV1RG
-B- 47.2 meters
"ONDAS DEL LAGO,"
MARACAIBO, VENEZUELA
8-11 p.m.

6316 kc. HIZ
-B- 47.5 meters
CIUDAD TRUJILLO
DOMINICAN REPUBLIC
Daily except Sat. and Sun. 11:0 a.m.-2:25 p.m., 5:10-8:40 p.m.; Sat. 5:10-11:10 p.m.; Sun., 11:40 a.m.-1:40 p.m.

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

6290 kc. YV5RC
-B- 47.69 meters
CARACAS, VEN.
LA VOZ DE LA PHILCO
Irregular

6282 kc. COHB
-B- 47.78 meters
P.O. BOX 85,
SANCTI SPIRITUS, CUBA
4-6, 9-11 p.m.

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

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

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

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

6185 kc. HI1A
-B- 48.5 meters
P. O. BOX 423, SANTIAGO, DOMINICAN REP.
11:40 a. m.-1:40 p. m.
7:40-9:40 p. m.
Wed. 6-10:30 p.m.

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

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

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

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

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

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

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

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

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

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

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

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

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

6130 kc. ZGE
-B- 48.94 meters
KUALA LUMPUR,
FED. MALAY STATES
Sun., Tue., and Fri.,
5:40-8:40 a. m.

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

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

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

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

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

6110 kc. ★GSL
-B- 49.1 meters
DAVENTRY
B. B. C., BROADCASTING HOUSE, LONDON, ENGLAND
9-11 p.m.

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

6105 kc. HJ4ABB
-B- 49.14 meters
MANIZALES, COL., S. A.
P. O. Box 175
Mon. to Fri. 12:15-1 p. m.; Tues. & Fri. 7:30-10 p. m.; Sun. 2:30-5 p. m.

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

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

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

6095 kc. JZH
-B- 49.22 meters
TOKIO, JAPAN
Irregular

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

6090 kc. ★CRCX
-B- 49.26 meters
TORONTO, CANADA
Daily 5:30-11:30 p.m.
Sun. 5-11:30 p.m.

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

6090 kc. ZBW2
-B- 49.26 meters
P. O. BOX 200
HONGKONG, CHINA
Irregular 11:30 p.m.-1:15 a.m., 4-10 a.m.

6085 kc. HJ5ABD
-B- 49.3 meters
"LA VOZ DE VALLE"
CALI, COLOMBIA
12 n.-1:30 p.m., 5:10-9:40 p.m.

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

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

6080 kc. HP5F
-B- 49.34 meters
CARLTON HOTEL
COLON, PANAMA
11:45 a.m.-1:15 pm., 7:45-10 p.m.

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

6079 kc. DJM
-B,X- 49.34 meters
BROADCASTING HOUSE,
BERLIN, GERMANY

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

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

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

6065 kc. HJ4ABL
-B- 49.48 meters
MANIZALES, COL.
Daily 11 a.m.-12 n., 5:30-7:30 p.m. Sat. 5:30-10:30 p.m.

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

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

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

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

(All Schedules Eastern Standard Time)

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

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

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

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

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

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

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

6030 kc. ★HP5B
-B- 49.75 meters
P. O. BOX 819
PANAMA CITY, PAN.
12 n.- 1p.m., 7-10:30 p.m.

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

6030 kc. ★OLR
-B- 49.75 meters
PRAGUE, CZECHOSLOVAKIA
Daily 2:45-4:30 p.m.
Mon. and Thur. 7-9 p.m.

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

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

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

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

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

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

6010 kc. VP3MR
-B- 49.9 meters
GEORGETOWN, BRI. GUIANA, S.A.
Sun. 7:45-10:15 a.m.
Daily 4:45-8:45 p.m.

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

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

6005 kc. ★CFCX
-B- 49.96 meters
CANADIAN MARCONI CO., MONTREAL, QUE., CAN.
Relays CFCF 6 a.m.-11:15 p.m.
Sun. 9 a.m.-11:15 p.m.

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

6000 kc. RNE
-B- 50 meters
MOSCOW, U.S.S.R.
Daily 12:30-6 p.m.

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

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

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

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

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

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

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

5910 kc. YV15RV
-B- 50.76 meters
MARACAY, VENEZUELA
Irregular

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

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

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

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

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

5850 kc. ★YV5RMO
-B- 51.28 meters
CALLE REGISTRO, LAS DELICIAS APARTADO de CORRES 214
MARACAIBO, VENEZUELA
6:45-9:45 a.m., 11:15 a.m.-12:15 p.m., 4:45-9:45 p.m. Sun. 11:45 a.m.-12:45 p.m.

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

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

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

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

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

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

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

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

5077 kc. WCN
-C- 59.08 meters
LAWRENCEVILLE, N. J.
Phones England irregularly

5025 kc. ZFA
-C- 59.7 meters
HAMILTON, BERMUDA
Calls U.S.A., nights

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

4975 kc. GBC
-C- 60.30 meters
RUGBY, ENGLAND
Calls Ships, late at night

4820 kc. GDW
-C- 62.24 meters
RUGBY, ENGLAND
Calls N.Y.C., late at night

4790 kc. VE9BK
-BX- 62.63 meters
RADIO SALES SERVICE, LTD., 780 BEATTY ST., VANCOUVER, B.C., CAN.
Daily exc. Sun. 11:30-11:45 a.m., 3-3:15, 6-8:15 p.m.

4752 kc. WOO
-C- 63.1 meters
OCEAN GATE, N. J.
Calls ships irregularly

4600 kc. HC2ET
-B- 65.22 meters
Apartado 248
GUAYAQUIL, ECUADOR
Wed., Sat., 9:15-11 p.m.

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

4274 kc. RV15
-B- 70.2 meters
KHABAROVSK, SIBERIA, U. S. S. R.
Daily, 1-10 a.m.

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

4098 kc. WND
-C- 73.21 meters
HIALEAH, FLORIDA
Calls Bahama Isles

4002 kc. CT2AJ
-B- 74.95 meters
PONTA DELGADA,
SAO MIGUEL, AZORES
Wed. and Sat. 5-7 p. m.

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

Alphabetical List of S-W Stations

By Call-Letter and Frequency

(Frequency in Megacycles)

CALL	FREQ.	CALL	FREQ.	CALL	FREQ.	CALL	FREQ.	CALL	FREQ.	CALL	FREQ.
CB960	9.06 mc.	DJO	11.8 mc.	GBL	14.65 mc.	HC2AT	8.40 mc.	HJ1ABP	9.62 mc.	IAC	8.38 mc.
CEC	19.68	DJP	11.86	GBP	10.77	HC2ET	4.60	HJ2ABC	9.59	IAC	6.65
CEC	15.87	DJQ	15.28	GBS	12.15	HC2JSB	7.85	HJ2ABD	5.98	IDU	13.39
CEC	10.67	DJR	15.34	GBU	12.29	HC2RL	6.64	HJ3ABD	6.05	ITK	16.39
CGA3	13.29	DZA	9.68	GBW	14.44	HC2TC	7.98	HJ3ABF	6.17	IUC	11.96
CGA4	9.33	DZB	10.04	GCA	9.71	HH2S	5.92	HJ3ABH	6.01	IUG	15.45
CJA3	11.41	DZC	10.29	GCB	9.28	HH3W	9.65	HJ3ABX	6.12	(I)2RO	11.81
CJRO	6.15	DZE	12.13	GCI	8.73	HIG	6.28	HJ4ABB	6.11	2RO	9.64
CJRX	11.72	DZG	15.36	GCJ	13.42	HIH	6.78	HJ4ABC	6.45	JVE	15.66
CNR	12.83	DZH	14.46	GCQ	8.76	HII	14.94	HJ4ABC	6.07	JVF	15.62
CNR	8.04	EAQ	9.86	GCS	9.02	HIL	6.50	HJ4ABD	5.93	JVH	14.60
COCD	6.13	EDM	20.86	GCU	9.95	HIN	6.24	HJ4ABE	6.09	JVM	10.74
COCH	9.43	EDM	10.07	GCW	9.79	HIN	11.28	HJ4ABH	9.52	JVN	10.66
COCO	6.01	EHY	20.86	GDB	4.32	HIT	6.63	HJ4ABL	6.06	JVP	7.51
COCQ	9.74	EHY	10.07	GDS	6.91	HIX	6.13	HJ4ABP	6.03	JVT	6.75
COCX	11.6	EHZ	10.37	GDW	4.82	HIZ	6.32	HJ4ABU	6.15	JVU	5.79
COKG	6.15	FO8AA	7.1	GSA	6.05	HI1A	6.19	HJ5ABD	6.09	JYK	13.61
CO9JQ	8.67	FTA	11.94	GSB	9.51	HI1J	5.86	HKB	9.93	JYR	7.88
COHB	6.28	FTK	15.88	GSC	9.58	HI1S	6.42	HKE	7.10	JYS	9.84
CP5	6.08	FTM	19.36	GSD	11.75	HI3C	6.10	HKV	8.80	JYT	15.76
CRCX	6.09	FTO	18.25	GSE	11.86	HI3U	6.02	HPF	14.49	JZH	6.1
CSL	6.15	FZR3	16.23	GSF	15.14	HI4D	6.56	HP5B	6.03	JZI	9.53
CSW	9.93	FZS	18.35	GSG	17.79	HI4V	6.48	HP5F	6.08	JZJ	11.8
CT1AA	9.65	FZS2	11.99	GSH	21.47	HI5N	6.14	HP5J	9.62	JZK	15.16
CT1GO	12.40	GAA	20.38	GSI	15.26	HI7P	6.80	HP5K	6.01	JZL	17.79
CT2AJ	4.00	GAB	18.04	GSJ	21.53	HI8A	6.45	HRD	6.24	KAY	14.98
DAF	12.33	GAD	19.48	GSL	6.11	HI9B	6.05	HRF	14.49	KAZ	9.99
DAF	8.77	GAP	19.16	GSN	11.82	HJA3	14.94	HRL5	14.49	KEE	7.72
DFB	17.52	GAQ	18.97	GSO	15.18	HJB	14.95	HRN	5.88	KEJ	9.01
DGU	9.650	GAS	18.31	GSP	15.31	HJN	5.95	HRP1	7.03	KEL	6.86
DJA	9.560	GAU	18.62	HAS3	15.37	HJU	9.50	HS8PJ	9.35	KES	10.41
DJB	15.20	GAW	18.20	HAT4	9.13	HJ1ABB	9.56	HS8PJ	19.02	KIO	11.68
DJC	6.02	GBA	13.99	HBJ	14.54	HJ1ABC	6.0	HS8PJ	15.22	KKH	7.52
DJD	11.77	GBB	13.59	HBL	9.60	HJ1ABD	7.28	HSP	17.74	KKR	15.46
DJE	17.76	GBC	17.08	HBP	7.80	HJ1ABE	9.50	HVJ	15.12	KKZ	13.69
DJL	15.11	GBC	12.78	HCETC	6.98	HJ1ABG	6.04	HVJ	5.97	KTO	16.24
DJM	6.08	GBC	8.68	HCJB	8.95	HJ1ABJ	6.03	IAC	17.76	KWO	15.42
DJN	9.54	GBC	4.98	HCK	5.89	HJ1ABK	7.07	IAC	12.80	KWU	15.36
										KWV	10.84 mc.
										KWX	7.61
										LKJ1	9.53
										LRU	15.29
										LRX	9.66
										LSF	19.60
										LSG	19.90
										LSI	9.80
										LSK3	10.25
										LSL	15.81
										LSL2	10.30
										LSM2	14.50
										LSN	9.89
										LSN	14.53
										LSN5	19.65
										LSN6	21.02
										LSX	10.35
										LSY	20.70
										LSY3	18.12
										LZA	14.97
										OAX4D	5.78
										OAX4G	6.23
										OCI	18.68
										OCI	10.97
										OCJ2	14.85
										OER2	6.07
										OLR	15.23
										OLR	11.76
										OLR	11.88
										OLR	6.12
										OLR	6.03
										OPL	20.04
										OPM	10.14
										ORG	19.20
										ORK	10.33

(Continued on page 710)

Studio of XGOX Shanghai, China.

LET'S "Listen In" With Joe Miller

Our Short-Wave "DX" Editor

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

If you like to "Listen In" to DX programs, but often fail to pick up the desired stations, then read Joe Miller's "tips" below. The data on the S-W stations here presented is actually checked "on the air" by Mr. Miller—not just copied from some printed schedule which is frequently subject to change.

● WE hope that last month's DX editorial has been read by you, and that you've decided to make yourself a DX goal to "shoot at," as one New Year's resolution that will be a pleasure to keep.

From now on, in mentioning any DXer's tips, we will give his DX standing in parenthesis, after his name, as, John Smith (10-55), which will indicate that he has 10 VAC or 10 *veries* from *all* six *continents*. The second figure will indicate the total countries verified.

In future articles, we will endeavor to list as many of these DXers, and their "pedigrees," as possible, as, when one sees his rating published, he'll generally feel the incentive to improve that DX standing, for all to see his progress, an understandable motive, "to show the boys."

We may remark here that as many of you Dxers will want to go after the real DX, we would advise that you make yourself a DX *tuning schedule*, copying down our tips in hourly sequence, as a station listed operating at 6 a.m. would be put in a column marked 6-7 a.m., and the wave also listed, and one can apportion his tuning time wisely, in this way, going after stations known to be in operation at certain hours.

Keeping such a list near your set and tuning daily, one should be able to "clean up" some good DX, as, provided one has an efficient S-W installation, there is nothing that will increase one's "log" as much as persistent tuning, or just "plugging at it." For those readers who have all our DX articles, as many of tips given were on commercial DX, these tips will still be useful, as commercial phones rarely change operating schedules, from season to season.

We would like to make plain here that we have no connection with the editing of the monthly DX station list.

Yugoslavia Heard

Though we rarely tune for Europe, we do feel a thrill in *logging* a new country, no matter where, and so we did enjoy the reception of YTC, listed on 49.18 meters, or 6.10 mc., despite the late hour of their schedule, when heard, 2:10 a.m. This station, located at Belgrade, the capital, is reported as operating from 1-3 a.m., 6:30-8:30 a.m., and 12-5 p.m. in afternoon. YTC is heard FB in the early hours, and we experienced excellent reception of this new addition to our total countries heard. Reports should be addressed to Poste de Radio a Ondas Courtes, 16 MILOSA VELIKOG, BELGRADE, YUGOSLAVIA.

Tripoli Is Logged

ICK, on 9.46 mc., located at Tripoli, North Africa, was at last heard, one morning at 5:47 a.m., after 2 years of searching! The station was calling "Pronto Asmara," and was tuned in just on the L.F. side of VK3ME, and ICK had a good R6-7 rating, tho voice had poor quality. Veries of this catch may be obtained by writing to the same QRA as for other Italian Africans, the Minister of Marines. ICK was also logged by our friend John De Myer (27-85) possessor of a great DX record there indeed! John snared ICK at 6:30-7 a.m., calling Rome. Glad our tip straightened things out, OM! John, whose pix appeared in last issue, is Mgr. of 6th DISTRICT of the I.D.A., and is the best ALL WAVE DXER it has ever been our pleasure to know!

The usual handsome QSL from another South African Ham.

Italian Africans

A new station has appeared, on about 14.50 mc., which is heard often phoning in early mornings, from about 6:30-7:30 a.m., with a strong signal. We believe this to be a new Eritrean, as it has been heard calling "*Pronto Addis Ababa, da Radio Asmara.*" Again it was heard to answer once at 6:55 a.m., to a call from IQA, 14.73 mc., Rome, of "Pronto Asmara."

This is the station heard mornings sending a 5 note musical call, so anyone can easily identify this station by the notes.

IUC, 11.955 mc., continues to be heard often, lately being heard at 1:40 a.m., phoning IAC, Coltano, Italy on 12.80 mc.

IUG, 15.45 mc, Addis Ababa, continues to be heard often around 10 a.m., with IAC, 17.76 mc. Ashley Walcott of San Francisco hears IUG with IAC, from 10-10:45 a.m., and also IDU, 13.38 mc., with IAC, 12.80 mc., from 11-12 noon.

Though we've received veries from Minister of Marines, our latest veri, of ITK, IUG, IUC, in one letter came from Mario della Spina, Radio S. Paolo, Rome, Italy! So we believe that either of the two addresses will verify OK. Ashley Walcott got his 1st African veri, IDU, and we know how you feel (*Continued on page* 708)

This gorgeous Multi-Colored QSL from Brazil brightens any wall!

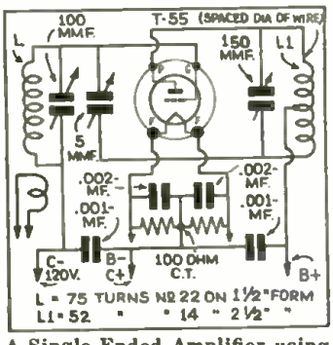
SHORT WAVE QUESTION BOX

EDITED BY
G. W. SHUART, W2AMN

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

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

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



A Single-Ended Amplifier using a T-55 Link Coupling is shown. (1047)

T-55 AMPLIFIER

John Novel, Cincinnati, Ohio.

(Q) I would like to build an amplifier for my 160 meter transmitter, employing a Taylor T-55 tube. The tube is to be used with the maximum 1500 volts on the plate. As I do not have data on this particular tube, I would like you to print the diagram showing the tuning capacities and the coil data.

(A) We have shown the diagram of the single T-55 in a plate neutralized amplifier. The amplifier should be link coupled to the driving stage. Data for the coils will be found in the drawing.

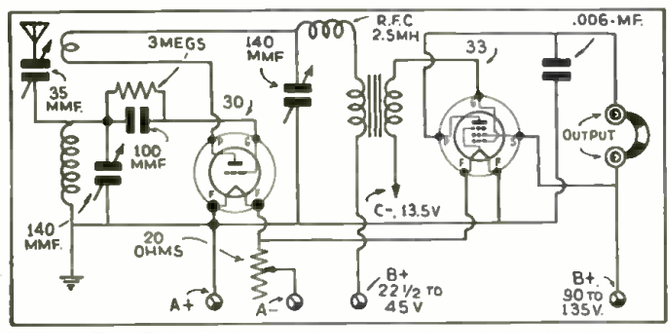
(A) We have shown a diagram of a suitable checking instrument for indicating over-modulation or frequency modulation. The method of operation is very simple. Place the wire "A" in a position so that it will pick up R.F. from the antenna of the transmitter. The meter M, will show some reading, the value depending upon the coupling between the wire "A" and the transmitter. During modulation no change in the meter reading should be noticeable. A variation in the reading will indicate frequency shift or over-modulation. This instrument can also be used for tuning the transmitter, the highest reading of the meter indicating the greatest amount of output.

2-TUBE BATTERY SET

Raymond Bonner, West Los Angeles, Cal.

(Q) Please print the circuit diagram of the Short-Wave receiver employing a 33 detector tube and a 30 amplifier. This should use from 45 to 90 volts B battery and standard plug-in coils. Regeneration should be controlled by a variable condenser.

(A) We have shown a diagram using 30 and 33. However we have employed the 33 as the audio amplifier, not as the detector. Regeneration is controlled by the 140 mmf. condenser and standard plug-in coils may be used. Data for the coils can be found in the February issue of the *Question Box*.

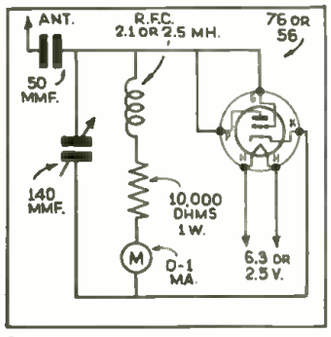


Two-Tube Battery set using a 30 and 33. (1048)

CARRIER SHIFT METER

Edward Anderson, Springfield, Mass.

(Q) I would like to build an instrument to check my phone transmitter. I want to make sure that there is no *carrier shift* or *over-modulation* present. Would you please print the necessary diagram in the *Question Box*.



Carrier Shift Indicator. (1049)

4-TUBE A.C. SET

John W. Smith, Baltimore, Md.

(Q) Would you be so kind as to illustrate a diagram in *Short Wave and Television* employing 4 tubes. This receiver should have a 58 tuned T.R.F. amplifier, a 57 regenerative detector and a 47 pentode power amplifier with an 80 in the power supply. Also show the connections for the power supply.

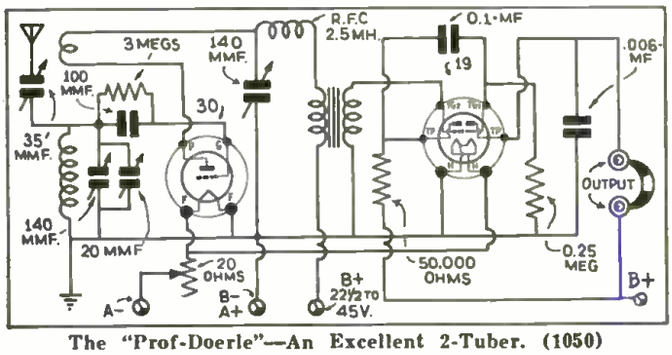
(A) We have shown a standard T.R.F. circuit; however, for loudspeaker operation, we believe there should be another audio amplifier, such as a 56, connected between the 57 and 47. This will enable you to obtain full speaker volume.

GETTING VERIS

John Anderson, Philadelphia, Pa.

(Q) Just how do I go about obtaining verification cards in order to enter the trophy contest?

(A) Merely make a note of the time, date and character of the program received. This, together with an International Postal Reply coupon should be sent to the station together with a request for verification.



The "Prof-Doerle"—An Excellent 2-Tuber. (1050)

THE "PROF DOERLE"

Edwin L. Rowland, Brooklyn, N.Y.

(Q) Could you furnish a diagram of the new Deorle 2-tube set using a 30 and a 19. Also I would like to know if another 33 could be added to increase the volume.

(A) We have shown a diagram of the "Prof. Doerle" receiver using 30 detector and a 19 as two stages of audio amplification. We do not recommend that a type 33 receiver be added to the receiver as shown, because there would be entirely too much audio gain and a great possibility of *feed-back* and *motor-boating*. If you desire to change the audio amplifier, we would advise substituting a 30 for the 19 so that the result will be only 2 stages of audio amplification. This will give you more satisfactory results.

LICENSE NEEDED

Nearly every mail brings a request from someone desiring to know whether a license is needed for this or that particular type of transmitter. For instance, a number of inquiries have been received from persons wishing to perform feats of magic on the stage or before a gathering of friends.

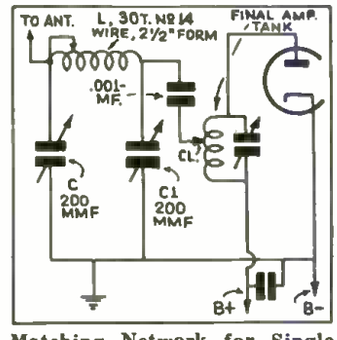
Regardless of whether the transmitter is used to cover a distance of a few feet, or a distance of a thousand miles, a license is necessary.

SINGLE WIRE ANTENNA

Harry Prescott, Indianapolis, Ind.

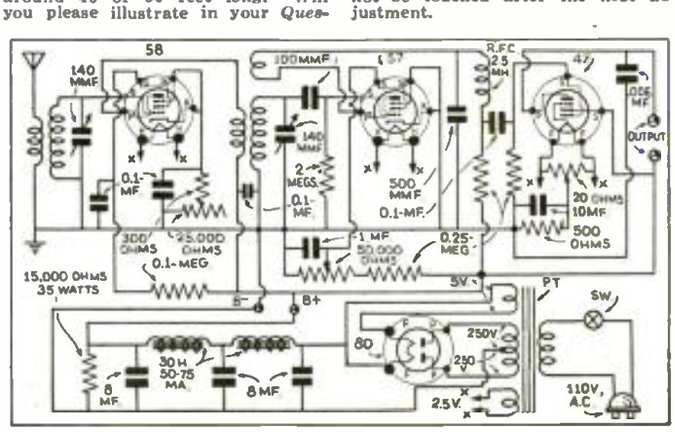
(Q) I live in a dwelling which will not permit the erection of a conventional antenna system and can at best only erect a small antenna consisting of a single wire around 40 or 50 feet long. Will you please illustrate in your *Question Box* just how this might be used as a transmitting antenna.

(A) We have shown the familiar impedance matching network consisting of a coil and 2 condensers. The method of adjusting is quite simple if you follow instructions. For instance, the amplifier tuning condenser should be adjusted to resonance as indicated by a minimum of plate current with the antenna clip "CL" disconnected. After this is done attach the clip to the final amplifier tank coil about ⅔-way from the cold end. With condenser C set about mid-scale, adjust condenser C1 for minimum plate current of the amplifier. If the plate current is too high or too low, re-adjust condensers C and C1.



Matching Network for Single Wire Antenna. (1051)

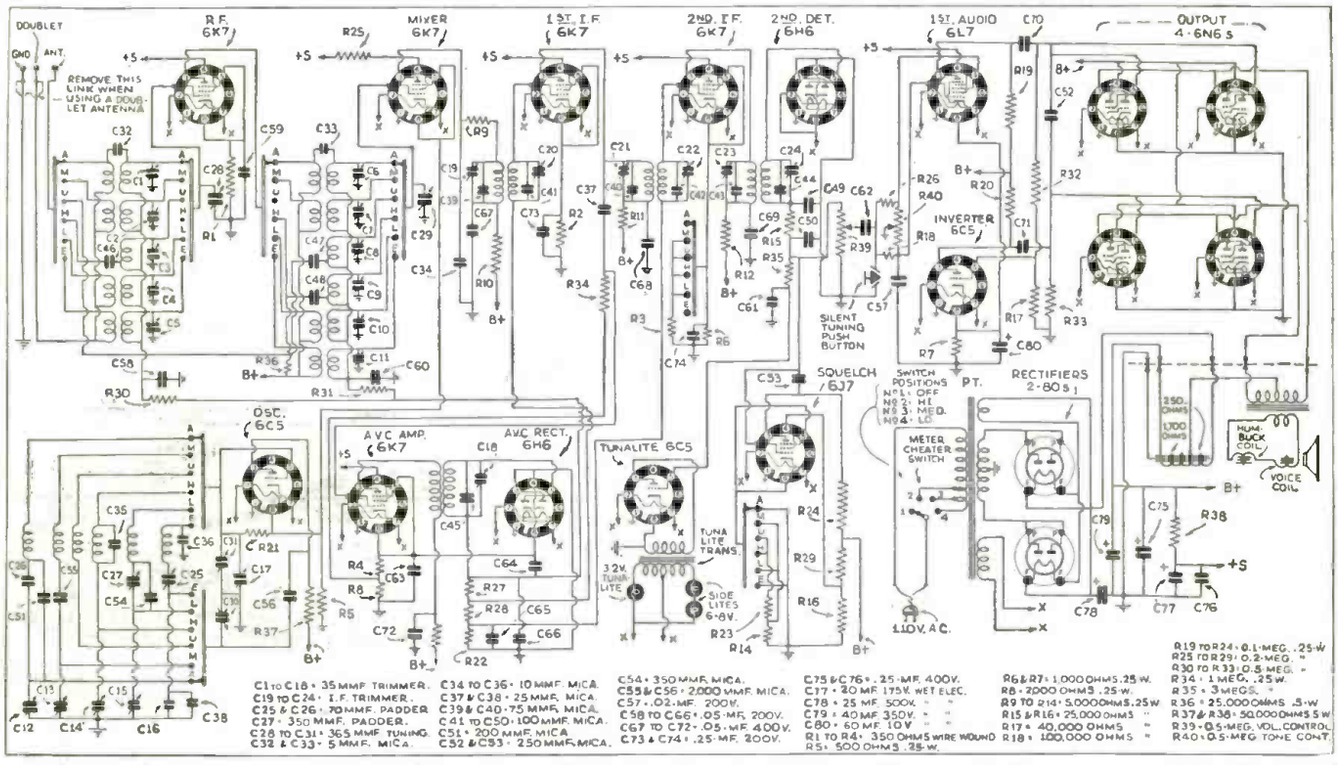
The last adjustment should be made with C1 for the lowest plate current which indicates resonance. The final amplifier tuning condenser should not be touched after the first adjustment.



Complete 4-Tube Receiver A.C. Operated. (1052)

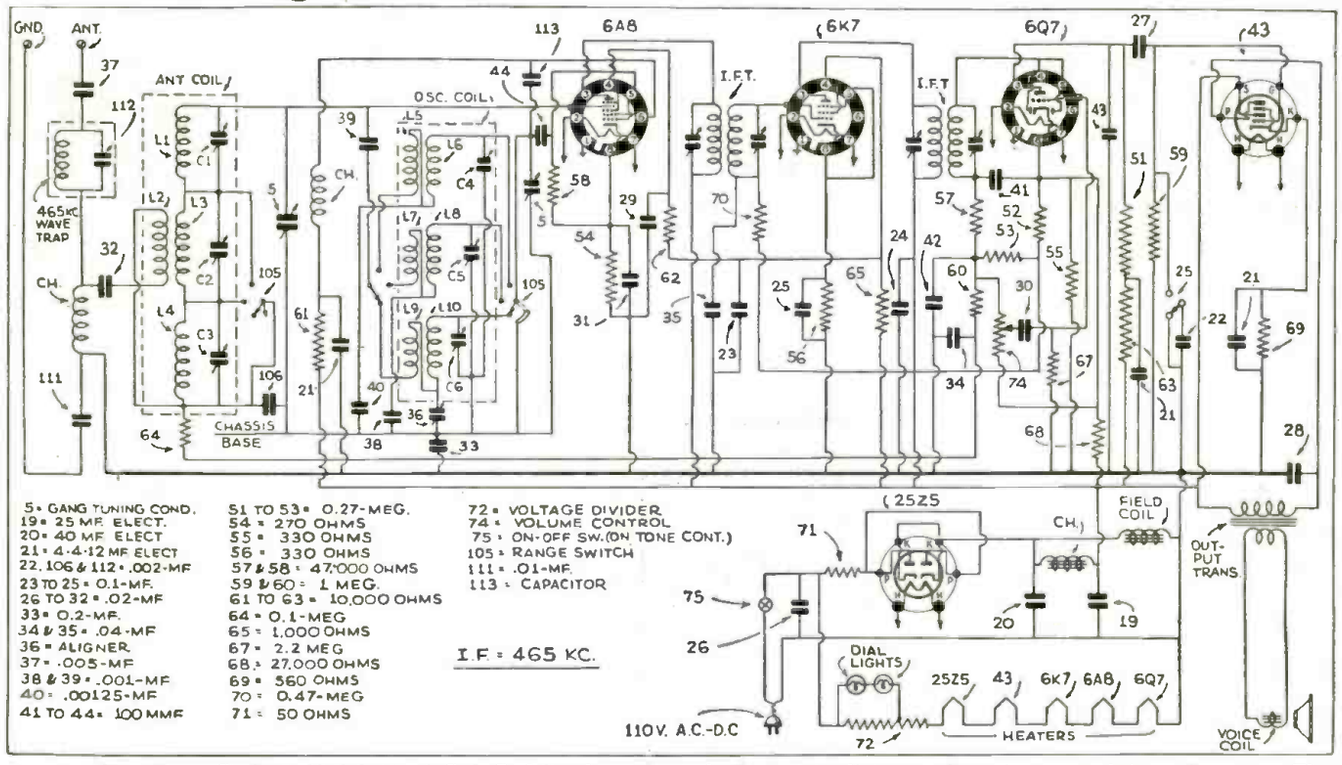
Diagrams of S-W Commercial Receivers

Midwest 18-Tube, 6-Band, 4½ to 2400 Meters



Above—Diagram of Midwest 18-tube receiver. Unusual volume and high-quality reproduction are assured by the use of four 6N6's in the push-pull parallel output stage. The various wavelength bands are tuned in by means of switches, indicated as sliders in the diagram. The AVC and special "Tunalite" circuits are interesting, as well as the "squelch" circuit. The values of the various condensers and resistors are given in the diagram.

Stromberg-Carlson Model 125 A.C.-D.C. 3-Band Set



The Stromberg-Carlson Model 125 A.C.-D.C. 3-band receiver shown in the diagram above is a very interesting one. The wave-trap in the antenna circuit prevents the pickup of signals at the 465 kc. I.F. frequency, which frequently manifests itself on broadcast receivers in the form of code signals superimposed on the broadcast program. The values of the condensers and resistors are given in the diagram; a study of this circuit of a modern well-engineered 3-band receiver will prove of value to all radio students. The tuning ranges are: 540 to 1,500 kc; 1,450 to 3,500 kc; and 5,600 to 18,000 kc. This circuit is designed for operation on 110 volts A.C. or D.C.

NEW 1937 SHORT WAVE APPARATUS

(PROMPT SHIPMENTS ON ALL ITEMS)

EILEN RX-17 7-tube BANDSPREAD RECEIVER

(8½ to 3,000 meters)

See article p. 544 Jan. issue Short Wave and Television.

Our largest, finest, and most sensitive new 1937 receiver, unequaled in appearance, performance and value. Uses a special, highly efficient and selective circuit producing results which **WILL** satisfy even the most discriminating short wave fan.

RX-17 is equipped with the famous EILEN NOISE SUPPRESSOR, the latest development of our laboratories and which is skyrocketing itself into immense popularity. This remarkable development, exclusive with EILEN, enables you to enjoy reception from those far-off stations with excellent clarity and volume.

Constructed of the finest materials and to conform with the highest engineering standards, this instrument uses two 6D6, two 6J5G, one 76, one 42, and one 5Y3 high gain tubes as **TUNED RF AMPLIFIER, TUNED ELECTRON COUPLED SCREEN-GRID REGENERATIVE DETECTOR,** powerful 3 stage audio frequency amplifier with power pentode output stage delivering 3 watts of audio power to the built-in high fidelity dynamic loudspeaker. **VARIABLE NOISE SUPPRESSOR,** rectifier and complete built-in **HUM-FREE** power supply. **BANDSPREAD TUNING**—a special electron tube circuit enabling the operator to reduce or eliminate certain types of noises occurring in all short wave receivers—automatic headphone jack—smooth and noiseless controls—highly efficient interchangable inductors—doublet or aerial-ground connections—**POWERFUL** hi-fidelity audio system—large, illuminated airplane type vernier dial—sensitivity, volume, and selectivity that will amaze you—are features to be found in **RX-17.**

RX-17 in BEAUTY, as well as performance, is in a class by itself—heavy steel cabinet with hinged lid finished in durable black shrivel—colored dial lights behind black and white scale—chrome plated escutcheon—calibrated dial plates—plated chassis and shielding—Operates entirely from your 105 to 130 volts AC house current.

RX-17 under fair conditions will bring in dozens of foreign as well as domestic short wave stations with enormous volume. Try one and see for yourself!

AMATEURS: Model RX-17-AB has same specifications as RX-17 except that it is equipped with plate voltage cut-off switch and special bandspread coils for 20-40-80-160 M bands spreading these bands 80% of dial scale. Add $1 to price of RX-17. (10 meter band coils if desired extra $1.45).

RX-17, complete, **READY TO USE,** with 7 RCA or Sylvania tubes, 12 low-loss silver plated coils for 8½ to 3000 meters, wired, in cabinet, and 7 page instruction booklet..... **$21.95**

(If metal tubes are preferred over the glass type, add $1 to above price.)

For those who wish to build their own we offer:

KIT of all parts, coils for 8½-3000 meters, unwired (less tubes & cabinet)..... **$14.95**

Cabinet, extra..... $2.50
7 matched Sylvania tubes, extra..... 3.35
Wired and tested, extra..... 2.00

RX-18 8-TUBE BAND SPREAD RECEIVER

(2½ to 3,000 meters)

RX-18 and RX-18-AB have the same specifications as the above RX-17 and RX-17-AB, but is equipped with an **EIGHTH TUBE** (6J5G) enabling the wavlength range to be extended down to 2½ meters. This additional tube is designed especially for ultra-high frequency wavelengths. This receiver is exceedingly simple to operate with excellent results.

ADD $4.50 to price of corresponding RX-17 or RX-17-AB model. Prompt delivery can be made.

BS-5

6-Tube Band switch Receiver

10 to 600 Meters

A powerful, sensitive, and selective SW receiver covering the entire wave-length span of 10 to 600 meters in 5 steps. **NO PLUG-IN COILS** are used. Simply turn the waveband selector switch and enjoy reception on any wavelength within this range.

Uses two 6D6, one 76, one 43, one K42A, and one 2525 tubes as RF amplifier, electron coupled screen grid regenerative detector, powerful 2 stage audio amplifier with pentode output stage, rectifier, and complete built-in power supply.

HUM-FREE—Hi-fidelity dynamic loudspeaker—illuminated, airplane type vernier dial—band spread tuning control—automatic headphone jack—extremely smooth acting controls—operates from your AC or DC house current—beautiful heavy, black shrivel finish chassis and cabinet.

See editorial article Page 482, Dec. Issue S.W.C.

DELIVERS GREAT LOUDSPEAKER VOLUME ON THE GREAT MAJORITY OF SHORT WAVE FOREIGN STATIONS UNDER FAIR CONDITIONS.

PRICE, complete with 6 tubes, cabinet, wired, and instructions, ready to use..... **$16.95**

BS-5 KIT, of necessary parts, including detailed instructions; less tubes, cabinet, unwired..... **$10.95**

SPECIAL: Complete kit, cabinet, tubes and instructions, unwired..... **$14.95**

(If metal tubes are preferred to glass type, add $1)

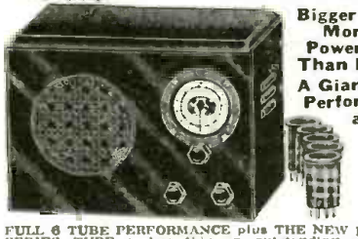
AMATEURS:

Model BS-5-AB has same specifications as BS-5 except that it has special bandspread circuit for 20-40-80-160 M bands and is equipped with plate voltage cut-off switch. Add $1.00 to above price.

7C 5-Tube

Short Wave Receiver

8¼ to 625 meters



Bigger and More Powerful Than Ever A Giant in Performance

FULL 6 TUBE PERFORMANCE plus **THE NEW K92A SERIES TUBE** makes this an outstanding value. Equipped with a powerful 3 stage audio frequency amplifier.

Uses 6D6-6F7 (twin 2 in 1 tube)—76—K92A-12A7 (twin tube) tubes as R.F. amplifier, electron coupled screen grid regenerative detector, powerful 3 stage audio amplifier with pentode output stage, rectifier and complete built-in power supply. Operates entirely from 105 to 130 volt AC or DC light socket.

BAND SPREAD TUNING—smooth regeneration control—built-in high quality loudspeaker—automatic headphone jack—large, illuminated airplane type vernier dial—large low-loss inductances. Heavy, black shrivel finish metal chassis and cabinet. Must be seen to be appreciated. Satisfied owners report as high as 35 foreign countries on the loudspeaker with this model. You may do the same under fair conditions. **ORDER YOURS TODAY! YOU WILL NOT REGRET IT!**

EILEN 7C RECEIVER, wired, in cabinet, complete, **READY TO USE,** with speaker 5 RCA tubes, 4 coils for 8½ to 200 meters, and simple instructions.... **$12.95**

2 Broadcast Band Coils, extra..... $1.25

7C KIT, unwired, of necessary parts, 4 coils for 8½ to 200 meters, and instructions less cabinet, speaker, tubes..... **$7.25**

Beautiful metal cabinet, extra..... $1.25
5 matched RCA tubes..... 3.15
Special loudspeaker..... 1.45
(2) Broadcast band coils, 200-625 meters.... 1.25
Labor for wiring & testing, extra..... 1.50

SPECIAL: COMPLETE KIT, unwired, cabinet, 5 tubes, speaker, 4 coils for 8½ to 200 meters, and simple instructions..... **$11.45**

2 broadcast Coils, extra..... $1.25

AMATEURS: Model 7C-AB, same specifications as 7C except that has special tuning circuit and coils for spreading out the 20-40-80-160 M bands over 80% of dial. Also equipped with plate voltage cut-off switch. Same price as 7C. Model 6B or 6B-AB battery model of 7C. Operates from inexpensive dry batteries. Same price.

3-Tube Short Wave Radio Only $3.25

(less tubes, phones, unwired)

A REAL, powerful 3 tube short wave set that readily brings in amateurs, police calls, broadcast stations, experimental and foreign stations with good volume under fair conditions. **THE WORLD AT YOUR DOOR!**

A dependable receiver which is guaranteed to give results. Operates entirely from the AC or DC house current. Simple to build and easy to operate. Beautiful, black shrivel finish cabinet and instructions furnished. Wavelength range 12-600 meters. An ideal set for the beginner who wishes to learn the thrill of short wave reception.

THREE TUBE BATTERY SET, less tubes, phones, unwired **$2.95**

TWO TUBE BATTERY SET, less tubes, phones, unwired **$2.00**

KITS wired, extra 75c. Tubes, each 50c. Broadcast band coils (2), extra 95c. Cannonball double headphones $1.35.

AN-5 Four Tube BANDSPREAD RECEIVER

A powerful and highly selective short wave receiver designed for the fan who prefers the use of headphones. Uses 6F7-6D6-76-84 tubes in five-tube performance circuit as TUNED RF amplifier, TUNED electron coupled screen grid regenerative detector, two stage audio amplifier, rectifier & built-in power supply. **HUM-FREE. POWERFUL.** Readily operates a speaker. Operates from your 105-130 volt AC house current.

AN-5, complete with 4 matched tubes, coils for 9 to 200 meters, cabinet, wired **READY FOR USE**..... **$15.95**

Broadcast band coils (2), extra..... $1.45

AMATEURS: Model AN-5-AB has same specifications as AN-5 except that has plate voltage cut-off switch and special bandspread coils for 20-40-80-160 meter bands. Add $1 to price of AN-5.

HF-35 3-Tube SW Transmitter

A powerful and well engineered amateur band transmitter of great beauty and efficiency—**AT A PRICE WITHIN THE AMATEUR'S REACH.** Uses 50-46-46 tubes as **TRITET CRYSTAL CONTROLLED OSCILLATOR—CLASS C RF POWER AMPLIFIER**—built-in antenna tuning system—beautiful, black shrivel metal case and shelving—Triplett meters—Eilen transmitting dials—highest quality construction — 35 watts of power output on **20-40-80-160 M bands. A** transmitter that you can be proud to own. An excellent exciter unit for high power stages to be added later. 3 coils for any 1 band and instructions included.

HF-35, assembled, and ready to wire (less tubes, power supply, crystal, holder and additional coils)..... **$21.95**

Matched Arcturus Tubes (3)..... $2.15
Eilen quartz crystal (80 or 160)..... $1.95
Eilen crystal holder..... 1.00
Coils for additional bands, per set..... 1.45

HV-475 1-Tube power supply for use with HF-35, less tube (ready to wire)..... **$12.45**

Labor for wiring extra $1.50

83 tube for HV-475, extra 55 cents

M-15 3-Tube Modulator for use with HF-35 and capable of modulating its entire output, at 100%, priced at **$14.95** (less tubes)..... **$14.95**

Three Arcturus tubes, 56-53-53, extra..$1.95

FREE: New 1937 catalogue

of short wave receivers, transmitters, & 5 meter apparatus. Send stamp to cover mailing costs on YOUR copy.

JUST OFF THE PRESS!

Prompt service. 20% deposit on C. O. D. orders

EILEN RADIO LABORATORIES, Dept. SC 3, 136 Liberty Street, NEW YORK, N. Y.

5-Meter Tests Made from "Above the Clouds"

(*Continued from page* 664)

Results of Transmitting Tests

On August 1, 1936, the following phone stations were worked from Skyline Drive. W3BSY—R6—Charlottesville, Va., 60 miles; W3BAI—R9—Bolling Field, Va., 72 miles; W3DBC—R9.

On August 6, 1936, from the same location and during a rain storm we again worked W3DBC and W3BAI and also W3EAP—R2—Alexandria, Va., 74 miles. Our signals were heard and reported by 11 Washington stations and 1 Baltimore station.

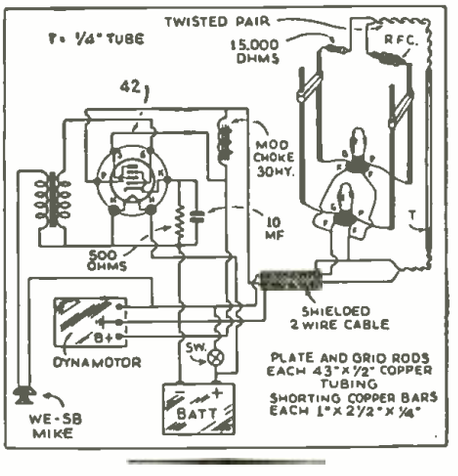
On August 14, 1936, from the same location with the same equipment but having substituted a 6K7 for a 6D6 detector we worked the following stations:

W3BSY, W3BAI, W3CXP, R9plus, Seat Pleasant, Md., 83 miles. W3CLF, R6, Baltimore, Md., 109 miles. W3BR, R9, Baltimore, Md., W3BSY and W3DBC.

During these tests my transmitter was always received with a steady R8 to 9 signal. Operating from here at Alexandria it consistently puts an R8 signal into Baltimore, Md., 40 miles.

The possibilities of this system of combined transmitter and radiator has been shown by the foregoing tests; however, even more interesting results may be attained by the addition of reflectors and directors. The entire assembly could easily be constructed so as to be rotated.

The receiver is a super-regenerative type employing a *separate quench-frequency* tube; an effective *hiss-filter* is used. The selection of the component parts of this receiver were made with the aid of a cathode ray oscillograph. Some of the finer adjustments such as the tuning of the hiss-filter could not have been perfected without the oscillograph. As a result the receiver operates with maximum sensitivity just before going into the hissing stage, and is very stable in this condition. With only a single 76 audio tube, it drives a magnetic speaker to good volume. The receiver, although developed during the spring is so nearly the same as that described by George W. Shuart in the September, 1936, *Short Wave Craft*, that a detailed description is unwarranted. Under all conditions either a vertical or fairly long (60 feet) *sloping* antenna provides the best reception.



WAKE UP! FELLOWS!

$20.00 Prize Monthly for Best Set

● THE editors are looking for "new" receiving circuits—from 1 to 5 tubes preferably. A $20.00 monthly prize will be awarded to the best short-wave receiver submitted. The closing date for each contest is 75 days preceding date of issue (Feb. 15 for the May issue, etc.). In the event of a tie, an equal prize will be given to each contestant so tieing. Address all entries to: Editor, SHORT WAVE and TELEVISION, 99 Hudson St., New York City.

A Crack German Ham Station and Its "CQ" Machine

(*Continued from page* 665)

upon the lower hard rubber contact support, careful selection is required for the contact spring installed above the plate contact. It is necessary to select a spring which is not only a good conductor but also has great elasticity. After much experimenting a spring taken from a disassembled telephone switch was used, because of its excellent elasticity, and in addition to this advantage because it was furnished with a silver contact point. The end of the spring (near the silver contact as indicated) was bent slightly upwards to avoid catching the paper tape, in case it is old and worn out.

However, any other spring of suitable size having the aforementioned qualities will do the trick as well. Instead of the very useful silver or platinum contact point, which is difficult to attach to the spring without proper tools, a small dent (punched into the spring with a center-punch at the point where contact is desired) must be provided.

The last point to be mentioned is the preparation of the paper tape which bears the contact holes in form of Morse characters. In case parchment paper is not obtainable, a durable but smooth wrapping paper will do the work as well. The necessary holes are punched into the tape by means of two small punch irons (not very expensive). One of these is used to punch the dots, the other one the dash signs. Before punching these holes it is advisable to mark them with pencil upon the paper. After the necessary perforation has been obtained, both ends of the tape must be pasted together in the form of an endless ribbon.

As to the making of such endless ribbons, experience has shown that even experienced "hams" can be fooled when the signs are punched into the tape with some irregularities, so as to conceal the fact that an automatic calling device is in use. About a half year passed before Mr. Baumgarten's trick was detected by his many friends. He used, of course, paper tapes of considerable length, and always changed the form of the signs just a little bit. That about covers the construction of the "auto caller." The usefulness and low cost of this gadget combine to make it worthwhile.

Televised Auto Races

(*Continued from page* 666)

transmitting station as shown in the picture below. These signals may be relayed by short-waves in some cases, where necessary.

At this juncture, two methods of procedure are open. First, the image and voice combined are re-radiated from the main television transmitter, or second—they may be broken down into two distinct components, and the image radiated on one frequency, and the voice on the other. If the combined voice and image were re-broadcast on one wavelength, this would necessitate a scanner and film recording and developing apparatus in the home of the televiewer.

In some cases where a suitable wire line, especially a concentric cable is available, the television truck unit may connect directly to this cable, instead of relaying the image and voice signals by short-waves.

Short Waves Serve Kent's Island Expedition

(*Continued from page* 666)

selected for the work they were to undertake. It is planned to have several more expeditions to Kent's Island in the coming summers and the personnel will be practically the same.

Radio provided the only satisfactory means of communication and it should be noted that the expedition depended upon "amateur radio" for this purpose. The station operated only within amateur bands and was licensed as such. However, next year it is hoped that the expedition can secure an experimental broadcast frequency, so that the transmissions will not be interfered with by amateur QRM. It is expected that higher power will also be used.

The radio equipment consists of a Collins 30FXC transmitter Super Skyrider and SW-3 receivers. For 20 and 40 meter CW two other transmitters are used, employing a HK-354 Gammatron and an Amperex HF 300 respectively as the final stage in crystal controlled transmitters. The expedition's sub-base located at Machias Seal Island was equipped with portable five meter equipment. The main station was equipped with the latest types of measuring equipment.

Two people are the sole inhabitants of the island during the winter months and they operate the meteorological equipment and observe bird life, etc. Arrangements have been made for a Canadian Government patrol boat to land a small relief party on the island during February.

The expedition depended almost entirely upon radio for communication. Daily schedules with W1INW, Lewiston, Maine, and other amateur radio stations in various cities handled all the party's messages. A daily *short-wave* broadcast every afternoon at 5:30 gave a complete weather report which stressed aspects concerned with aerial and sea navigation. VE1IN, the expedition's station, was heard all over the world. Field parties were equipped with 5-meter transmitters and receivers so that their whereabouts were always known at the base camp.

James Eads Levings of the Institute of Geographical Exploration at Harvard is completing the first topographic maps ever to have been made of Kent's and neighboring islands.

Miniature Oscilloscope

(*Continued from page* 680)

This is capable of doing that which the larger CRO National oscilloscope will do. Except, of course, all images are reproduced in a much smaller size.

The over-all height is 6⅛ inches, width 4⅛ inches, depth 8 inches.

The four controls, together with the on-and-off switch, are located in the front of the clocks. Provisions are made for a 60-cycle sweep and external connections are available for applying various other sweep frequencies.

bleeder allow the spot or pattern to be shifted up and down or from side to side, an unnecessary refinement, perhaps, but one that is found in most of the more expensive oscilloscopes. Two other potentiometers control focus and intensity. *Do not allow* the spot to be of more than moderate intensity or brilliance, especially when it is not in motion. An intensity setting that will give a good, clear pattern when the spot is in motion will often be found too high when the spot is fixed, and may cause a blackened spot on the screen unless the intensity is reduced.

The 180 volt winding is used to give a 60 cycle sweep voltage which is useful in some measurements. When the double pole switch is turned right, the H plate is connected through its potentiometer to the H binding post.

The transformer is designed for use in a more elaborate instrument which incorporates a saw-tooth sweep oscillator, the type 885, which has a 2.5 V. heater. In our instrument this heater winding is not needed, but may be used for a pilot lamp.

The small transformer at the left of the 913 is not needed as it was used in early experiments to obtain the 60 V. sweep voltage, when a power transformer without the required winding was used.

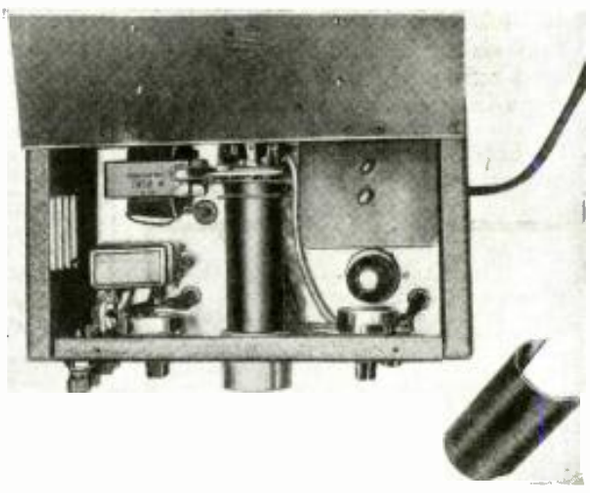
Low-Cost Oscilloscope

(*Continued from page* 684)

The construction of this instrument is quite simple. The chassis is fastened to the front of the box, leaving a gap of about $\frac{1}{16}$" between the two for the bottom of the box to slide into. The various parts are quite simple to mount and wire. The tube on the front of the box shields the screen and makes it easier to see a pattern with other lights on. Since the constructor will, in many cases, use parts on hand, no dimensions are given and the actual layout used here need not be followed exactly if not desirable. (A magnifying lens may be used in front of the tube.—Editor.)

All leads connected to the deflection plates and associated circuits *must* be shielded in order to prevent stray pickup. Use considerable care in wiring up the intensity and

(*Continued on page* 698)



Interior of the Oscilloscope, using the new 913 Cathode Ray Tube.

Are You a Subscriber? See Pages 712 and 716 for Remarkable Subscription Offers.

focus controls and the heater of the 913 since they are at rather high potential. It is best to use heavily insulated wire for these, rather than the usual cotton covered push-back wire.

The upright bracket which holds the 913 socket should have the socket mounting hole so arranged that the tube may be rotated about ¼" either way in order to have the 60 cycle sweep exactly horizontal. Be sure to mount the socket so that the No. 1 pin, looking at the bottom of the tube, is uppermost.

The name plates are made by drawing the required wording on white drawing paper with india ink. The sheet is then taken to a commercial printer and a *glossy* white on black photostat made. The plates are cut from the resulting sheet and fastened to the panel with rubber cement.

Testing

When the wiring has been checked carefully, the current may be turned on, with the 913 out of its socket. A voltage check should show a range of about —50 V. on the intensity control, and about 80 V. on the focus control, reading from the cathode of the 913. Also the beam shift controls should have a range of about 10 V. each side of center position as read from the potentiometer arm to ground. This reading will be positive on one side and negative on the other. If voltages are found to be in the above ratio with about 450 V. total across the bleeder, the 913 may be inserted in its socket and the power turned on. Set the intensity control at full negative and the focus control at midscale. After ½ minute to allow the tube to heat, slowly turn the intensity control towards the end connected to the 913 heater until a light green pattern of any shape appears on the screen. Keep this light very dim and adjust the focus control to bring it to a small spot. Then switch on the 60 cycle sweep and it should be possible to obtain a line across the screen by manipulating the H range potentiometer. If this line is not quite horizontal, the tube must be shifted slightly to make it so. If the line is not straight or is broad at the center, it means that the tube is getting voltage on the vertical plate showing insufficient shielding. It may be necessary to bend a shield of thin iron such as is shown beside the case and slip it over the tube, turning until the pattern is a straight thin line.

Your oscilloscope is now ready for use and should afford much valuable information on transmitter operation as well as many other measurements.

List of Parts for Oscilloscope

ICA
1—case 5"x6"x9"
1—chassis for same
2—binding post strips
5—knobs
2—octal sockets
1—SPDT switch
1—SPST switch

RCA RADIOTRON
1—913 tube
1—6X5 tube

ELECTRAD
1—1 meg. potentiometer
2—100,000 ohm potentiometers
1—25,000 ohm potentiometer
1—15,000 ohm potentiometer

CORNELL-DUBILIER
2—.25 mf. 200 V. can type condensers
1—.25 mf. 200 V. tubular condenser
2—4 mf. 450 V. electrolytic type JR
2—.02 mf. 400 V. tubulars

RESISTORS
1—75,000 ohm 2 W.
2—20,000 ohm ½ W.
2—.5 meg. ohm ½ W.

KENYON
1 power transformer especially designed for the 913

Lots of New Features for *Both* "Fan" and "Ham" in April Issue. Don't Miss It!!

Short Wave Scouts

(*Continued from page 677*)

W1XAL, 6,040 kc., Boston, Mass.
W1XK, 9,570 kc., Boston, Mass.
W8XAL, 6,060 kc., Cincinnati, Ohio.
W2XE, 11,830 kc., Atlantic Broadcasting Corp., New York, N.Y.
W2XE, 6,120 kc., Same as above.
W2XE, 15,270 kc., Same as W2XE.

Foreign Stations

CJRX, 11,720 kc. James Richardson & Co., Winnipeg, Canada.
CJRO, 6,150 kc., Same as above.
DJC, 6,020 kc., Der Deutsche Kurzwellensender, Zeesen, Germany.
DJE, 17,760 kc., Same as above.
DJP, 11,855 kc., Same as DJC.
DZA, 9,675 kc., Same as DJC.
DJA, 9,560 kc., Same as DJC.
DJB, 15,200 kc., Same as DJC.
DJN, 9,540 kc., Same as DJC.
2RO, 9,635 kc., Radio E.I.A.R., Rome, Italy.
2RO, 6,084 kc., Same as above.
XEBT, 6,000 kc., Mexico City, Mexico.
XEXA, 6,180 kc., Mexico City, Mexico.
JVN, 10,665 kc., Tokyo, Japan.
PRF5, 9,501 kc., Rio De Janeiro, Brazil.
EAQ, 9,860 kc., Radiodifusion Ibero-Americana, Madrid, Spain.
VRR4, 11,595 kc., Telephone Co., Station, Stony Hill, Jamaica.
HH2S, 5,910 kc., Port Au Prince, Haiti.
HH3W, 9,595 kc., Port Au Prince, Haiti.
11,700 kc., Radio Colonial, Paris, France.
11,900 kc., Same as above.
15,250 kc., Same as above.
RKI, 15,140 kc., Moscow, Russia.
HJ3ABD, 6,050 kc., Bogota, Columbia.
HJ4ABC, 6,040 kc., "La Voz de Pereira, Columbia.
HJ1ABG, 6,047.5 kc., Barranquilla, Columbia.
HJ4ABA, 11,710 kc., "La Voz de Montana," Medellin, Columbia.
CT1AA, 9,600 kc., Estacap Radio, "Radio Colonial," Lisbon, Portugal.
OAX4G, 6,230 kc., Lima, Peru.
HC2RL, 6,670 kc., "Quinta Piedad," Guayquil, Ecuador.
HCJB, 8,770 kc., "La Voz de Los Andes," Quito, Ecuador.
"El Prado," 6,618 kc., Riobamba, Ecuador.
HIZ, 6,310 kc., Santo Domingo, Dominican Republic.
HIX, 5,980 kc., Santo Domingo, Dominican Republic.
HI1A, 6,190 kc., "La Voz Del Yaque," Santiago De Los Caballeros, Dominican Rep.
HI1S, 6,420 kc., "La Voz De La Hispaniola," Puerto Plata, Dominican Republic.
TIGPH, 5,830 kc., San Jose, Costa Rica.
TIRCC, 6,550 kc., San Jose, Cost a Rica.
COCO, 6,010 kc., Havana, Cuba.
COCD, 6,130 kc., "La Voz de Aire," Havana, Cuba.
CO9JQ, 8,665 kc., Camaguey, Cuba.
COCH, 9,428 kc., Havana, Cuba.
CO9GC, 6,150 kc., (Now COKG), Havana, Cuba.
YV2RC, 5,800 kc., "Broadcasting Caracas," Caracas, Venezuela.
YV3RC, 6,150 kc., "Radiodifusora Venezuela," Caracas, Venezuela.
YV6RV, 6,520 kc., "La Voz de Carabobo," Valencia, Venezuela.
YV5RMO, 5,650 kc., "Ecos Del Caibo," Maracaibo, Venezuela.
YV12RM, 6,300 kc., Maracay, Venezuela.
VK3LR, 9,580 kc., National Broadcasting Service, Lyndhurst, Australia.
VK2ME, 9,590 kc., "The Voice of Australia," Sydney, Australia.
VK3ME, 9,510 kc., Melbourne, Australia.
PHI, 11,730 kc., "The PHOHI Station," Eindhoven, Holland.
HBP, 7,797 kc., "League of Nations Station," Geneva, Switzerland.

Trophy Contest Entry Rules

(*Continued from page 677*)

When sending in entries, note the following few simple instructions: Type your list, or write in ink, **penciled matter is not allowed.** Send verification cards, letters and the list all in one package, either by mail or by express prepaid; **do not split up the package.** Verification cards and letters will be returned, at the end of the contest, to their owner; the expense to be borne by **SHORT WAVE & TELEVISION** magazine.

In order to have uniformity of the entries, when writing or typing your list, observe the following routine: USE A SINGLE LINE FOR EACH STATION; type or write the entries IN THE FOLLOWING ORDER: Station call letters; frequency station transmits at; schedule of transmission if known (all time should be reduced to Eastern Standard which is five hours behind Greenwich Meridian Time); name of station, city, country; identification signal if any. Sign your name at the bottom of the list and **furthermore state the type of set used by you to receive these stations. State total No. stations.**

RX-18—An 8-Tube, 2.5 to 3,000 Meter Receiver

By Guy Stokely, E. E.

The RX-18 Receiver

● MODEL RX-18, an eight-tube version of the Eilen RX-17 receiver, covers all wave-lengths between 2.5 and 3,000 meters; it is extremely compact, and is equipped with the Eilen Noise-Suppressor system. The set delivers loud-speaker volume on foreign as well as domestic stations, and is very easy to tune.

Inspection of the set discloses the use of a 6D6 hi-gain tube as tuned RF amplifier, 6D6 as hi-gain electron-coupled screen-grid regenerative detector, two type 6J5G medium-mu triodes as resistance-coupled audio amplifiers, followed by one type 42 power pentode output stage tube, which is capable of delivering a full 3 watts of audio power to the built-in dynamic loud-speaker. One 76 super-triode tube is used in a special circuit, which is very effective in reducing certain types of noises occurring in hi-frequency reception. Power-supply is obtained from a 5Y3 full-wave rectifier, rectification being accomplished by means of the field coil (1800 ohm), and 20 mf. of electrolytic condensers. The AC hum-level is entirely negligible. Bias for the output stage is obtained from the 300 ohm tap on the field coil. Tunable hum filters are used in all places in the circuit where such effects are liable to occur.

The section of the receiver just described is used for reception on wavelengths from 8½ to 3,000 meters. For reception below 8½ meters, an additional 6J5G tube is used in an extremely sensitive, super-regenerative circuit, whose output is fed in the amplifier in the usual manner. Good volume is obtainable at these low wavelengths as well as on the higher waves. The new 6J5G, just released by the tube manufacturers, is designed particularly for use at these frequencies and is far superior to previous types of tubes used for this purpose. A single pole-two throw switch is used to select the proper tubes and detection systems for the two ranges. No other changes or adjustments whatever are necessary.

The receiver operates entirely from the electric house system, any voltage between 105 and 130 volts A.C. being satisfactory. Special models for use in certain sections of foreign countries, where 25 cycle current is used, are available at no extra cost.

For the fan who prefers the use of metal tubes throughout, the receiver is available using 6K7-6K7-6J5-6J5-6J5-6F6-76-5Z4 tubes. Performance is the same as with the glass type tubes.

For the transmitting amateur, who is interested primarily in the 10-20-40-80-160 meter amateur bands, there is model RX-18-AB, which is equipped with special coils for these bands as well as 5 meters, and a plate voltage *cut-off* switch for use during transmitting periods.

This article has been prepared from data supplied by courtesy of Eilen Radio Laboratories.

New!! Readers' Technical Service Department

● Realizing that it is not an easy matter for the average reader to obtain technical data prepared by various laboratories of large manufacturers, the editors are offering our readers a new service. A careful study is being made of all technical data prepared by various manufacturers of radio equipment and that data which we believe to be of most value to the reader, insofar as furthering his technical knowledge of operating and maintaining radio apparatus is concerned, will be offered through this department.

Naturally, some of this data is obtainable free of charge, although some of these bulletins are prepared at considerable cost and cannot be given away. However, you can rest assured that any information offered here, regardless of whether there is a slight charge or not, will be of exceptional value to the reader.

Transmitting Tube Manual

● The first is a *radio transmitting tube manual* covering nearly all types of transmitting tubes giving technical data and characteristics of each tube together with transmitter construction data, explaining the proper LC ratio, neutralizing and excitation, cause of condenser arcing, inductance and capacity charts, together with standard tube arrangements in transmitting apparatus.

Data is also given on class "B" modulators, together with data for calculating the power output. This bulletin may be obtained free of charge by requesting bulletin No. 100A. Readers Technical Service Dept., SHORT WAVE & TELEVISION, 99 Hudson St., New York City.

Xmitter Circuit Manual

● Amateurs who are really interested in getting the "low-down" on a number of different circuits, will find this Kenyon Transmitter Manual of exceptional interest.

It contains 57 pages of amateur transmitters, diagrams and data. There are, for instance, all types of transmitters described, including phone and CW, for operation on all present amateur bands; each one is explained in detail, and many helpful hints are given regarding adjustment and maintenance.

There are also a great many useful charts and tables covering data for matched impedance Q. antennas, coil specifications, inductance charts, call prefixes and various other interests together with amateur abbreviations, antenna data, rules and regulations of the F. C. C. together with 13 pages of Ken-O-Graf's, which cover everything from decibel to meter-kilocycles, conversion—without tedious calculations.

This book is available for 25c. Send either stamps, coin, or money order to Readers Technical Service Dept., SHORT WAVE & TELEVISION, 99 Hudson St., New York City. Book No. 101A.

RADIO INSTRUCTION

Television Course

(*Continued from page* 669)

fect synchronization between receiver and pick-up. Accurate control is much more easily obtained through electrical, than through mechanical, means and, while the scanning discs depend upon synchronous motors for synchronization, does it not seem better to use methods that are entirely electrical?

Synchronization in modern *electronic television* must be accurate to *one-two millionth of a second!* Could such accuracy be attained in mechanical scanning? True, the apparatus of Fernseh with discs revolving at 6000 revolutions per minute in a vacuum have approached this, but are these laboratory achievements practical in the field?

The answer seems to be that *electrical* scanning is far superior to *mechanical* scanning, for here there can be more perfect synchronization. In America, R.C.A., Philco, and Farnsworth are all working with *electrical scanning*, and it is now quite accepted that these systems will be the *basic* systems of American television.

In the following chapters *electronic television* will be dealt with, the television which is now emerging from the laboratories of R.C.A., Philco, and Farnsworth, and the television which is about to be presented to the American public, and which meets the standards recommended by the Radio Manufacturers Association.

* * * *

Odd Colors Used for Television Actors' "Make-up"

Making up a singer in the Farnsworth studios. Note blue lips, and "panchromatic" grease paint.

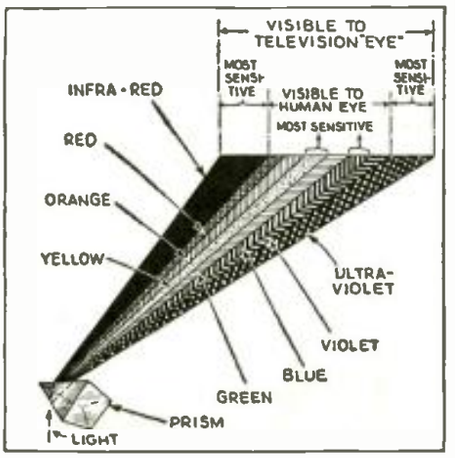
● THE human eye is sensitive only between the red and violet of the spectrum, or better, only the band from red to violet is visible to the human eye. However, the "eye" of the electronic television camera is sensitive, in fact most sensitive, in the infra-red and ultra-violet bands, bands *invisible* to the human eye. Therefore the television camera sees things differently than does the human eye. It sees reds that the human eye *cannot* see, and what the television camera eye "sees" is transmitted to a receiver, where the whole picture of what the camera picked up is presented in black and white, green and white, or similar colors. In short, all that the camera "eye" sees, far more than the human eye can see, is brought at the receiver into the range of the human eye.

This makes it necessary to use such make-up in the studio as will show up best at the receiver. If a girl made up with red lip stick, and rouge, the television camera eye, being very sensitive in the reds and infra-red, would show little or no contrast between the red of the skin and red of the lips.

RADIO INSTRUCTION

In television research, therefore, the lips have been made up in *blue*, the eye-brows and hair lines in greenish hues, and a panchromatic grease paint used that is almost dovoid of reds. Thus a picture is obtained at the television receiver giving good and strong contrasts of lips, etc., for it must be remembered that the receiver picture is in black and white, green and white, or similar contrasts.

The reason for the television camera being sensitive in the infra-red and ultra-violet is, of course, the fact that the photo-electric cell is most sensitive in these bands, and the principle of the photoelectric cell is one of the basic principles behind electronic television.



This shows the bands of the spectrum visible to the human eye, and the far wider band, extending into the infra-red and ultra-violet, visible to the television camera "eye."

The ACR-155 . . A New Amateur Communication Receiver

(*Continued from page 679*)

over the world. The set showed signs of being *exceptionally sensitive*. There is band-spread on all the prominent amateur bands (from 160 meters down to 20); this receiver does not take in the 10-meter band.

As mentioned before, this receiver covers the broadcast band and all other intermediate frequencies up to 22 megacycles, thus allowing various short-wave and long-wave programs to be brought in and making it suitable for either the Ham or Fan who desires the last word in short-wave receivers.

The ACR-155 is one of the most beautiful receiving sets it has been our good fortune to see in a long time. The finish on the metal cabinet is really superb, and the dial is a very handsome affair and works in a beautifully smooth fashion with ample band-spread. All of the other controls spaced along the bottom of the front panel of the cabinet are neatly labeled with specially made metal plates. This set will prove a dandy for short-wave "Fans," as it incorporates sharp tuning, together with excellent quality and volume. The beat oscillator will be found very useful in locating the carriers of those weak DX stations.

Further tests are being made by our DX editor, Mr. Joe Miller, in his listening post, and we hope to publish the results of these tests at a later date.

This article has been prepared from data supplied by courtesy of RCA Manufacturing Co.

RADIO INSTRUCTION

A Beginner's Super

(*Continued from page 671*)

Adding "Tickler" to I.F. Transformer

The tickler winding may be added to the Hammarlund I.F. transformer, either before or after it has been wired into the circuit. In either case the following method is used: Remove the two machine screws at the top of the shield can, as shown in the drawing and gently pull the can apart. The trimmers and the screws at the bottom of the can should not be bothered, and do not dismantle or disturb the connections inside the unit after it has been removed from the shield. Now wrap enough No. 32 silk-enameled wire around a small cardboard form about ¾ inch square, to wind *85 turns* on the ½ inch transformer core, pass this between the core and the supporting bracket and proceed to wind the tickler *helter-skelter fashion* in the *same direction as that of the grid coil.* In case the direction of the grid winding cannot be determined, due to the impregnating compound or some other cause, the tickler may be wound in *any* direction and the *leads reversed* in their connections to the plate and "B" plus circuits until oscillation is obtained. The plate lead is brought out through the center-tap hole (the center-tap is not used in this circuit); the "B" plus lead is in the same hole as the ground (diode) lead. After the winding has been completed, replace the shield and fasten it in place with the two machine screws.

Test First for "Short-Circuits"

The receiver is now ready to be adjusted and tested. Before the batteries are connected, however, it is wise to test from each "B" plus lead to the chassis (negative filament), with the power switch in the "on" position, in order to determine whether any *short-circuits* exist. A pair of head-phones and a small 1½ volt battery will serve for this purpose. If everything appears to be correct, the batteries may now be connected, as shown in the diagrams, and an antenna and ground connected to their respective binding posts. For best results, a fairly long antenna (75 to 100 feet) of the single wire type should be used.

Turn up the rheostat until the tube filaments glow at a dull cherry-red color and adjust the regeneration control until the familiar rushing sound of regeneration is heard in the phones. Slowly rotate the tuning dial for a signal and adjust the 20 mmf. trimmer for best reception. If the signal is weak or whistles, adjust the potentiometer for sensitivity and clear reception in exactly the same manner as in the ordinary regenerative set. Now, leaving the signal tuned in as accurately as possible, adjust each trimmer of the I.F. transformer for *maximum* signal volume. It is necessary to turn the set upside down to "peak" the plate trimmer as this is in the bottom of the shield can. After this has been done, the *aligning process* is completed and the only adjustments necessary are those carried out with the regeneration control and the trimmer on the front panel.

It must not be expected that this receiver will show any extremely high degree of sensitivity or selectivity, even though it is of the superheterodyne type. However, if a pair of *sensitive* headphones, such as the Brush type A crystal units, and a long antenna are used, reception is usually much better than that obtained with the average regenerative or tuned-radio-frequency short wave set.

If the above instructions are carefully followed, no difficulty should be experienced in constructing the little super. However, if any trouble should arise, or if the builder desires additional information, the author will be glad to correspond with readers who enclose a *stamped and self-addressed envelope* for reply. Address all letters direct to the author in care of *Short Wave & Television.*

200 Watt Xmitter Features New Pen-Tet Exciter

(*Continued from page* 683)

to 40 meters to work on that band; the plug-in coils need not be changed. Then, for operation on 20 meters, the 20 meter coils must be inserted in the 6L6 and 807 circuits. We are then *quadrupling* in the plate circuit of the 6L6, while the 807 still remains a straight amplifier. For operation on 10 meters with an output of approximately 18-watts, it is only necessary that a 10 meter coil be inserted in the 807 plate circuit.

In this manner we have covered all bands from the 80 to 10 meters with a single crystal and with a minimum of plug-in coils. The exciter unit is capable of furnishing from 20 to 25 watts, which is quite sufficient to excite the average push-pull medium powered amplifier. The amplifier chosen in this case is a pair of HF-100's, which perform exceptionally well on all bands even down to five meters, although this transmitter is not designed to work on that band. However, with the use of the 20-meter crystal it would be entirely feasible to operate it on 5-meters and probably have an output of around 200 watts, or better. All of the coils in this transmitter except the final-amplifier plate-tank coil are wound on Hammarlund isolantite forms, with either number 16 or 18 B&S tinned copper wire, according to the specifications given in the coil table. The plate coil, L5, of the HF-100's is wound with No. 14 wire and is of the self-supporting type, employing celluloid strips.

These can be made by hand or may be purchased at almost any amateur radio supply house. If they are purchased, make sure that they will tune to the desired bands with a maximum capacity of 50 mmf. The output of the final stage will be anywhere from 200 to 300 watts, depending upon the plate voltage applied and the input. However, in all cases the plate current of the 2-tubes should not exceed twice the value specified for a single tube, by the manufacturers. *A good rule to follow in all cases is not to exceed the maximum plate current as supplied by the manufacturers of the tube.*

Getting back to the oscillator circuit, we find that the adjustment is slightly different from those we have been accustomed to operating. A jack is supplied for the oscillating plate current and it will be found that this will be in the neighborhood of 20 to 25 mills (M.A.) with 400 volts on the plate and 30 mills with 500 volts on the plate.

The plate voltage is not critical and can be anywhere from 350 to 500. The higher voltage provides better efficiency when quadrupling with the 6L6. With the proper coils in place, the easiest method of adjustment is to plug the meter in the 6L6 plate circuit. With the crystal not oscillating this plate current will be in the neighborhood of 10 M.A. Then swing the 250 mmf. oscillator plate tuning condenser and you'll notice that at one point the plate current of 6L6 will climb. This indicates that the crystal is oscillating. Tune the oscillator for highest plate current, of the 6L6, then decrease the plate condenser slightly.

From here we adjust the plate condenser of the 6L6 to whichever output frequency is desired. It is difficult to adjust the oscillator stage by watching the oscillator current, because there is very little change when the crystal goes in and out of oscillation. Remember that the very low amount of feed-back present in the 6F6 means that we have to use a *good* crystal. If an inactive crystal or one which is not a ready oscillator is employed, some form of external feed-back between plate and grid will have to be used. A small capacity of one or two mmf. should be sufficient, although this will increase the crystal current slightly. It is better to use a good crystal and employ the circuit shown. If the crystal is exceptionally *cold*, it may be found necessary to *warm* it slightly in order to get it to oscillate. We mention this because one morning when the "shack" was exceptionally cold, we could not make the crystal oscillate. Removing the crystal and holding it against the 6F6 shield, which, incidentally, becomes very hot, for just a few moments proved sufficient to heat the crystal and it went right off into oscillation.

The entire transmitter is composed of two sections; one is the exciter, the other the amplifier. They are both mounted on 19 by 8¾-inch steel rack panels and the chassis are 2 by 17 by 7 inches; complete details for placement of parts is shown in photographs. For convenience, the 807 was mounted horizontally, thus providing short leads and reducing feedback possibilities. The output of the exciter is link-coupled to the final amplifier and although direct coupling for matched impedance feeders is shown in the diagram of the final amplifier, the coils each contain a two-turn link; we prefer to link couple the final amplifier to the antenna tuning unit.

Parts List—For Transmitter Exciter Unit

HAMMARLUND
4—2.1 mh. R.F. chokes
2—octal sockets, isolanite
2—5 prong sockets, isolanite
3—4 prong isolantite sockets
9—4 prong isolantite coil forms
1—250 mmf. variable condenser MC250M
2—200 mmf. variable condenser MC200M

CORNELL-DUBILIER
4—.01 mf. mica condensers, receiving type
3—.001 mf. mica condensers, receiving type
3—.0001 mf. mica condensers, 1,000 V.

ELECTRAD
1—2,000 ohm 20 watt resistor
1—5,000 ohm 20 watt resistor
1—50,000 ohm 20 watt resistor
2—20,000 ohm 20 watt resistor
1—15,000 ohm 10 watt resistor

BLILEY
1—LD2 crystal, 80 meter band

RCA
1—6F6 tube
1—6L6 tube
1—807 tube

TRIPLETT
1—0-100 ma. meter small bakelite case
1—0-200 ma. meter small bakelite case

DIALS
3—4-inch dials, 0-100

PAR-METAL
1—18¾ by 19 inches steel panel
1—7 by 17 by 2 inches sub-base

MISCELLANEOUS
2—single closed circuit jacks
2—snap switches
1—phone plug for meter

Parts List for Final Amplifier

HAMMARLUND
1—split stator condenser, MCD-100S
2—2.1 mh. R.F. chokes
1—5 mh. heavy duty R.F. choke
3—4-prong isolantite socket
2—MC. 20-SX condensers remodeled to have 2 rotors and 1 stator, double spaced

CARDWELL
1—split stator transmitting condenser 100 mmf. per section, MT-100-GD mycalex insulation

ELECTRAD
1—5,000 ohm. 20-watt resistor
1—100 C.T. resistor, round type

CORNELL-DUBILIER
3—.001 mf. mica condensers, 1,000 V.
1—.001 mf. mica condensers 5,000 V.

TRIPLETT
1—0-300 ma. meter large bakelite case

AMPEREX
2—H.F. 100 tubes

DIALS
2—4 inch dials

PAR-METAL
1—8¾ by 19 inches steel panel
1—7 by 17 by 2 inches sub base

MISCELLANEOUS
2—single closed circuit jacks

Coil Data

*80-40 Meter Bands

OSC	Multiplier	Buffer	Size Wire
17 turns	18 turns	20 turns	No. 18 tinned

20 Meter Band

same as 80	8 turns	10 turns	No. 16 tinned

Final Amp. Grid

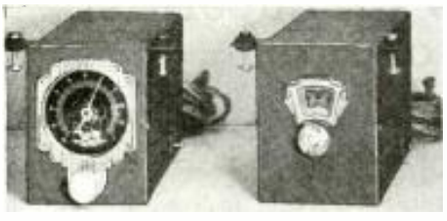
80 m.	32 turns		No. 20 DSC
40 m.	25 turns		No. 18 tinned
20 m.	16 turns		No. 16 tinned

Final Amp. Plate

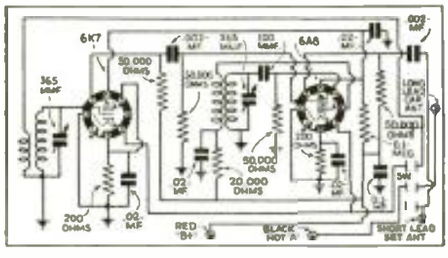
80 m.	32 turns	dia. 2½"	No. 14 tinned
40 m.	24 turns	dia. 2"	No. 14 tinned
20 m.	14 turns	dia. 2"	No. 12 tinned

All coils except the final plate coil are wound on 4 prongs, 1½ inch dia. isolantite forms (Hammarlund) and spaced to a length of 1½ inches. The final plate coils are spaced to a length of 4 inches.

*One set of coils is used for both bands.



Short-Wave Converters for use with automobile sets; model 600 at the left, and model 500 at the right.



Wiring diagram for models 500 and 600 Converters. (Refer to No. 599)

S-W Converter for Auto Radios

● GOOD short wave radio reception in automobiles is made possible with any automobile radio by attaching one of the Short-Wave Converters pictured.

In each of these units two metal tubes are employed, one providing R.F. amplification of short wave signal while the other supplies the signal which may be picked up by the radio receiver at 600 to 700 kilocycles.

Wave bands available are as follows: Model 500 covers 1600 to 6000 kilocycles suitable for Police, Airway and Amateur use; Model 600 covers 6000 to 18000 kilocycles suitable for short-wave reception of foreign broadcasts.

In tropical climates where the static makes reception on the broadcast bands practically impossible, the Model 600 covering 49-31-25-19 and 16 meter bands makes satisfactory automobile radio short-wave reception possible. With this unit a distance range of 6000 to 12000 miles is possible.

The model 500 Police converter makes possible the use of standard automobile radio receivers for police work. Its exceptional distance range makes it especially adapted to use of the police.

(It should be noted that certain states and municipalities have laws prohibiting the use of short-wave sets in autos, except where they are under the control of licensed operators.—Editor.)

Our Information Bureau will gladly supply manufacturers' names and addresses of any items mentioned in Short Wave and Television. *Please enclose stamped return envelope.*

The "McEntee-6"—A Super-Het for Fan or Ham

(*Continued from page 673*)

found that the receiver is easiest to operate by using the regeneration control at a moderate setting, only advancing to gain sensitivity or selectivity as may be needed. The I.F. gain control should also be operated at less than maximum so as to avoid over-loading the second detector on strong signals. The A. F. volume control will be used mainly when head-phones are connected.

The grid circuit of the 6L7 should always be kept in resonance by adjusting the trimmer condenser that is connected across one section of the main tuning condenser. The proper position is secured when the trimmer is turned to the point of greatest hiss-level with no signal tuned in.

All plug-in coils are wound on 1¼" ribbed bakelite forms, and if home-constructed should have the following specifications:

Detector Coil

Turns sec.	Turns on tickler	Length of Second winding	Size Sec. wire
6	2	1"	20
14	2	1 3/8"	22
25	3	1 3/8"	26
53	6	1 3/8"	28

Oscillator Coil

Turns sec.	Turns on tickler	Length of Second winding	Size Sec. wire
6	4	1"	20
13	7	1¼"	22
22	9	1"	26
42	10	1 1/8"	28

"McEntee-6" Parts List

BUD
4—octal wafer sockets
2—octal ceramic sockets
1—4 pr. ceramic sockets
1—5 pr. ceramic socket
1—set coils No. 397
1—16 mh. choke
1—case No. 1190
1—chassis No. 1189
3—grid clips
1—binding post strips
2—toggle switches
6—lug strips
2—coils wire

HAMMARLUND
1—dual 140 mmf. cond.
1—50 mmf. trimmer
1—25 mmf. trimmer
1—small 1FT No. ST.465

RCA
1—6A8
1—6L7
1—6K7
1—5Z4
1—6C5

RAYTHEON
1—6N6G

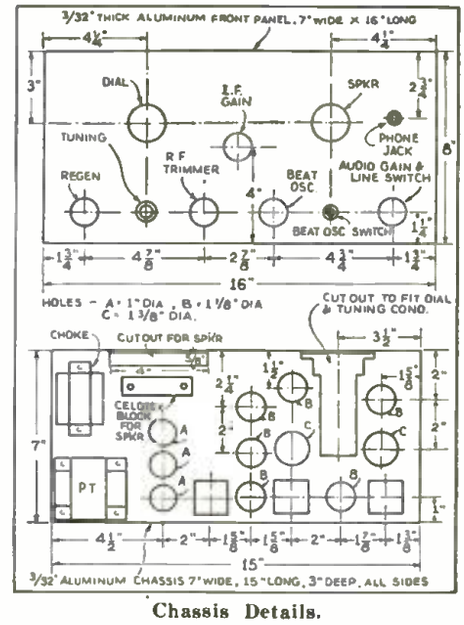
CORNELL DUBILIER
3—8 mf. 500 V. electrolytics
6—.01 mf. 400 V. tubular
5—.1 mf. 400 V. tubular
2—100 mmf. mica
2—250 mmf. mica
1—.005 mf mica
1—.001 mf. mica

KENYON
1—Power trans. 6.3 V. 350 V. 75 ma.
1—choke 30 H. 75 ma.

MISCELLANEOUS
1—5 inch speaker
2—Meissner iron core I.F. Transfs. 465 kc.
1—dial with extra escutcheon
1—Electralloy panel 8 x 16 x 3/32"

ELECTRAD
1—.5 meg. vol. control
1—50M ohm screen regen. control
1—25000 ohm bias con.
1—50000 25 W. voltage divider

RESISTORS
1—50000 ½ W. carbon
1—5000 ½ W. carbon
4—.1 meg. ½ W. carbon
1—200000 ½ W. carbon
1—300 ohm carbon
1—300 ohm carbon
5—2 inch dials with knobs



Chassis Details.

Girl Operators, Attention!

Listen "YL's" and "XYL's"!! Why not send the Editor a good photo of your "Rig"—and don't forget yourself. A separate photo of yourself will do, with a "clear" photo of that station! $5.00 for best "YL" photo.—Editor.

A Control Unit for the Ham Operator

(*Continued from page* 684)

two ends, and a top of ⅛" thick black Masonite, with a slight bevel, was used. The same quarter-inch Masonite used for the base can be used for the top, however, if a scrap is available. The front panel was cut from a small panel secured from a radio supply house, of the same material finished in black crackle lacquer, and ⅛" thick. A piece large enough for two panels was secured for 35c, and cut to size with a hand-saw.

The panel is fastened to the front of the cabinet ends by ¾" flat-head wood screws, countersunk flush with the panel, and touched with black enamel, making them very inconspicuous. The top is secured in place with six ¾" round-head nickel-plated wood screws.

The operation of the entire unit centers around the control switch, and in selecting the proper switch, first list the operations it is necessary to perform to accomplish the change-over from send to receive. In the station for which this unit was initially built, it was desired to open the plate of the R.F. amplifier in the receiver, to prevent too great a "thump" in the phones when sending, short the receiving antenna to ground to lessen the pick-up from the transmitter, close the high-voltage circuit in the transmitter—accomplished by "making" the NEGATIVE high voltage lead, and light a ruby indicator lamp on the control panel, all these operations being performed with the control switch thrown to the SEND position. Conversely, when thrown to the RECEIVE position, it was required to extinguish the ruby light and light a green one, break the high-voltage circuit—oscillator and buffer supply in this particular case—remove the "short" from the receiving antenna, and restore the receiver R.F. plate circuit. Poring through the catalogs to find a suitable switch for the purpose, two or three were discovered. The familiar anti-capacity switches of the telephone type were found to be entirely adequate, and one of the twelve spring size—really two double-pole double-throw switches—was selected as offering the easiest throw. Rotary panel switches of the type used to change bands in all-wave receivers are also entirely suitable, if the builder prefers a rotary movement. Select the switch to suit the controls you are required to perform, as suits your fancy.

The indicator lights are the small panel mounting style, and as two small 2.5 volt transformers were on hand, they were used, and the switching done in the primary side, which permitted opening the A.C. line by merely placing the anti-capacity switch in its middle or off position, when not using the rig. Otherwise, a single small filament transformer will serve, switching the secondary, but some provision should be made to turn off the primary voltage when not using the equipment, either by an extra pair of contacts on the control switch, or a small nickel plated toggle switch on the panel. The wiring diagram shown here, illustrates the connections used with an anti-capacity switch and two filament transformers, in the original model—it is shown merely as a guide, and the individual may necessarily have to change it somewhat to adapt it to his particular needs.

In the initial unit, it is merely necessary to throw the switch to the UP or TRANSMIT position, and commence sending. This lights the ruby and indicates the transmitter is "hot". Likewise, to receive, the switch is merely thrown down, extinguishing the ruby and indicating on the green light, that the receiver is in operation. Placing the switch in its center position, turns off both lights and breaks the A.C. line to the panel-lighting transformer, as well as leaving both transmitter and receiver inoperative. It will be wise to mount the switch as shown, so that should you accidentally drop something where it might hit the switch lever, it will push it to the receive position, and cause no damage—if it is the other way, you might be in the transmitter and catch a thunderbolt. Remember, we're warning you!

The key was mounted on the overhanging part of the base, thus making a complete control unit, and it also eliminated the necessity for screwing the key down, which often meets with family opposition if it happens to be a hahogany table!

Connection may be made to a suitably marked terminal strip on the rear, or, as was done in our model, by means of cable and plugs, into wafer sockets on the back face, making it readily detachable.

There is sufficient room inside the cabinet to contain the average "key-click" filter also, if used, or a "tube keyer," or one of the magnetic or mercury vapor "key relays" may be mounted there, the entire assembly making a truly universal control unit, that will eliminate scattered switches and wiring, and add that commercial appearance and convenience, so often lacking in the average amateur station.

Universal Power Supply for the Ham

(*Continued from page* 681)

Parts List—Power Supply

KENYON

1—T-654 Triple winding transformer (250 ma.)
1—371-4-winding filament transformer, see text
1—T-355 3-winding filament transformer
2—T-164 14 henry—250 ma. filter chokes

ELECTRAD

1—50,000 ohm—50 watt resistor
1—25,000 ohm—50 watt resistor

CORNELL—DUBILIER

1—2 mf. 2,000 volt filter condenser
1—2 mf. 1,000 volt filter condenser

RCA

3—83 tubes

PAR-METAL

1—17 by 12 by 3 inch crackle finished chassis

MISCELLANEOUS

3—4-prong wafer sockets

Let's "Listen In" With Joe Miller

(*Continued from page* 690)

OM, and hope you'll have 40 or 50 Africans more in your log book soon, hi! "Keepplugging" is the word! Charlie Miller (20-68) of Covington, Ky., also logged IUG 9-10 a.m.

We must commend the Italian Government for being so prompt in replying. A FB example!

Algiers—24.75 Meters

We have lately had the good fortune to log Algiers on a new wave of 24.75 meters, or 12.12 mc., being heard one morning at 6:33 a.m., using similar side-band secrecy Xmission as their other station on 8.96 mc. The carrier wave is strong and steady, but rarely does one hear voice on this wave, usually only CW being the fare. Pierre Portmann also logged Algiers, as did Eddie Schmeichel (23-75). FB!

Siam

HSP, Bangkok, on 17.74 mc., was heard at 5:40 a.m., signal fair. Ashley Walcott sends along a FB bit of dope received with an HSP veri, direct from Siam, here goes: HSG2, 15.53 mc., tests with Tokio, Sundays, 11 p.m., and Fridays, 1 a.m., HSP reserved for Berlin fone work. Another card, from HS8PJ, says that BC's all now on Mondays, on 19.02 mc., and 15.53 mc., alternately. Usually, however, the 19.02 frequency is used. Charlie Miller got HS8PJ on 9.35 mc., on Thanksgiving Day, congrats, OB! John De Myer has HS8PJ veried on 10.955 mc., and reports out on 19.02 and 9.35 mc. That's cleaning up!

China

XGW, Shanghai, 10.42 mc., was logged at 2 a.m. and XGM, 17.64 mc., was conversing with GBA, 16.14 mc. Rugby England at 6:40 a.m., Ashley Walcott sends along some FB new data on Chinese fones. Daily except possibly Sunday, from 9:30-11 a.m., sometimes till noon, Shanghai tests with San Francisco using any one, two, or even all three of the following Xmtrs: XGW, 10.42 mc., XOU, 8.04 mc., XTD, 5.74 mc. Between 7-10 a.m., XTD phones XTV, 9.50 mc., believed in Hangkow.

This is all FB dope, and we suggest that you DXer's plug as often as possible, as veries from China are prompt and specific, and who wouldn't like to have a few of these verified! Eddie Schmeichel hears XGW phoning Dixon at 11 p.m.

Africa

SUZ, Cairo, 13.82 mc., was heard at 1:15 p.m., as usual foning GBB, 13.58 mc., SUZ, however usually is heard earlier, starting at 11 a.m., sharp with GBB, whenever traffic is to be carried. SUZ makes contact in clear speech, but switches to inverted when carrying messages. Ashley Walcott supports the 11 a.m., sharp tip, adding that occasionally London will be busy with Canada till 11:30 a.m., or so, and SUZ will postpone its call till GBB is free and clear.

Eddie Schmeichel says that FZE8, Djibouti, French Somaliland, 8.75 mc., is being heard at 2:30 a.m., calling Paris. Ed Goss, N.Y. State Mgr. of IDA has received a veri of FZE8, 17.28 mc., from Paris! That is indeed a catch of which to be proud, OB, and our sincere congrats.

CR7AA, the Mozambique station on 6.137 mc., has notified Roy Myers, Los Angeles, that, beginning Jan. 1, 1937, they will be on the 31 meter band! Further details were not given.

Huby Fey, L. I. City, reports hearing ITK, IUC, SUZ, and EAJ43, which Huby insists is EHZ. Our letter from EAJ43 makes no mention of EHZ, a commercial Xmtr located at Tenerife, Canary Islands. Huby has also heard EA8AB again FB OB! Pierre Portmann has logged IUG. ZSS, 18.89 mc, located at Klipheuvel, So.

Africa, was heard phoning at 7:19 a.m., later than their usual sked of 6:30-7 a.m.

Asiatics

Roy Myers reports YAA, 5.2 mc., located at Kabul, Afghanistan, contacting YAH, also in Afghanistan, daily at 8:30 a.m., but weak.

XOJ, 15.795 mc., Shanghai, was heard phoning JVE, 15.66 mc., at 11:50 p.m. JZB, 10.065 mc., Shinkyo, Manchukuo, also listed in veri as TDB, was heard phoning at 6:35 and 7 a.m.

According to Ashley Walcott, TDD, 5.83 mc., Shinkyo, Manchukuo, phones JVU, 5.79 mc., Tokio, between 6-9 a.m.

JIB, 10.53 mc., Formosa, or Taiwan, Japan, was heard with music at 6:25 a.m. JIC, 5.89 mc., Taihoku, Formosa, phones JVV, 5.73 mc., 6-9 a.m.

JVH, 14.60 mc., Tokio phoned GBL, 14.67 mc., at 6:35 a.m. RIO, 10.17 mc., Bakou, U.S.S.R., phoned Moscow at 1 a.m. JVM, 10.74 mc., Tokio, phones KWX at midnite.

YBG, Medan Sumatra, on 10.40 mc., was heard phoning at 6:28 a.m. Just inside their daily sked of 5:30-6:30 a.m.

Also KTP, 8.12 mc., Manila, phones KWY, 7.565 mc., around 10.30 a.m., and is heard on Pacific Coast with tremendous volume.

PMH, 6.72 mc., Bandoeng is heard till 9:30 a.m., week days, and till 11:30, Saturdays, relaying NIROM programs.

A number of Soviet phones have been heard lately, operating around midnite, several near 40 meters, and unidentified as yet. Eddie Schmeichel reports JVG, 14.91 mc., phoning at 7 a.m.

Other DX

TFJ, 12.24 mc., Reykjavik, Iceland, phones OXT, Copenhagen, Denmark, around 10 a.m., calling London after 10. OXT is listed on 12.30 mc. This data from Ashley Walcott.

PZH, 7:00 mc., Suriman, Dutch Guiana, heard signing off at 9:40 p.m., by Charlie Miller, FB. PZH signs off with the Dutch National Anthem.

Ham Stardust

The Africans on 20 phone, which held "open house" last month, (Nov.), have quieted down very much, being heard only occasionally now, in evenings. ZU6P or ZS6AJ heard about 11 p.m., on L.F. end. In afternoons now, ZS6AJ and ZU6P also heard about 2:30-3 p.m. ZS2N, on 14.260 kc., also was heard FB, at 11 p.m.

Ashley Walcott reports ZS6AJ, 14050 kc., Johannesburg, at 11:15 a.m. Out on the West Coast the Africans do come in around 9:30-11:30 a.m.

Charlie Miller reports EA9AH, 7.00 mc., R9 at 9:15 p.m. EA8AK, on 7.12 mc., at 9 p.m., also. Nice DX, Charlie! Huby Fey reports SUIKG and ZS6AJ, too. Also, PK1MV, 14090 or so at 6 a.m. And Huby has a QSL from VS2AK, Malay States, 1st Eastern U.S. report. Congrats, OM!

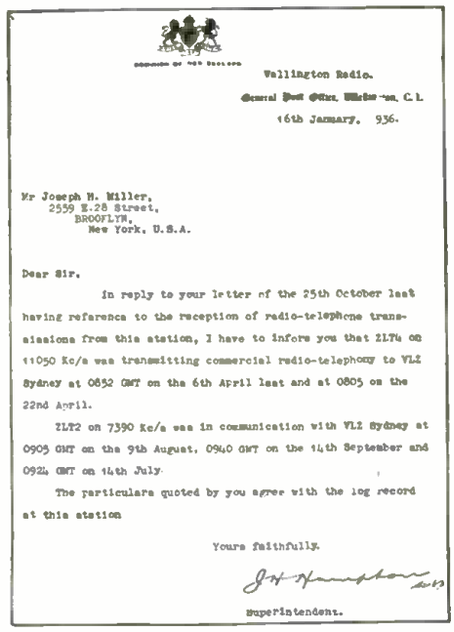
Roy Myers reports from Los Angeles the following Ham DX: VS6AQ, 14.300, Hong Kong; J8CA, 14080, Korea. Also, VP2KM, 14.120, St. Kitts Island; EA8AT, 14.100 Canary Islands; VS7RA, 14.040, Ceylon. The following in South Africa: ZT2B, 14.010; also ZS6AM, 14.070; ZS2X, 14.360; ZU6P, 14.050; ZT6N, 14.024. And VQ4CRO, 14.090, Kenya Colony, which was heard at 11 p.m., E.S.T., Mondays. That's a great collection, OM. Our sincere congrats!

Our tip for February tuning is to try the 40 meter band in early mornings from 3-6 a.m., or so. Last year in February we logged a number of VK phones on 40 meters, and the most handsome VK QSL we have is from VK4FB, a 40 meter veri! Already heard is VK2BQ on 40 meter phone in mid-December at 6:15 a.m.

Also suggested for tuning are OER2, 6.072 mc., in Vienna, Austria, and CT2AJ, 4.02 mc., Azores Islands, which were excellently heard Feb. of last year. OER2 comes in best between 5-6 p.m., on Saturdays, and CT2AJ, located on H.F. edge of 75 meter ham band, is best heard Saturdays 6-7 p.m. Both send handsome QSLs, previously illustrated in these articles. Go to it, DXers, with our best wishes!

Our QLSs for past month have been scarce but of good quality, you'll agree, hi! Here goes: ITK, IUG, IUC, VK2CP, VQG, CR6AA, VK3GQ.

Well, here's our sign off, so, with best wishes for DX in the New Year, es very 73, Ye Ed.—Joe Miller.



Wellington Radio.
General Post Office, Wellington, C.1.
16th January, 936.

Mr Joseph H. Miller,
2559 E.28 Street,
BROOKLYN,
New York, U.S.A.

Dear Sir,

In reply to your letter of the 25th October last having reference to the reception of radio-telephone transmissions from this station, I have to inform you that ZL7G on 11050 Kc/s was transmitting commercial radio-telephony to VL2 Sydney at 0852 GMT on the 6th April last and at 0805 on the 22nd April.

ZL72 on 7390 Kc/s was in communication with VL2 Sydney at 0905 GMT on the 9th August, 0940 GMT on the 14th September and 0924 GMT on 14th July.

The particulars quoted by you agree with the log record at this station

Yours faithfully.

J H Hampton

Superintendent.

A "wholesale" veri of 2 New Zealand phones which now refuse to verify.

The Editors Want

articles describing in detail television receivers on which short-wave experimenters may pick up the television images being broadcast by the RCA Station, atop the Empire State Bldg., in New York City, on about 5 meters, and also those being broadcast from the Don Lee Station on a similar wavelength in California. All articles accepted and published will be paid for at regular space rates. Send outline of article and what photos or diagrams available to: The Editor, Short Wave and Television, 99 Hudson St., New York, N.Y.

Alphabetical List of S-W Stations

(*Continued from page 689*)

CALL	FREQ.	CALL	FREQ.
OXY	6.06 mc.	WMF	14.47 mc.
PCJ	15.22	WMN	14.59
PCJ	9.59	WNA	9.17
PCV	17.81	WNB	10.68
PDK	10.41	WNC	15.06
PDV	12.06	WND	4.10
PHI	17.78	WOA	6.76
PHI	11.73	WOB	5.85
PLE	18.83	WOF	14.47
PLO	11.50	WOG	16.27
PLP	11.5	WOK	10.55
PLV	9.42	WON	9.87
PMA	19.35	WOO	17.62
PMC	18.14	WOO	12.84
PMH	6.72	WOO	8.56
PMK	11.5	WOO	4.75
PMN	10.26	WOO	4.27
PMY	5.15	W1XAL	15.25
PNI	8.78	W1XAL	11.79
PPU	19.26	W1XAL	6.04
PRADO	6.63	W1XK	9.57
PRF5	9.50	W2XAD	15.33
PSA	21.08	W2XAF	9.53
PSF	14.96	W2XE	21.52
PSH	10.22	W2XE	17.76
PSK	8.19	W2XE	15.27
RIM	15.25	W2XE	11.83
RIM	7.63	W2XE	6.12
RIO	10.17	W3XAL	17.78
RIR	10.08	W3XAL	6.10
RKI	15.09	W3XAU	9.59
RKI	7.50	W3XAU	6.06
RNE	12.0	W3XL	17.31
RNE	6.0	W4XB	6.04
RV15	4.27	W4XCA	31.60
RAN	9.60	W6XKG	31.6
RW96	15.18	W8XAL	6.06
SMSSX	11.71	W8XK	21.54
SPW	13.64	W8XK	15.21
SUV	10.06	W8XK	11.87
SUX	7.86	W8XK	6.14
SUZ	13.82	W8XWJ	31.60
TFJ	12.24	W9XAA	11.83
TFK	9.06	W9XAA	6.08
TFL	5.0	W9XBS	6.43
TGF	14.49	W9XF	6.10
TGS	5.71	W9XPD	31.6
TGWA	9.45	XBA	6.98
TGXA	6.13	XBC	6.55
TG2X	5.94	XBJQ	11.20
TIEP	6.71	XEBT	5.99
TIGPH	5.83	XECR	7.38
TIPG	6.41	XEFT	6.12
TIR	14.49	XEME	8.19
TIRCC	6.55	XEUW	6.02
TI4NRH	9.67	XEWI	11.9
TI5HH	5.50	XEXA	6.17
TI6OW	6.85	XGM	17.65
TI8WS	7.55	XGOX	6.85
TPA2	15.25	XGW	10.42
TPA3	11.88	YBG	10.43
TPA4	11.72	YDA	6.04
TYA	12.22	YDA	3.04
TYB	12.25	YDB	9.65
TYF	14.64	YDB	11.86
VE9BJ	6.09	YDC	15.15
VE9BK	4.79	YNA	14.49
VE9CA	6.03	YNLF	9.65
VE9CS	6.07	YVC	13.35
VE9DR	6.01	YVQ	6.67
VE9HX	6.13	YVR	18.30
VIZ3	11.56	YVR	9.15
VK2ME	9.59	YV1RG	6.36
VK3LR	9.58	YV2RC	5.80
VK3ME	9.51	YV3RC	6.16
VK6ME	9.59	YV5RC	6.29
VLJ	9.76	YV5RMO	5.85
VLK	10.52	YV6RV	6.52
VLZ2	9.76	YV8RB	5.90
VPD	13.08	YV9RC	6.40
VPD2	9.54	YV10RSC	5.72
VP3MR	6.01	YV11RB	6.55
VQ7LO	6.08	YV12RM	6.30
VRR4	11.60	ZBW2	6.09
VUB	9.57	ZBW3	9.53
VUC	6.11	ZBW4	15.19
VWY	8.98	ZBW5	17.76
VWY2	17.51	ZFA	5.03
WCN	5.08	ZFB	10.06
WKA	21.06	ZGE	6.13
WKF	19.22	ZHI	6.02
WKK	21.42	ZHJ	7.63
WKN	19.82	ZLT2	7.39
WLA	18.34	ZLT4	11.05
WLK	16.27	ZSS	18.89
WMA	13.39	ZTJ	6.10

Landing Planes "Blind"

(*Continued from page 662*)

tells him that he is 10,000 feet from the airport and that he should get ready to land. As he starts to glide down, the pilot cuts through the second "warning signal"; this tells him that he is 1,000 feet from the airport. Gliding along the *directional beam* the pilot can land his plane safely, despite murky weather conditions such as fog, snow, rain, etc.

Micro-Ray Communication

(*Continued from page* 668)

The transmitter carrier frequency is generated by means of a triode with positive grid.

Fig. 1 shows a micro-ray tube. It is a triode but differs from conventional valves as regards its grid, which is a wire helix, both ends of which are brought out. The plate, also symmetrical with regard to grid and filament, is a molybdenum cylinder. The two grid leadouts are connected to a transmission line to which the load is applied. In the concrete case of a valve oscillating at 17.4 cm. (6.96") the length of the wire grid is 19 cm. (7.6"), i.e., more than one wavelength. The grid may therefore no longer be regarded as an electrode but rather as a transmission line which, as it maintains oscillations in the exterior transmission line connected to it, must have negative leakance. It is suggested that the explanation of this negative leakance lies in the compression and rarefaction of the electron stream at the grid caused by variation in the time of flight of the electron according to the phase of a-c. grid voltage at the moment that the electron leaves the filament. If the voltages are properly chosen, the a-c. component of the electron current at the grid will be in phase opposition to the grid voltage.

It is found by experiment that the same frequency can be generated for different grid and plate voltages.

The aerial system for micro-ray communication may follow the lines of ordinary radio practice. At these short wavelengths, however, we are able to make use of the usual optical devices such as lenses, zone plates, mirrors, and gratings. Micro-rays can quite well be focused by means of lenses even when made of opaque dielectrics such as ebonite (hard rubber). In one particular case a double convex *ebonite lens* about 2 feet in diameter and about 5 inches thick at the center brought a micro-ray source about 6 meters in front of it to a focus 40 cm. behind it. The concentration represented a gain of about ten decibels.

The zone plate is another optical device for focusing rays (Fig. 3). A zone plate consists simply of a number of concentric metal rings of suitable inner and outer radii. When radiation from T (Fig. 2), reaches the obstacle ABCD, the intensity at any point R may be determined by forgetting the original source T and considering each point on the plane ABCD as the source of a secondary disturbance, with amplitude and phase dependent on its distance from T. These secondary disturbances radiate to all points on the right of plane ABCD.

Set TBR—TAR $= \lambda/2$ and TCR—TBR $= \lambda_2/2$, etc. The intensity at R, due to the secondary source at B, will be out of phase with the intensity at R, due to the secondary source at A. Similarly, at any point source between B and C there corresponds a point source between A and B whose intensity at R is 180° out of phase. Alternate zones AB and BC, therefore, tend to destroy one another. If we let all the radiation from T reach R, i.e., if we remove the obstacle ABCD, we obtain a certain intensity at R. If, however, we block out the rays reaching zones BC and DE, etc., the influence of which is destructive at R, we increase the intensity at R, i.e., we bring the rays to a focus there. The zone plate shown in the slide gave a measured gain of 8.6 db.

The paraboloidal mirror with micro-ray source at the focus, however, gives greater gain than either lenses or zone plates. As it is usually convenient to have equipment of this kind made in the factory rather than on site, its size is limited by transport and other practical considerations. The problem then, as it presents itself to the engineer, is to design such a mirror so as to obtain the greatest gain for a given aperture.

A moment's consideration will show that every point on the mirror surface is not

energised equally by a micro-ray doublet at the focus, as the doublet itself has a distinct radiation diagram. For example, points in line with the doublet are not excited at all.

Considerations given in the paper show that actually destructive areas occur, i.e., areas whose contribution to the signal at a distance is out of phase with the main signal. Fig. 4 shows the destructive areas projected on to the director plane. If the focal plane lies in the aperture, these destructive areas disappear and it is, therefore, not surprising that calculation shows that the gain is then a maximum and equal to the number of wavelengths in half the aperture circumference. In the case of the Lympne reflectors this gain was 28 db., which was increased to 31 db. by the use of a hemispherical mirror in front of the doublet.

In order to obtain correct phasing the diameter of the spherical mirror must be a multiple of half a wavelength, and not an odd multiple of a quarter wavelength as might be expected. This is due to the curious Gouy effect, whereby the phase of rays is accelerated 180° at passage through a focus.

The practical points involved are well illustrated in the installation of the Lympne-St. Inglevert link, which not only uses the shortest *wavelength of any commercial station in the world*—17.4 cm. (6.96")—but also constitutes the longest micro-ray circuit in regular operation up to the present time.

As regards the purely micro-ray side of the equipment, the aerial and reflector assemblies at both ends of the link are similar in construction and are based on the optical reflector principle instead of the orthodox aerial array. The aerial is of the half-wave dipole pattern, located at the focus and in the aperture of a paraboloidal aluminum mirror reflector some 10 feet in aperture diameter, spun from aluminum sheet approximately 0.2 inch thick. A special advantage of the optical system of reflectors, as compared with the array, is that the plane of polarization of the beam is uniquely determined by the plane of the dipole element, which can easily be rotated. Accordingly, on the Lympne-St. Inglevert link, the two channels are operated on different planes of polarization, thereby still further reducing the possibility of cross-talk. The Lympne-St. Inglevert channel is operated with a horizontally polarized wave, the other channel being operated with a vertically polarized wave, and the transmitter and receiver aerial doublets are placed horizontally and vertically, respectively, at the Lympne end of the link. There is no particular merit in this selection of planes of polarization; any two planes at right angles would give the same benefits.

Provision is made for rather fine adjustment of the micro-ray operating voltages, and also that plate and grid voltages, derived from metal rectifiers, are stabilized by means of small capacity floating batteries. Simplified schematics of the micro-ray portions of the transmitter and receiver are shown in Fig. 5 and Fig. 6, respectively.

Propagation measurements covered the two links, St. Margarets-Escalles and Lympne-St. Inglevert, over a discontinuance period from February, 1931 to July, 1935. As a general conclusion, it may be stated that the signal is steady during the winter months but subject to large variations during the summer. A fall of 40 db. in the output audio signal has been encountered. In the case of both links there is an unobstructed optical path between terminal stations and, in the case of the St. Margarets-Escalles link, the distance station can be easily seen on a clear day.

Fading has been found to be simultaneous in both directions on the same wavelength and to be independent of polarization. This applies to either link; in fact, propagation conditions over the two links are very similar, though one is twenty-one miles and the other thirty-five miles long. Inasmuch as the links are unaffected by rain, hail, snow, or fog, provided meteorological conditions are constant, the fading appears to be due to changes in an interference pattern, rather than to absorption.

New "Super Pro" Developed Skillfully

(*Continued from page* 680)

settings of the band-width at 3, 6, 10 and 16 respectively a remarkable precision result. Since the major portion of the receiver's selectivity is in the I.F. amplifier, there is but little variation throughout its entire tuning range. The type 6D6 tubes are used in this amplifier circuit.

Two stages of radio frequency amplification using 6K7 tubes are used in this model, to afford a high input with maximum image suppression.

The AVC system used is of the amplified and delayed type, using the 6B7 as both amplifier and rectifier.

The audio components of the 6B7 second detector diode circuit is capacitively coupled to the A.F. gain control. This first A.F. stage is resistance-capacity coupled to the grid of the driver stage, which uses a 6F6 in class "A". The output stage is transformer-coupled to the driver and consists of two 6F6's operated as triodes class AB. A special curve was made for the fidelity of this receiver with the results shown in figure B. The test was made with the input at 100 microvolts modulated 30% from 30 to 10,000 CPS, with a 50 ohm resistor in series with each "A" post. The sensitivity was adjusted to produce two watts (4 volts across 8 ohm load) at a modulation frequency of 400 CPS. The A.F. gain was set at 10, and the signal frequency was 1,000 kc.

(*Continued on page* 713)

New Super-Pro

(Continued from page 712)

Taking the 6 db loss as the cut-off point, it is seen that the fidelity follows closely the settings of the band-width control with settings of 3, 4, 6, 10 and 16.

Another important feature of the new "Super Pro" is the individual coil construction and application. Each tuning coil is mounted on an isolantite base. The coils for the lowest frequency ranges are four-bank litz windings, while the others are space-wound solenoids on low-loss bakelite tubing. Each coil has a trimming capacitor mounted on its isolantite base for circuit alignment at the high-frequency end of its range. At the low-frequency end, alignment is accomplished by adjusting the inductance with a copper disc on an adjusting screw turning in a friction bushing mounted in the top of each coil. In the case of the five oscillator coils, the trimming capacitors consist of air-dielectric variables, similar to those used in the intermediate frequency transformers. The use of these special air-dielectric condensers assures stability of both the gain and selectivity, even under the most adverse atmospheric conditions.

Another interesting feature is the *Send-Receive* switch, which enables the operator to cut-off the receiver B supply, but still keep the filaments heated, so that the set can he promptly turned on again without any loss of the signal tuned to, either as to volume, tone, or quality.

(Next Mr. Lewis will describe still other features and discuss an unusual "listening post" test.)

(This article has been prepared from data supplied by courtesy of Hammarlund Mfg. Co.)

Ultra Short Waves and "Blind Landing" in Europe

(Continued from page 668)

on the instrument panel lights up, warning him of the fact, and telling him how far to travel before bringing his plane to a stop.

The Ground Equipment

The radio equipment which permits this positive landing is interesting to the radio man and is therefore described briefly, below.

The main landing beam which is operated on a wavelength of 9 meters consists

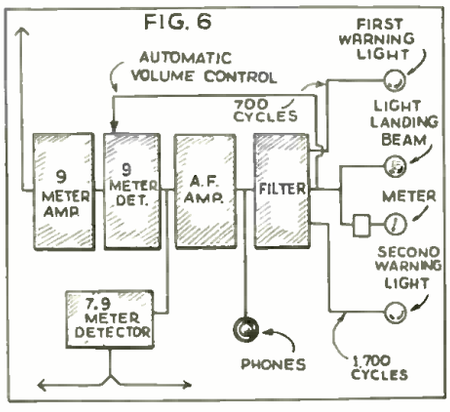


Fig. 6, Block diagram showing "landing beam" and "warning" receivers and antennas.

of a 500 watt, remote-controlled transmitter, feeding a vertical di-pole and two reflectors, in such a way that the left beam sends *dashes* and the right beam sends *dots*. These dots and dashes are synchronized so that the dots fill the spaces between the dashes, thus giving a continuous signal "on course." The way in which this double signal system is accomplished can be seen in Fig. 1. The antenna with one reflector sends out a signal "off side" in one direction, while the antenna with the second reflector sends signals "off side" in the opposite direction. The combination of the two is a sharply focused signal in the direction of the beam. Fig. 2 shows the appearance of the aerial and the two reflectors.

The appearance of the transmitters which send out the signals for the warning lights, which are 5 watt units operating on 7.9 meters using horizontal di-pole aerials having curved screen reflectors placed below them, are shown in Fig. 3. These transmitters send waves straight up, as shown in Fig. 4, which shows the shape of the radiated waves.

An idea of the complete set-up can be seen in Fig. 5. The positions of the transmitters on opposite sides of the landing field are indicated as well as the distances between them.

The Plane Equipment

The receiver on the plane which picks up the signals for blind landing is quite ingenious. As shown in Fig. 6, in block form, it consists of a 9 meter amplifier and detector for the landing beam and a 7.9 meter detector fed from a different aerial, both sets feeding into a common A.F. amplifier and separated by a series of filters which separate the 700, 1150 and 1700 cycle modulation notes of the "first warning," "landing beam" and "final warning," respectively.

A pair of headphones is inserted in the circuit before the filter, so that *all three modulated signals* can be heard as they are picked up.

Up to the present time, according to *L'Industrie Francaise Radio-Electrique* (Paris) in which the description originally appeared, landing beams of this type have been installed at the airports in Paris, Berlin, Hanover, Cologne, Zurich, London, Vienna, Varsovie, Munich, Leipzig and several other cities. Additional set-ups are being prepared for many other cities, so that a plane equipped with the Lorenz equipment can land safely during fog or blinding storm in any city in Europe, due to the standardization of the equipment.

4-Color Diagrams

● TO facilitate study of the action of a Tuned Radio Frequency Receiver, Sprayberry Academy of Radio announces a lesson in which a circuit diagram in full *four colors* plays a prominent part. This and other lessons with color diagrams now in the course of preparation will be supplied at no additional cost to students.

By illustrating various circuit components in colors, study is greatly simplified. It becomes easy for the student to trace a signal through the circuit or to understand the action of various units.

In preparing the colored diagram, Mr. Sprayberry has attempted to portray the various kinds of voltage and current in a graphic, readily understandable manner. Signal voltage is represented throughout the circuit, for instance, by orange dots and dashes. The relative grouping of these dots and dashes also indicates, to a fair degree, the amplification of the signal as it passes through the various stages.

This article has been prepared from data supplied by courtesy of The Sprayberry Academy of Radio.

What Size Condenser or Resistor?

(*Continued from page 674*)

receiver must be selected so that their reactance will be equal to 1/50 of the value of the isolating resistor in ohms, at a frequency of 550 kc. For example, a plate circuit isolating resistor has a resistance of 5,000 ohms. The lowest frequency encountered in this particular circuit is 550 kc. (the low frequency end of the broadcast band). What capacity condenser should be used?

From the table under the 500 kc. (the closest to 550 kc.) column we find that a .005 mf. condenser would have a reactance of 63 ohms, and that a .001 mf. condenser would have a reactance of 318 ohms. The proper condenser to select would be the .005 mf. condenser, as it more closely fulfills the requirements of having a reactance of 100 ohms or less at the lowest frequency involved in the circuit. The condenser having a capacity of .005 mf. with its resistance of 63 ohms is ideal as its reactance is actually less than 1/50 of the value of resistor R.

Let us take another example, and select the suitable capacity which is to be used to prevent degeneration in the cathode circuit of a pentode-type power tube. The normal cathode biasing resistor of the tube is known to be 400 ohms. Selecting a condenser with a reactance of 8 ohms at 50 cycles, the lowest audio frequency in the circuit (assumed) which is 1/50 of 400 ohms, this would indicate the use of 400 mf. condenser, which is not available and is entirely too costly and impracticable. Therefore, there must be some minimum ratio which can be used under conditions such as this, which will give a reasonable degree of efficiency and justify the use of the capacity in the circuit.

Practical Versus Theoretical Values

Tests involving the efficiency of the reactance method of calculation, particularly at low frequencies, proves for the optimum operating conditions that the ratio of 1/50 is correct. However, for *general purposes*, where the value of R is very low and where absolute efficiency of performance must be sacrificed to some degree in order that the components ordinarily available can be used, a ratio of 1/10 will give results that will be effective enough to justify the cost. We find from the chart that an 80 mf. condenser would have a reactance of 39.8 ohms at 50 cycles, which would satisfy the operating condition 1/10 of 400 or 40 ohms. However, the standard condensers which are available for this purpose would be of the dry electrolytic type, and as these units are available in 50 and 100 mf. capacities today, it would be wise to make a choice of the 100 mf. unit which would have a reactance of 31 ohms.

It will be noted from the above that the hard part of the problem in selecting the condenser is that as R and the lowest signal frequency goes down, C must increase in size, thus increasing the cost of the isolating network. This may bring up a point in the reader's mind where in actual practice 25 mf. dry electrolytic condensers were used to prevent degeneration in pentode tube bias circuits with apparently satisfactory results. However, a 25 mf. condenser at 50 cycles will have a reactance of 63 ohms, and when used in conjunction with a 400 ohm resistor would not prevent degeneration at 50 cycles, although it would prevent degeneration at frequencies *HIGHER* than 50 cycles. That is why the use of a 25 mf. condenser apparently decreases the effect of degeneration as far as the ear is concerned, when considered from the angle of receivers and loud-speakers with limited low audio frequency range. It must be remembered that the reactance of the condenser will decrease with an increase in frequency and

thus become more effective. In audio channels used with the "average" *short-wave receiver*, we find that we are not interested so much in quality and if the response above 150 cycles is satisfactory, then a compromise value of condenser capacity can be used in the interest of economy. However, if you have a loud-speaker and amplifier system that is capable of low frequency reproduction, the difference between the two capacities, namely, the 100 mf. and the 25mf. will become more pronounced, and the additional smoothness of tone on low frequency passages makes the additional expense justifiable.

Judging the Best of 2 Values

Some confusion may develop in the reader's mind as to the method of reconciliation between the statement of having the capacitive reactance equal to 1/50 the resistor value in ohms, as compared to having the reactance equal to 1/10 of the value of the resistor in ohms. Wherever possible, the 1/50 ratio should be used and the 1/10 ratio used only at low audio frequencies when the value of R is limited by circuit considerations and efficiency is not important. Naturally, at high frequencies, it is a very simple matter to obtain the proper value of capacity reactance in relation to the resistance of R in ohms, so that economical filters or isolating networks can be designed. However, at low audio frequencies, where C must necessarily be large to obtain a low value of reactance, some compromise must be entered into to fulfill the reactance requirements at the lowest frequency encountered in the circuit. In very case, experimentation shows that any ratio of less than 1/10 is *practically useless* and the condenser might as well be left out of the circuit.

Information covering the proper value of bias resistor isolator or *voltage-dropping* resistor for any particular tube is seldom available when needed. Thus, this is one portion of the "R-C" problem that will require some figuring.

Many experimenters fail to take all of the possible currents that can flow in a cathode circuit into consideration. For that reason the circuits of Fig. 3 are shown. Note that the current flowing through the cathode resistor is the *sum total current* in that particular tube circuit. In all calculations be sure that you have taken *all possible currents* into consideration when calculating the bias resistor.

Practical Examples

Ohm's Law should be part of every radio experimenter's background. So, while the following may not be useful to some it surely will be helpful to many. In all of the following examples, "E" is the potential in Volts. "I" is the current in Amperes. (Not milliamperes). "R" is the resistance in Ohms. "W" is the power in Watts. Those readers not familiar with the applications of the *law* would do well to study the examples. Study the circuits of receivers and see how the various resistor values have been derived. This is excellent practice and the experience obtained will be useful in solving the many problems encountered in building a receiver. Especially when you have to try to adapt material already on hand.

The drawing of Fig. 4 illustrates the three basic units—E, I and R. If any two are known it is a simple matter to find the value of the third by means of the following:

1. $I=\frac{E}{R}$	6. $I=\sqrt{\frac{W}{R}}$
2. $R=\frac{E}{I}$	7. $E=\sqrt{W \times R}$
3. $E=I \times R$	8. $E=\frac{W}{I}$
4. $W=E \times I$	9. $I=\frac{W}{E}$
5. $W=I^2 \times R$ or $R=\frac{W}{I^2}$	10. $W=\frac{E^2}{R}$ or $R=\frac{E^2}{W}$

Formula 1

Known—Voltage and Resistance.

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(Signed)
William Owens,
30 North Fifth Street,
Bangor, Penna.

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I received the Globe-Lamp and I am very much pleased with it. I think it is handsome and think a good deal of it. I wouldn't take $15.00 for it. The lamp sets on top of the radio and is handy to glance at when I hear the foreign stations.
Warren G. Ryder,
Barnstable Radio Shop,
Barnstable, Mass.
P.S.: Many thanks for the lamp! WGR

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Gentlemen:
The Globe-Lamp arrived today, also the magazine. Congratulations on a premium so unique, beautiful and, above all, useful, especially to DXers on the short-wave bands. I already have a large globe, but I expect to use this small one much more frequently and with equal satisfaction. It goes fine with the new Hammerlund "Super Pro."
T. H. Warnock,
99 Elm Street,
Meriden, Connecticut.

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Unknown—Current.
Example—3 Volts appears across a 300 ohm resistance. What current is flowing?
Solution—$\frac{3}{300}$ = .01 ampere
Answer 10 milliamperes

Formula 2

Known—Voltage and Current.
Unknown—Resistance.
Example—What value "R" for biasing a 2A5 tube? The voltage drop should be 16.5 volts. The cathode current is .034 ampere.
Solution—$\frac{16.5}{.034}$ = 485 ohms.

Formula 3

Known—Current and Resistance.
Unknown—Voltage.
Example—The screen circuit of a tube draws .0005 Ampere. A resistor of 500,000 ohms is used as a isolator and voltage dropping resistor. What Voltage will drop across the resistor?
Solution—.0005 (ampere) × 500,000 (ohms) = 250 Volts

Formula 4

Known—Voltage and Current.
Unknown—Watts.
Example—The above 500,000 ohm resistor has a current of .0005 ampere flowing through it. What wattage will be dissipated in the resistor when the voltage drop is 250 Volts?
Solution—250 Volts × .0005 ampere = .125 watt.

Formula 5

Known—Current and Resistance.
Unknown—Watts.
Example—As in the above problem a current of .0005 Amperes flows through a 500,000 Ohm resistor. What is the Wattage dissipation?
Solution—I^2=.00000025
I^2R .00000025 × 500,000 = .125 watt.

Formula 6

Known—Wattage and Resistance.
Unknown—Current.

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Example—The 300 Ohm resistor of Formula 1 is rated at 1 Watt by the manufacturer. What is the maximum permissible current through the resistor?

Solution—$I = \sqrt{\frac{W}{R}\ \frac{W}{R}} = \frac{1}{300} = .0033$

$\sqrt{.0033} = .057$ ampere (or 57 Milliamperes.)

Formula 7

Known—Wattage and Resistance.
Unknown—Maximum permissible Voltage drop across the resistor.
Example—A 5000 Ohm resistor is rated at 20 Watts. What is the maximum voltage drop permissible across the resistor?
Solution—$.5000 \times 20 = 100000$
$\sqrt{100000} = 316$ (Volts).

Formula 8

Known—Watts and Current.
Unknown—Voltage that will cause resistor to dissipate rated Wattage.
Example—A resistor is rated at 20 Watts. The current flowing through it is known to be .01 ampere. What voltage will cause the resistor to dissipate rated wattage?

Solution— $\frac{20}{.01} = 2000$ (volts.)

Formula 9

Known—Watts and Volts.
Unknown—Current flowing when unit is dissipating rated Wattage.
Example—In the above Formula 8 the voltage is 2000 volts. The rated wattage is 20. What current flows when the resistor is dissipating rated wattage?

Solution— $\frac{20}{2000} = .01$ (Ampere) or 10 milliamperes.

Formula 10

Known—Resistance and voltage.
Unknown—Wattage.
Example—The resistor of formula 1 is a 300 ohm unit. The voltage drop across it is 3. What wattage is the resistor dissipating?

Solution— $\frac{E^2}{R} = \frac{3 \times 3}{300} = \frac{9}{300}$ .03 (watt)

Having covered all of the applications of Ohm's law and armed with the tabulations of Fig. 5 we can combine these useful tools and make intelligent "R-C" selections.

Can Short Waves Prevent "Lost" Planes?

(*Continued from page* 663)

halfway across one of our smaller states), away from the last *location* report.

Another scheme suggested by the writer is to have a distinctive radio signal for each plane, and these signals could be transmitted continuously or at very short intervals of a few minutes and the individual signals recorded at the *ground* stations. Of course, with a large number of planes flying over our various air routes, it might be objected that this scheme would require too many different signals, but in view of the fact that only a few planes would be flying over a certain 100 or 200 mile section at one time, this plan would seem to be within the realm of practicability. Fig. 1 graphically shows this idea.

Reports state that the pilot of the plane which crashed on a mountain-top at Port Jervis, thought he was over Camden, New Jersey, (about 100 miles distant) and he therefore reduced his altitude and was looking for the Camden Airport. In the same breath, the pilot had gotten off the Washington and Newark radio beacon paths, and was off the beam at least 50 miles. Some reports say that he was heading for the Newark Airport; in any event, if one of the new Simon radio-direction finders had been installed on the plane, and considering that high winds and bad visibility had forced the plane off the beacon path, he could have quickly determined his location by taking a *radio sight* on a broadcast station or two. The regular short-wave broadcasting stations such as those at Bound Brook, N.J., or some other stations which

would have given him a triangulation check.

The Simon direction finder has been so perfected that even the distance from the radio transmitting station can be read on the instrument. But this instrument costs an appreciable sum and it takes time of course, for the aviation companies to satisfy themselves that such an instrument is accurate and reliable. Another reason why this is mentioned, is because of the fact that considerable radio research work is carried out by radio engineers connected with the aviation interests and it would seem that research in this direction should be speeded up.

With bad visibility, and not knowing his exact location, the pilot of a plane more than once has crashed into a mountain as occurred at Port Jervis recently. Scientists have long busied themselves in trying to perfect an altitude meter that would indicate the presence of a mountain, and some years ago a radio type instrument was demonstrated by engineers of the General Electric Company. Of course, it could occur that a plane fitted with the best type of altitude meter could be flying over level ground and in another minute or two strike a mountain, a radio tower or other structure. The only way to prevent this is possibly to use either a sound wave or radio wave *echo* system, such as that employed on the S. S. *Normandie* for detecting obstacles ahead of it

In this way the pilot, providing he was flying off the beacon signal and with bad visibility could switch on the echo *obstacle-detector* and be shooting out short waves (or a sound wave) ahead of the plane. Any reflected echo, such as would result if he were flying toward a mountain, would cause an instrument to announce this fact immediately.

Another possibility of checking an accurate mark on the location of a plane and utilizing short waves might be patterned after the method now used by the government weather bureau experts, and by means of which the *location* and *altitude* of a trial balloon is checked for considerable distances and long after the balloon has passed out of sight. Fig. 4 shows a triangulation method whereby signals radiated from the plane, possibly from a special transmitter giving a constant stream of a certain predetermined type of signal is constantly "spotted" by the ground stations. A system somewhat similar to the one here discussed is used in checking planes by radio in their flight across the Pacific. Following up this idea from another direction, we have just received pictures and data on a new German ultra-short-wave *surveying* instrument, which has been developed to a very high state of precision. A variation of this device might be worked out to keep track of planes in flight. An article on this new radio surveying device will appear shortly.

Television Images Seen 70 Mi. from Transmitter

(*Continued from page* 663)

New York and other large cities. In other words, due to radio shadows, absorption, etc., due to steel-frame buildings, in which thousands of apartment dwellers reside, it does not seem—from the field tests made by engineers in the past few years, that anything like *uniform* reception of image signals will be obtained by those attempting to use television receivers in office or residential buildings in a city like New York.

Most probably, at least for the first few years of television, we will not have to pick-up more than one frequency; in this case an elevated aerial of the dipole type for instance, may be erected on top of an apartment, hotel, or office building, and the image signals *piped* through a suitable lead-in or *concentric cable* to a series of transformers or other coupling devices, and to which the respective television receiving sets will be connected. Thus tomorrow, if you should purchase a television receiver and wish to use it in one of the steel-frame buildings in a city, it will probably be the case that instead of erecting your own antenna (or trying to use a dipole right in the apartment or office, and possibly having to move the set or the aerial around to a number of different locations, in order to pick up a sufficiently strong signal) that you will simply connect the television receiver to an antenna terminal or an outlet provided for your apartment or office.

As we go to press, a radio experimenter in New York City, states that he has actually seen television images reproduced on one of the new small cathode ray tubes measuring about 6-inches long. By placing a magnifying lens in front of a small cathode ray tube, and providing the efficiency of the cathode tube is improved to the point where a good brilliant image is produced, the secret of the low-priced popular television receiver which the public is looking for and will demand seems to have been found.

We recently described one of the new German television receivers which utilized this principle, but the cathode tube was not as small as the new one now available on the American market and supplied specifically for use in oscilloscopes for studying wave patterns.

A television receiver, employing a cathode ray tube anywhere from 12 to 24 inches in length and costing from $20.00 to $40.00, will not make television very popular with the general public, especially when a *replacement* tube has to be purchased. It may take considerable laboratory research but the "handwriting is on the wall" and this small cathode ray tube, costing but a few dollars, is going to be the real secret of *tomorrow's* television receiver for Mr. John Q. Public.

Short Waves and Long Raves

(*Continued from page* 667)

tinents have been worked in an hour, Africa being the stumbling block for WAC at the time. The station is now WAC several times, WBE, and the O.M. is an original foundation member of the *Rag Chewers Club*. To date 54 countries have been worked in all continents. Some 2400 contacts have been made, using never more than a 202 or 210. The aerial is a single-wire, with small counterpoise, in a poor location but is always used.

Harold L. Hobler,
202 Campbell Street,
Rockhampton,
Queensland,
Australia.

He Finds Our Sets O.K.!

Editor, SHORT WAVE & TELEVISION:

I wish to congratulate you upon some of your fine circuit designs. I have built quite a few sets from your plans, such as the *Oscillodyne*, *Pocket Set*, and *Monocoil*. All of these sets work f.b. (Fine Business.)

I am now using a set consisting of a 57 detector, 56 first audio, pair of push-pull 2A5 amplifiers, and an 80 rectifier. This was built from parts of different circuits which I found described in *Short Wave Craft*. I have heard all of the American short-wave stations and all of the English G's and German D2's. I've also heard EAQ, 2RO, T1PG, CRCX, YV2, RC-COCO-COCD, YV3RC, HP5B, CJRX, LKJ1, VK3LR, HF4ABC, HJ1ABB, H13U, YV5RMO.

I have also received seventy-five police stations and approximately one hundred amateurs. This is a total of about 250 short-wave stations, not counting CW—I must say that *Short Wave & Television* is the best radio magazine on the market hi-hi.

D. R. King,
6931-1st Ave., No.
Birmingham, Ala.

He Enjoys Every Page

Editor, SHORT WAVE & TELEVISION:

I am taking this opportunity to express my opinion in regards to the *Short Wave & Television* magazine.

I have been very much interested in radio for about five years. My brother is a "HAM" and has a ticket. His call is WIJUZ. About a week ago he received a special privilege of which he applied for, from the A. R. R. L. This is the official *QRR* emergency "key-station" ticket of this district. He is on forty, twenty, eighty, and five meters, with most of the work being done on the five-meter band at the present time. He uses an RCA-ACR-136 receiver.

I, as yet, am not a licensed "Ham" but I intend to get my "ticket" in a very short while. I feel that I have had quite a good deal of experience with my brother's "rig," and all that is holding me back from getting a license at the present time is the amount of school work that takes up most of my time.

I have greatly enjoyed *Short Wave & Television* for a number of years, because of its up-to-date and well-written material. I usually buy it every month and read every page of it with the greatest of enjoyment. I am glad to be able to find and to buy such a useful, up-to-date magazine.

I have a General Motors six-tube receiver that will go as low as sixteen meters, covering all the amateurs and foreign short-wave stations. I am intending to get a Ham receiver that will be able to give me a great deal more bandspread and I hope more DX. At the present time I will manage to pull through a few G5's and VE's without complaining too much. *Hi!*

Hulbert Irving Wit,
38 Burr Road,
Newton Center, Mass.

(Swell! Hulbert, let's hear more!—Ed.)

• Index to Advertisers •

(While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.)

. . . SHORT WAVE ESSENTIALS

FOR MEMBERS OF THE SHORT WAVE LEAGUE . . .

Application for Membership SHORT WAVE LEAGUE

SHORT WAVE LEAGUE 3-37
99-101 Hudson Street, New York, N. Y.

I, the undersigned, herewith desire to apply for membership in the SHORT WAVE LEAGUE. In joining the LEAGUE I understand that I am not assessed for membership and that there are no dues and no fees of any kind. I pledge myself to abide by all the rules and regulations of the SHORT WAVE LEAGUE, which rules you are to send to me on receipt of this application.

I consider myself belonging to the following class (put an X in correct space): Short Wave Experimenter ☐ Short Wave Fan ☐ Radio Engineer ☐ Student ☐

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A FEW WORDS AS TO THE PURPOSE OF THE LEAGUE

The SHORT WAVE LEAGUE was founded in 1930. Honorary Directors are as follows: Dr. Lee de Forest, John L. Reinartz, D. E. Replogle, Hollis Baird, E. T. Somerset, Baron Manfred von Ardenne, Hugo Gernsback, Executive Secretary.

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

FREE MEMBERSHIP CERTIFICATE

As soon as you are enrolled as a member, a beautiful certificate with the LEAGUE'S seal will be sent to you, providing 10c in stamps or coin is sent for mailing charges.

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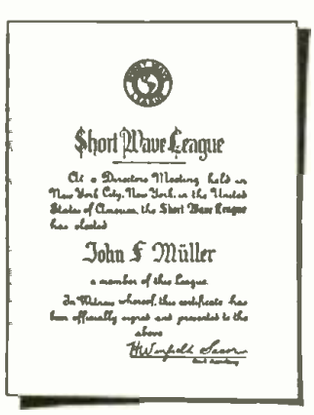


If you wish your name engraved on the Free membership certificate, as illustrated above, please send 25c to cover cost.

SHORT WAVE ESSENTIALS LISTED HERE SOLD ONLY TO SHORT WAVE LEAGUE MEMBERS

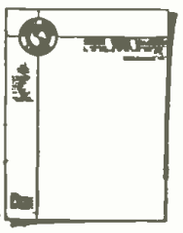
They cannot be bought by anyone unless he has already enrolled as one of the members of the SHORT WAVE LEAGUE or signs the blank on this page (which automatically enrolls him as a member, always provided that he is a short wave experimenter, a short wave fan, radio engineer, radio student, etc.).

Inasmuch as the LEAGUE is international, it makes no difference whether you are a citizen of the United States or any other country. The LEAGUE is open to all.

SHORT WAVE LEAGUE LETTERHEADS

A beautiful letterhead has been designed for members' correspondence. It is the official letterhead for all members. The letterhead is invaluable when it becomes necessary to deal with the radio industry, mail order houses, radio manufacturers, and the like; as many houses have offered to give members who write on the LEAGUE'S letterhead a preferential discount. The letterhead is also absolutely essential when writing for verification to radio stations either here or abroad. It automatically gives you a professional standing.

A—SHORT WAVE LEAGUE letterheads, per 100..... **50c**



A—50c per 100

RADIO MAP OF THE WORLD AND STATION FINDER

The finest device of its kind published. The world's map on heavy board is divided into 23 sections, while the rotary disc shows you immediately the exact time in any foreign country. Invaluable in logging foreign stations. Also gives call letters assigned to all nations. Size 11"x22".

C—Radio Map of the World and Station Finder .....Prepaid **25c**

GLOBE OF THE WORLD

This highly important essential is an ornament for every den or study. It is a globe, 6 in. in diameter, printed in fifteen colors, glazed in such a way that it can be washed. This globe helps you to intelligently log your foreign stations. The base is of solid walnut, and the semi-meridian of a nickel-like metal. Entire device substantially made, and will give an attractive appearance to every station, emphasizing the long-distance work of the operator.

D—Globe of the World .....Prepaid **89c**

C—25c each

SHORT WAVE LEAGUE LAPEL BUTTON

This beautiful button is made in hard enamel in four colors, red, white, blue and gold. It measures three quarters of an inch in diameter. By wearing this button, other members will recognize you and it will give you a professional air. Made in bronze, gold filled, *not plated*. Must be seen to be appreciated.

E—SHORT WAVE LEAGUE lapel button.....Prepaid **35c**

EE—SHORT WAVE LEAGUE lapel button, like the one described above but in solid gold .....Prepaid **$2.00**

SHORT WAVE LEAGUE SEALS

These seals or stickers are executed in three colors and measure 1¼ in. in diameter, and are gummed on one side. They are used by members to affix to stationery, letterheads, envelopes, postal cards and the like. The seal signifies that you are a member of the SHORT WAVE LEAGUE. Sold in 25 lots or multiples only.

G—SHORT WAVE LEAGUE seals.....per 25, Prepaid **15c**

SHORT WAVE MAP OF THE WORLD

This beautiful map, measuring 18x26 in. and printed in 18 colors is indispensable when hung in sight or placed "under the glass" on the table or wall of the short wave enthusiast. It contains a wealth of information such as distances to all parts of the world, political nature of the country in which a broadcast station is located, etc., and from the manner in which the map is blocked off gives the time in different parts of the world at a glance.

F—SHORT WAVE Map of the World.....Prepaid **25c**

D—89c each

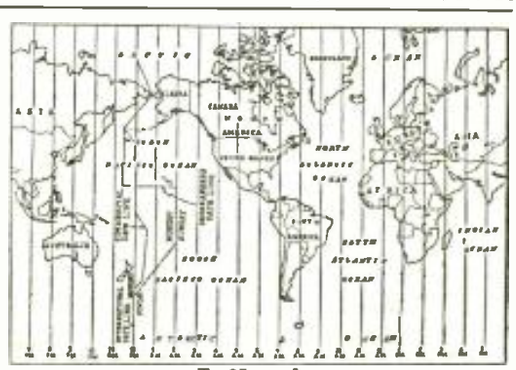
PLEASE NOTE THAT ABOVE ESSENTIALS ARE SOLD ONLY TO MEMBERS OF THE LEAGUE—NOT TO NON-MEMBERS.

Send all orders for short wave essentials to SHORT WAVE LEAGUE, 99-101 Hudson Street, New York City.

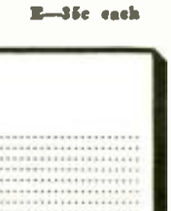
If you do not wish to mutilate the magazine, you may copy either or both coupons on a sheet of paper.

SHORT WAVE LEAGUE 99-101 Hudson St., New York, N. Y.

G—15c for 25



F—25c each



E—35c each

SHORT WAVE LEAGUE, 99-101 Hudson Street, New York, N. Y.

Gentlemen:

I am already an enrolled member in the SHORT WAVE LEAGUE ☐
I am a new member and attach my application to this coupon ☐
Please send me the following short wave essentials as listed in this advertisement:

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for which I enclose $..... herewith.

(The LEAGUE accepts money order, cash or new U. S. Stamps in any denomination. Register cash and stamps.)

Name .....
Address .....
3-37 City and State .....
Country .....

KABLE BROS. CO., PRINTERS

BEHIND THE NEW CATALOGUE

Behind the new National Catalogue is a group of fine products that show in every detail the twenty-two years experience that guided their design. National has always stood for quality. The small group of transmitter parts shown above are representative of the entire National line, for each National part has a specialized fitness, each does its task superbly well. Send tor your copy of the new catalogue to Dept. S.W.

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I HAVE TRAINED MANY MEN TO START A SPARE TIME OR FULL TIME RADIO SERVICE BUSINESS WITHOUT CAPITAL

Do you want to make more money? I'm so sure that I can train you at home in your spare time for a good Radio Job that I'll send you a sample lesson absolutely FREE. Examine it, read it, see for yourself how easy it is to understand even if you've never had any technical experience or training.

Many Radio Experts Make $30, $50, $75 a Week

Radio broadcasting stations employ engineers, operators, station managers and pay up to $5,000 a year. Spare time Radio set servicing pays as much as $200 to $500 a year. Full time Radio servicing jobs pay as much as $30, $50, $75 a week. Many Radio Experts own and operate their own full time or part time Radio sales and service businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, paying up to $6,000 a year. Radio operators on ships get good pay and see the world besides. Automobile, police, aviation, commercial, Radio, and loud speaker systems offer good opportunities now and for the future. Television promises many good jobs soon. Men I have trained are holding good jobs in all these branches of Radio.

Many Make $5, $10, $15 a Week Extra in Spare Time While Learning

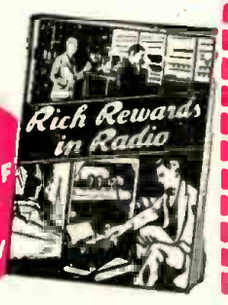
Practically every neighborhood needs a good spare time serviceman. The day you enroll I start sending you Extra Money Job Sheets. They show you how to do Radio Repair jobs that you can cash in on quickly. Throughout your training I send you plans and ideas that have made good spare time money—from $200 to $500 a year—for hundreds of fellows. I send you special Radio equipment and show you how to conduct experiments and build circuits which illustrate important Radio principles. My training gives you practical Radio experience while learning.

Get My Lesson and 64-Page Book FREE—Mail Coupon.

In addition to my Sample Lesson, I will send you my 64-page Book, "Rich Rewards in Radio." Both are free to any fellow over 16 years old. My book describes Radio's spare time and full time opportunities and those coming in Television; tells about my Training in Radio and Television; tells about my Money Back Agreement; shows you actual letters from men I have trained, telling what they are doing and earning. Find out what Radio offers YOU! MAIL THE COUPON in an envelope, or paste it on a penny postcard—NOW!

J. E. SMITH, Pres., National Radio Institute, Dept. 7CB3, Washington, D. C.

THIS FREE BOOK HAS HELPED HUNDREDS OF MEN MAKE MORE MONEY



MAIL THIS NOW

J. E. SMITH, President, Dept. 7CB3,
National Radio Institute. Washington, D. C.

Dear Mr. Smith: Without obligation, send me a sample lesson and your free book about the spare time and full time Radio opportunities, and how I can train for them at home in spare time. (Please write plainly.)

Name ..... Age .....

Address .....

City ..... State 14x1