THE RADIO EXPERIMENTER'S MAGAZINE

HUGO GERNSBACK
Editor

SHORT WAVE CRAFT

April

WORLD'S LARGEST SHORT WAVE CIRCULATION

An Ultra Short-Wave
BURGLAR ALARM
See Page 716

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for Short Wave Enthusiasts—
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Each globe contains a listing of several thousand cities in nations all over the world—spellings conform to international geographic standards—all globes are of 1935 production. They contain such important features as—traces of Admiral Byrd's recent voyage to Little America; Lindbergh's Paris flight; the new Japanese Empire; principal railroads; **principal international short-wave radio stations** and call letters; steamship routes; and other equally important data.

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PHYSICAL INFORMATION

Mountain ranges—Mountain peaks, volcanos—Plateaus, steppes—Glaciers, shelf ice—Swamps—Deserts, oases—Ocean currents in white—Rivers and river systems—Important lakes—Cataracts (Nile)—Depressions (Death Valley)—Unexplored areas in white.

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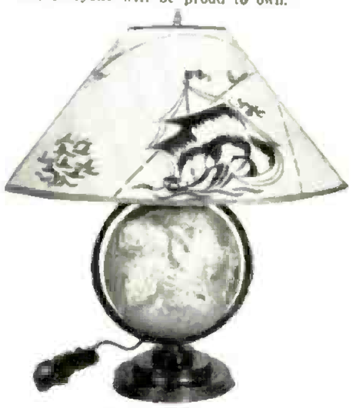

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World Globe-Atlas No. R-12

World Globe-Atlas No. R-12

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SHORT WAVE CRAFT 99 HUDSON STREET, NEW YORK, N. Y.

IN THIS ISSUE: PROMINENT SHORT-WAVE AUTHORS

Roberts • Free • Eckhardt • Palmer • Hooton • Shuart • Haynes

HUGO GERNSBACK
Editor

SHORT WAVE CRAFT

H. WINFIELD SECOR
Managing Editor

GEORGE W. SHUART, W2AMN
Associate Editor

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New 5-Meter Transmitter, by Howard McEntee, W2FHP.

Some Little-Known Facts about Short-Wave Aerials, by Arthur H. Lynch.

An A.F. Amplifier for Use with the Average S-W Receiver, by M. Harvey Gernsback.

"Frequency Modulation" Explained So That You Can Understand It, by Wilhelm Schrage.

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

OUR COVER

● The cover this month shows the ultra short-wave "burglar alarm" devised by Thomas S. McCaleb, Instructor in the Institute of Geographical Exploration of Harvard University. This method of trapping intruders by ultra short-waves is illustrated and described on page 716.

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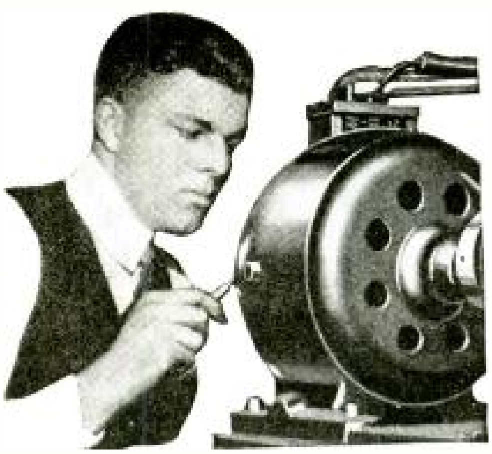

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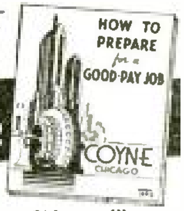

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HUGO GERNSBACK, EDITOR

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SHORT WAVE CRAFT

Short Wave Weather Forecasting

An editorial by HUGO GERNSBACK

● WE live on an approximately round ball, which may be compared with an ordinary apple. The earth, as we know, has a diameter of some 8,000 miles; the breathable atmosphere above the earth has a thickness of only about six miles; above this region we are in a zone of increasingly rarefied air. 50 miles up, the vacuum is probably better than the ordinary air-pump can produce.

If you compare the 8,000 miles diameter of the solid earth to the 15 miles of gas which comprises our explorable atmosphere, you will observe that the thickness of the atmospheric layer compares roughly, with the thickness of the peel of our apple.

In other words, our atmosphere is really insignificant in quantity, when we compare it with the rest of the earth's bulk.

Yet, in this exceedingly thin film of air—because that is really what it is—all the various atmospheric phenomena take place. Rain, snow, tornadoes, all the weather changes that we know of, take place in this very thin film of air. In addition to that, many of our radio wave phenomena occur in this layer.

A little farther up, from 50 to 200 miles, roughly, we find several films of ionized particles (the *ionosphere*). The so-called *ionosphere*, far up in the highly rarefied atmosphere, reflects most of our longer waves.

In the micro-wave spectrum, that is below 3 meters, no reflection back to the earth from this layer, seems to take place.

Observation has shown, though, that changes in the upper atmosphere have an effect upon the strength of ultra-short wave signals due to varying reflection. And these effects may be linked with our weather conditions, for our weather is "made" in this atmosphere. Changes in the upper atmosphere have long been known to affect various weather conditions, but it is only recently that their effects upon the ultra-short waves have been learned. And thus ultra-short waves may be employed in discerning the conditions in the upper atmosphere which cause different types of weather and so forecast future weather conditions.

From all of this it will be seen that our atmosphere is intimately linked with radio-wave propagation.

Formerly, while radio was still young, it was thought that the atmosphere had little or no effect upon radio waves. Little by little this idea underwent serious changes, till now we begin to realize that it will soon become possible to actually forecast the weather by close study and observation of the behavior of ultra-short waves.

This is borne out by an etirely new method of weather forecasting, which utilized the intensity or strength of ultra short-wave radio signals to indicate the conditions in the upper regions of the atmosphere.

This was recently described by Prof. Charles F. Brooks, director of the Blue Hill Meteorological Observatory of Harvard University.

While admitting that the use of this new weather forecasting method is still in the experimental stage, Professor Brooks went on record that short-wave broadcasting between the Blue Hill and Harvard meteorological station on top of Mt. Washington and observation posts located at other New England points, had already provided a good starting point for rough-weather forecasting.

"It was found a year ago," Prof. Brooks stated, "that ultra-high-frequency radio emissions from Blue Hill, received at Hartford, underwent variations in intensity which almost matched the changes in temperature between the surface and a height of 6,500 feet."

"Such variations are used by Ross A. Hull, who operates the receiving station for rough-weather forecasting."

"Rising signal strengths usually indicate the arrival of a warmer air mass aloft and presage rain or snow. Experiments with different wavelengths may provide us with more exact information in this indirect manner."

In addition to the above, Prof. Brooks made the observation that he holds out great hope for immediate improvement of weather forecasting, thanks to the new radio sounding balloons recently developed by Blue Hill Observatory staff.

He also remarked that he does not think that the millennium in weather forecasting is about to come immediately; but from the experimental work it would seem evident that a considerably higher degree of accuracy can be obtained, as more information and additional research work is made available.

"After all," says Prof. Brooks, "the weather is largely made overhead, so that is where we should be observing it—by clouds, by pilot balloons, by mountain stations, by airplanes, by radio transmission, by radio-meterograph sounding balloons."

And it is right here that radio experimenters and short-wave fans in particular can help science. It is suggested that they make observations as to the intensity of signals received from the four points of the compass; these observations can be plotted on a sheet of paper. Then, on the same sheet of paper, within 24 hours, the weather conditions are noted. The same thing can be repeated within 48 hours. Each day a new chart can be started.

Then, over a period of weeks and months, the results can be plotted; and it will be interesting to note exactly how radio intensity and radio phenomena are interrelated with the weather. If many hundreds of radio experimenters thus make observations, it will not be long before they will contribute a good deal of information to weather forecasting which in the future will be vital.

The interesting part for experimenters is that no new equipment is necessary: only their regular short-wave set, a few sheets of paper, and common sense in interpreting the relative intensities of radio signals as they come in from four different stations, located at four points of the compass.

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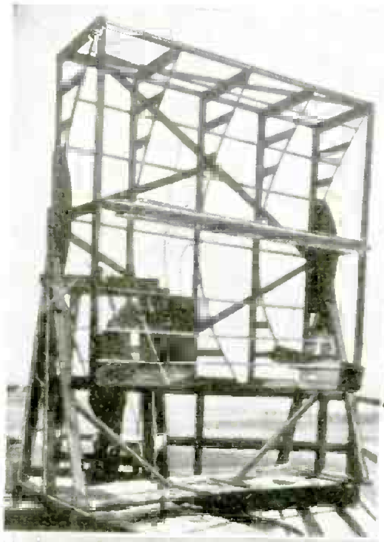
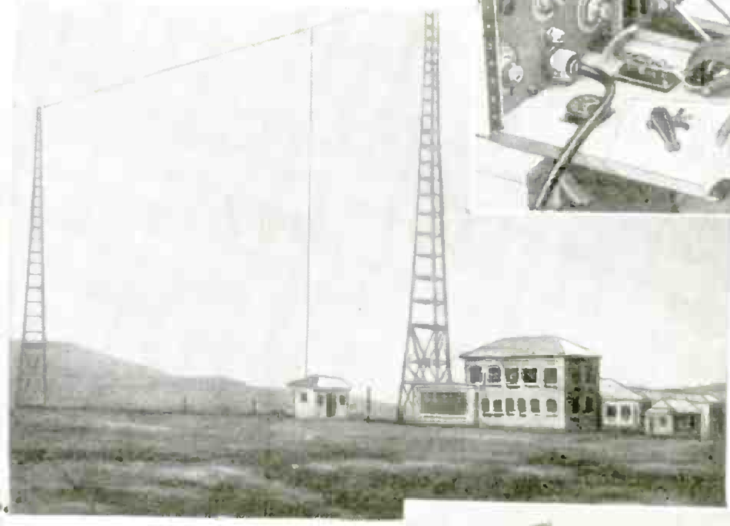
SHORT WAVE SNAPSHOTS

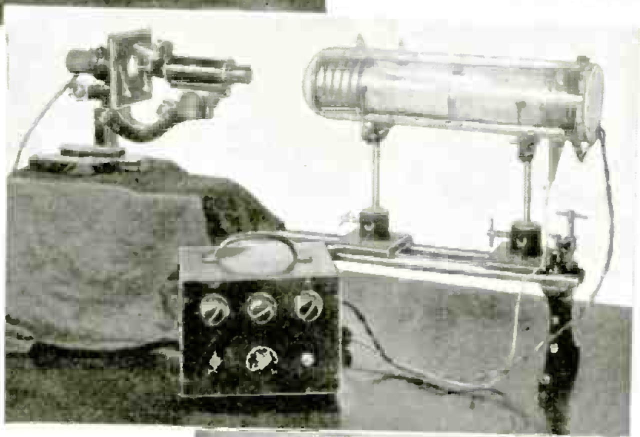
Short Waves in the Ethiopian Army—New Parabolic Reflector for short waves—latest S-W Diathermy Apparatus—New Zeppelin S-W Apparatus.

Below—new parabolic reflector for an 80 centimeter transmitter. A network of rods serves the same purpose as a smooth mirror surface and the waves are radiated in a concentrated beam by this reflector.

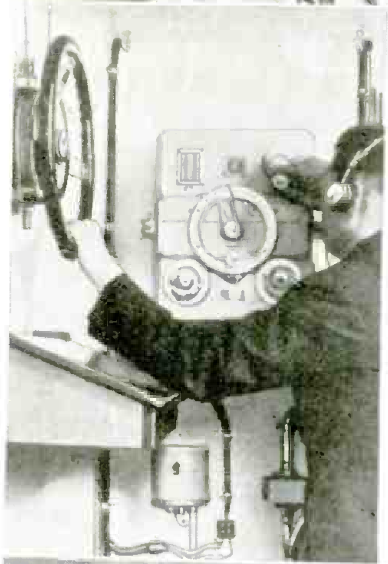




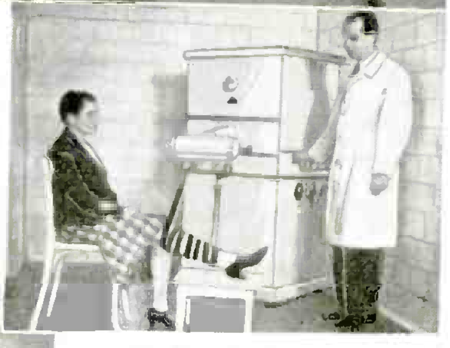
Short waves in the Ethiopian Army. Photo above shows two of Haile Selassie's radio experts operating short-wave transmitting and receiving apparatus in the field. This picture was taken near Dessye. Photo at left shows Ethiopia's short-wave link with the outside world; the station at Addis Ababa.

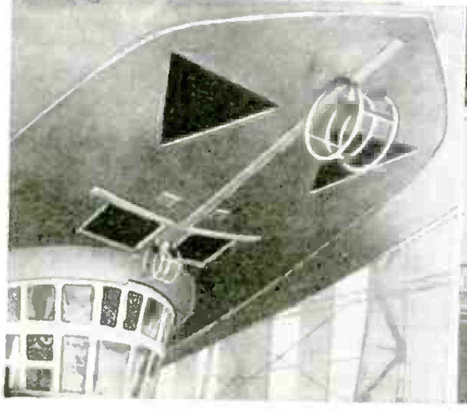


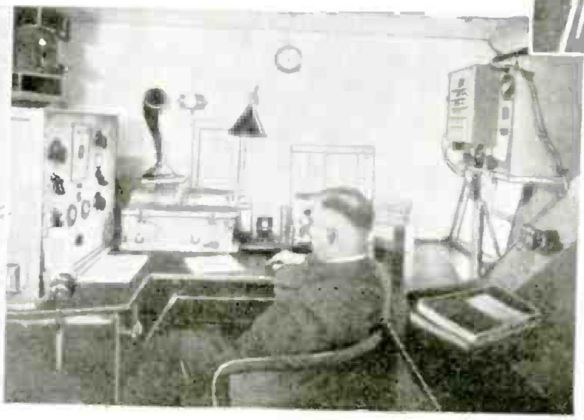
Right—A new electron image tube enabling man to "see through the dark," which was recently demonstrated before the American Association for the Advancement of Science in St. Louis, by Dr. V. K. Zworykin and Dr. George A. Morton of the Radio Corporation of America laboratories. The image tube (right) is used with an infra-red microscope. By means of this device, sensitive to infra-red rays, the development of hitherto baffling minute living organisms may be brought within the range of human vision. Such cells have been studied in the past by means of intense light or stains, that often kill them. The assembled scientists witnessed the projection of motion pictures through a dark glass filter that stopped all visible light rays. An "Electron telescope," using the same principle and opening the possibility of seeing through atmospheric haze, also was demonstrated.



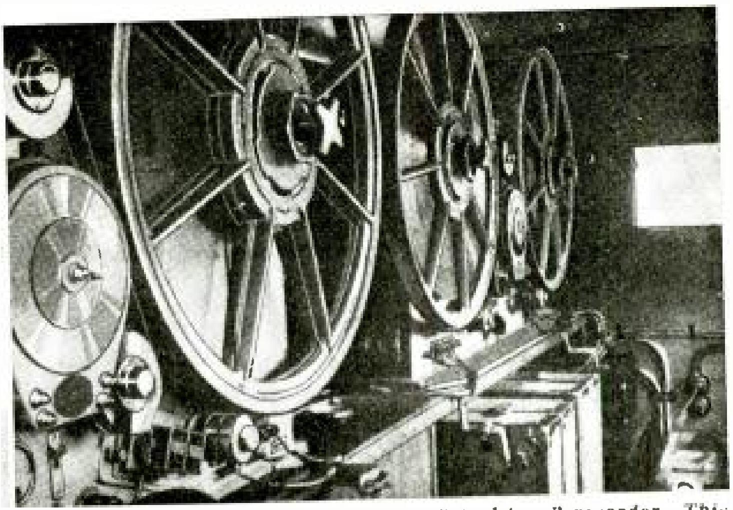
Three photos, left and below—new radio installation aboard German Zeppelin LZ 129. The radio equipment comprises a 200 watt long-wave transmitter, range 600 to 2,000 meters; one short-wave transmitter having a maximum out-put of 150 watts. The wave length range is continuously variable between 15 and 75 meters, and the set is suitable for code or phone. The same type tubes are used in both the short and long wave transmitters, thus simplifying replacement. Two all-wave receivers are provided, having variable range between 15 and 20,000 meters.







Above—latest German method of giving short-wave diathermy treatments. A heavy flat insulated cable, which is thoroughly flexible, is wound around the part of the body to be treated and the high frequency current from the vacuum tube oscillator is passed through this cable, heat being produced in the part under treatment. For some ailments the cable is wound around the neck, arm, and even around the trunk.



The German Broadcasting Company uses a special designed "sound truck," which is equipped with a "steel-tape" recorder. This truck is sent through the streets of Berlin and interviews the "man on the street" for his opinion about daily events, etc. The interview is recorded upon a steel tape and then presented to the listeners in the daily evening program under the heading "The Echo of the Day." The truck carries enough tape to record continuously a program lasting 1½ hours. By means of a magnet, the wire is "cleaned" of the previous recordings and can be used again and again.

Steel Tape Now Records Voice

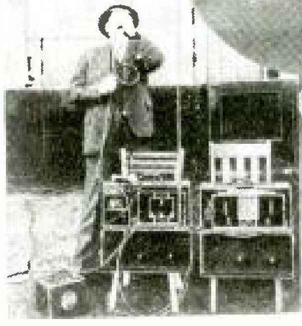
For Re-broadcast

• ENGLAND and Germany now record interesting program features on *steel tape*. The German Broadcasting Company, especially the transmitters at Berlin and Hamburg, and frequently the German *short-wave* transmitter are using steel tape recordings for an interesting and popular feature of their respective programs. The feature is well-known in Germany and abroad under the caption—"*The Echo of the Day.*" The British Broadcasting Company uses steel-tape recordings only to record or "store" the *news bulletins* radiated during the day over their domestic stations for a play-back over the Empire *short-wave* station at a later hour.

While the British Broadcasting Company applies stationary devices only, the German stations are furnished with some "sound-trucks" completely equipped with a steel recording outfit. This truck is sent through the streets of Berlin, Hamburg, etc., each day and interviews with the "man on the street" about his profession, his opinion on interesting daily events, etc., recorded. The car catches secretly also the talk of bystanders when an accident has happened and similar features which might be of interest to the radio audience later. The interviews are recorded inside the truck on steel tape and then transmitted in the evening under the popular title "*The Echo of the Day.*" As thousands of letters sent to the German broadcasting stations indicate, this feature is the best liked (*Continued on page* 750)

Pilot Explains Maneuvers By Short Waves

Major Al Williams and his Gulf Hawk, equipped with ultra-high frequency radio telephone equipment by means of which the noted flyer carries on a conversation with an announcer on the ground, explaining difficult aerial maneuvers as he goes through them and responding to requests made by the announcer, both ends of the conversation being amplified for the benefit of spectators. The plane's antenna is a wire about 6 feet long, stretched from the stub mast on top of the vertical rudder post to an insulator above the fuselage just aft of the cockpit.—Photographs from Western Electric Co.



Announcer carrying on a conversation with Major Al Williams, flying high over head in his "Gulf Hawk," by means of portable ultra-high frequency radio telephone equipment. Conversation made audible to spectators through loudspeakers; radio set consists of a 5-watt transmitter (left) and a receiver (right) both crystal controlled. The vertical rod about 7 feet long which serves as antenna for both receiving and transmitting may be seen. It can be telescoped into a length convenient for transporting.

Above: Ultra-high frequency radio telephone units in the cockpit of Major Al Williams' Gulf Hawk by means of which Major Williams carries on a conversation with an announcer on the ground. The unit at the left is the receiver and the one at the right is a 5-watt transmitter, both "crystal-controlled." Power is supplied by dynamotors under the forward cowling.

• HOW a flyer maneuvers and how he feels when he does so is being told to airport crowds by Major Al Williams, noted aviator, while actually in the air by means of a novel arrangement of radio and loudspeaking equipment. The apparatus, employing ultra-high frequencies, is being used for the first time in an airplane.

Major Williams demonstrates difficult aerial maneuvers and explains them to the spectator below as he goes along. He has already given this demonstration at the Miami air races and plans to repeat it at other airports in the future. His plane is a Curtis-Hawk equipped with an ultra-high frequency radio transmitter and receiver of the type ordinarily used to equip police cars for two-way communication with headquarters.

The transmitter has a power of five watts and operates on 35.6 megacycles, compared to the standard aviation band of 3 to 6 megacycles. Major Williams has obtained from the Federal Communications Commission a special license which permits him to operate in this experimental band for educational purposes.

The ultra-high frequency enables him to use an extremely short antenna on his plane, a wire running from the back of the fuselage to the top of the vertical fin. It measures only six feet in length where as the conventional airplane antenna is 35 feet long. His receiver is modified from the standard police type so that he can wear headphones as he twists and turns.

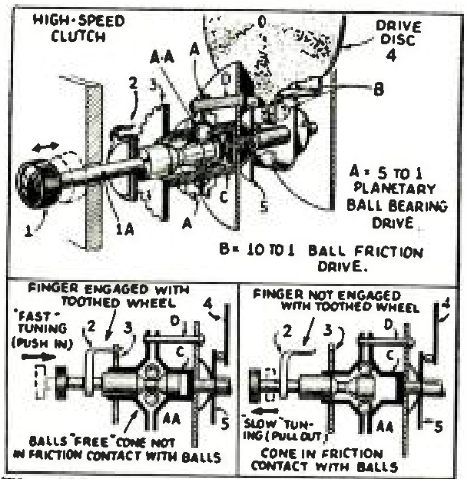
On the ground is located a similar transmitter, and a receiver of the type used in police headquarters or precinct stations. The antenna is a vertical steel rod about seven feet high, a so-called "fish-pole" antenna.

Once in the air, Major Williams converses with (*Continued on page* 746)

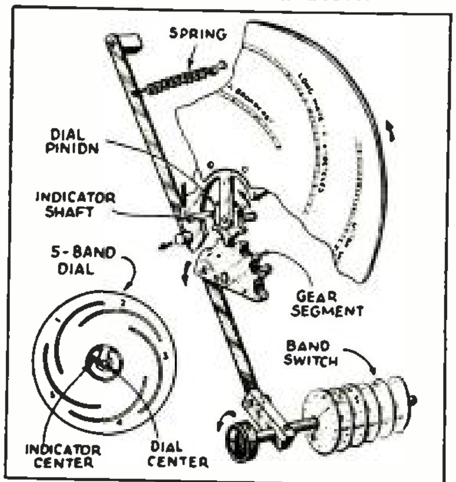
"Magic Brain" and "Eye" Make S-W Tuning Easy!

The "Magic Brain," now quite familiar to many short wave enthusiasts, combines several very clever mechanical engineering developments to simplify tuning; the "Magic Eye" tells you when the station is perfectly tuned in.

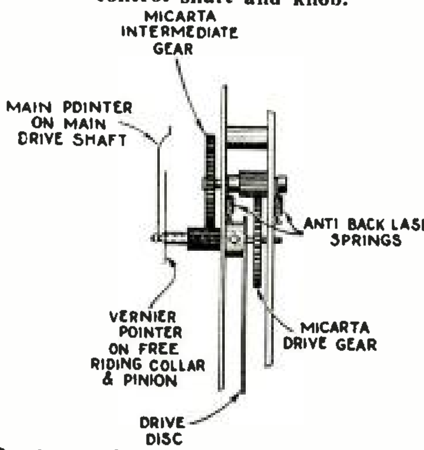
The appearance of the "Magic Eye" when the tuning is off resonance (left) and when on the exact resonance point of the station (right).



The "Magic Brain" method of selecting high or low speed tuning, by simply pushing a single knob in or out, is made clear from the drawing above.



The clever technique used in the "Magic Brain" for shifting the new dial scales for the different bands is illustrated above; it is coupled to the band-switch control shaft and knob.



Band-spread is effected in the "Magic Brain" by the simple gear system illustrated, springs taking up any backlash.

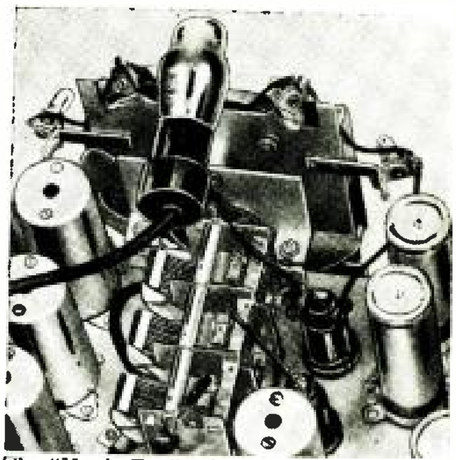
How "Magic Brain" Works

● MANY thousands of short-wave listeners have recently found that tuning in those elusive DX stations located "half-way 'round the world," is a comparatively easy job today—thanks to the "magic brain" and the "magic eye."

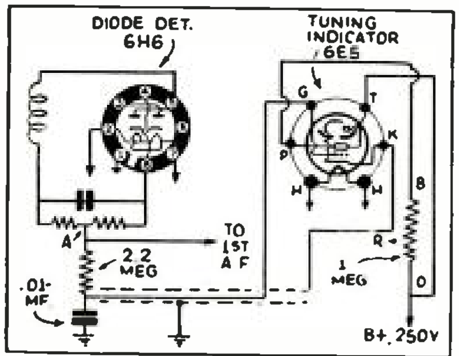
Probably the most important advance in the design of a short-wave receiver, so far as the general listener is concerned, is the "magic brain." One of the accompanying drawings shows a sectional view of the "magic brain" dial mechanism. Other features which this new tuning device provides, are positive drive of the tuning dial without any *backlash* or lost motion, and also *dual ratio tuning,* which is made instantly available to the operator of the set. All one has to do is to push in on the tuning knob and the tuning ratio is changed. The second drawing shows how a number of scales for the different frequency bands are cleverly laid out on a dial, which changes its position in a progressive, eccentric manner so that as the band-switch knob is changed to a new frequency band, for example, the *gear segment* is simultaneously rotated one tooth, and this in turn causes the dial pinion to rotate one tooth also; the result is that a new dial scale jumps into view behind the opening in the sub-panel each time the band switch is changed. Rotating the band selector switch knob, besides bringing a new dial into view, also takes care of changing a group of switches, all mounted on the same shaft, which changes the coils in the tuning circuit, etc.

The *speed-change* features of the "magic brain" dial are made clear from the drawing showing the ball-bearing drive. When the tuning knob 1, is pushed "in," the high-speed clutch finger 2, engages with the toothed wheel 3, and the mechanical drive to the main dial or drive disk 4, is through the self-centering cone race assembly A, spring washer assembly 5 and balls B, and these balls transmit rotary motion to the drive disk 4.

When the tuning knob 1, is pushed "in," the speed reduction is only 10 to 1. When the tuning knob is pulled "out" for *extra slow speed* tuning on the *short waves*, for example, the knob shaft, 1A, transmits its motion to the balls, AA and thence to the hub C. The balls, AA, are retained in three radial holes in the hub C and through this method of driving, the rotation speed of hub C is reduced 5 to 1. The assembly A is prevented from turning by the pin D. The spring washer, 5, pressing against the balls B, in contact with the drive disk 4, cause it to rotate; a further speed reduction of 10 to 1 is gained at this point—the total speed reduction from tuning knob 1 to the disk 4 is 50 to 1.



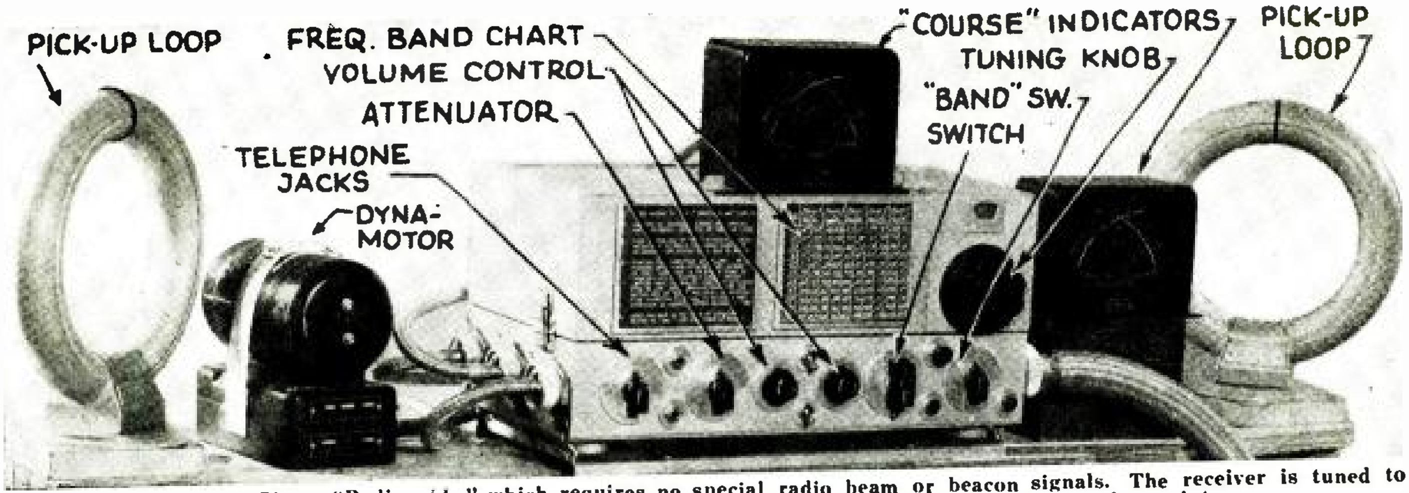
The "Magic Eye" tube, type 6E5, is mounted just above the tuning dial on the front of the chassis as here shown.



The simplified diagram shown above will help to make clear how the "Magic Eye" indicates when the station is tuned to exact resonance.

The "Magic Eye"

The "Magic Eye" actually permits you to "see" when the radio set is exactly tuned. It consists of a special cathode-ray tube (center) installed in the receiver so that only its dome, which bears a striking resemblance to the human eye, is visible. Designed to do by sight what the ear and the sense of touch cannot do as accurately, it does away with bothersome adjustments and off-center, blurred tone. It also permits silent tuning, because the volume need not be turned up until the station has been tuned in. When the radio receiver is in operation the "Eye" becomes luminous with a greenish fluorescence marked only by a fan-shaped shadow. As the signal is tuned in, *the shadow narrows down to a thin line* indicating that the set is tuned precisely to the station. To produce this effect, a cathode ray gun within the "Magic Eye" tube directs a stream of millions of tiny electrons on the photo-sensitive, or fluorescent surface of the "eye." The incoming signals vary this stream of electrons and control the movement of (*Continued on page* 747)



Appearance of the new Simon "Radioguide," which requires no special radio beam or beacon signals. The receiver is tuned to "any" broadcast or short-wave station and the plane can then be flown directly to that point.

Flying the Broadcast and the "Short-Wave"

By Henry W. Roberts
Pilot and Aviation Expert

A marvelous radio invention indeed is the new Simon "radio direction indicator" for aircraft. With this instrument the pilot can set his course on a certain broadcast or short-wave transmitting station and fly directly to this point.

● IN THE February issue of the *Short-Wave Craft* we described how pilots fly the radio range beacons. There are ninety-four such beacons, forming a coast-to-coast network, and serving the air traffic along the principal airways.

On the other hand, there are some 568 broadcast stations within the United States, and 104 marine range beacons along both coasts and the shores of the Great Lakes, and numerous short-wave stations. Each of these is a landmark to the pilot whose airplane is equipped with a reliable radio direction finder. By taking bearings on two or more of these stations, the pilot *off the beaten track* can find his exact position, or fly to any destination, whether it is served by the airway range beacon system, or not. The next step forward in the development of our aviation is the aircraft radio direction finder.

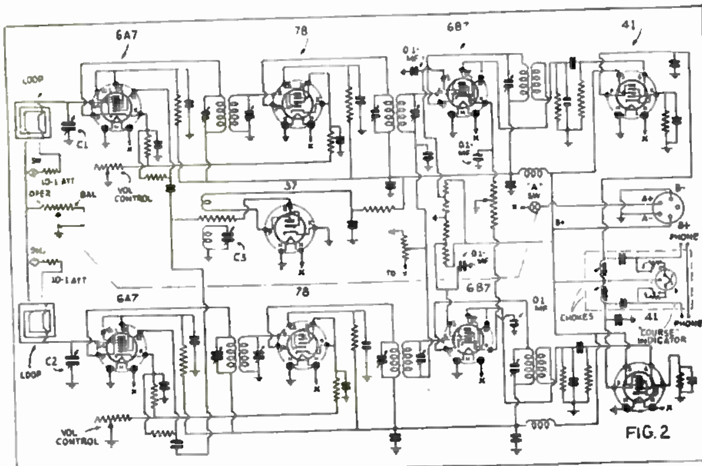
Radio direction finding is not new, and several types of devices have been developed for the purpose. The problems of radio navigation of aircraft, however, are so exacting and so complex, that many years had gone by before a truly practical radio direction finder for aircraft was perfected.

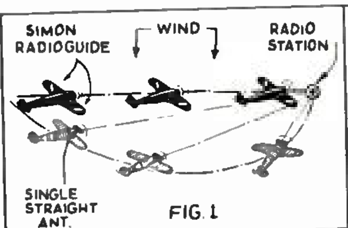
What a Pilot Needs to Fly "Blind"

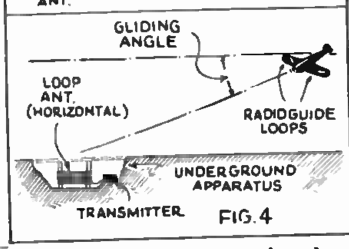
Let us consider the radio requirements of a pilot flying "blind", often at more than two hundred miles an hour, to his invisible destination. First, the range of his receiver must embrace the long-wave beacon system; next, the *short-wave* airway services. Between these two lies the well populated broadcast band; and all three are capable of providing the pilot with vital information as to his position and course. This information must be always instantly available—a pilot flying "blind" has not much time to spare for complicated operations, and his "radio aid" must be truly an aid and not a burden.

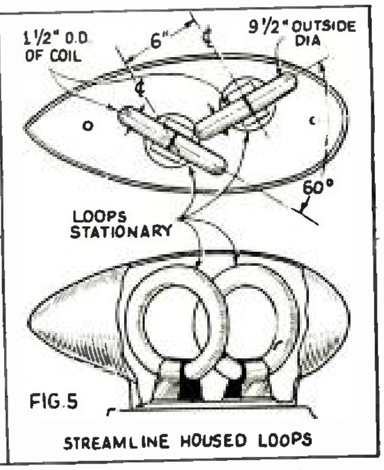
All of the successful radio-direction finders developed to date, are based on the familiar property of the vertical loop antenna, which is most sensitive to signals emanating from points lying within its plane, and least sensitive to those lying at right angles to it. Since the sensitivity of such antennas varies as the cosine of the angle between the plane of the loop and the signal source, the most exact directional reading is obtained, theoretically, in the "nil" position, i.e., with the loop antenna at right-angles to the source of signals, when no signal is picked up by the loop. Such an arrangement, however, is

(*Continued on page* 754)









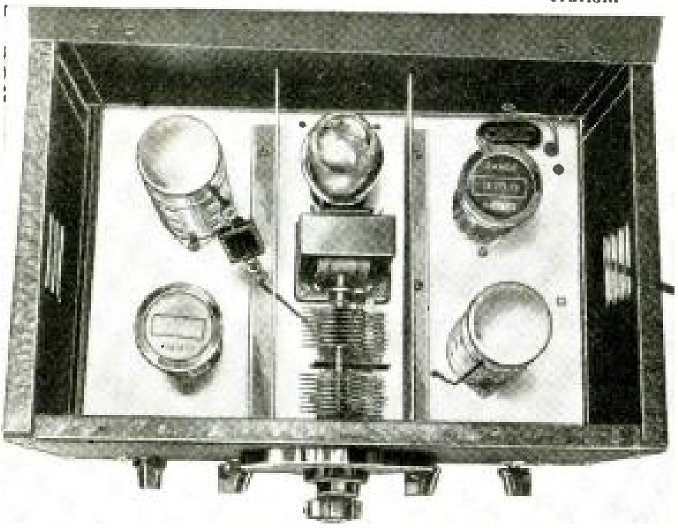
Above—Wiring diagram of the "Radioguide," showing how two receiving sets amplify signals picked up on two loops and cause a differential reading to be given on the "double-needle" course indicator instrument, which resembles a double milli-volt meter. The other diagrams show how "gliding angle" can be determined, and also how course is flown. Right—Streamline housing for loops.

A 3-TUBE Battery Type S-W Receiver

By Keith Free — This Month's $20.00 Prize Winner

The editors have received numerous requests for a simple, smooth-working, 3-tube, battery-operated short-wave receiver. Mr. Free has provided the answer to this problem, we believe, in very fine shape, and this set will work a speaker on fairly strong signals.

● NO doubt there are many set-builders living in the rural districts, where the A. C. lines have not been installed, who are looking for a good battery set with the battery drain as small as possible. Moreover, a set which does not look like a pile of trash. This set should meet all three of the above requirements close enough to suit most anyone, unless he wants to spend a small fortune.

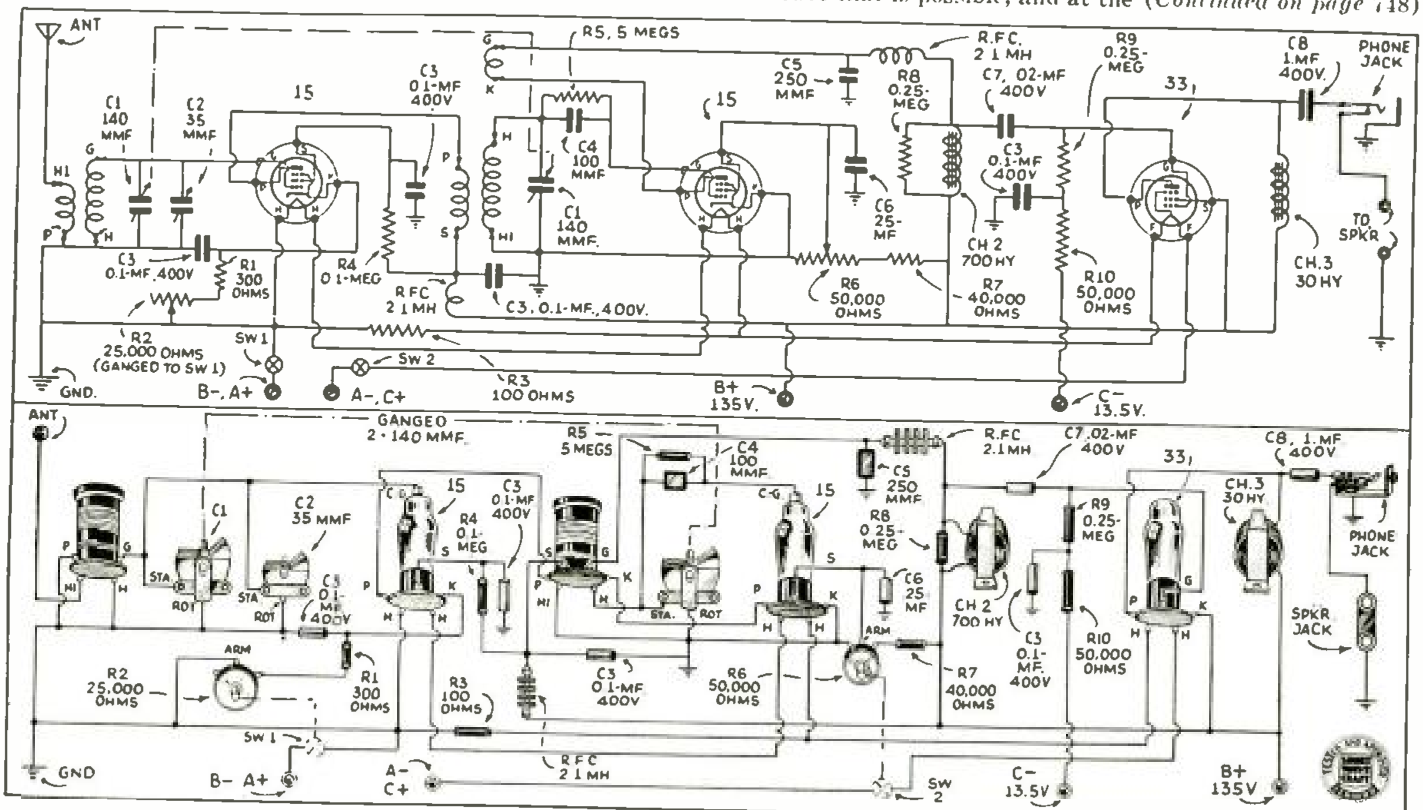


Right—Mr. Free's 3-tube battery receiver is here seen "rolling 'em in." Below—A top view of the 3-tube receiver. The parts are well spaced so as to provide smooth operation.

Features

Before going into details about the construction of the receiver, here are some of the features. It has a tuned R.F. stage ahead of the detector, which adds quite a bit in volume and sensitivity, eliminates all dead-spots due to the aerial, and cuts *background* noise to a minimum. This R. F. stage has a *gain-control* in the cathode circuit of the tube, which will prevent blocking of the detector on strong signals. The coupling between the R.F. and Detector stages is inductive, which gives us greatest selectivity and gain. The detector uses a type 15 pentode, (one of which is also used in the R.F.) and as in all such sets of this type, it is *regenerative*.

Regeneration is controlled by varying the screen voltage with the usual 50,000 ohm resistance. As will be noticed in the circuit, the plate voltage is supplied through a 700 henry audio choke, shunted by a 250,000 ohm resistor. As the choke offers very low resistance to the D.C. current, the plate voltage will be high enough to get all the gain out of the tube that is possible, and at the (*Continued on page 748*)



Schematic and picture wiring diagrams for the 3-tube battery receiver are given above. Plug-in coils are used, and the tubes employed, ensure a very small drain on the batteries.

Daily Weather Maps By Radio

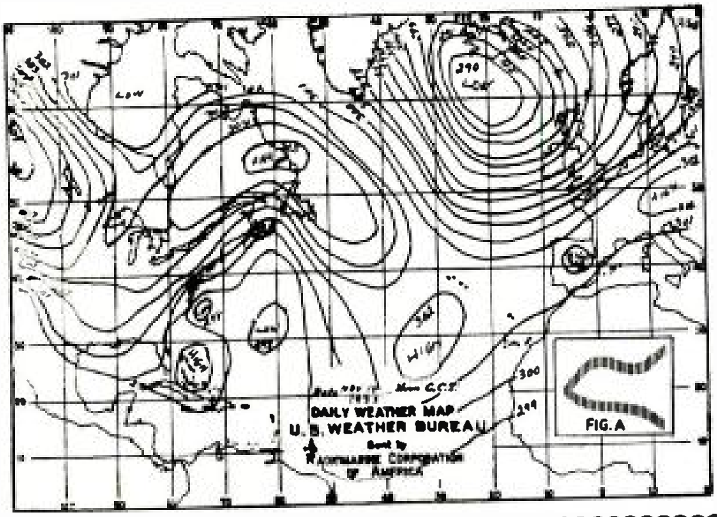
It is now possible through the aid of high-speed facsimile to transmit daily weather maps by short waves. A specimen is here illustrated.

● RADIO facsimile will reach out to ships at sea within the next few weeks to transmit weather maps, printed matter and pictures on a regular, scheduled basis. That advance was disclosed recently at the demonstration of receiving apparatus for the service at the Second Annual Marine Exhibition in New York City.

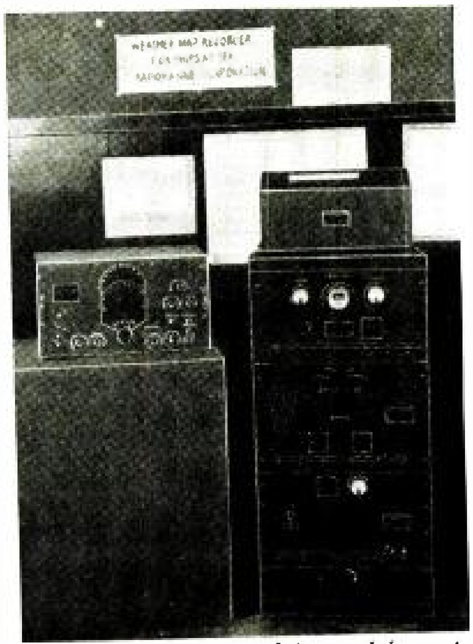
The achievement of a regular facsimile service to ships is a culmination of several years of development by the RCA laboratories, including many experimental tests at sea.

The development of terminal apparatus has been completed, and equipment identical with that being shown at the Marine Exhibition will be placed on four chosen vessels as they make their next call at the port of New York. The ships are of American, German, Norwegian and Spanish registry, arrangements having been previously made by Charles J. Pannill, President of the Radiomarine Corporation of America when he was in Brussels last summer.

This step toward the extension of the Radiomarine Corporation's service to vessels of other nations is natural, since the American company is first in the world, in this field, to have developed radio facsimile for marine service.



This entire weather map is transmitted by short-wave radio. Figure A, shows that the entire map is constructed of vertical lines of varying length.



Here we have a complete receiving set-up used in recording weather maps. This is a typical marine installation.

Short waves will be employed for transmission, as in the present commercial transoceanic service of picture transmission. That part of the radio spectrum is best suited to long distance transmission.

The U. S. Weather Bureau will supply the radio company daily with weather maps of the Atlantic, and these will

(*Continued on page* 749)

New Farnsworth Multipactor Tube

By Geo. H. Eckhardt

● THE science of radio communication has been built up largely because of the availability of devices which will amplify feeble and very rapid electrical variations. These amplifiers are essentially relay devices in which a feeble electric voltage "triggers off" a constant source of power in such a manner as to give a new electrical variation similar in all respects to the original, except of much greater magnitude. This process is repeated successively many times until the final variation may be more than a million times greater than the original electrical impulse.

The extent to which such amplification may be carried, however, is limited by the fact that electrical charges are not a homogeneous fluid but have a definite atomistic structure and as the amount of amplification is increased, we eventually reach a point where we are recording the effect of single electrons of statistical variations in the flow of electrons. There are two types of such statistical variations to be considered.

One of these is directly due to the corpuscular nature or grain of the electric fluid. The interference "noise," as it is called, produced by such grain size of the current is called Schotke effect, and may be compared to the noise produced by the patter of rain on a tin roof.

Another source of interference which limits the amount of electrical amplification that may be used, is termed "thermal noise," and is due to the fact that the electrons in a substance share the movement of the molecules in the material and thereby produce rapidly varying electric currents in the elements of the amplifier, and results in random voltages being applied to the input of the amplifier which are indistinguishable from signal impulses of the same order of magnitude.

The new Farnsworth tube can be built to have tremendous amplification. The outstanding tube development of the year.

In television both of these small effects become important and constitute the limit to the amount of amplification that may be employed in the image pick-up device. This is true for two reason:

First: The electric currents generated by the transmitting device are extremely feeble.

Second: The duration of certain components in the picture currents is so short that as low as 5 or 10 electrons may represent the total quantity of electric charge involved.

It is a matter of common observation that the amount of noise produced by rain increases as the rainfall becomes heavier. Similarly, the amount of fluctuation noise generated in an amplifier is proportional to the intensity of the electric current which is used in an amplifier.

In the ordinary hot cathode type of amplifier, widely used in radios today, the total current flowing across the tube may be a million times larger than the component of that current which represents the amplifier signal.

This and other considerations led Philo T. Farnsworth to undertake to develop an amplifier having a much lower fluctuation noise level than could be obtained with the ordinary thermionic relay. After a great many years of research, there has evolved the so-called electron multiplication system of amplification, and this electron multiplier not only has achieved the results of lower fluctuation noise, making possible approximately two hundred times more amplification of a television picture signal, but has also resulted in many quite unexpected new and valuable applications.

Briefly, the principle of electron multiplication is as follows:

When an electron stream having sufficient velocity is directed against a suitable metal surface, the primary electrons, as they are called, "splash out" other so-called secondary electrons from the surface, and the number of secondary electrons so ejected may be several times greater than the primary electrons which produce them. If these electrons are then

(*Continued on page* 743)

An Ultra Short-Wave BURGLAR ALARM—Cover Feature

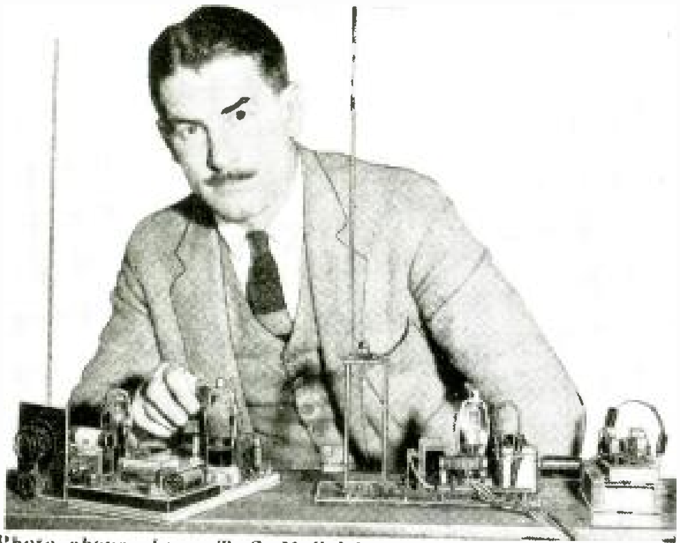


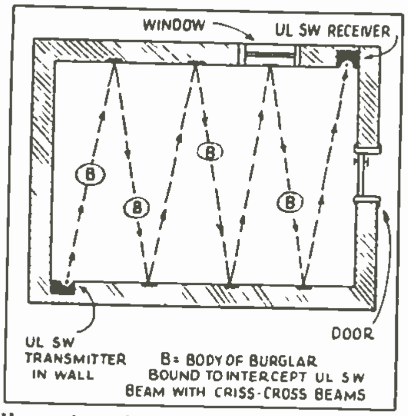
Photo above shows T. S. McCaleb, of Harvard University, inventor of the new "burglar detector" and alarm which utilizes ultra-short waves. In another form it may be adapted to the detection of aircraft which cannot normally be seen nor heard, such as high-flying aircraft at night or during a fog.

● THE very latest application of ultra-short waves takes the form of a *burglar detector*—and this ingenious device has been worked out by Thomas S. McCaleb, instructor in the Institute of Geographical Exploration of Harvard University.

The intruder is caught in the meshes of a veritable network of ultra-short waves, invisible to him, but which act at once to sound an alarm either locally or else relay it through to police headquarters. Another application of this interesting radio principle might be the development of a device for detecting the presence of aircraft at night or in a fog, which would be a very important aid for military purposes.

So sensitive is this ultra-short wave detector that if a person enters a room every movement of the intruder's body can be registered. Similar apparatus was worked out some time ago by another inventor, but instead of using ultra-short waves, light rays were employed in connection with a photo-electric cell; the drawback to this system is, of course, that the light ray can be seen, and for that reason has a marked disadvantage in that the intruder might be clever enough to evade it.

The apparatus devised by Mr. McCaleb comprises an ultra-short wave transmitter and receiver which may be secreted in the walls on opposite sides of the room. High-frequency signals with a wave length of about 7/10ths of a meter are radiated from the transmitter; before the waves reach the receiving set, hidden in the opposite wall of the room, they are caused to reflect back and forth between the walls of the room many times, so that (*Continued on page* 746)



How the ultra-short waves are reflected back and forth across a room, for example; the body of an intruder would intercept these waves and result in a reduced strength of signal being picked up at the receiver.

Television Advances in Italy

● WHILE a great deal is known in this country about the television experiments of other European countries, practically nothing has been published about television progress in Italy. This is very surprising, since the "Zworykin of Italy," M. Arturo Castellani, has since the year 1930, in which he displayed and operated his television experiments at the Radio Show of Milan, always kept pace with the television developments in other countries.

Mr. Castellani makes his television research in cooperation with a well-known Italian radio manufacturer of Milan, which provided him with an excellent equipped laboratory and complete television studio. Even a 500 watts ultra short-wave transmitter operating on a wavelength of 7 meters for the image transmission, and a smaller one of 50 watts output for the sound transmission is at his disposal. The latter one operates on a wavelength of 5 meters.

The latest progress of the Castellani-Safar television system is a television camera for direct pickup called "Télépantoscop." The nucleus of this new camera is a very ingenious device, which is actually a combination of a photo-electric-cell and a cathode-ray tube; a combination which has some similarities with the pickup device developed in this country by Farnsworth and lately by Dr. Zworykin.

As is well known all the experiments intended to apply the ordinary photo-electric cell for direct pickup have not as yet been very successful, because of lack of sensitivity of the photo-electric cells at present available. However, Mr. Castellani increased the *sensitivity* of such a photo-electric cell by using an electron beam as produced by a cathode ray tube as a "pulling" device. That means in simple language the electron beam of a cathode-ray tube touches the surface of a photo-electric cell, in a manner which may be compared with the effect as if a (*Continued on page* 747)

Television studio of the "SAFAR" Radio Corporation of Milano. The apparatus in the very front is the television camera for direct pickup. The main part of this camera is a new Photo-Electric-Cell, called the Telepantoscope, which has been invented by Mr. Arturo Castellani.

Television reception in a private home in Italy. The television receiver at the left side reproduces an image as bright as a powerful "home-movie" projector. Size of image 5 by 7 inches. Complete receiver costs about $500.00.

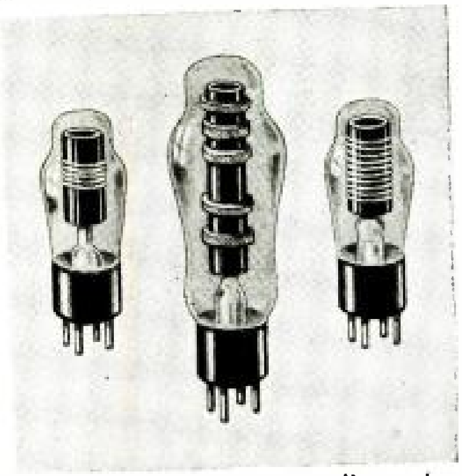
WORLD-WIDE SHORT-WAVE REVIEW

—Edited By C. W. PALMER

New Short-Wave Coils

● SOMETHING distinctly new in coil design has just been introduced in France.

As shown in the sketches which appeared in *Le Haut Parleur* (Paris), the coils are entirely enclosed in *glass envelopes*, similar to those used for vacuum tubes. The coils are thus protected from moisture, oxidation of the wire, as well



A radical departure in S-W coils; enclosing them in glass bulbs as a protection against moisture.

as dust and other effects which deteriorate coils after a time.

The coils are plugged into tube sockets just like any other plug-in type.

Coils of this construction are available for short waves, broadcast waves and I.F. circuits. They are manufactured by a company by the name of *Ariane* and were shown for the first time at the "Radio Show" in Paris.

A German Ultra-Short-Wave Set

● THE acorn tube has reached Germany and is now being used in some of their short wave receivers, according to a statement in a recent issue of *Radio Welt* (Vienna).

Also, in the same issue, a circuit of an ultra-short-wave receiver using the same tube was printed.

We are reprinting this circuit because it is one of the first European receivers to be designed particularly for the Acorn tube and also because some experimenters might wish to try it out.

An examination shows that it consists of a regenerative detector of the plate feed-back type, followed by a resistance-coupled triode A.F. amplifier and terminated with an A.F. power pentode. No power-supply is included, but the filaments of the tubes are arranged for A.C. operation. Note particularly the filtering in the detector filament circuit to permit A. C. filament supply without excessive hum.

● The Editors have endeavored to review the more important foreign magazines covering short-wave developments, for the benefit of the thousands of readers of this magazine who do not have the opportunity of seeing these magazines first-hand. The circuits shown are for the most part self-explanatory to the radio student, and wherever possible the constants or values of various condensers, coils, etc., are given. Please do not write to us asking for further data, picture-diagrams or lists of parts for these foreign circuits, as we do not have any further specific information other than that given. If the reader will remember that wherever a tuned circuit is shown, for instance, he may use any short-wave coil and the appropriate corresponding tuning condenser, data for which are given dozens of times in each issue of this magazine, he will have no difficulty in reconstructing these foreign circuits to try them out.

Novel All-Wave Coils

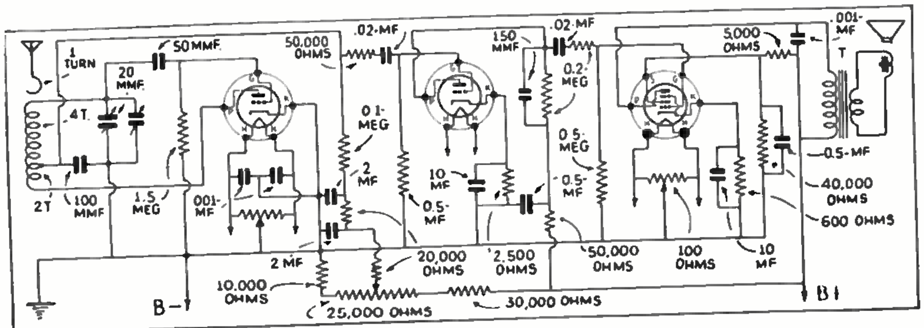
● SOMETHING new in all-wave coils was introduced in *Radio-Amateur* (Vienna) recently. It represents an Austrian idea of how all wave coils should be made.

The coil shown here illustrates what this new coil looks like. It is different from the usual types in that the *wave-switch* is incorporated as a part of the coil itself. In other words if three coils are used, one for the aerial coupling, one for detector and the third for the oscillator, three units such as that shown would be used. The knob on the front which controls the wave-switch would be "ganged" to the other coils, so that the switching can be controlled by a single knob.

Novel all-wave coil with "built-in" switch.

This method of switching keeps connections very short, but it also has another effect which is valuable. The individual circuits (antenna, R.F. and oscillator) are not brought close together as in most other switching methods. This should reduce the tendency toward instability.

The coil shown covers three bands, the international short-wave band; the broadcast band and a long-wave band used by several European broadcast stations.

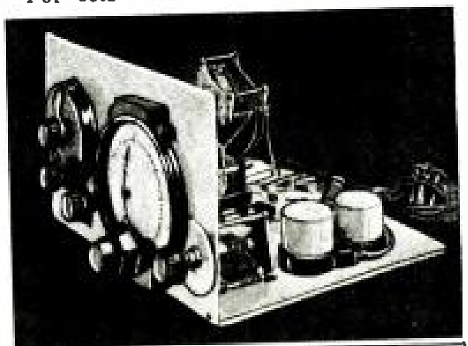


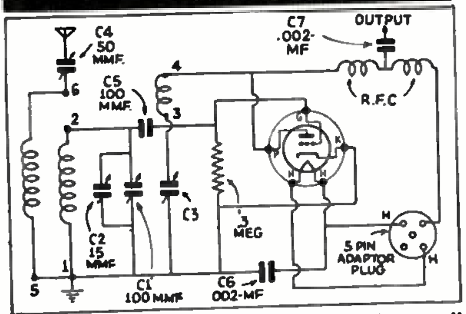
An interesting German ultra short-wave receiver hook-up.

An All-Wave Converter-Adapter

● THE latest issue of *Practical Television and Short-Wave Review* (London) presented a unit which combines the functions of a short-wave adapter and converter.

For sets with sufficient R.F. amplification or superheterodynes, the unit is connected to the aerial terminal of the set and acts as a converter of the autodyne type.





Appearance and hook-up of "all-wave" converter.

For small sets, with only one stage of R.F. or if for other reasons a converter cannot be used, the unit can be connected to the detector socket of the receiver and then it acts as a short-wave adapter in which position it acts as a regenerative detector and the A.F. amplifier of the receiver is used.

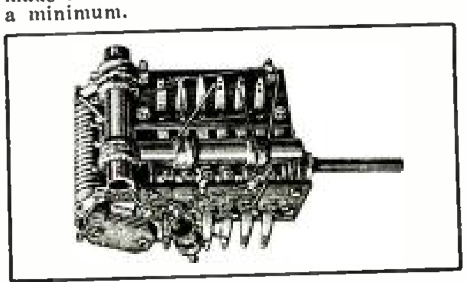
The coils may be either plug-in units or a coil and switch assembly may be used for covering the various bands.

A New All-Wave Coil Unit

● A FRENCH version of the all-wave tuner comprising wave-change switch, coils for signal tuning and oscillator circuits, as well as the necessary padding condensers was illustrated recently in *Radio-Vente* (Paris).

The coils are placed in such a way that the important ones are extremely short. Note that some of the coils are lengthwise, some crosswise and some diagonally placed with reference to the switch.

The switch, too, is unusual in that switching is accomplished with flat spring contacts—these, however, are short, in order to keep the capacity low. The contacts are made of silver to keep contact resistance at a minimum.



A French unit which combines band-switch and coils.

2-Tube Receiver for the S-W FAN

By Harry D. Hooton, W8KPX

Two metal tubes, together with a simplified switch arrangement serve to make this little receiver an ideal one for the short-wave "Fan"—it has a range of 16 to 130 meters and the various frequency bands are made available by simply turning a switch. The 6.3 volt tubes will work on batteries or A.C., the plate current being taken from batteries or from an A.C. power-pack.

The "Metal Tube-2" Short Wave Receiver with "hand-switch" is here shown in operation. It makes an ideal headphone receiver for the S-W "Fan."

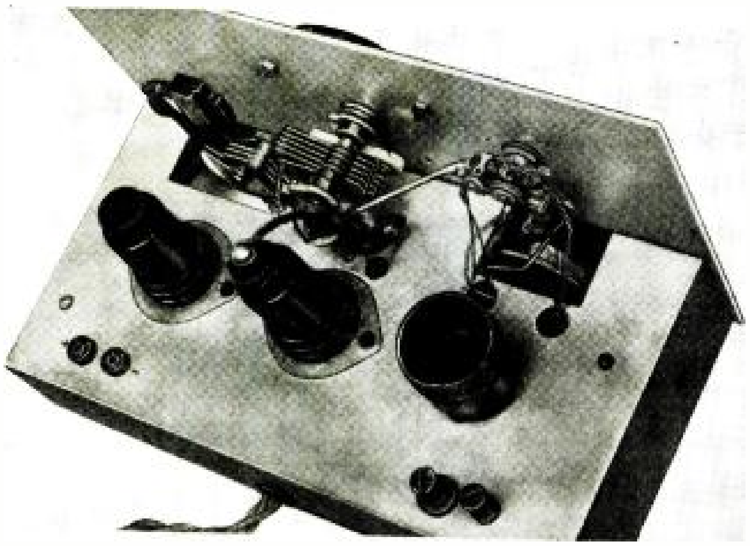


Photo at left shows rear view of the 2-tube receiver, and as will be seen, it is a very simple job to construct. A home-made switch can be used if no other is available, and the coil winding data is given in the article.

IN the design of the little metal tube receiver to be described in this article, the author has incorporated the best features of a number of good short-wave sets he has owned during the past several years. The result is that we have a simple short-wave receiver that is truly universal, operating equally well on either a power-pack or "A" and "B" batteries, *without bothersome plug-in coils*, with a "modified" band-spread over the entire tuning range and last but by no means least, using two of the new metal high efficiency tubes.

Electron-Coupled Detector Used

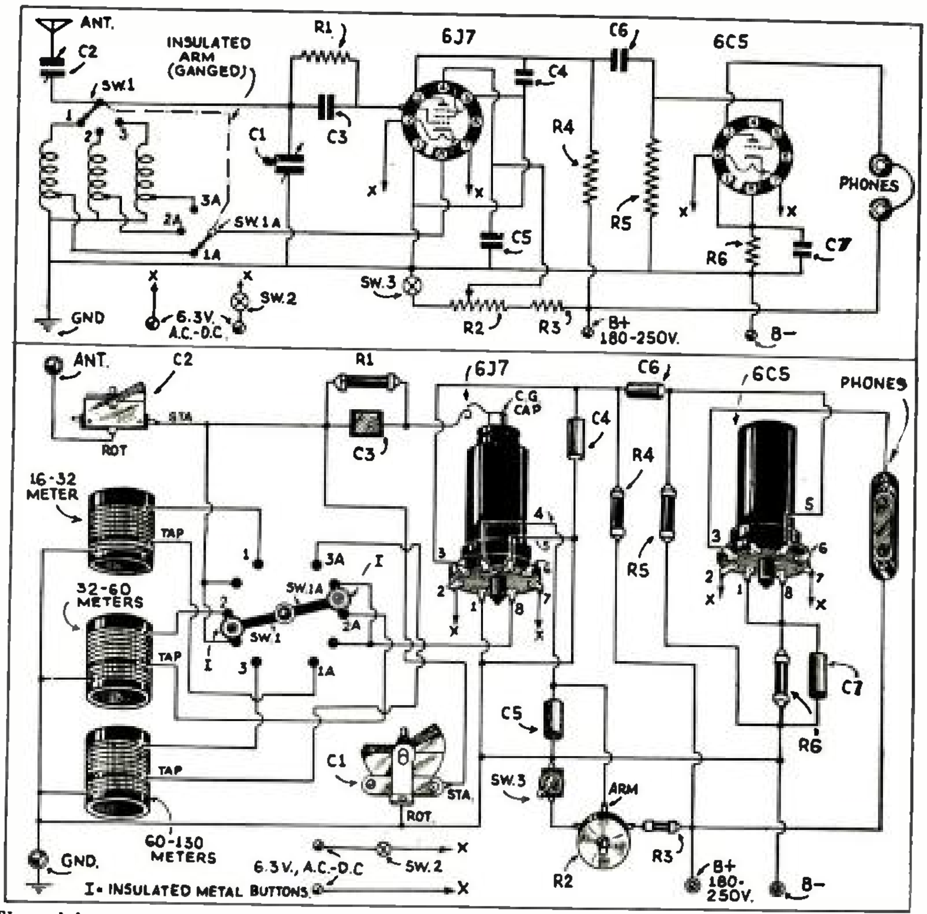
As shown in Fig. 1, there is nothing radically different about the circuit. The detector is of the familiar electron-coupled type using a 6J7 tube; the audio stage is resistance-capacity coupled to the plate of the detector and uses a 6C5 as amplifier. The tickler or feed-back coil is connected in the cathode circuit of the 6J7, which gives better stability and freedom from body capacity effects when operating the detector close to the point of oscillation. Regeneration is controlled by the usual 50,000 ohm potentiometer in the screen-grid circuit. The entire set is built up on an aluminum panel and chassis 6x11x5x2 inches.

Arrangement of Coils

Three coils are used to cover the entire range between 16 and 130 meters as follows: Position "one" (on wave-band switch) 16 to 32 meters; position "two" 32 to 60 meters; position "three" 60 to 130 meters. The 16 to 32 meter coil has been designed so that both the 14 mc. amateur band and the 19, 25 and 31 meter broadcast bands can be brought in by a 180 degree rotation of the tuning dial. This coil has been mounted above the chassis on ¾ inch supports in order to reduce the inter-coupling to the minimum, since it is at the high frequencies that most losses from this trouble occur.

The two lower frequency coils are mounted below the chassis and are

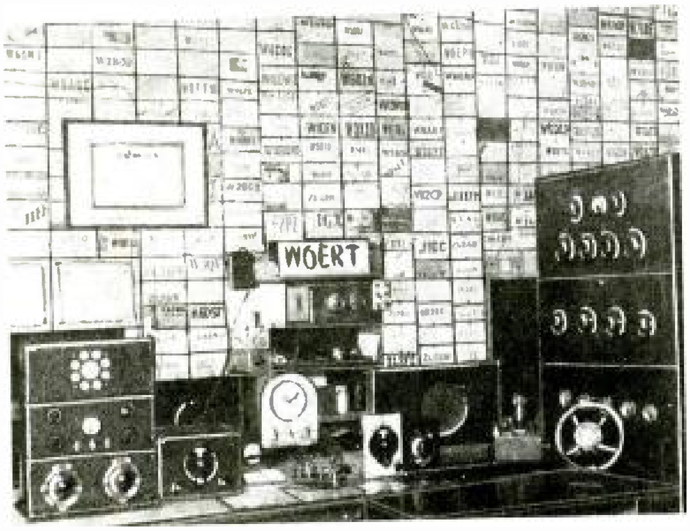
(*Continued on page* 740)



The wiring connections for the 2-tube receiver, using latest metal tubes and a band-switching arrangement which eliminates plug-in coils, is shown above.

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

W6ERT's Ham Station Wins Prize



Some Ham station! It is owned by Al Goodyear, W6ERT of San Pedro, Calif., and he operates on practically every frequency alloted to amateurs.

Editor, SHORT WAVE CRAFT:

It is with pleasure I wish to congratulate you on your excellent publication. I have been reading it since it first came out, which, I think speaks for itself.

Herewith a picture of my station.

The transmitter at the right consists of a 47 Xtal oscillator, 46 buffer-doubler, 210 buffer amplifier and a W.E. 242A in the "final amplifier."

Each stage has its own power supply, and a pair of 866's serve as rectifiers for the final power supply of 1500 volts.

Also contained in the transmitter rack is the audio system for radio telephony, consisting of two stages of resistance-coupled speech amplifiers; a pair of 45's driving a pair of 210's in push-pull "Class B" modulators.

A double-button carbon microphone can be seen at lower right.

A five-meter push-pull oscillator can be seen next, then the station electron-coupled frequency meter, which is used for monitoring transmissions and frequency calibration.

Next the five-meter receiver, a standard super regenerative job using a type 37 high frequency detector, a 37 low frequency oscillator, and a 38 in the out-put.

Next is a SW3 stand-by receiver and this is also used for receiving on ten meters.

Next is the station receiver proper; as can be seen it is built rack and panel, ten tubes in all. It is a real "ham" job and works as good as any of them.

All of the equipment except the SW3 receiver is "home-built."

On "CW" the input to transmitter is 300 watts.

One Year's Subscription to
SHORT WAVE CRAFT
FREE
for the "Best" Station Photo
Closing date for each contest—75 days preceding date of issue: March 15 for June issue, etc. The editors will act as judges and their opinions will be final. In the event of a tie a subscription will be given to each contestant so tying.

On phone an input of 120 watts is used. All bands are used at this station including the two and one-half meter band. Equipment for this band is not shown in the photograph, but consists of a pair of 27 type tubes in push-pull as the oscillators, modulated with a single 59 type tube.

The record "Dx" on the several bands worked from this station is as follows:

Two and one-half meters—four miles.

Five meters 90 miles; a total of 92 different stations worked.

Ten meters CW, East Coast and Mexico City.

Twenty meters CW—England, Germany, France, Australia.

(*Continued on page* 749)

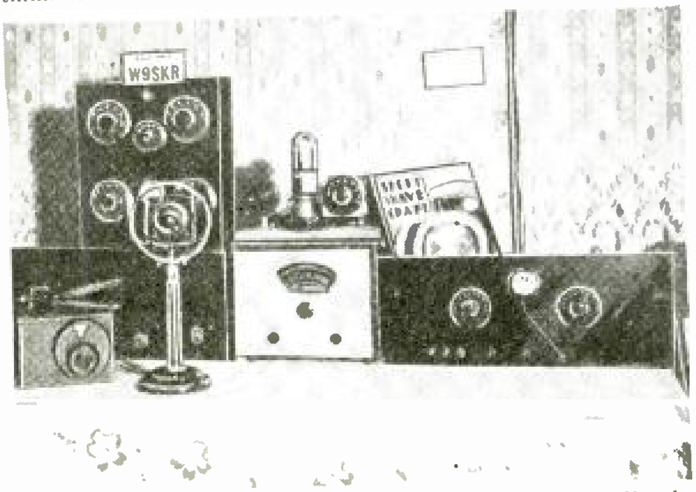
George Vesely, W9SKR, Has "Live" Station

Editor, SHORT WAVE CRAFT:

Here is a photo of my station W9SKR. The outfit from left to right consists of the following equipment: extreme left is an A.C. monitor, using a 27 rectifier and a 27 detector. Behind it is a 160 meter phone transmitter made up of three shelves. On the bottom shelf is the 27-45 speech amplifier and the 2-250's parallel modulators. Next shelf is a 45 oscillator, 46 buffer. The top shelf is the final modulator amplifier, using 2-210's in push-pull.

The receiver is the A.C. Doerle using a 57 detector and 56-47 audio. On the extreme right is the C.W. outfit using a 56 Xtal oscillator, 35 doubler, 35 doubler buffer and 210 buffer.

The final stage is on the receiver employing a UV203-A. The input is 250 watts. All power supplies are under the table. To the right of the final amplifier is Vol. 1, No. 1 "S.W.C." I have been reading S.W.C. ever since it came out, because I think it is the best radio magazine. (*Continued on page* 749)



A dandy little station owned and operated by George Vesely, W9SKR, Chicago, Ill.

All the Way From South Africa

Amateur radio station ZU1X operated by B. H. Beukes in South Africa.

Editor, SHORT WAVE CRAFT:

I send herewith a photo of my Amateur Station (ZU1X) for publication in your valuable magazine. The transmitter is a 4-stage rack-and-panel type, and uses a type 47 tube as Xtal oscillator, 46 as buffer and two 46's in final amplifier. Am using three separate power supplies for Xtal oscillator, final amplifier and speech amplifier.

The Collins system of antenna coupling is in use. Am also using a self-excited transmitter with a 1 tube and 500 volts on the plate. The length of aerial used being 88 feet and 11 feet counterpoise working on the 7th harmonic. I have had splendid results with this transmitter and have worked California on several occasions—a distance of 12,000 miles from here.

My receiver is an OV 2 Grebe (*Continued on page* 749)

SHORT WAVE SCOUTS . . .

Honorable Mention Awards

W. R. Guenther, Milwaukee, Wisconsin, 71 veris.

T. Taffee, Jr., Elmsford, New York, 62 veris.

● 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 CRAFT. 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.

TWENTY-FIFTH "TROPHY CUP"

Presented to

SHORT WAVE SCOUT

ANDREITA O. CLOQUELL
Arecibo, Porto Rico, W. I.

For her contribution toward the advancement of the art of Radio

by

SHORT WAVE CRAFT

Magazine

25th TROPHY WINNER

79 Stations—All Foreign!

● IT is with great pleasure that we award the twenty-fifth trophy to Mrs. Andreita O. Cloquell, Calle Santa Rosa Num. 13, Arecibo, Porto Rico, W.I.

Mrs. Cloquell had an excellent total of seventy-nine stations, all of which came within the rules of our contest. Some of our readers may be interested in knowing that sixty-three of these veris were obtained within a *ten-day* period! In fact, seventy stations were received but only sixty-three veris came through. And in the whole thirty-day period one hundred and fifteen stations were heard and logged, although they did not all verify.

The receiver used was a G.E. 8 metal tube receiver operated in conjunction with a G.E. "V" doublet antenna.

Below is the list of verified stations:

List of Short-Wave Program Broadcasting Stations Logged

Stations heard and verified during the period of 30 days, using a General Electric A87, 8 metal tubes set, with a G.E. "V" Doublet antenna from North West to South East, about 60 feet high. All stations heard and logged by Mrs. Andreita O. Cloquell of Santa Rosa St. No. 13, Arecibo, Puerto Rico.

HJ4ABA—11.71 mc.—Voz de la Montaña, Medellin, Colombia.
HVJ—15.12 mc.—Radio Vaticano, Vatican City.
PRADO—6.61 mc.—El Prado, Riobamba, Ecuador.
W3XAU—9.59 mc.—Philadelphia, Pa.
XEOR—7.38 mc.—Gobierno Nacional, Mexico City.
COCO—6.01 mc.—Havana, Cuba.
HAT4—9.12 mc.—Radio Labor, Budapest, Hungary.
YVQ—6.67 mc.—Gobierno Nacional, Maracay, Venezuela.

(*Continued on page* 753)

Trophy Contest Entry Rules

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

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 per cent "foreigns") 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.

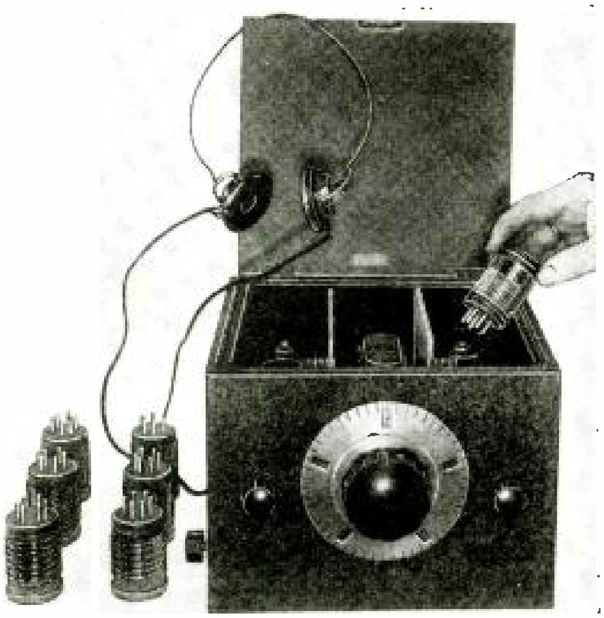
Only commercial "phone" stations should be entered in your list, no "amateur transmitters" or "commercial code" stations. This contest will close every month on the 25th day of the month, by which time all entries must be in the editors' hands in New York City. Entries received after this date will be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

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

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

When sending in entries, note the following few simple instructions: Type your list, or write in ink, pencilled 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 owners; the expense to be borne by SHORT WAVE CRAFT 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.



Front view of the De Luxe 3-tuber.

De Luxe 3-Tuber for FAN or HAM—New Super-Bandspread Dial a Feature

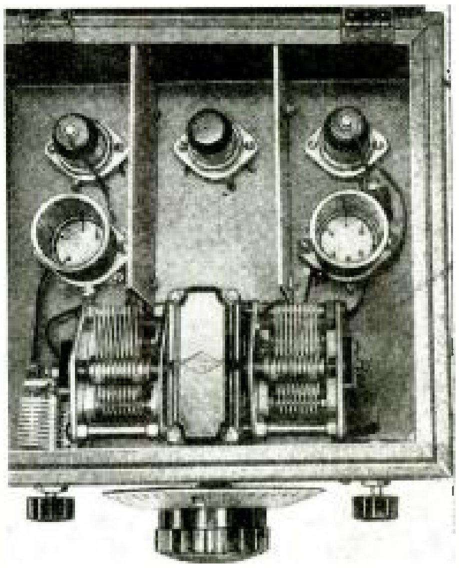
For the "Ham" or "Fan," this 3-metal tube receiver, featuring the National "band-spread" dial, pre-eminently fills the bill. The *amateur* bands, as well as the short-wave *broadcast* bands, are unbelievably spread out over the dial, making this the "ideal" set you have longed for.

● PROPERLY designed and constructed of high-grade parts, the tuned R.F. (radio frequency) receiver represents a most popular and highly efficient set.

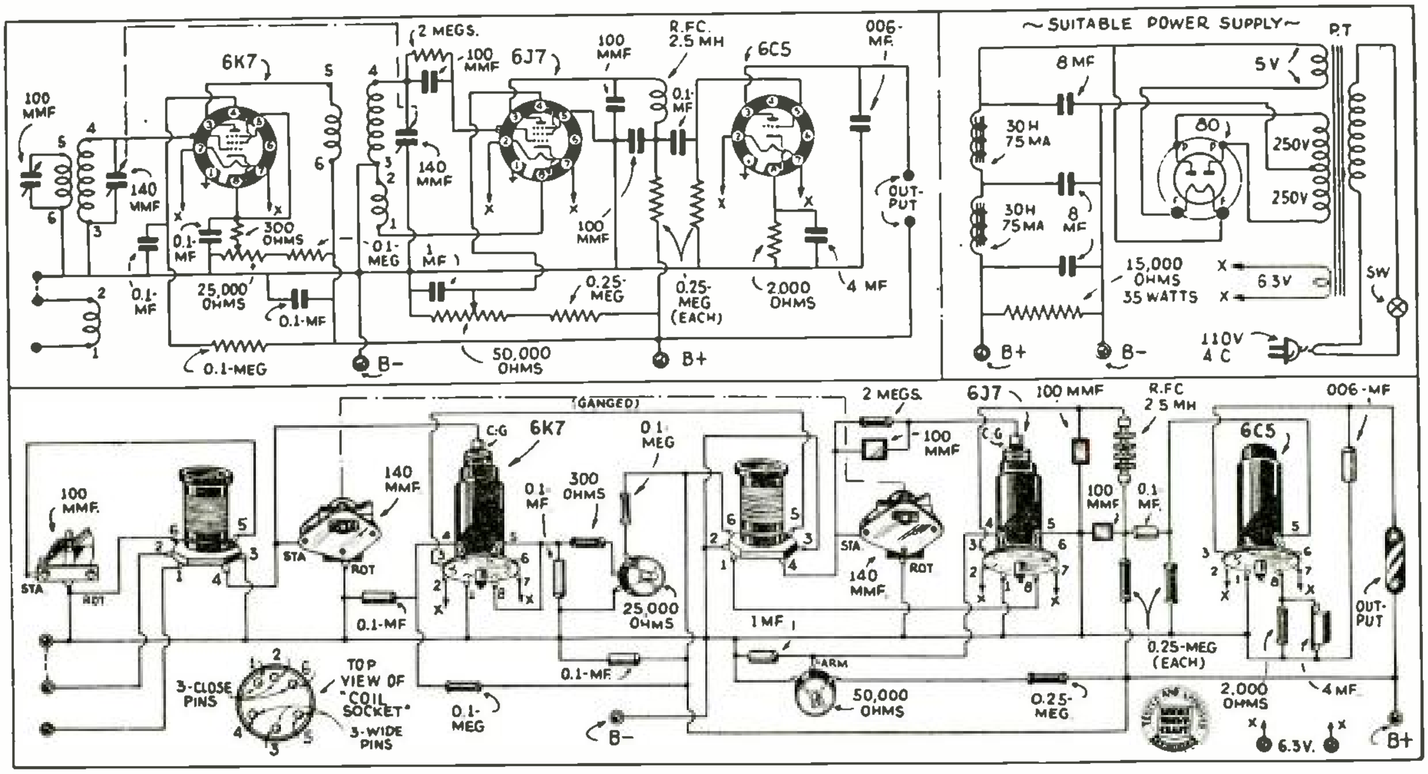
The T.R.F. receiver is not only easy to "get going" but is really a very sensitive arrangement. Of course there are many who will say that it is not selective enough to compete with the now very densely populated short-wave *broadcast* and *ham* bands. This may be true of a receiver not operated properly, but—in the hands of an experienced operator—these receivers will do nearly all that the average "superhet" will, and furthermore *they are just as sensitive as the average low-cost super!* The selectivity is even better than a great many supers. Of course they cannot be compared with the higher grade superhets having a crystal filter. We have made some comparative tests and were agreeably surprised at the results; the above statements were more than borne out. When correctly designed and using good parts, the T.R.F. receiver is really very stable. No tricky regeneration adjustment is necessary and the two circuits may be made to "track" excellently.

A 3-tube Set—and What Band-spread!

For one who does not wish to go into the intricacies (*Continued on page* 759)



Top view, showing the shields and how the parts are laid out. →



Both schematic and physical wiring diagrams of the "Ham" and "Fan" 3-tube T.R.F. receiver.

HOW WAVES are Radiated from ANTENNAS

—Part 2—

First part appeared in January number

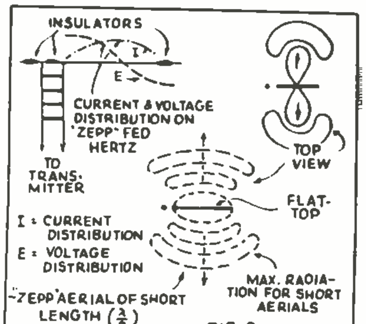


FIG. 9A-1

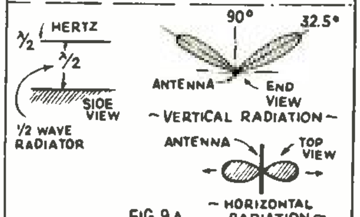


FIG. 9A

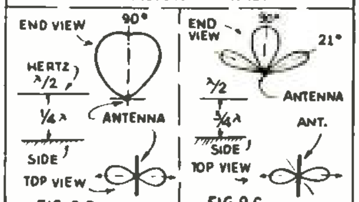


FIG. 9 B FIG. 9-C

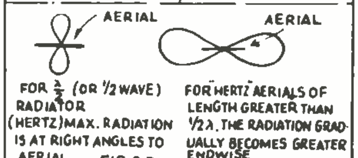
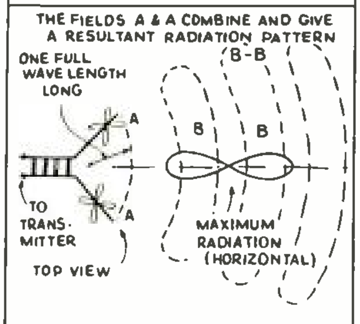


FIG 9-D



"V" TYPE AERIAL FIG 10

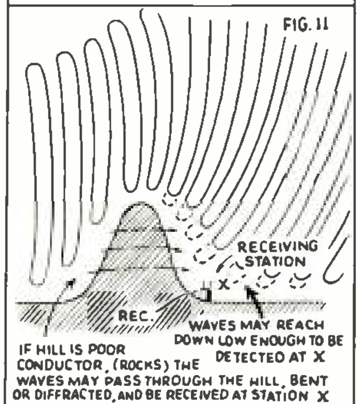
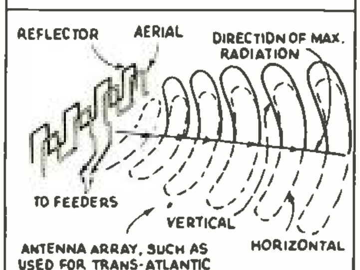


FIG. 11



ANTENNA ARRAY, SUCH AS USED FOR TRANS-ATLANTIC TRANSMISSION FIG. 12

● THE Zeppelin or "Zepp" antenna used for transmitting purposes by many amateur or "Ham" stations, is shown in Fig. 9. The minimum direction of activity of this aerial is along the axis of the radiating or horizontal section of the aerial proper, practically no radiation taking place from the vertical feeder line.

Fig. 10 shows a type of directional aerial frequently used for transmitting by "Ham" stations and this is built in the form of a "V." The sharpness of the horizontal radiation wave pattern is increased by bringing the outer legs of the "V" closer together. This holds up to a certain point and then radiation decreases rapidly.

Fig. 11 shows short waves passing over a hill or mountain and why it is that a receiving station located at a fairly close distance to the hill will usually find itself in a *dead-spot* or *shadow*. Fig. 12 shows maximum direction of radiation from a *zig-zag* type aerial, with a similar style reflector spaced a fractional wavelength behind it. This type of directive aerial has been used especially for trans-Atlantic transmission on short wave work.

Fig. 13 shows the well-known "T" aerial and the horizontal radiation pattern for it. In other words, the maximum activity of the "T" aerial lies along the axis of the flat-top section.

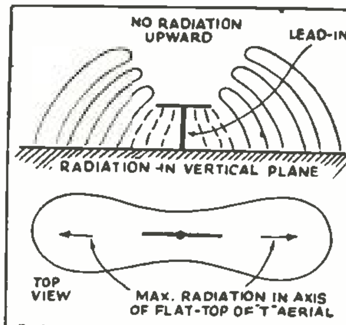
Maximum reception with the *doublet* aerial, now so popular with short-wave "Fans," is at right angles to the doublet as shown in Fig. 14. Note that the man-made electrical disturbances or fields therefrom will not be picked up (or rather, the interference currents picked up are caused to cancel out each other at each transposition) by the transposed lead-in, but that if the main receiving or horizontal sections R and R of the doublet are low enough or near enough to the local disturbing fields, such as that extending around A.C. primary wires, etc., then you will pick up the interference anyway. The flat-top R R must be placed as far as possible away from all telephone and A.C. lighting circuit wires in all cases.

Fig. 15 shows the relation between the electro-static lines of force surrounding an antenna and its complement of electro-magnetic lines of force at right-angles. Fig. 16 shows how the ground wave in short-wave transmission becomes highly attenuated at a relatively short distance, B, from the transmitter at A. Note the skip distance between B and C, in which no signal will be picked up. Due to changes in the density of the highly ionized gaseous layers 50 miles or more above the earth's surface (the Ionosphere) and which are generally believed to act as reflectors, a low-angle radiation is preferred to a high-angle radiation as witness Fig. 16. That is the greatest range is obtained with a fairly low-angle radiation.

The angle of radiation can be controlled by altering the height of the aerial (or the length of the flat-top in a horizontal aerial, such as the Zeppelin) or the general design of the radiating and reflecting sections. When an antenna is caused to oscillate on the half-wave the best radiation and longest range are obtained usually.

Recently 5-meter signals were picked up in Chicago from a transmitting station located near New York City, a distance of about 750 miles, which is very phenomenal. Usually 5-meter signals are only heard over a range of 50 to 100 miles, or within "optical sight" of each other. It has been and still is the prevailing opinion of experts that waves as short as this practically obey the law of optical sight transmission followed by light rays. In other words, the receiving antenna should be within *optical sight* of the transmitting antenna.

To bring about this condition with ultra short-waves the antennas are usually mounted on elevated towers or on high buildings, such as was the case in recent successful 5-meter transmission experiments made by Arthur H. Lynch, well-known (*Continued on page* 758)



"T" TYPE AERIAL FIG. 13

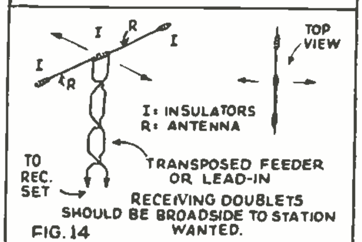


FIG. 14

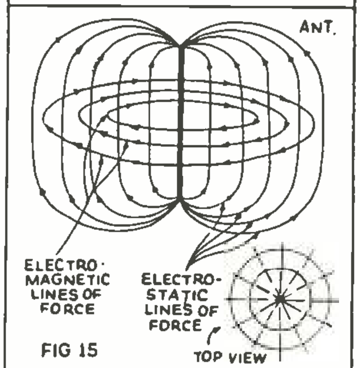
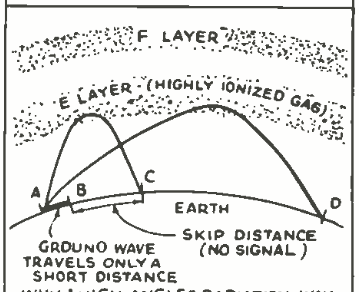
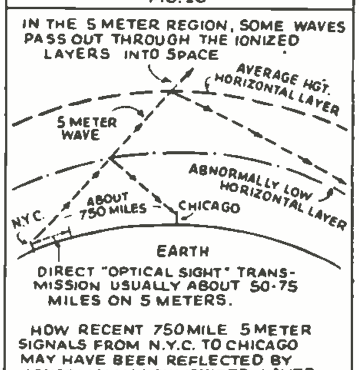


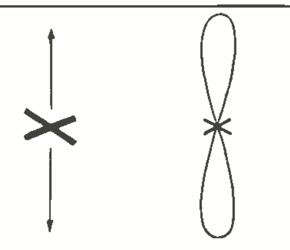
FIG 15



WHY "HIGH ANGLE" RADIATION MAY SHORTEN RANGE OF CERTAIN WAVE FIG. 16



HOW RECENT 750 MILE 5 METER SIGNALS FROM N.Y.C. TO CHICAGO MAY HAVE BEEN REFLECTED BY ABNORMALLY LOW IONIZED LAYER FIG. 17


HORIZONTAL RADIATION FIELD FOR 2 LOOPS FIG. 18

The Mono-Tube 5-Meter Transceiver

By Charles Alextuinas

This 5-meter Transceiver was demonstrated to the Editors and proved that a handy 2-way phone outfit could be built into the tiny case shown; weight 3 lbs.

Talking to and from car is just one of the tasks assigned to a good Transceiver.

● AFTER three years of experimenting with ultra short waves, together with past radio experience, I have designed and constructed an extremely small, light-weight transmitter-receiver with a self-contained battery power supply in a single unit. It is hardly believable what splendid telephone conversations have been carried on over a radius of one mile with this midget transceiver.

Split-Colpitts Circuit Used

The arrangement of parts is novel but radio experimenters will recognize the transmitting unit is of the split-Colpitts circuit. Using this circuit experimentation has shown suitable inductance values, best spacing, also best size blocking condenser and radio frequency choke coils. Antennas of a suitable length placed at a point so it will not upset balance, makes a perfect radio frequency oscillator for generating frequency in the neighborhood of 56 megacycles or a wave length of 5 meters. Now by placing in the grid return circuit a grid-leak and condenser of proper value, it converts the transmitter into a super-sensitive well-balanced receiver.

Some of its features are extremely high frequency stability in transmission and receiving, smooth variation in frequency tuning free from *dead-spots* and regenerative howls, excepting the super-regenerative "rush" sound which is brought to zero when the signal is heard. Extremely low battery current drain from "A" battery for tube filament and microphone is 80 milliamperes; the "B" battery plate current drain is but 2 milliamperes.

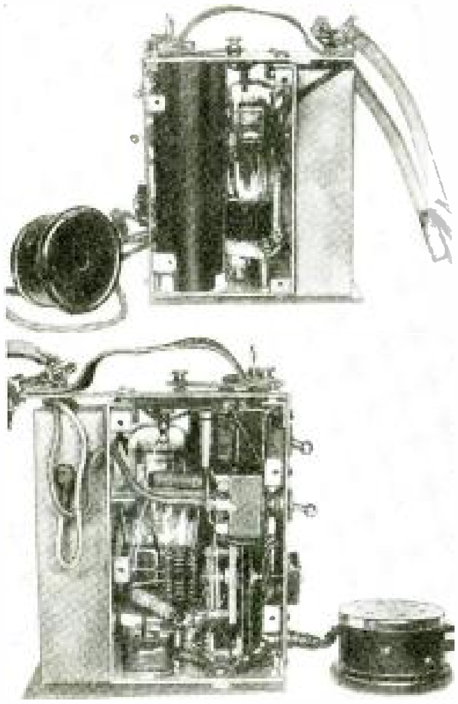
Mike-Receiver—all one unit

Microphone and receiver are fastened "back-to-back" with bakelite tubing forming one unit; the head-phone receiver is disconnected from the plate circuit through change-over switch when *transmitting*. The reason for this is to increase the plate circuit voltage to maximum of 45 volts. The transmitter, receiver and battery are mounted entirely in an aluminum cabinet; dimensions are 3½ x 4½ x 5 inches and weight 3 pounds complete, including "mike," receiver and antennas. In handling the transceiver unit, transmission or receiving is not affected unless the body comes close to the antennas (within 3 inches).

In constructing the transceiver care must be taken in assembling and spacing of parts (important); substitute no parts of other values than those given. Keep the wiring as short as possible and free from *loops* and *bends*.

Inductance (*Continued on page* 753)

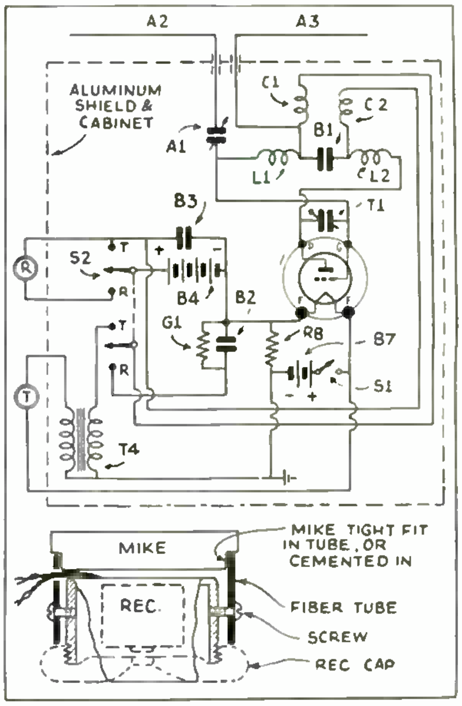
The author with two of his "Transceiver" units. Each is complete with self-contained batteries. Flip a switch to talk or receive.



Side views of the "Transceiver" showing the "battery side" and also the opposite end of the compartment filled with the "innards" of the set.

Parts List for Transceiver

C-1 and C-2 are radio frequency choke coils having an inductance of ½ of a millihenry.
Construction of radio frequency coils composed of fifty turns of No. 30 copper wire enamel coated with double-cotton cover, wound on a bakelite tube, ¼ inch in diameter by 1⅛ inch in length.
L-1 and L-2 are inductance coils; they are composed of four turns each ⅝ of an inch in diameter, of No. 16 enamel coated wire. Spacing between each turn is 3/64 of an inch, spacing between L-1 and L-2 is 3/16 of an inch.
T-1 is the main tuning condenser, having a capacity of 2 mmf. to 20 mmf. Hammarlund (Bud.)
B-1 main blocking condenser, having a capacity of .001 mf. condenser. Aerovox.
B-2 grid-leak condenser having a capacity of .001 mf. condenser. Aerovox.
G-1 grid-leak having a resistance of 100,000 ohms.
B-3 radio frequency by-pass condenser, capacity of .006 mf. condenser.
A-1 antenna balancing condenser, capacity 3 to 30 mmf. condenser, Hammarlund isolantite midget trimmer.
T-2 is a three-element electron tube type No. 30, RCA Radiotron.
S-1 is a single-pole switch.
S-2 is a double-pole, double-throw switch, used as a "change-over" for converting into a **transmitter** or **receiver.**
B-4 45 volt midget B battery. Eveready.
B-7 are Eveready No. 950 flashlight cells, giving 1.5 volts each cell; the 2 cells totaling 3 volts.
R- receiver or head-phone of 11,000 ohms impedance; Trimm.
M- 200 ohm sensitive microphone; Universal, Model W
T-4 Microphone input transformer. Thordarson.
R-8 filament resistance 8 ohms.
A-2 antenna, 19 inches in length; made from No. 14 solid copper wire.
A-3 antenna, 19 inches in length is made from flexible stranded wire rubber and cotton covered.
S-Bud 4 prong Isotex socket.
J-1 and J-2 are Pin-Jacks.



Wiring diagram of the 5-meter "Transceiver." Switches enable the operator to "talk" or "receive" in a jiffy. The "mike" and receiver are built into one unit.

Dodging QRN in a Tough Situation

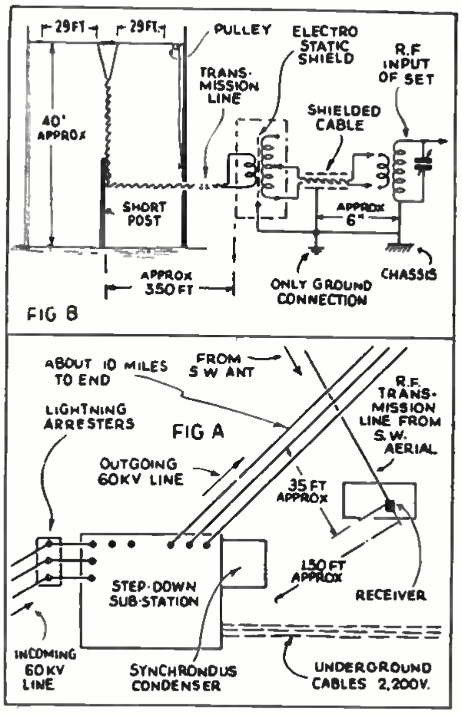
By Sydney R. Elliott
(Allenby, British Columbia)

● A GLANCE at Fig. (a) will show a receiver location which any SW listener would be glad to be well away from! However, reception experience in the past year or more has shown that even such a nasty proposition as this can be very successfully dealt with, by application of modern practice, so as to give really satisfactory results at the receiver.

The never-failing source of interference in this case is the incoming 60,000 volt line, which is practically the extreme end of a 200-mile line, on the other end of which are some of the largest installatons of mercury-arc rectifiers in the world. The R.F. "mush" generated by these is propagated along the whole length of the power lines, and radiated very strongly from its end (far more so than at any point alongside the line). The out-going short 60 K.V. line, which passes within about 35 ft. of the receiver, is more often than not a source of extra R.F. grief, varying with weather conditions.

The intensity of the noise field at the receiver location may perhaps be understood from the fact that, using a short open antenna, such as would be used in any normal location, the actual *measured* AF output from the receiver, from noise alone, was from about 2.5 to 4 watts, according to the R.F. frequency.

The present antenna system used for S.W. work—a separate system, in a different direction, is used for B.C. reception—is, as shown in Fig. (b) a simple *horizontal doublet*, each half 29 ft., supported from a pair of convenient trees, and about 350 ft. away from the receiver, in the direction indicated in Fig. (a). The *twisted-pair* R.F. transmission line is of the type used for telephone services, known as Style "B", the copper conductors being No. 19 S.W.G. At the upper end, the pair is opened out for a length of about 3 ft.,—tied at the point of bifurcation, to prevent further untwisting—and the free ends joined onto the aerial "halves," either side of the central pair of strain insulators, as shown. This spreading of the line end improves the matching of aerial to line, acting in similar manner to a step-down tranformer.



Diagrams showing how Mr. Elliott arranged his short-wave aerial to reduce interference from high-tension power lines.

The line is dropped down vertically to a short post under the center of the aerial, then strung on trees where available, and on light poles, away to the "shack." No insulators were used on the line, for reasons of economy. The line was padded with tape at points of support, for mechanical protection, and no trouble has occurred due to weather effects, our climate (British Columbia) being very dry.

At the receiver end, mounted only a few inches from the chassis, is a simple matching transformer, in a copper shield can. The line side of this transformer has 10 turns, the secondary about 50, with several taps, so that best point can be selected, to match any input impedance in the receiver. There is of course nothing critical about the windings on this transformer, as it is not tuned in any way. Between primary and secondary windings is a grounded

(*Continued on page* 741)

Tuning the I.F. Amplifier in S-W Super-Heterodynes

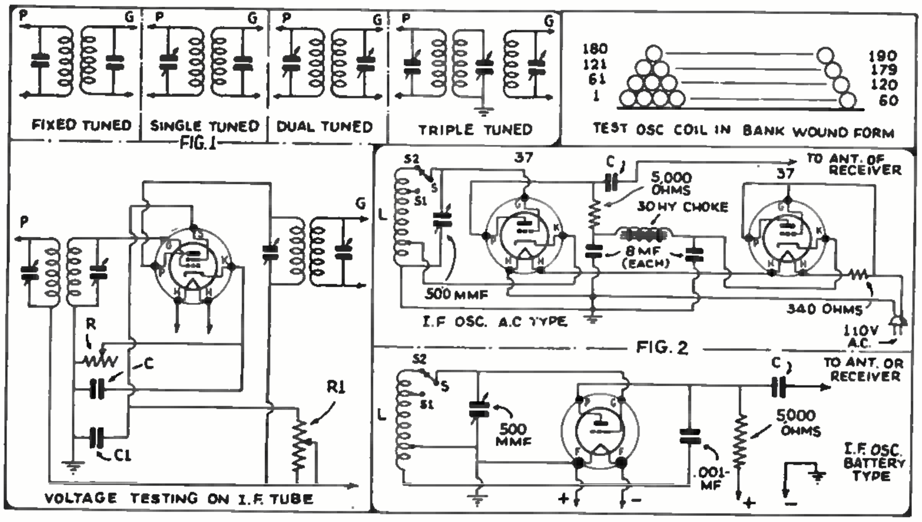
By Thos. Ensall, R. E.

● THE satisfaction to be gained from the use of any receiver on short waves is governed by the accuracy of adjusting the various circuits and their applied voltages. Particularly so, in the Super-Heterodyne type of receiver in which we find many circuits where the adjustments must be accurate and all tuning controls must be correctly adjusted if we are to obtain maximum results.

In this type of receiver we have several factors which govern the ease of control and the amount of volume obtained. Most important, and that which should be adjusted perfectly, is the I.F. Amplifier. While there are many types of Super-Heterodynes, differing merely in their design, the I.F. Amplifier operates the same in all types. The purpose is that of amplifying the beat frequency generated by the input circuits. Usually the Amplifier consists of several transformers and tubes forming a circuit in which is included a number of adjusting controls and requiring each of these to be correctly adjusted to properly amplify the signal.

Practically all I.F. circuits are of the tuned type and in Fig. 1 is shown those which comprise most transformer designs. Each one should be adjusted in the same manner.

The use of an Oscillator is of utmost importance to the correct adjusting of the I.F. Transformers. The circuit of the Oscillator in the AC type and in the battery type is shown in Fig. 2. These are quite simple in design. The AC type is one which supplies its own power and operates directly from the 110 volt lines. Any type of tube may be used in an oscillator of this type. The heater voltages and the current rating should, however be the same for each tube. The test oscillator shown uses the 37 tube as oscillator and a 37 as the rectifier. The resistance for the filaments is based on the voltage drop and the current rating of the tubes. For instance the two 37 tubes have a rating of 6.3 volts and draw .3 amperes each. The total then is 12.6 volts and 3. amperes. On a 115 volt line our resistance will be figured for the voltage drop of 12.6 volts from 115 volts and while the line voltages vary we assume 100 volts as being the correct value on which to figure our resistance. The voltage divided by the amperes equals the required resistance and this we find is 333 plus. If we use a 340 ohm resistance at R2 the tubes will operate satisfactory. (*Continued on page* 757)



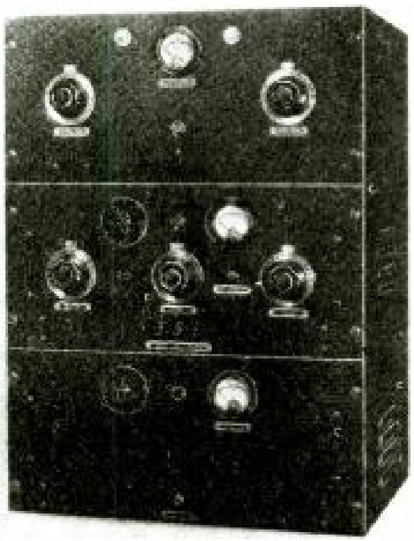
Diagrams of typical I.F. amplifiers and a special oscillator used in lining up super-hets. Complete details are given in the article.

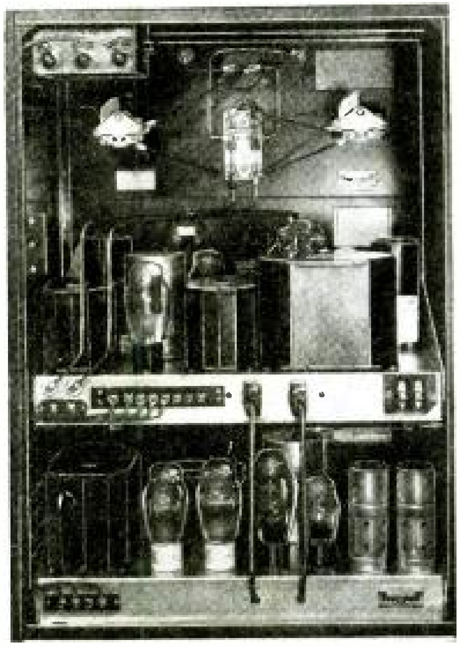
WHAT'S NEW In Short-Wave Apparatus

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

New 40 Watt Amateur Transmitter

The latest in Amateur Phone and CW Transmitters. This compact "Ham" Transmitter is a fine example of compactness, simplicity, and efficient engineering design.





● HERE is a new, compact 40-watt "Ham" transmitter which includes everything from the antenna coil down to the speech amplifier. It can be used for either phone or CW, is crystal controlled, and moreover it employs the very latest in tubes and circuits.

The complete transmitter consists of three units and a cabinet rack. Each unit is built around a standard rack-mounting panel and may be purchased separately. The units are:

ACT-40-A Antenna Unit
ACT-40-R R-F Unit with Power Supply
ACT-40-M Modulator Unit with Power Supply
ACT-40-C Cabinet Rack

The R-F Unit

The basic unit in this transmitter is the ACT-40-R which contains the complete crystal-controlled oscillator, buffer-doubler, power amplifier and power supply.

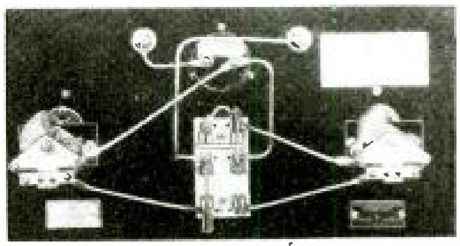
Left—Front and rear views of the new RCA ACT 40 Amateur Transmitter.

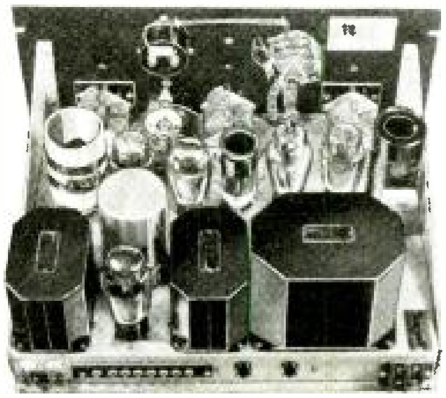
The oscillator employs an RCA-47 tube which is excited by a crystal mounted in any style holder having standard spring contacts spaced ¾". Plug-in plate coils are available for 40, 80 and 160 meter crystals. The crystal stage plate tuning is accomplished by a variable air-capacitor adjustable from the front panel. Plate current of the crystal oscillator tube should be read to facilitate adjustment.

The *Buffer-Doubler* stage consists of an 802 R-F Pentode in a conventional circuit. A combination of battery and grid-leak bias is used on this tube to keep the plate current at a safe value when excitation is removed. Buffer-doubler plate coils are also available for the 20, 40, 80 and 160 meter amateur bands. Output adjustments of this stage can be made by observing either its plate current or the grid current of the final amplifier tubes. Neutralization in this stage is unnecessary on any of the four bands.

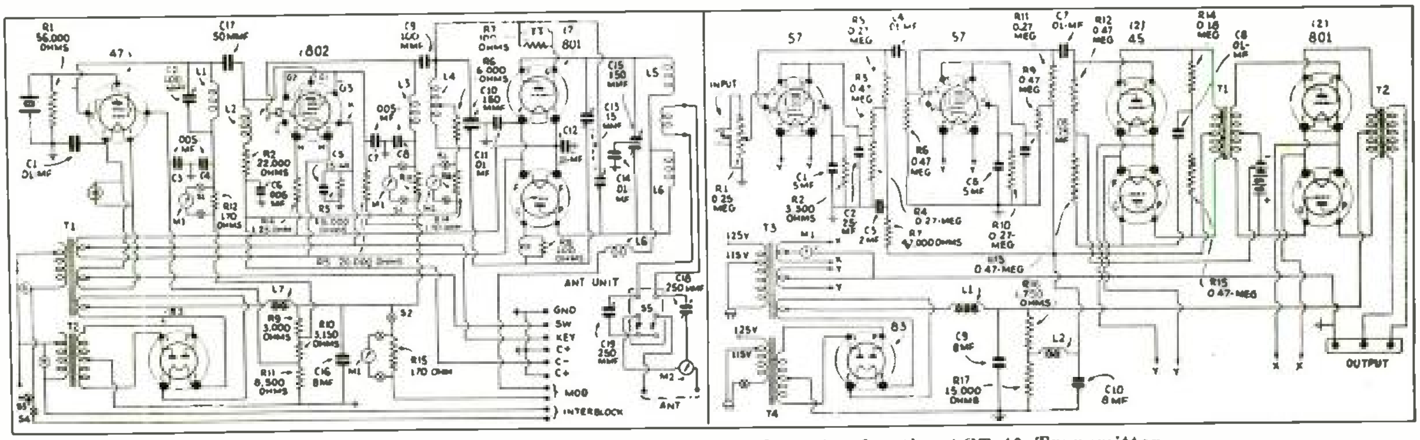
The *Final Amplifier* consists of two 801 triode tubes in push-pull, operating Class

(*Continued on page* 754)





Right—rear view showing the extremely neat construction of the RCA 40-watt transmitter. (No. 524)



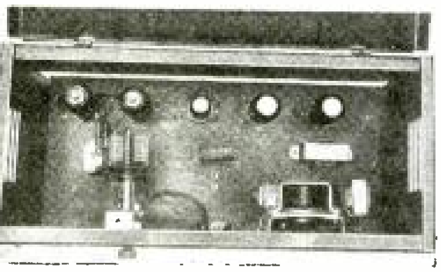
Wiring diagram of R.F., A.F. and power supply units for the ACT 40 Transmitter.

Names and addresses of manufacturers of apparatus described on this and following pages furnished upon receipt of 3-cent stamp; mention No. of article.

New Regen.-Super-Regen. Receiver

Covers All Wave Lengths from below 5 to 555 Meters!

By A. J. Haynes



Top view of the new 5 to 555 meter receiver. (No. 522).

Features

1. Low, high and ultra high frequency reception.
2. Band switching (5 bands) from below 5 to 555 meters using R. F. amplification, plus regeneration.
3. Super-regeneration below 15 meters, using simple pin-jack plug-in coils.
4. No "skips" or "dead-spots" anywhere in its range.
5. Dual regeneration control; and hiss reduction control on super-regeneration.
6. Both "loud-speaker" and "phone" reception on all bands
7. Hum inaudible—even in ear-phones.

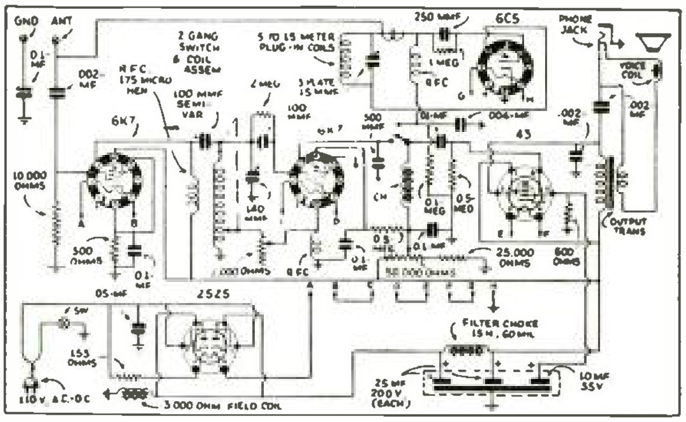
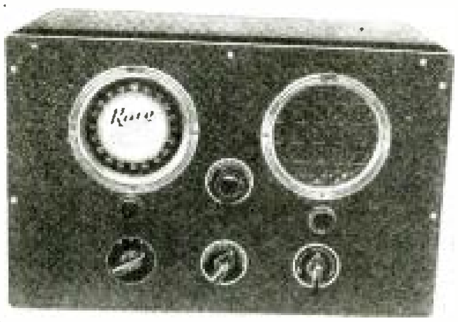


Diagram of Regen. Super-Regeneration set.



Front panel appearance of new receiver with range of below 5 to 555 meters.

● REGENERATION and its high-powered brother, *Super-regeneration*, are acknowledged to be the nearest approach to "something for nothing" that exists in radio. It is possible to obtain remarkably fine long-distance reception with both of these circuits, if they are properly applied.* The "catch" lies in the matter of *careful circuit design* and *smooth regeneration control.* Nothing can be much more aggravating than a regenerative receiver that refuses to slide smoothly into oscillation and produces a conglomeration of squeals and squawks.

Uses Metal or Metal-Glass Tubes

The R-S-R (Regenerative-Super-Regenerative) Receiver was designed with the idea of using every part and control that would, in any way, contribute towards combining maximum results with perfect tuning and regeneration control in a simple, fool-proof circuit.

Either the new *metal* or *metal-glass* tubes may be used. The latter are perfectly satisfactory and are considerably less expensive. Two 6K7 triple-grid super-control tubes are used as R.F. amplifier and detector. A 6C5 serves (*Continued on page* 755)

40 Watt Transmitter

Becomes 400 Watter As You Add Stages

● THE sponsors of the new All-Star Transmitter have designed it so that it can be built up progressively through a number of stages.

Starting with a simple 40-watt CW transmitter, this can be added to until the amateur has constructed a 500-watt CW transmitter, and finally, with further additions, it can be converted into a 400-watt phone transmitter. As can be seen from the photos, it is built in unit style on the conventional relay rack. In the transmitter, as shown, the power supplies and audio equipment are contained within the first five lower shelves, and the complete R.F. position in the two upper sections. The second section from the top contains the 40-watt unit mentioned previously. This starts off with a crystal controlled type 47 oscillator and is then followed by an 802 buffer or frequency doubler, whichever the requirements may be, and this, in turn, is followed by two 802's in push-pull. The top compartment contains two 838 tubes in a push-pull neutralized R.F. Power amplifier.

The 838's, incidentally, as high-mu triods are capable of 500-watts output, when operated push-pull class C. These tubes require no external battery bias, and this stage is the only one requiring neutralization. The low-powered stages using the 802 screen-grid pentode tubes of course, need not be neutralized. When operating the complete trans- (*Continued on page* 752)

This new All-Star transmitter may be built in unit fashion. Starting with the 40-watt R.F. unit, the amateur has an excellent low-power transmitter to which can be added the various amplifier units, from time to time, finally completing a 400-watt modern transmitter.

Left—Front view of new All-Star transmitter. Right—Rear view showing the general construction. (No. 527)

NEW APPARATUS FOR THE HAM

Bliley LD2 Crystal, H42

● MODERN radio practice demands that the "Ham's" transmitter be free of frequency drift or frequency modulation. The LD2 crystals provide an excellent guarantee against these evils. The LD2 is so ground as to provide a minimum of frequency drift during changes in operating temperature of the crystal.

The LD2's are available for the 40, 80, and 160-meter bands, and the new HF2 Bliley crystal for the 20-meter band.

This 20-meter crystal now makes possible a *simple* ultra-high frequency crystal controlled transmitter.

New Bliley Low-Drift Crystal

Ultra Midget Batteries, H43

● THE National Carbon Company, Inc., manufacturers of the famous Eveready Batteries, have introduced three new units designed particularly for portable apparatus. One is the X-202 three-volt "A" battery, measuring 2½ by 2⅝, by 1¼" and weighing 7½ ounces. Another is the X-203, a 45-volt "B" battery measuring 3¾ by 2⅞, by 1¼", and weighs 13 ounces. The X-204 is a 7½-volt "C" battery tapped at 4½ volts and measures 1⅝ by 2⅞, by ⅝"; this weighs only three ounces.

All three of these batteries are shown in the photo. Their small size can be readily appreciated.

Ultra-Midget Batteries H43

2½ to 10 Meter Receiver

Front view of Eagle Minute Man receiver.

By Leonard Victor, W2DHN, and Irving Rosenberg, W2CQI

● WHAT'S the latest in radio? Well, for the past eight or nine months it's been the *five-meter band*. Throughout the country, and especially in well populated areas, the *ham* (radio amateur) with an experimental turn of mind has been "going up" to the ultra high frequencies. Every day more and more operators are digging down into that "parts box" for the simple equipment needed for five meter work. A year ago, only an occasional station was heard on the fifty-six megacycle band, and then only in the evening. Today, in the New York City area, all you have to do is flip the switch, and there are plenty of stations to "rag-chew" with, *twenty-four hours a day!*

But don't get the idea that the five meter band is only for the fellow who lives in or near a big city. Signals have been heard over a distance of more than eight hundred miles, and two-way communication over hundred-mile distances are already becoming commonplace.

Today the five-meter band is the same as the regular short-wave bands were ten years ago; an open field for experimentation, with new records to be set, new circuits to be designed. If you're tired of commonplace DX (dis- (*Continued on page* 751)

Rear view of the 2.5 to 10-meter receiver.

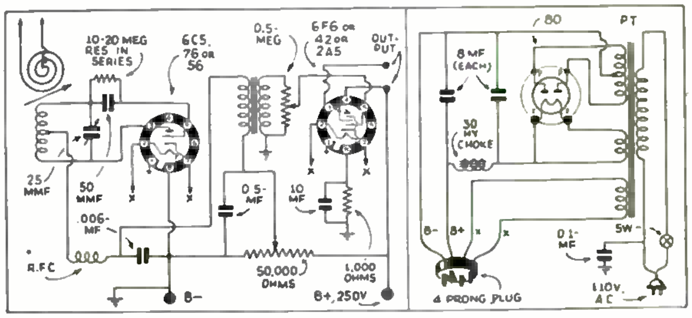


Diagram of Minute Man Receiver (No. 525)

New Superhet Features 6 Metal Tubes and Preselection

● THIS receiver is available in set form and incorporates a good many modern improvements to aid in short wave and long wave reception. Band-switching is accomplished with a 3 unit shielded switch-coil in which 4 bands are incorporated.

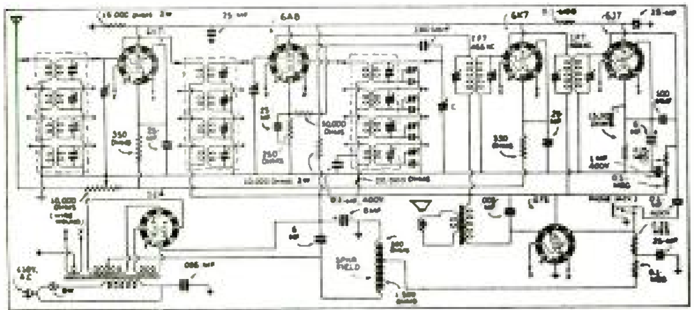
One point on the switch covers the broadcast band, while the remaining three break up the popular short wave bands into three sections. In the circuit diagram we find that metal tubes are used; a 6K7 being used as the pre-selector or tuned rf. stage which is inductively coupled to a 6A8 converter tube, from here we go into a 6K7 intermediate amplifier operating on a frequency of 465 kc. and then into a 6J7 second detector.

The audio amplifier is a 6F6 power amplifier pentode and provides sufficient volume to operate the 8" diameter speaker. This is an A.C. set and employs a standard transformer and rectifier tube; the rectifier is a 5Z4. The field of the dynamic speaker serves as the filter choke and is by-passed on either side with an 8 mf. filter condenser. A tap is taken off this field at 300 ohms in order to provide grid bias for the pentode audio amplifier.

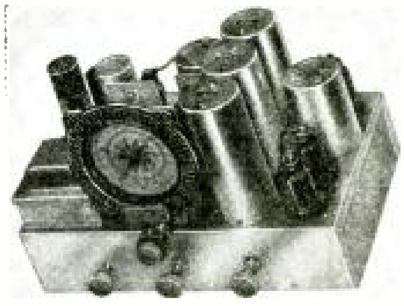
In the photo we see the general view of the completed receiver. Note its compactness and convenient lay-out.

This is a single control receiver, there are no trimmers that require adjustment during operation and there is a jack for the use of earphones. Owing to the use of the new metal tubes the performance on the low wavelengths is particularly smooth.

Article prepared from data supplied by Thor Radio Corp.



This receiver features pre-selector stage on all bands; range 16-550 meters. (No. 526)



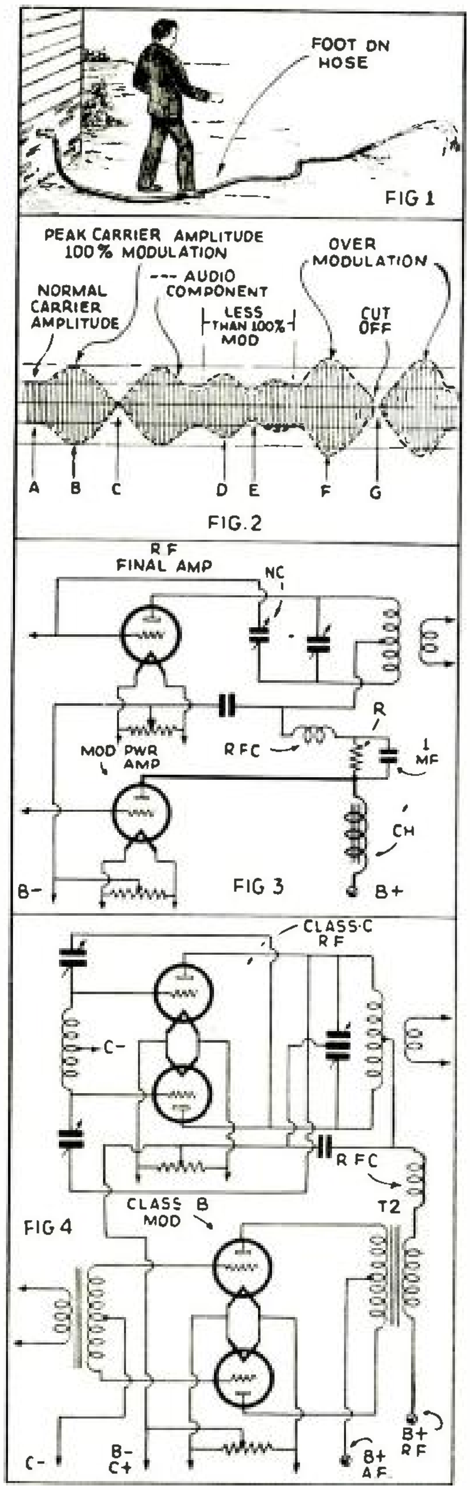
Note extremely neat appearance of 6 metal tube "All-Wave Pathfinder."

Names and addresses of manufacturers of apparatus described on this and following pages furnished upon receipt of 3-cent stamp; mention No. of article.

THE RADIO AMATEUR

Conducted by Geo. W. Shuart

Radio Amateur Course



Simple analogy and graphic illustration of amplitude modulation.

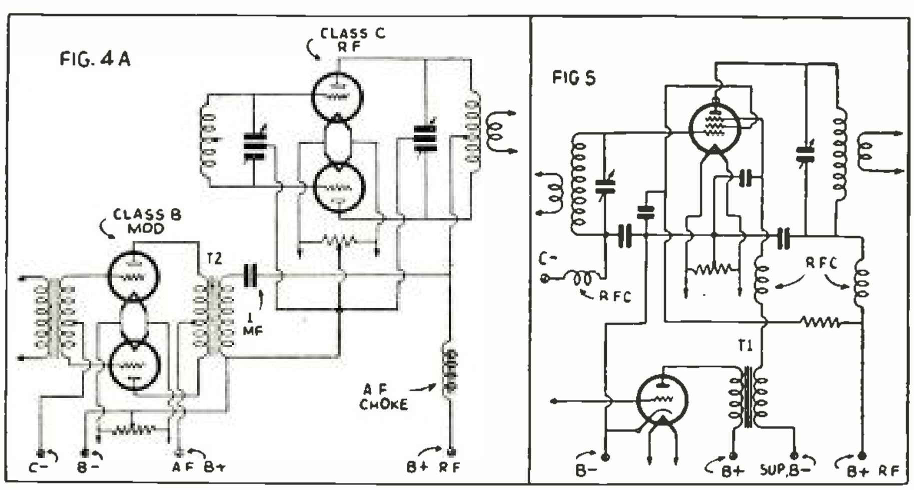
8th Lesson—Explaining the Fundamentals of Amplitude Modulation in Simple Language

AMPLITUDE MODULATION OF CONTINUOUS WAVE TRANSMISSION

● THIS term alone might scare the uninitiated, but, really, the radio transmission of voice and music is not in the least complicated if a few of the basic principles are clearly understood. An ordinary continuous wave or CW transmitter emits a wave of constant power or amplitude when the key is held down. Theoretically when transmitting code signals, the transmitter is modulated in the form of dots and dashes. In this case, however, the wave is cut off abruptly to form the characters. In the case of radio telephony, the audio frequency modulation varies the power output of the transmitter in accordance with the intensity of the audio frequency variation imposed upon the microphone.

The analogue shown in the drawing Fig. 1, where we have a person standing on a hose indicates a hydraulic analogy of modulation. For instance, if the gentleman in question were to press his foot down, shutting off half the water flow, he would then by moving his foot up and down be able to either increase or decrease the flow of water. The degree by which he may increase or decrease the water would be analogous to the volume of the imposed voice signal, and the rapidity with which he may repeat this motion would be analogous to the voice frequency. In other words, modulation does nothing more or less than vary the output of the transmitter at voice or audible frequencies. The degree of variation is the percentage of modulation, and the number of times it makes a complete change is the frequency of the audio component. In diagram 2 we have graphically illustrated how modulation affects the transmitted wave. In the beginning at "A" we have the normal carrier amplitude. Now if we increase this 75%, for example, on one-half of the audio cycle it would naturally be followed by a similar decrease below normal, during the opposite half of the audio cycle.

Therefore, it can be seen by referring to the diagram, that we have limits to the increase and decrease. This limit is commonly termed 100% modulation. At point "B" we find the carrier has been doubled in amplitude, then this is followed by the reverse of this action and the carrier is reduced to zero at point "C." If we only modulated the carrier slightly or some amount less than 100%, it does not cut off completely, and neither does it increase to double the amplitude. This is shown in points "D" and "E." We may, however, modulate the transmitter more than 100% as shown in points "F" and "G." The peaks here are well over twice the normal carrier and while the transmitter output can be reduced no further than zero, distortion comes about due to the fact that the output remains zero for the same length of time that it was greater than twice the amplitude. This causes considerable distortion and interference and should be avoided in all cases.



Diagrams of the various types of modulators and methods of coupling to the r.f. amplifier. Also, suppressor grid modulator diagram.

Thoroughly studying the hydraulic analogue, together with the graphic illustration in Fig. 2, should provide anyone with the necessary knowledge of how modulation is accomplished.

Modulation of a transmitter may be accomplished electrically in a number of ways. The plate voltage to the final amplifier of a transmitter may be varied as shown by various methods shown in Fig. 3 and 4.

In Fig. 3 the modulator merely changes the plate power input to the rf. amplifier at voice frequencies. By connecting the output circuits of the modulator and rf. amplifier in parallel and feeding the D.C. voltage to the two tubes through the audio frequency choke CH, the audio voltage is developed across the choke and either adds to the effective plate voltage applied to the amplifier or cancels it. If we were to develop 300 volts of audio frequency across the choke and the voltage applied to the rf. amplifier without modulation was 300 volts, we would find that on the plus half of the AF cycle we would have 600 volts applied to the rf. amplifier. This would be the 300 original

Another method of varying the output of the transmitter is shown in Fig. 5. This is the recently introduced suppressor modulation, where changes in suppressor voltage have direct control over the output of the amplifier. These tubes are pentodes such as the 802, 803, RK20, and many others. In this case, however, the audio power requirements are not as severe as when plate modulation is used. For in plate modulation if we have 50 watts input to the R.F. amplifier, that is D.C. plate voltage times D.C. plate current, we need at least 25 watts of audio power. In other words, for plate modulation the audio requirements are just 50% of the power input to the modulated amplifier for 100% modulation. In figure 5, the audio requirements are, of course, much less. Usually 5 or 6 watts of audio is more than sufficient to modulate even the largest of pentodes. The adjustment of a suppressor modulated amplifier is quite simple. The suppressor voltage is adjusted until the output of the amplifiers is reduced 50%. This is accomplished by running the suppressor *negative*. The audio voltage is then

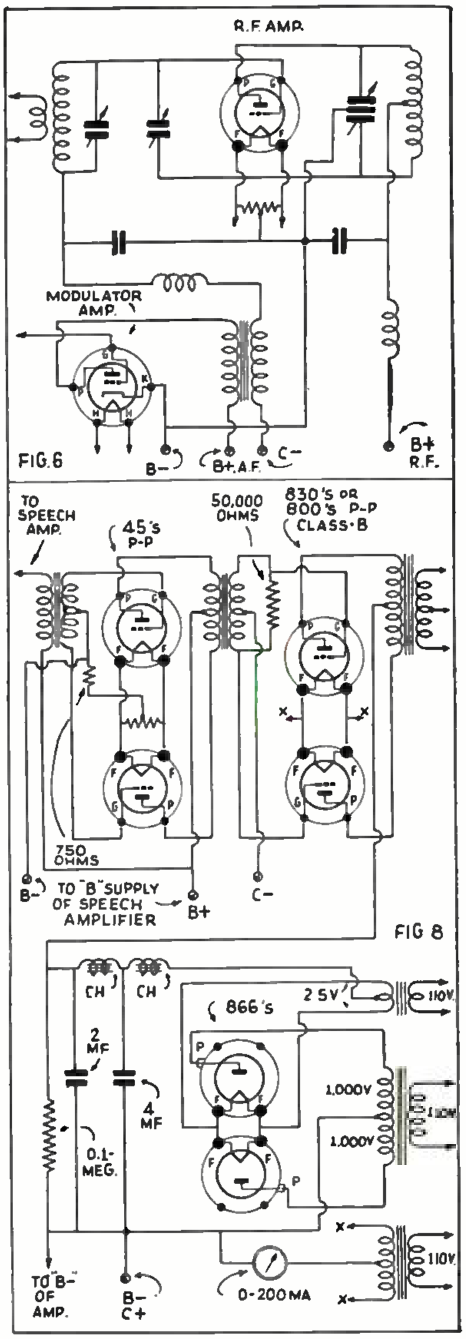
In this lesson we have endeavored to provide a very clear picture of modulation—how it is accomplished, and what it does. Also, numerous diagrams have been given of various types of modulators and speech amplifiers. Three types of obtaining amplitude modulation are discussed in this lesson. They are: Plate modulation; Suppressor modulation; Control Grid modulation. Have you started a "scrapbook" for these "Course" lessons? You will find them very valuable for reference later. If you haven't a complete set of the lessons, we would strongly suggest that you obtain the earlier lessons and complete the set to date. Otherwise you may find it impossible to do so later, as the older copies are frequently out of print just when you want them most.

volts and the 300 volts developed by the modulator. Now on the negative half of the cycle we have 300 volts minus which actually nullifies the original 300 volts applied to the rf. amplifier, resulting in zero plate voltage. The rf. amplifier in this case is operated *class C*, as described in the previous lesson, where the changes in power output is directly proportional to changes in the power input. Therefore, when the plate voltage is doubled the amplitude of the carrier is doubled and when the plate voltage is reduced to zero, of course the output is also zero. In Fig. 4 we have other methods of accomplishing the same conditions through the use of push-pull modulators coupled to the amplifier through transformers.

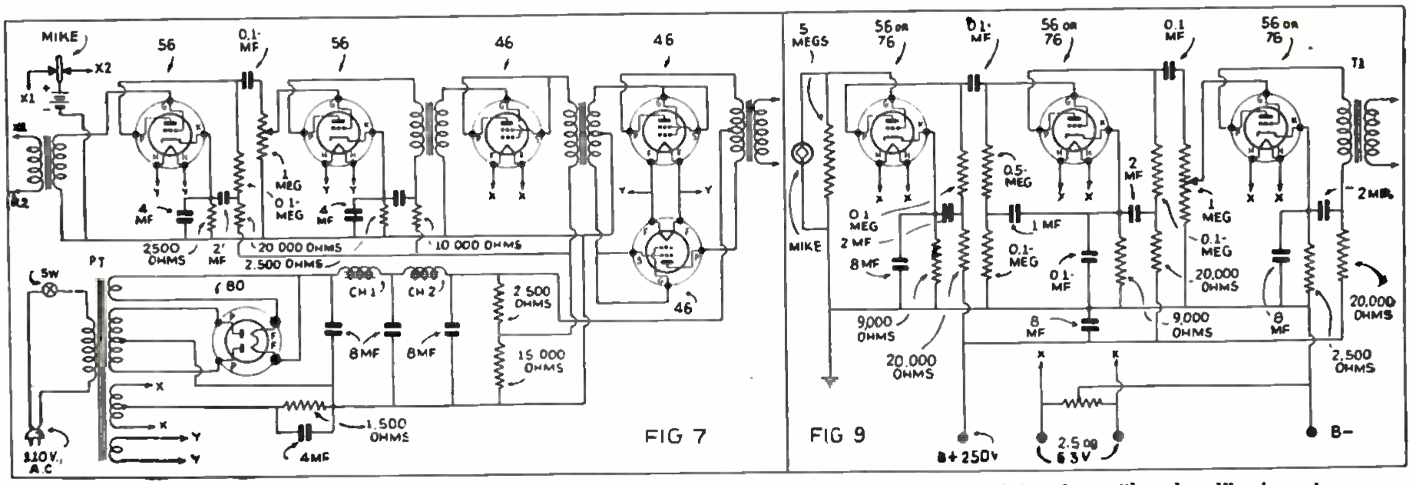
coupled to the suppressor through a suitable transformer, and in this manner will increase and decrease the suppressor voltage, thus causing an increase and decrease in the power output of the tube.

In Fig. 6, we have grid modulation. This is accomplished by adjusting the R.F. amplifier so that the variation in output is directly in proportion to the changes in grid voltage. Here, too, only a low-powered modulator is required. The output of a grid modulator may even be less than that required for suppressor modulation.

In Fig. 7, we have a diagram of a complete modulator with an output of around 25 watts. We have two stages of speech amplification using type 56 tubes, coupled to a 46 connected as a triode driver for the class B 46's. The output transformer should be of proper design to match (*Continued on page* 752)



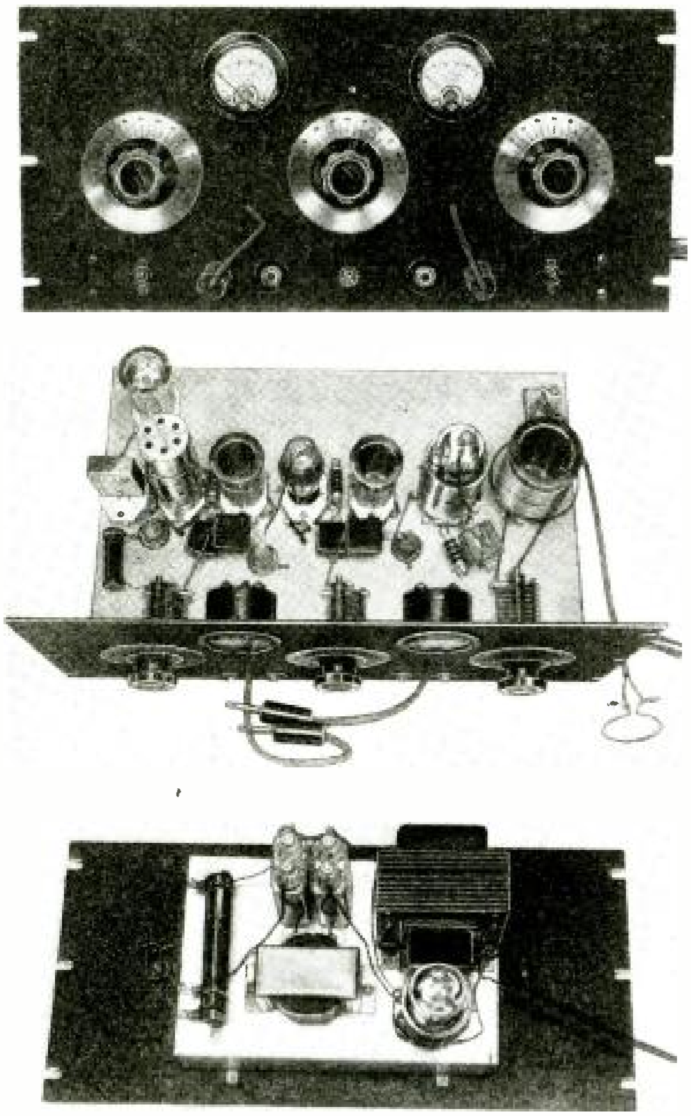
Method of modulating the control-grid, also diagram of high-power modulator and power supply.



Complete 25-watt modulator and speech amplifier diagram together with a speech amplifier for a "low-level" microphone.

W2AMN's All-BAND TRANSMITTER—

By George W. Shuart, W2AMN



Front and top views of the exciter and rear view of the power supply.

We are pleased to present this article—Part I—of a series describing a modern "all-pentode" all-band phone CW transmitter recently designed and built by W2AMN. This transmitter has features which should be of vital interest to all amateurs who wish to keep up to date in transmitter design.

● AFTER many years of building transmitters of all descriptions from 5 to 500 watts, the writer decided to build a new transmitter which would be *modern* in every respect. This transmitter must be efficient and above all *simple* to operate. By simple operation we mean that changes can be made from one band to the other, without tearing the thing apart and rebuilding it.

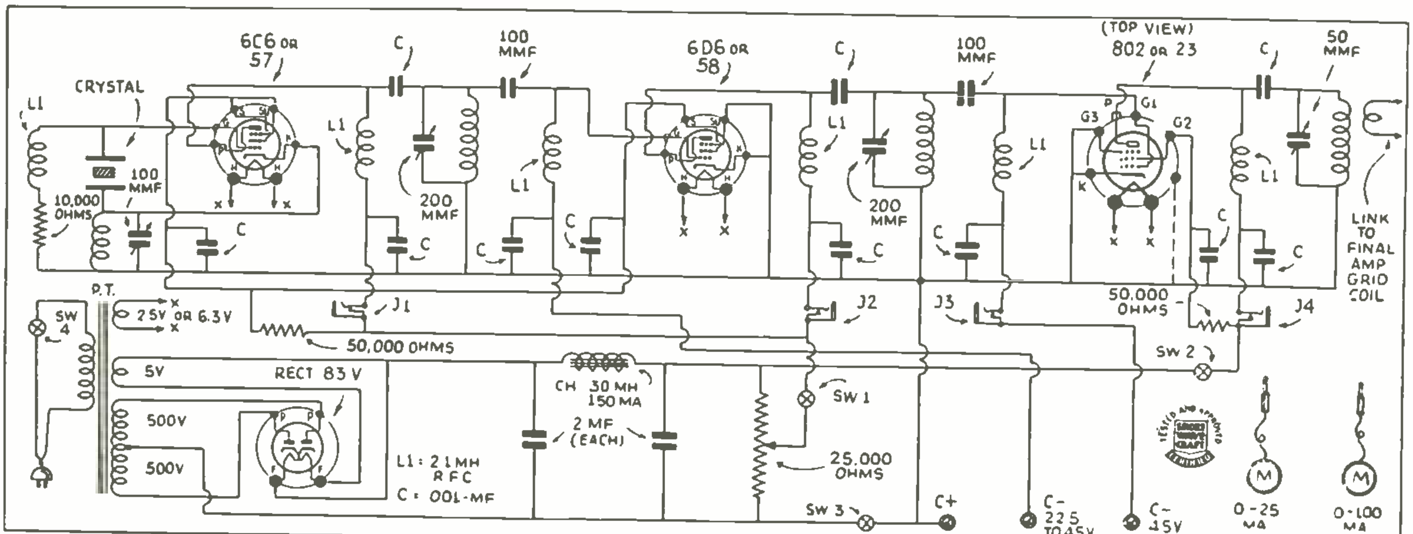
The first thought was naturally toward *band-switching*. But experiment has shown that the convenience is not worth the constructional difficulties encountered. The major difficulty in changing bands was overcome by allowing the tuned circuits of the exciter or low-power stages to cover two bands with a single set of coils. For high efficiency the power amplifier coils should be built to the proper size anyway so the only inconvenience was in the low-power stages.

In keeping with modern design the "rig" of course was built in "rack and panel" style. This takes up less space in the shack and presents a more pleasing and professional appearance.

"Believe it or not" choosing the low-power tubes was quite a problem. The line-up finally decided upon was as follows: A 57 "tritet" crystal controlled oscillator, a 58 first buffer or frequency doubler, and an RK-23 second buffer, these are for a 2.5 volt heater supply. For 6.3 volts they would be 6C6, 6D6 and an RCA-802. The line-up outlined above allows operation of the last tube on any one of *four* amateur bands; a really flexible arrangement. Of course the final power amplifier to feed the antenna was long ago decided on; we just had to use one of those *new high-power pentodes!* The output of the 15 watt pentode in the exciter is more than sufficient to drive the "big bottles" even though doubling may be necessary in the last stage of the exciter. That is the story—four pentodes; in fact the whole doggone family, starting with the smallest and ending with the largest. We say *largest*—and hope that the tube makers don't go us one better before this appears in print!

Standard Relay-Rack Used.

The exciter unit is built on a standard relay-rack panel 19x8¾ inches and a chassis 17x11x2½ inches. All tuning condensers are grounded to the (*Continued on page 744*)



Schematic wiring diagram of the 3-tube "all-pentode" exciter—the heart of W2AMN's new transmitter.

CORRECTED AND REVISED Monthly

Short-Wave Stations of the World

Complete List of Broadcast, Police and Television Stations

We present herewith a revised list of the short-wave broadcasting, experimental and commercial radiophone stations of the world. This is arranged by frequency, but the wavelength figures are also given for the benefit of readers who are accustomed to working with "meters."

All the stations in this list use telephone transmission of one kind or another and can therefore be identified by the average listener.

Herewith is also presented a very fine list of police as well as television stations. 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 themselves. A post card will be sufficient. We will safely return to you any verifications that you send in to us. Communications of this kind are a big help.

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

Around-the-Clock Listening Guide

Although short-wave reception is notorious for its irregularity and seeming inconsistency (wherein lies its greatest appeal to the sporting listener), 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 3 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 1 p.m.-8 p.m., the 25-35 meter will be found very productive. To the west of the listener this same band is generally found best from about 8 p.m. until 9 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.

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
6-8:45 a.m. Irregular

21520 kc. W2XE
-B- 13.94 meters
ATLANTIC BROADCASTING CORP.
485 Madison Ave., N.Y.C.
Irregular 8 a.m.-12 n.

21420 kc. WKK
-C- 14.01 meters
A. T. & T. CO.
LAWRENCEVILLE, N. J.
Calls Argentina, Brazil and Peru, daytime

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

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

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

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

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

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

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

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

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

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

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

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

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

18270 kc. ETA
-C- 16.42 meters
CHIEF ENGINEER
P. O. Box 283, ADDIS ABABA, ETHIOPIA
Irregularly

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

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

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

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

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

17810 kc. PCV
-C- 16.84 meters
KOOTWIJK, HOLLAND
Calls Java, 6-9 a. m.

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

17780 kc ★ W3XAL
-B- 16.87 meters
NATIONAL BROAD. CO.
BOUND BROOK, N. J.
Relays WJZ, Daily exc. Sun. 9 a.m.-1 p.m.

17775 kc. PHI
-B- 16.88 meters
HUIZEN, HOLLAND
Used Irregularly

17760 kc. ★ W2XE
-B- 16.89 meters
ATLANTIC BROADCASTING CORP.
485 Madison Ave., N.Y.C.
Irregular 11 a.m.-1 p.m.

17760 kc. DJE
-B- 16.89 meters
BROADCASTING HOUSE
BERLIN, GERMANY
8:05-11:30 a.m.

17760 kc. IAC
-C- 16:89 meters
PISA, ITALY
Calls ships, 6:30-7:30 a. m.

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

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

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

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

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

16240 kc. KTO
-C- 18.47 meters
MANILLA, 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

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- 19.18 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.

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. DJT
-X.C- 19.53 meters
REICHSPOSTZENSTRALAMT, ZEESEN, GERMANY
Works with Africa and broadcasts 11 p.m.-1 a.m.

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

15340 kc. DJR
-B,X- 19.56 meters
BROADCASTING HOUSE, BERLIN, GERMANY
1:30-3:30 a.m.

15330kc. ★ W2XAD
-B- 19.56 meters
GENERAL ELECTRIC CO.
SCHENECTADY, N. Y.
Relays WGY daily, 2-3 p.m.
Sun. 10:30 a.m.-4 p.m.

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

15290 kc. LRU
-B- 19.62 meters
"EL MUNDO"
BUENOS AIRES, ARGENTINA, S. A.
Testing 7-7:45 and 11-11:45 p.m. Soon on regular daily schedule.

15280 kc. DJQ
-B- 19.63 meters
BROADCASTING HOUSE
BERLIN, GERMANY
12:30-2:15 a.m., 8:05-11:30 a.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
12:15-2:15 p.m.

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

15245 kc. ★
-B- 19.68 meters
"RADIO COLONIAL"
PARIS, FRANCE
Service de la Radiodiffusion
98, bis, Blvd. Haussmann
6.55-11 a.m.

15220 kc. ★ PCJ
-B- 19.71 meters
N.V. PHILIPS' RADIO
EINDHOVEN, HOLLAND
Sun. 8-11 a.m.
Also Tues. 3-8 a.m., Wed. 7-11 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
12:30-2:15, 3:45-11:30 a.m.

15180 kc. GSO
-B- 19.76 meters
DAVENTRY
B.B.C., BROADCASTING HOUSE,
LONDON, ENGLAND
Irregular

(All Schedules Eastern Standard Time)

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
ROME, ITALY
10:30 to 10:45 a.m., except Sunday
Sat. 10-10:45 a.m.

15110 kc. DJL
-B.X- 19.85 meters
BROADCASTING HOUSE, BERLIN, GERMANY
4-6 a.m.

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

15070 kc. PSD
-C- 19.91 meters
RIO DE JANEIRO, BRAZIL
Calls N.Y., Buenos Aires and Europe, daytime

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

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

14600 kc. JVH
-B.C- 20.55 meters.
NAZAKI, JAPAN
Phones Europe 4-8 a.m.
Irregular 12 m-1 a.m.
Mon. and Thurs. 4-5 p.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

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

14460 kc. DZH
-C.X- 20.75 meters
REICHSPOSTZENSTRALAMT, ZEESEN, GERMANY
Works on telephony and broadcasts 12 n.-2 p.m.

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

13635 kc. SPW
-B- 22 meters
WARSAW, POLAND
Sundays 11:30 a.m.-12:30 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

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

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

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

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

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

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

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

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

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

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

12130 kc. DJS
-C.X- 24.73 meters
REICHSPOSTZENSTRALAMT, ZEESEN, GERMANY
Works phone and broadcasts 7-9 p.m.

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

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

11955 kc. ETB
-C- 25.09 meters
ADDIS ABABA, ETHIOPIA
See 18270 kc.

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

11880 kc. ★
-B- 25.23 meters
"RADIO COLONIAL"
PARIS, FRANCE
4-5 a.m., 11:15 a.m.-6:05 p.m.

11870 kc. ★W8XK
-B- 25.26 meters
WESTINGHOUSE ELECTRIC & MFG. CO.
PITTSBURGH, PA.
5-9 p.m.
Fri. till 12 m
Relays KDKA

11860 kc. GSE
-B- 25.29 meters
DAVENTRY,
B.B.C., BROADCASTING HOUSE, LONDON, ENGLAND
9 a.m.-12 n.

11855 kc. DJP
-B.X- 25.31 meters
BROADCASTING HOUSE, BERLIN, GERMANY
2-4 a.m.

11830 kc. W2XE
-B- 25.36 meters
ATLANTIC BROADCASTING CORP.
485 MADISON AVE., N. Y. C.
Relays WABC 6-8 p.m.

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

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

11810 kc. ★2RO
-B- 25.4 meters
E.I.A.R.
Via Montello 5
ROME, ITALY
8:15-9 a.m., 9:15-11 a.m., 11:30 a.m.-12:15 p.m.

11800 kc. CO9WR
-X- 25.42 meters
P. O. Box 85
SANCTI SPIRITUS, CUBA
4-6, 9-11 p.m.
9 a.m.-12 n.

11795 kc. DJO
-B.X- 25.43 meters
BROADCASTING HOUSE, BERLIN, GERMANY
5-7 a.m.

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

11770 kc. DJD
-B- 25.49 meters
BROADCASTING HOUSE, BERLIN, GERMANY
12-4:30 p.m.

11750 kc. ★GSD
-B- 25.53 meters
DAVENTRY,
B.B.C., BROADCASTING HOUSE, LONDON, ENGLAND
12:15-4 p.m.

11730 kc. PHI
-B- 25.57 meters
HUIZEN, HOLLAND
Daily exc. Tues. and Wed. 8-10 a.m., Sat. and Sun. 8-11 a.m.

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

11715 kc.
-B- 25.61 meters
"RADIO COLONIAL"
PARIS, FRANCE
6:15-9 p.m.
11 p.m.-1 a. m.

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

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

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

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. Also broadcasts irregularly on Sunday, 9-10 a.m.

11000 kc. PLP
-B-C- 27.27 meters
BANDOENG, JAVA
Relays NIROM programs 5:30-10 a.m. irregular on Sundays

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
Tues. and Fri. 2-3 p.m., Mon. and Thurs. 4-5 p.m.

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

10670 kc. ★CEC
-C- 28.12 meters
SANTIAGO, CHILE
Broadcasts Thurs., Sun.
8:30-9 p.m., Daily 7-7:15 p.m.

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

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

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

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

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

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

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

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

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

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

10290 kc. DIQ
-X- 29.16 meters
KONIGSWUSTERHAUSEN, GERMANY
Broadcasts irregularly

10260 kc. PMN
-B-C- 29.74 meters
BANDDENG, JAVA
Calls Australia 5 a.m.
Broadcasts Sun. 5:30-10 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

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

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

10042 kc. DZB
-C- 29.87 meters
ZEESEN, GERMANY
Works with Central America and broadcasts 2-4 p.m.

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

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, 4-7 a. m.

9800 kc. LSE
-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

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

9675 kc. DZA
-C- 31.01 meters
ZEESEN, GERMANY
Works with Africa and broadcasts 5-7 p.m.

9635 kc. ★2RO
-B- 31.13 meters
E.I.A.R., ROME, ITALY
M., W., F., 6-7:30 p.m.
Tues., Thurs., Sat. 6-7:45 p.m.
Daily 1:30-5 p.m.

9625 kc. ★CT1AA
-B- 31.17 meters
LISBON, PORTUGAL
Tues., Thurs., Sat. 4:30-7 p.m.

9620 kc. YDB
-B- 31.19 meters
N.I.R.O.M.
SOERABAJA, JAVA
5:30-11 a.m.

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. 7:30-8:30 a.m., 1-2, 7-8 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
NEWTOWN SQUARE, PA.
Relays WCAU
12 N-7:50 p.m.

9580 kc. LRX
-B- 31.32 meters
"EL MUNDO"
BUENOS AIRES, ARGENTINA
Testing

9580 kc. ★ GSC
-B- 31.32 meters
DAVENTRY,
B.B.C., BROADCASTING HOUSE, LONDON, ENGLAND
4:15-5:45, 6-8, 10-11 p.m.

9580 kc. ★VK3LR
-B- 31.32 meters
Research Section,
Postmaster Gen'ls. Dept.,
61 Little Collins St.,
MELBOURNE, AUSTRALIA
3-7:30 a.m. except Sun.
also Fri. 10:30 p.m.-2 a.m.

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

(All Schedules Eastern Standard Time)

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

9560 kc. ★DJA
-B- 31.38 meters
BROADCASTING HOUSE, BERLIN
4:55-10:45 p.m., 8:05-11:30 a.m.

9540 kc. ★DJN
-B- 31.45 meters
BROADCASTING HOUSE BERLIN, GERMANY
3:45-11:30 a.m., 4:55-10:45 p.m.

9530 kc. ★W2XAF
-B- 31.48 meters
GENERAL ELECTRIC CO.
SCHENECTADY, N. Y.
Relays WGY 4 p.m.-12 m.
Sun. 4:15 p.m.-12 m.
Sat. 12 n.-12 m.

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

9518 kc. ★VK3ME
-B- 31.54 meters
AMALGAMATED WIRELESS, Ltd.
G. P. O. Box 1272L,
MELBOURNE, AUSTRALIA
Daily exc. Sun. 4-7 a.m.

9510 kc. ★GSB
-B- 31.55 meters
DAVENTRY,
B.B.C., BROADCASTING HOUSE, LONDON, ENGLAND
12:15-4, 4:15-5:45, 6-8 p.m.

9501 kc. PRF5
-B- 31.58 meters
RIO DE JANEIRO, BRAZIL
Irregularly 4:45-5:45 p.m.

9450 kc. TG1X
-B- 31.75 meters
MINISTRE de FOMENTO
GUATEMALA CITY, GUATEMALA
Irregular 6-11 p.m.

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.
Broadcasts Tues. and Thurs., Sat. 10-10:30 a.m. irregularly

9330 kc. CJA2
-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

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

9065 kc. HJU
-B- 33.09 meters
NATL. RAILWAYS,
BUENAVENTURA, COLOMBIA
Heard between 8 and 11:30 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

8795 kc. HKV
-B- 34.09 meters
BOGOTA, COLOMBIA
Irregular; 6:30 p.m.-12 m.

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

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

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

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

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

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

8590 kc. YNVA
-B- 34.92 meters
MANAGUA, NICARAGUA
8-10:30 p.m.

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

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

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

8220 kc. ZP10
-B- 36.4 meters
ASUNCION, PARAGUAY
7-9 p.m.

8214 kc. HCJB
-B- 36.5 meters
QUITO, ECUADOR
7-11 p.m., except Monday
Sun. 11 a.m.-12 n.; 4-10 p.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.

7854 kc. HC2JSB
-B- 38.2 meters
GUAYAQUIL, ECUADOR
8:15-11:15 p.m.

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

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

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

7620 kc. ETD
-C- 39.37 meters
ADDIS ABABA, ETHIOPIA
See 18270 kc.

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

7510 kc. ★JVP
-B.C- 39.95 meters
NAZAKI, JAPAN
Tues. and Fri. 2-3 p.m.

7400 kc. HJ3ABD
-B- 40.54 meters
P. O. Box 509
BOGOTA, COLOMBIA
Daily 12-2 p. m.; 7-11 p. m.
Sunday, 5-9 p. m.

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

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

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

7080 kc. VP3MR
-B- 42.68 meters
GEORGETOWN, BRI. GUIANA, S.A.
Sun. 7:45-10:15 a.m.
Mon. 3:45-4:45 p.m.
Tues 4:45-6:45 p.m.
Wed. 4:45-7:45 p.m.
Thur. 5-6:45 p.m.
Sat. 4:45-7:45 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 18,
PARAMIRABO, DUTCH GUIANA
Sun. 9:36-11:36 a.m.
Mon. and Fri. 5:36-9:36 p.m.
Tues. and Thur. 8:36-10:36 a.m., 2:36-4:36 p.m.
Wed. 3:36-4:36, 5:36-9:36 p.m.
Sat. 2:36-4:36 p.m.

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

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

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

6814 kc. HIH
-B- 44.03 meters
SAN PEDRO de MACORIS
DOMINICAN REP.
12:10-1:40 p.m., 7:30-9 p.m.,
Sun. 3-4 a.m. 4:15-6 p.m.

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

6750 kc. ★JVT
-B.C- 44.44 meters
NAZAKI, JAPAN
KOKUSAI-DENWA KAISHA, LTD., TOKIO
Broadcasts 12 m.-1 a.m., 4-8 a.m.

6710 kc. ★TIEP
-B- 44.71 meters
LA-VOZ 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.

6660 kc. ★HC2RL
-B- 45.05 meters
P. O. BOX 759, GUAYAQUIL, ECUADOR, S. A.
Sunday, 5:45-7:45 p. m.
Tues., 9:15-11:15 p. m.

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

6618 kc. ★PRADO
-B- 45.33 meters
RIOBAMBA, ECUADOR
Thurs. 9-11:45 p.m.

6611 kc. RV72
-B- 45.38 meters
MOSCOW, U. S. S. R.
1-6 p. m.

6600 kc. YV5AM
-B- 45.45 meters
"ECOS de LLANO"
SAN JUAN de LOS MORROS, VENEZUELA
Testing in evening

6550 kc. TIRCC
-B- 45.77 meters
RADIOEMISORA CATOLICA COSTARRICENSE
SAN JOSE, COSTA RICA
Sun. 12:45-2:30, 6-7, 8-9 p.m.

6528 kc. HIL
-B- 45.95 meters
CIUDAD TRUJILLO, D.R.
Sat., 8-10 p.m.

6520 kc. ★YV6RV
-B- 46.01 meters
VALENCIA, VENEZUELA
12 n.-1 p.m., 6-10 p.m.

6500 kc. HJ5ABD
-B- 46.15 meters
MANIZALES, COL.
12-1:30 p. m., 7-10 p. m.

6482 kc. HI4D
-B- 46.28 meters
CIUDAD TRUJILLO, DOMINICAN REPUBLIC
Except Sun. 11:55 a.m.-1:40 p.m.; 4:40-7:40 p.m.

6450 kc. HJ4ABC
-B- 46.51 meters
"LA VOZ de CAMBEBE,"
IBAQUE, COLOMBIA
7:30-11 p.m.

6447 kc. HJ1ABB
-B- 46.53 meters
BARRANQUILLA, COL., S. A.
P. O. BOX 715,
11:30 a. m.-1 p. m.; 5-10 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.
Irregular in evening

6410 kc. TIPG
-B- 46.8 meters
APARTADO 225,
SAN JOSE, COSTA RICA
"LA VOZ DE LA VICTOR"
12 n.-2 p.m., 6-10 p.m.

6380 kc. HI3U
-B- 47.02 meters
SANTIAGO de los CABALLEROS, DOM. REP.
Irregular in evening

6375 kc. YV4RC
-B- 47.06 meters
CARACAS VENEZUELA
4:30-10:30 p.m.

6316 kc. HIZ
-B- 47.5 meters
CIUDAD TRUJILLO
DOMINICAN REPUBLIC
Daily except Sat. and Sun. 4:40-5:40 p. m.; Sat., 9:40-11:40 p. m.; Sun., 11:40 a. m.-1:40 p. m.

6230 kc. OAX4G
-B- 48 meters
Apartado 1242
LIMA, PERU
Daily 7-10:30 p.m.
Wed. 6-10:30 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.

6180 kc. XEXA
-B- 48.54 meters
DEPT. OF EDUCATION
MEXICO CITY, MEX.
8 p.m.-12 m.

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

6170 kc. HJ3ABF
-B- 48.62 meters
BOGOTA, COLOMBIA
6-11 p.m.

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

6155 kc. COKG
-B- 48.74 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.

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

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

6150 kc. HJ5ABC
-B- 48.78 meters
CALI, COLOMBIA
Daily 11 a.m.-12 n., Sun. 12 n.-2 pm., Daily except Sat. and Sun. 7-10 p.m.

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

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

6130 kc. COCD
-B- 48.92 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- 48.92 meters
KUALA LUMPUR,
FED. MALAY STATES
Sun., Tue., and Fri., 6:40-8:40 a. m.

6120 kc. ★W2XE
-B- 49.02 meters
ATLANTIC BROADCASTING CORP.
485 MADISON AVE., N. Y. C.
Relays WABC, 8-11 p.m.

6120 kc. XEFT
-B- 49.02 meters
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. HJ1ABE
-B- 49.05 meters
CARTAGENA, COL.
P. O. Box 31
Mon. 10 p.m.-12 m.
Daily 7:30-9 p.m.

6110 kc. ★CHNX
-B- 49.1 meters
P.O. BOX 998
HALIFAX, N.S., CANADA
Daily 9 a.m.-12:30 p.m., 4-10 p.m.

6110 kc. ★GSL
-B- 49.10 meters
DAVENTRY,
B.B.C., BROADCASTING HOUSE, LONDON, ENGLAND
2:30-4, 10-11 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.
Relays WENR, Chicago

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.

6090 kc. ★CRCX
-B- 49.26 meters
TORONTO, CANADA
Daily 5:30-11:30 p.m.
Sun. 11:45 a.m.-11:45 p.m.

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

(All Schedules Eastern Standard Time)

6085 kc. 2RO
-B- 49.3 meters
E.I.A.R.
ROME, ITALY

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
Tests 3-5 p.m.

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

6070 kc. HJ4ABC
-B- 49.42 meters
PERIERA, COL.
9:30-11:30 a.m., 7-8 or 9 p.m.

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

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

6060 kc. ★W8XAL
-B- 49.50 meters
CROSLEY RADIO CORP.
CINCINNATI, OHIO
6:30 a.m.-8 p.m.; 11 p.m.-1 a.m.
Relays WLW

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

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

6050 kc. HI9B
-B- 49.59 meters
CIUDAD TRUJILLO, DOM. REP.
Irregular 6 p.m.-11 p.m.

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

6045 kc. HJ3ABI
-B- 49.63 meters
BOGOTA, COLO.
Irregular in evening

6042 kc. HJ1ABG
-B- 49.65 meters
BARRANQUILLA, COLO.
12 n.-1 p.m., 6-10 p.m.
Sun. 1-6 p.m.

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

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

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

6040 kc. YDA
-B- 49.67 meters
N.I.R.O.M.
TANDJONGPRIOK, JAVA
5:45-6:45 p.m., 10:30 p.m.-1:30 a.m.

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

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

6020 kc. CQN
-B- 49.83 meters
MACAO, CHINA
Mon. and Fri. 3-5 a.m.

6020 kc. ★DJC
-B- 49.83 meters
BROADCASTING HOUSE, BERLIN
12 n.-4:30 p.m., 4:55-10:45 p.m.

6020 kc. HJ3ABH
-B- 49.83 meters
BOGOTA, COLO.
APARTADO 565
7-11 p.m.

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

6018 kc. ZHI
-B- 49.9 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.

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., Sun. 8-10 p.m.
Sat. also 11 p.m.-12 m.

6005 kc. HJ1ABJ
-B- 49.96 meters
SANTA MARTA, COLO.
6-11 p.m. except Wed.

6005 kc. VE9DN
-B- 49.96 meters
CANADIAN MARCONI CO., MONTREAL, QUE., CANADA
Saturdays at 11:30 p.m.

6000 kc. TGWA
-B- 50 meters
GUATEMALA CITY, GUAT.
12 n-1 p.m., 6:30-7:30 p.m. 10-11 p.m. Sat. also from 12 m.-6 a.m. (Sun.)

6000 kc. RV59
-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.

5985 kc. HJ2ABC
-B- 50:13 meters
CUCUTA, COLOMBIA
6-9:30 p.m.

5980 kc. XEVI
-B- 50.17 meters
MEXICO CITY, MEX.
Mon., Wed., Fri., 2-3 p.m., Tues. 7-8, Thurs. 7-9, Sat. 8-9 p.m., Sun. 12 m-1 p.m.

5980 kc. HIX
-B- 50.17 meters
CIUDAD TRUJILLO, DOMINICAN REP.
Sun. 7:40-10; Tues. and Fri. 11:40 a.m.-12:40 p.m., 4:40-5:40 and 8:10-10:10 p.m., Mon., Wed., Thurs. and Sat. 11:40 a.m.-12:40 p.m. and 4:40-5:40 p.m.

5970 kc. HJN
-B- 50.28 meters
BOGOTA, COL.
6-11 p.m.

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

5950 kc. HJ4ABE
-B- 50.42 meters
MEDELLIN, COLO.
Daily 11 a.m.-12 n., 6-10:30 p.m.

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

5910 kc. HH2S
-B- 50.76 meters
PORT-au-PRINCE, HAITI
7:30-10 p.m.

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

5880 kc. YV8RB
-B- 51.02 meters
"LA VOZ de LARA"
BARQUISIMETO, VENEZUELA
6-10 p.m.

5875 kc. HRN
-B- 51.06 meters
TEGUCIGALPA, HONDURAS
5-9:30 p.m.

5860 kc. HI1J
-B- 51.19 meters
SAN PEDRO de MACORIS, DOM. REP.
6-8:40 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
11 a.m.-1 p.m., 5:30-10 p.m.

5825 kc. TIGPH
-B- 51.5 meters
SAN JOSE, COSTA RICA
6:15-11 p.m.

5800 kc. ★YV2RC
-B- 51.72 meters
BROADCASTING 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
Broadcasts 2-7:45 a.m.

5780 kc. OAX4D
-B- 51.9 meters
P.O. Box 853
LIMA, PERU
Mon., Wed. & Sat. 9-11:30 p.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
GAUTEMALA CITY, GUAT.
Tues., Thurs., and Sun. 6-8 p.m.

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

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

4600 kc. HC2ET
-B- 65.22 meters
Apartado 249
GUAYAQUIL, ECUADOR
Wed., Sat., 9:15-11 p.m.

4470 kc. YDB
-B- 67.11 meters
N.I.R.O.M.
SOERABAJA, JAVA
10:30 p.m.-1:30 a.m., 5:45-6:45 p.m.

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

4273 kc. RV15
-B- 70.20 meters
KHABAROVSK, SIBERIA, U. S. S. R.
Daily, 3-9 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.

3543 kc. CR7AA
-B- 84.67 meters
P. O. BOX 594
LOURENCO MARQUES, MOZAMBIQUE, E. AFRICA
1:30-3:30 p.m., Mon., Thurs., and Sat.

3490 kc. YDH3
-B- 85.96 meters
BANDOENG, JAVA
Daily except Fri., 4:30-5:30 a.m.

3040 kc. YDA
-B- 98.68 meters
N.I.R.O.M.
TANDJONGPRIOK, JAVA
5:30-11 a.m.

(All Schedules Eastern Standard Time)

Police Radio Alarm Stations

CGZ	Vancouver, B.C.	2342 kc.	KGPB	Minneapolis, Minn	2430 kc.	KGZF	Chanute, Kans.	2450 kc.
CJW	St. Johns, N.B.	2390 kc.	KGPC	St. Louis, Mo.	1706 kc.	KGZG	Des Moines, Iowa	2466 kc.
CJZ	Verdeen, Que.	2390 kc.	KGPD	San Francisco, Cal.	2466 kc.	KGZH	Klamath Falls, Ore.	2442 kc.
KGHA, KGHB, KGHC	Portable-Mobile In State of Wash.	2490 kc.	KGPE	Kansas City, Mo.	2422 kc.	KGZI	Wichita Falls, Tex.	2458 kc.
			KGPF	Santa Fe, N.Mex.	2414 kc.	KGZJ	Phoenix, Ariz.	2430 kc.
			KGPG	Vallejo, Cal.	2422 kc.	KGZM	El Paso, Tex.	2414 kc.
KGHG	Las Vegas, Nev.	2474 kc.	KGPH	Oklahoma City, Okla.	2450 kc.	KGZN	Tacoma, Wash.	2414 kc.
KGHK	Palo Alto, Cal.	1674 kc.	KGPI	Omaha, Neb.	2466 kc.	KGZO	Santa Barbara, Cal.	2414 kc.
KGHM	Reno, Nev.	2474 kc.	KGPJ	Beaumont, Tex.	1712 kc.	KGZP	Coffeyville, Kans.	2450 kc.
KGHN	Hutchinson, Kans.	2450 kc.	KGPK	Sioux City, Iowa	2466 kc.	KGZQ	Waco, Tex.	1712 kc.
KGHO	Des Moines, Iowa	1682 kc.	KGPL	Los Angeles, Cal.	1712 kc.	KGZR	Salem, Ore.	2442 kc.
KGHP	Lawton, Okla.	2466 kc.	KGPM	San Jose, Cal.	2466 kc.	KGZT	Santa Cruz, Cal.	1674 kc.
KGHQ	Chinook Pass, W.	2490 kc.	KGPN	Davenport, Iowa	2466 kc.	KGZU	Lincoln, Neb.	2490 kc.
KGHR	(Mobile) in Wash.	2490 kc.	KGPO	Tulsa, Okla.	2450 kc.	KGZV	Aberdeen, Wash.	2414 kc.
KGHS	Spokane, Wash	2414 kc.	KGPP	Portland, Ore.	2442 kc.	KGZW	Lubbock, Tex.	2458 kc.
KGHT	Brownsville, Tex.	2382 kc.	KGPQ	Honolulu, T.H.	1712 kc.	KGZX	Albuquerque, N.Mex.	2414 kc.
KGHU	Austin, Tex.	2442 kc.	KGPR	Minneapolis, Minn.	2430 kc.	KGZY	San Bernardino, Cal.	1712 kc.
KGHV	Corpus Christi, Tex.	2382 kc.	KGPS	Bakersfield, Cal.	2414 kc.	KIUK	Jefferson City, Mo.	1674 kc.
KGHW	Centralia, Wash.	2414 kc.	KGPW	Salt Lake City, Utah	2406 kc.	KNFA	Clovis, N.Mex.	2414 kc.
KGHX	Santa Ana, Cal.	2490 kc.	KGPX	Denver, Colo	2442 kc.	KNFB	Idaho Falls, Idaho	2458 kc.
KGHY	Whittier, Cal.	1712 kc.	KGPZ	Wichita, Kans.	2450 kc.	KNFC	SS Gov. Stevens, (Wash.)	2490 kc.
KGHZ	Little Rock, Ark.	2406 kc.	KGZA	Fresno, Cal.	2414 kc.	KNFD	SS Gov. J Rogers, (Wash.)	2490 kc.
KGJX	Pasadena, Cal.	1712 kc.	KGZB	Houston, Tex.	1712 kc.	KNFE	Duluth, Minn.	2382 kc.
KGLX	Albuquerque, N.M.	2414 kc.	KGZC	Topeka, Kans.	2422 kc.	KNFF	Leavenworth, Kans.	2422 kc.
KGOZ	Cedar Rapids, Iowa	2466 kc.	KGZD	San Diego, Cal.	2490 kc.	KNFG	Olympia, Wash.	2490 kc.
KGPA	Seattle, Wash.	2414 kc.	KGZE	San Antonio, Tex.	2482 kc.	KNFH	Garden City, Kans.	2474 kc.

"WHEN TO LISTEN IN"
Appears on page 742

(Continued on Page 763)

SHORT WAVE LEAGUE

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

SHORT WAVE SCOUT NEWS

Report from Chester, Vt.

● IN a verification from Reichspostzentralamt, Berlin, confirming reception of DJI, DJJ, and DJM, they advise me of the following new stations:

		Eastern Standard Time
DJR	15,340 kc.	1:30 to 3:30 A.M., Daily
DJP	11,855 kc.	2:00 to 4:00 A.M., Daily
DJL	15,110 kc.	4:00 to 6:00 A.M., Daily
DJO	11,795 kc.	5:00 to 7:00 A.M., Daily
DZH	14,460 kc.	12:00 to 2:00 P.M., Daily
DZB (formerly DJJ)	10,042 kc.	2:00 to 4:00 P.M., Daily
DJM	6,079 kc.	3:00 to 5:00 P.M., Daily
DZA (formerly DJI)	9,675 kc.	5:00 to 7:00 P.M., Daily
DJS	12,130 kc.	7:00 to 9:00 P.M., Daily
DJT	15,360 kc.	11P.M. to 1:00 A.M., Daily

Of these the following have been heard: DZH, DJS, DJP, DJO, DZA, DZB, DJM. The three others, on 19 meters, will be hard to hear, due to the time of the day they are on the air.

New stations heard:

HI-1-S, Puerto Plata. HI-3-U, Santiago de los Caballeros. HI-9-B, "Ciudad Trujillo," on 6,420, 6,380, and 6,050 respectively.

LRU, on 15,290 kc. of Radio "El Mundo," Buenos Aires at 11 P.M., one night. Distorted signal, due to frequency and time of day.

ZSR, 9,180 kc., Cape Town, South Africa, working Rugby, for the speech of British Prime Minister, on death of King George V. Signal was good, and very intelligible, with slight qrm on low frequency side from WNA, Lawrenceville. Time 4:30 to 5 P.M.

OER-2, 6,072 kc., Vienna, was heard with a good signal one afternoon from 4:45 to 5 P.M., signing off as follows in German, French and English "Vienna calling, short wave OER-2, 49.4 meters, between 3 and 11 P.M., Central European Time" (that is 9-5 E.S.T.).

Verifications received:

S.S. Monarch of Bermuda, S.S. Columbus, S.S. Deutschland. XEVI, XEXA, HC2JSB, JVN.

ALAN E. SMITH, M.D.

Listening Post Report from Tulsa, Okla.

● MOST of the "foreign locals" received here during the month. I want to mention several European stations that are not classed as "locals," as follows:

HAT-4—Budapest, Hungary, 9.12 mc., Sun. 6-7 P.M. This station cannot be heard sometimes on account of heavy code QRM.

RIO—Bakou, U.S.S.R. A phone heard irregular on 10.17 mc. any time from 10:00 P.M. to 3:00 A.M., E.S.T.

EHY—Madrid, Spain, Heard irregular around 3:00 a.m., E.S.T., phone.

DJI (now DZA)—Zeesen, Germany, a new German station, heard on 9.67 mc. irregular, testing about 5:00 P.M.-7:00 P.M., E.S.T.

DIQ—10.29 mc.. Koenigswusterhausen, Germany, used for relay, heard irregular, afternoons.

DJJ (now DZB)—Zeesen, Germany, irregular, afternoons.

Africa

OPM—Belgian Congo, 10.14 mc., 2:15 A.M., E.S.T.

EHZ—Canary Islands, 10.43 mc., early A.M., E.S.T.

Asia

KTO—Manila, P.I., 16.23 mc., 7:00 P.M.,-8:00 P.M., E.S.T.

JVM—Nazaki, Japan, 10.74 mc., 2:35 A.M., E.S.T., music.

JVN—Nazaki, Japan, 10.66 mc., 10:50 P.M., E.S.T., broadcast.

PLE—Bandoeng, Java, 18.83 mc., 7:00 P.M., E.S.T., phone.

South and Central America

HKV—Bogota, Colombia. 8.79 mc., 2:00 P.M., E.S.T.

YVQ—Maracay, Venezuela, 13.35 mc., 2:40 P.M., E.S.T., phone.

CEC—Santiago, Chile, 10.67 mc., 7:00 P.M.-8:00 P.M., E.S.T.

HJU — Buenaventure, Colombia, 9.06 mc., 9:10 P.M., 10:00 P.M., E.S.T.

LSX—Buenos Aires, Argentine, 10.36 mc., irregular evenings 7:00 P.M., E.S.T.

HRW—Honduras, 11.05 mc., phone 6:40 P.M., E.S.T.

Many other stations received from these parts.

Oceania

ZLT—Wellington, N.Z., 11.05 mc., 3:24 A.M., E.S.T., phone VLK.

VLK—Sydney, Australia, 10.52 mc., 2:50 A.M., E.S.T., phone GCP.

VK3LR — Melbourne, Australia, 9.58 mc., any time after 1:00 A.M., E.S.T.

VK2ME—Sydney, Australia, 9.59 mc., on schedule time.

KKH—Hawaii, 7.52 mc. heard testing irregular 2:20 A.M., E.S.T.

A number of stations heard this month, but could not be identified.

Verifications received this month are GAA, GCB, KZRM, OPM, OPL, DJJ, EHZ.

WADE CHAMBERS, Tulsa. Oklahoma.

Report from Richmond, Va.

● CONDITIONS at this post have not been very good for the last

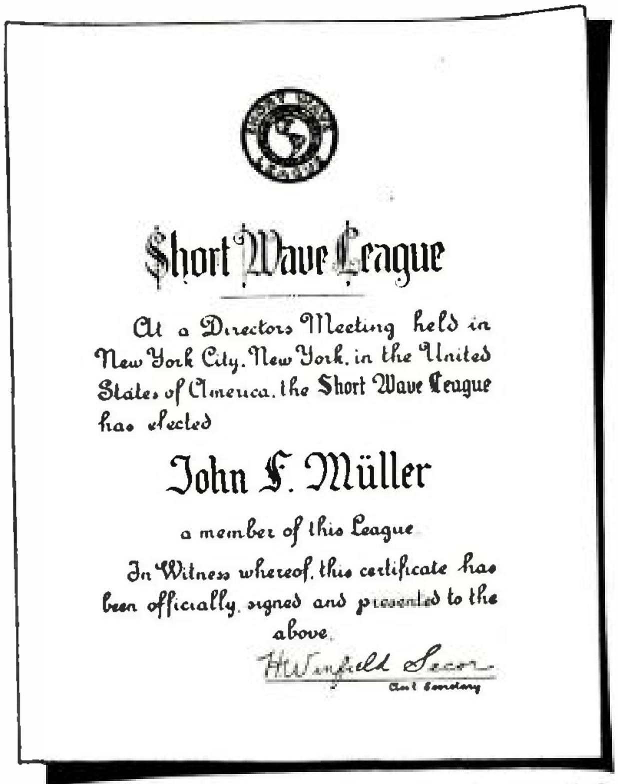
(*Continued on page 765*)

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.


Short Wave League

At a Directors Meeting held in New York City, New York, in the United States of America, the Short Wave League has elected

John F. Müller

a member of this League

In Witness whereof, this certificate has been officially signed and presented to the above.

H. Winfield Secor
Asst. Secretary

This is the handsome certificate that is presented FREE to all members of the SHORT WAVE LEAGUE. The full size is 7¼" x 9½".

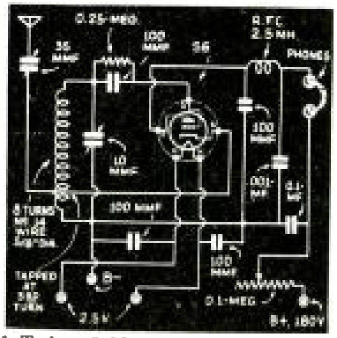
See page 762 how to obtain certificate.

• • Short Wave

1-TUBE 5-METER RECEIVER

James Heffernan, Staten Island, N.Y.

(Q) Please publish a diagram of a 1-tube 5-meter receiver using a type 56 tube. This should be a regenerator. I would like to experiment with the 5-meter amateur band and "get in on some of the fun."



1-Tube 5-Meter Super-Regenerative Receiver

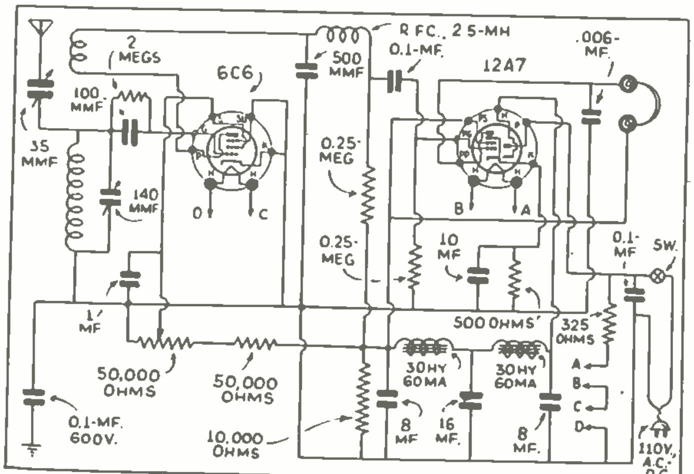
(A) The diagram is printed herewith. Super-regeneration is obtained automatically, as the detector is a *self-quencher*. Regeneration is controlled by the 100,000 ohm resistor in the plate lead. This should be adjusted until a hissing sound is heard. A slight adjustment after the station is tuned in will usually increase the sensitivity and improve the quality of the signal.

A.C.-D.C. RECEIVER

Winsaw Verner, Winsaw, Ont.

(Q) I would appreciate it very much if you would print a diagram in one of your coming Question Departments. I have an A.C.-D.C. receiver using the following tubes: A 6C6 as a regenerative detector and a 12A7 as the pentode audio amplifier and rectifier.

(A) We are printing the diagram you request, and believe that you should have excellent results with it. Remember, though, that A.C.-D.C. sets are a little "fussy" when it comes to filtering out the hum. Some experimentation in the lay-out may be necessary.



A.C.-D.C. Receiver Using 6C6 Detector and 12A7 Amplifier and Rectifier

ONE TUBE BATTERY SET

John Brand, Jr., Lincoln, Nebr.

(Q) Please print a diagram in your *Question Box* of a one-tube receiver using a 30 tube, a .0005 mf. condenser, and a .00025 mf. condenser, both variable.

(A) We give herewith the necessary diagram; however, standard condensers are shown. These match the various coils, data for which can be found in the *Question Box* of the January issue. With the larger condensers the tuning adjustment of the receiver will be quite intricate, and, for instance, the entire 49-meter band may only occupy two or three scale divisions on the dial. Therefore, we recommend the smaller condensers as specified, inasmuch as a greater *spread* will be obtained.

THE "UDAR" SET

Byron Bray, Scottsbluff, Nebr.

(Q) Would you kindly publish a diagram of a 12A7 and the 6F7. This is to be operated from either A.C. or D.C. power lines.

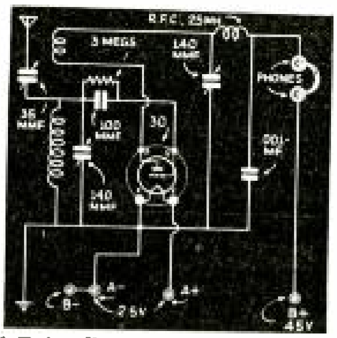
(A) In the May, 1935 issue on page 12, you will find the "UDAR" described. This set is identical.

COIL DATA

Lawrence Martin, Milwaukee, Wisconsin.

(Q) While finishing up the A.C. Super-Wasp four tube short-wave set which was built by Robert Hertzberg and published in the *Short Wave Manual* of 1930, I discovered that there is no Plug-In data for it and I don't know how to figure them out. I would appreciate it very much if you would send me all information about it that you can and let me know how to figure them out for any set.

(A) In the January, 1936 *Question Box*, we printed complete data on both two and three winding plug-in coils. We suggest that you refer to this issue. More technical data regarding the construction of plug in coils and the calculation of size can be obtained from the "*Short Wave Coil Book*" which is obtainable at this office for $0.25.



1-Tube Battery Operated S-W Receiver

BAND-SPREAD REGENERATION

Frank Cerny, Cleveland, Ohio

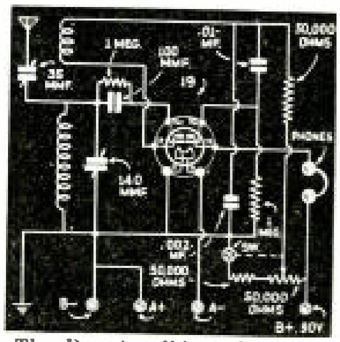
(Q) Would you kindly tell me if I could use the *band-spread regeneration* shown in the February *Short Wave Kinks* on the "police alarm" short-wave receiver shown in the October issue, instead of the one originally designed for this set.

(A) In the diagram of Mr. Doerle's "police alarm" receiver, fixed voltage is applied to the screen of the 24A. The band-spread idea can be connected to this very simply by running the lead marked "to screen" to the 45 volt terminal or screen grid lead of the receiver.

LICENSE NEEDED FOR TRANSCEIVER

Warren W. Huffstutter, Kearney, Nebraska.

(Q) I am interested in obtaining a license which would permit me to operate a five meter transceiver.



The Duo-Amplidyne Diagram

(A) It will be necessary for you to obtain a regular amateur license. You must be able to pass the code test of ten words per minute.

DUO-AMPLIDYNE

Charles Dunnel, Brainerd, Minn.

(Q) Please print the diagram of the *Duo-Amplidyne* which was described in the June 1934 issue of *Short Wave Craft*. Also, I would like to know why the type 99 tube is never used in midget portables.

(A) The *Duo-Amplidyne* has proven a very popular receiver, and we are very pleased to reprint the diagram for you. Regarding the 99's, the type 30 tube—besides being more economical than the type 99—is nowhere near as microphonic and is generally considered quite an improvement over the type 99.

POWER SUPPLY DIAGRAM

Frank Zerwekh, Peoria, Ill.

(Q) I have a power transformer with a 650-volt center-tapped secondary and several filament windings. Would you print a diagram of a complete power supply.

(A) In the diagram which we have printed, the voltage divider should have a number of taps. The number and size will depend upon the various voltages needed. For best regulation a 1 mf. condenser should be connected between each tap and the "B" negative.

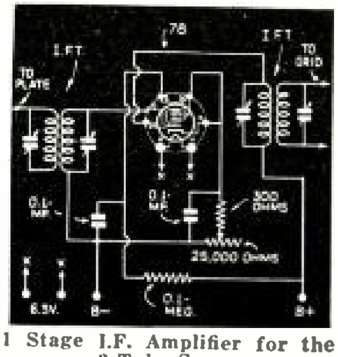
I.F. AMPLIFIER FOR 2-TUBE SUPERHET

C. Barr, Buffalo, N.Y.

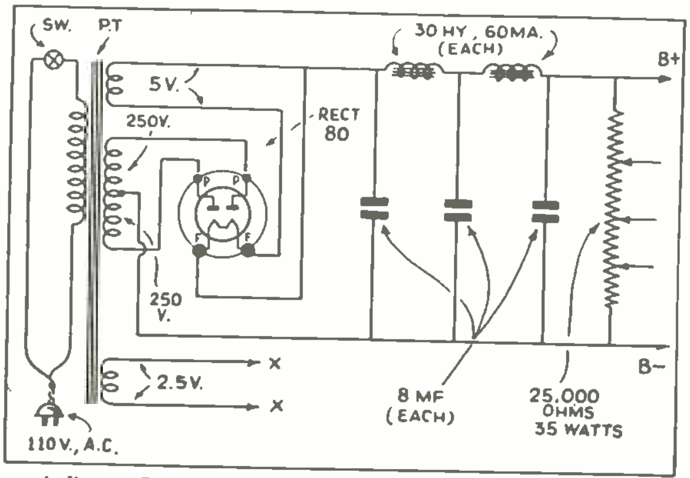
(Q) Will you please print in the *Question Box* a diagram of an I.F. amplifier which can be added to the two tube Victor superhet.? I would like to use a type 78 tube. Also show a diagram circuit for a 2A5 or a 42 in place of the 41.

(A) The I.F. amplifier diagram is shown and should considerably increase the gain of the Victor 2-tube set. Regarding the audio tube, the circuit diagram shown of the 2A5, 42, and 41 is identical. The 42 can be used in place of the 41 with no changes, while the heater voltage should be reduced from 6.3 volts to 2.5 for the 2A5; the connections of course, will remain the same, values likewise.

In the cathode circuit of this amplifier we have shown a variable resistor for volume control and it is absolutely necessary.



1 Stage I.F. Amplifier for the 2-Tube Super



A Power-Supply Which Can Be Used With Any Short-Wave Receiver

QUESTION BOX

EDITED BY GEORGE 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 problems involving considerable research will be quoted upon request. We cannot offer opinions as to the relative merits of commercial instruments.

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

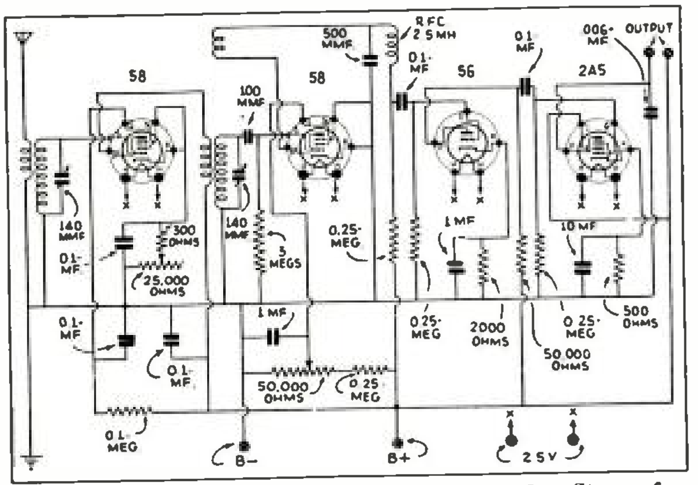
4-TUBE A.C. SET

Stuart G. Patterson, Philadelphia, Pa.

(Q) I intend constructing a receiver using two 58's, one 56 and one 2A5. Would you be kind enough to print the necessary diagram showing the various parts, as well as a voltage control and a regeneration control?

(A) In this diagram a 58 is used as the tuned R.F. amplifier, another 58 as a regenerative detector with a screen-grid potentiometer for controlling regeneration, a 56 resistance-coupled audio amplifier, and a 2A5 out-put pentode. This should work the speaker very satisfactorily.

If you wish to use a doublet on this receiver, merely break the connection beside the lower side of the primary and "B" negative. The ground connection remains intact.



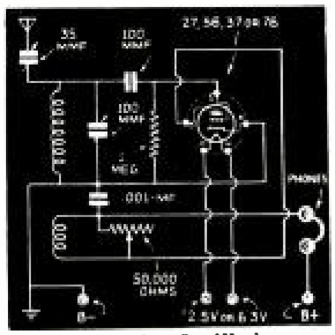
4-Tube Receiver Diagram Using A.C. Tubes, One Stage of T.R.F. Detector, and Two Stages of Audio

1-TUBE OSCILLODYNE AGAIN!

Vernon Vale, Oak Park, Ill.

(Q) I hear so much about the *Oscillodyne* receiver that I have finally decided to build one. I would appreciate it very much if you would print the diagram.

(A) The *Oscillodyne* is, no doubt, one of our most popular receiver designs, and we are re-printing the diagram for those who are interested and who may not have seen it before. This is a super-regenerative receiver and should be adjusted much the same as the one-tube, 5-meter receiver described elsewhere on this page.



The 1-Tube Oscillodyne Diagram

SHORT-WAVE ADAPTER

George Butschky, Bronx, N.Y.

(Q) I would like to make an adapter for my Philco model 511 receiver, in order to tune in the short-wave stations.

(A) We hesitate to print the diagram of an adapter because generally our readers have had very little success with them. We suggest that you refer to the January *Question Box* in which you will find a diagram of a 2-tube converter. This is shown on page 547.

201A RECEIVER

Walter Karasek, Woonsocket, R.I.

(Q) I would like to have you show the receiver for the "amateur" bands, using 201A tubes, assuming that it would work a loud-speaker with fair satisfaction. "Band-spread," of course, would be necessary.

(A) It surely seems like "old times," drawing diagrams for 201A tubes! However, a very nice receiver can be constructed around these tubes, and the diagram gives complete details. Regeneration is controlled with a "throttle" condenser in the plate circuit, and band-spread is obtained by connecting a 35 mmf. condenser across the main tuning condenser. The small condenser, of course, is used for "tuning."

WILL A METAL CABINET WORK?

Richard Kunan, Holbrook, Mass.

(Q) I intend using a 12x6x7 inch metal box for the 1-tube pocket set. Will this give satisfactory results if the case is grounded?

(A) Aside from being a trifle large for a one-tube set, we see no reason why it should not work well. The ground should aid in reducing body-capacity effects.

SET SQUEALS

Roy McHale, Philadelphia, Pa.

(Q) I have constructed the "Ham-Band Pee-Wee" and after adding an audio stage have experienced body capacity effects and squealing when the regeneration control is advanced. The amplifier added was a 2A5.

(A) Undoubtedly the trouble is due to R.F. getting into the pentode circuit. We suggest that you try a .006 mf. condenser between the plate and B negative and if this does not help or if you have already tried it, it will be necessary for you to change the lay-out of parts. You also might try reducing the value of grid resistance for the 2A5.

SET BREAKS INTO HOWL

Paul Makow, Georgetown, Pa.

(Q) I built a receiver using a 57 detector, 56 first audio, and a 2A5 out-put tube. When regeneration is advanced, the set develops a considerable squeal. I would like to know if there is any remedy for this?

(A) In most cases this squeal you mention is due to R.F. getting into the audio stages. We suggest that you use a 2.5 mh. R.F. choke in series with the plate lead feeding the first audio stage with a .0001-mf. by-pass condenser on each side of the choke. If you are using transformer coupling you should try connecting a 200,000 ohm resistor across the secondary of the first and second audio stages.

COILS FOR POCKET SET

Harold Walchli, Clarendon, Pa.

(Q) I would like to use the 1-tube "pocket set" on the *amateur* bands. Would you please publish the necessary coil data?

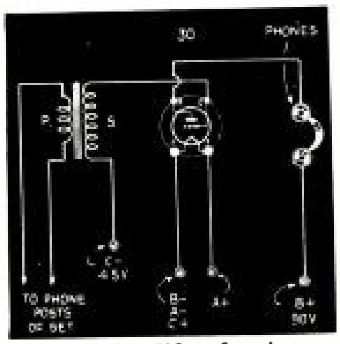
(A) The 1-tube "pocket set" is absolutely not suitable for use on the *amateur* bands, either for phone or C.W. The lack of selectivity in this receiver, together with the *crowding* in these bands, make its use utterly unsatisfactory.

5- AND 10-METER RECEIVER

J. R. Leakey, Syracuse, N.Y.

(Q) Is it best to use an A.C.-D.C. circuit consisting of 6F7 and a 1V rectifier on 5 and 10 meters? If so, please print the diagram.

(A) We do not recommend that you use the 6F7 on the shorter wave lengths; it is best to use a separate tube for each function. In the past issues of *Short Wave Craft* you will find many articles on 5-meter receivers.



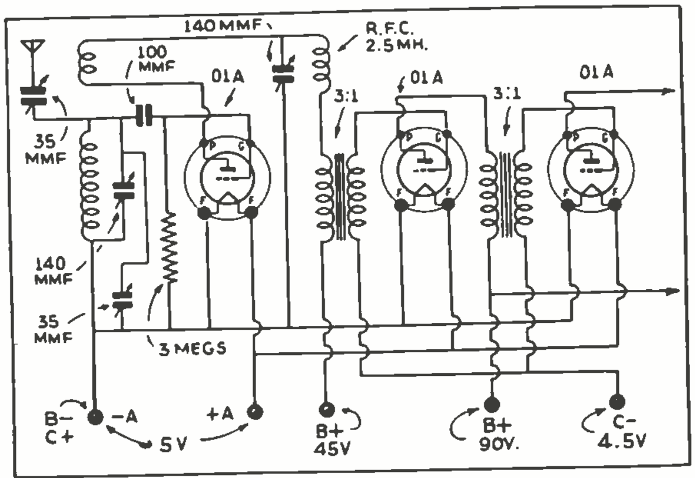
Audio Amplifier for Any Battery Type Receiver

1-TUBE AMPLIFIER FOR BATTERY SET

Paul Chamberlain, Gaston, Ore.

(Q) I have built a battery-operated receiver and now would like to add an audio amplifier to it. Would you be kind enough to print a diagram of a 1-stage amplifier using a type 30 tube?

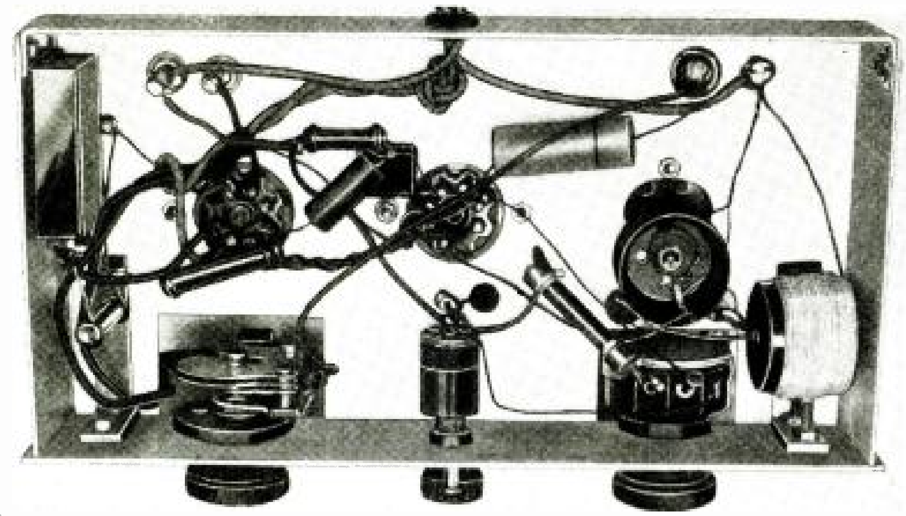
(A) For the one-tube diagram shown it is only necessary to connect the two "in-put" terminals of the primary of the audio transformer to the phone "output" terminals of your present receiver.



Detector and Two Stages of Audio Using 01A Tubes

2-Tube Receiver for the S-W Fan

(*Continued from page* 718)



Bottom View of Receiver.

placed at right angles to each other. That we have succeeded in eliminating coupling effects is proved by the fact that there are no "dead spots" in any part of the tuning scale, due to absorption, even though no provision has been made for short-circuiting the unused coils. A complete set of coil specifications will be found at the end of this article.

The tuning condenser used in this receiver is a Hammarlund Midline midget of 80 mmf. maximum capacity. The author has found this size most satisfactory for general short-wave use as it gives "modified" band-spread on the DX region between 16 and 50 meters. However, a 140 mmf. tuning condenser and standard size coils may be substituted for those shown with equally as good results except for the sharper tuning.

Position of Controls in Front Panel

In laying out the front panel the author has placed the most used controls (regeneration and antenna) at the bottom and low enough to allow the operator's hand to rest upon the table while tuning. Large round knobs on these controls make fine adjustments easy. These are important considerations when one is tuning for extremely weak or rapidly fading signals.

Metal Tube Data

The actual construction of the receiver is not at all difficult but, unless the reader has had some experience with the new *metal tubes*, he will do well to familiarize himself with the following data before attempting to build the set. The new standard basing arrangement of the 6J7 tube is as follows: *Pin No. 1, shell; pin No. 2, heater; pin No. 3, plate; pin No. 4, screen-grid; pin No. 5, suppressor grid; pin No. 6, open; pin No. 7, heater; pin No. 8, cathode.* The control-grid connection is at the top. The pin arrangement of the 6C5 is as follows: *Pin No. 1, shell; pin No. 2, heater; pin No. 3, plate; pin No. 4, open; pin No. 5, control grid; pin No. 6, open; pin No. 7, heater; pin No. 8, cathode.* Readings are in a clockwise direction on bottom of socket using slot as reference point. A complete data chart on the metal tubes was published on page 508, December, 1935, *Short Wave Craft.*

All wiring, especially the leads between the coils and the wave-band switch and from the switch to the tuning condenser and the tube socket should be kept as short and direct as possible. Most of the wiring in the radio frequency portion of the set has been done with No. 14 tinned bus (copper) wire; the paper condensers, carbon resistors, etc., are mounted directly on the tube sockets, their tinned leads being of sufficient stiffness to support them. The use of the new *insulated* resistors would eliminate the possibility of a "short-circuit" to chassis.

How to Solder Neatly

All connections should be well soldered with a *hot and clean* iron and rosin core solder. Use just enough solder to make a good electrical connection. One must be extremely careful when soldering connections to the terminals of the wave-band switch to keep melted rosin or solder from running over or down between the switch contacts. Rosin, even though it is an insulator of direct or low frequency alternating currents, will cause severe losses when placed across radio frequency circuits. All excess flux should be removed from the joints by wiping with a clean cloth dipped in alcohol. Most of the losses attributed to switch coil arrangements can be traced to poor or high loss connections in the R.F. circuit of the set.

Bias for 6C5 Tube

Bias for the 6C5 tube is provided by means of the voltage drop across the 2,000 ohm resistor in its cathode lead. This resistor is by-passed by a 1mf. 200 volt paper condenser. The *tone* is very good. However, if more "lows" are desired, an electrolytic condenser of about 20 mf. 50 volt rating my be substituted for the paper type. In this case the "positive" terminal of the condenser should be connected to the cathode of the tube since it is at positive potential with regard to the chassis (the term "chassis" as used here does not mean an actual connection to the chassis at that point. In this receiver all *negative* connections are soldered to a single length of copper bus wire and the bus wire is grounded to the chassis at one point only. This method of construction helps to prevent the circulation of eddy currents in the metal chassis and panel).

The choice of a power supply depends somewhat upon the desires and conveniences of the constructor. The author uses 135 volts of heavy duty "B" batteries and a 6 volt storage battery with excellent results. With this arrangement the small "off-on" switch at the upper right corner of the front panel is connected in the heater circuit and the off-on" switch just below the tuning dial is in the "B" negative lead to prevent the batteries discharging through the 50,000 ohm potentiometer when the set is not in use. If a power pack is used the "B" switch is not needed and the heater switch would be placed in the 110 volt a.-c. lead.

A power-pack would probably be more economical and satisfactory in the long run. Any small power unit capable of supplying 6.3 volts for the heaters and 180 to 250 volts for the plates and screen should be satisfactory if the output is well filtered. A number of good power-packs have been described in past issues of *Short Wave Craft* and we feel sure that, if the reader will look through his back numbers, he will find one to his liking.

Results With This Set

Having progressed thus far the reader will undoubtedly be interested in knowing just what results he can expect from the set and as to how it compares with receivers using the regular plug-in type of coils. During the past two months or so we have used the set mostly for 20 meter amateur work and for listening on the 19, 25, 31 and 49 meter broadcast bands. All of the usual foreign and DX stations have been received with good volume. The extreme quietness of the 6J7 detector makes even the very weak signals readable and this is especially true on the higher frequencies where most regenerative sets are noisy.

On the 20 meter amateur band we have heard phone and C.W. stations in all parts of the world. In fact the set has a better "pickup" in this region than a well-known 7 tube all-wave superheterodyne receiver owned by the author. So far as a comparison with regular plug-in coils are concerned, we can find no perceptible difference in sensitivity, selectivity or noise level. It is sufficient to say that the author will never willingly use plug-in coils again.

The author would be very much interested in hearing from readers who build the little receiver and to learn of the results obtained with it. All letters will be answered if a *stamped self-addressed envelope* is enclosed. Letters may be addressed in care of *Short Wave Craft.*

Coil Data

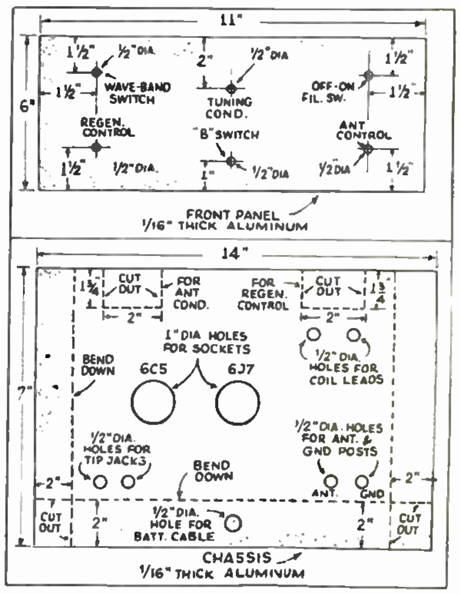
Range	Turns	Tap	Diameter
16-32 meters	7 clw.*	2 (from bottom)	1½"
32-60 meters	15 clw.*	3 (from bottom)	1½"
60-130 meters	31 clw.	1¼ (from bottom)	1½"

*Note: These coils have the cathode windings spaced about ¼" from rest of turns; there is no spacing of the 60-130 meter coil.
clw=close wound.

List of Parts

C1—Hammarlund midget condenser, 80 mmf. (.00008mf.)
C2—Midget condenser, 35 mmf. (.000035 mf.) Hammarlund.
C3—Mica condenser, 100 mmf. (.0001 mf.) Aerovox.

(*Continued on next page*)



Dimensions of Chassis.

C4—Mica condenser, 1000 mmf. (.001 mf.) Aerovox.
C5—Tubular paper condenser, .1 mf. 400 w.v. Cornell Dubilier.
C6—Tubular paper condenser, .01 mf. 400 w.v. Cornell-Dubilier.
C7—Paper condenser, 1 mf. 300 w.v. (may be an electrolytic condenser up to 20 mf. if desired) Cornell-Dubilier.
R1—Carbon resistor 3 megohms, ¼ watt I.R.C.
R2—Wire-wound potentiometer, 50,000 ohms (may be with or without switch) Electrad.
R3—Carbon resistor 500,000 ohms, 2 watts I.R.C.
R4—Carbon resistor 250,000 ohms, 1 watt I.R.C.
R5—Carbon resistor 1 megohm, ¼ watt I.R.C.
R6—Carbon resistor 2,000 ohms, 2 watts I.R.C.
L1, L2, L3—See "coil data" above.
SW1—Wave-band switch (see text)
SW2—Rotary off-on switch (see text)
SW3—Snap switch off-on type (may be on rear of potentiometer. See text for instructions).
Two sockets for new metal tubes. (Isolantite.)
One Aluminum panel 6 by 11 inches.
One Aluminum chassis 5 by 10 inches (7"x14" panel)
Dial, coil forms, knobs, supply of No. 24 D.C.C. magnet wire, solder,
RCA 6J7 and 6C5 tubes, etc.

Dodging QRN in a Tough Situation

(*Continued from page 724*)

electrostatic shield, of copper foil. This is essential, *to prevent capacity coupling*.

It will be noticed that *no ground whatever* is used in the actual input circuit, the input primary in the receiver being of the low-impedance type, and isolated from ground. Grounding one side of the input (in receiver), or even grounding a center-tap on the line primary, as often recommended, proved worse than useless, introducing a great deal of QRN (noise).

Preliminary tests around the antenna site with a small portable receiver, had shown that even so far out from the power lines, etc., there is a considerable amount of pick-up of interference. When connecting the line to aerial, it was found that by trying out both ways, it can be so phased with the aerial that whatever QRN voltage is picked up by the transmission line, which actually passes under a power-line, as shown in Fig. (a) will actually buck out to a considerable extent that which is picked up by the antenna array. This is shown by a very noticeable difference in noise-level at the receiver, when reversing the line-to-aerial connections. Provision is made for easily reversing the line connections at the line-receiver transformer, this being found necessary as conditions change from day to day and on different frequency bands.

While the residual noise-level is still considerably higher than in any normal location, it is now so low that there is no difficulty in getting thoroughly satisfactory entertainment from all the usual European, Australian, and Asiatic SW broadcast stations, here about 200 miles from the Pacific.

The receiver used is a high-gain superhet, having one T.R.F. stage, and two I.F. stages, with efficient A.V.C., and of course is very carefully designed with adequate shielding to prevent pick-up of the local QRN direct to any part of the set.

The antenna is oriented so as to have maximum pick-up of signals from Europe in general, and Daventry in particular.

WATCH FOR THE NEXT "HAM" NUMBER, THE MAY ISSUE, OUT APRIL 1.

When to Listen In
By M. Harvey Gernsback

(All Schedules in Eastern Standard Time)

● THREE different transmitters are now being employed simultaneously by the English station in Trans. 4 and Trans. 5. The other transmissions still employ only 2 transmitters, although it is likely that Trans. 2 and 3 will soon make use of an extra transmitter. Each transmitter has a power of approximately 12-15 kw. at present. The schedule for March is as follows: Trans. 1 on GSB and either GSD or GSF from 2:15-4:15 a.m. (after Mar. 14 this will be 1:15-3:15 a.m.) Trans. 2. on GSG and either GSF, GSH or GSJ from 6:00-8:45 a.m. Trans. 3. on GSF and either GSG or GSE from 9:00-10:30 a.m.: on GSF and either GSE or GSG from 10:30 a.m.-12 n. Trans. 4, 12:15-2:15 p.m. on GSI, GSD and GSB, 2:15-4:00 p.m. on GSD, GSB and GSL; 4:15-5:45 p.m. on GSC, GSB and either GSL or GSF. Trans. 5, 6:00-8:00 p.m. on GSB, GSC and either GSA or GSD. Trans 6, 10:00-11:00 p.m. on GSL and GSC.

GERMANY

The following new stations are now heard testing daily:

DJR, 15,340 kc., 1:30-3:30 a.m.; DJP, 11 855 kc., 2:00-4:00 a.m.; DJL, 15,110 kc., 4:00-6:00 a.m.; DJO, 11,795 kc., 5:00-7:00 a.m. All these waves are assigned to the Berlin short-wave station for broadcast purposes. The following waves are used by the German post office department for commercial telephone service overseas. They are testing with broadcasts at present as follows; DZA (formerly DJI), 9,675 kc., 5:00-7:00 p.m.: DZB (formerly DJJ), 10,042 kc., 2:00-4:00 p.m.; DZH, 14,460 kc., 12 n.-2:00 p.m.; DJS, 12,130 kc., 7:00-9:00 p.m.; DJT, 15,360 kc., 11 p.m.-1 a.m.

POLAND

SPW, the station at Warsaw on 13,635 kc., which was heard testing on Sundays from 11:30 a.m.-12:30 p.m. several months ago, has been silent pending the construction of a new aerial beamed at North America. The old aerial was directional to S. America. When completed the station will broadcast programs for Poles in the U.S.A. The station should be back on the air before this notice appears.

BUENOS AIRES

The new stations LRX and LRU mentioned last month have been reported by many listeners as testing on LRU, 15,290 kc., from 7:00-7:45 and also around 11:00 p.m. LRX has not been reported. By the time this is printed these stations will undoubtedly be on a regular schedule. Address in care of LR1, "El Mundo," Buenos Aires, Argentina. They welcome requests for "veris."

COLOMBIA

A new station is HJU at Buenaventura, Col., operated by the Natl. Railways. They are on 9,065 kc. and can be heard in the evening from 8:00-11:00 p.m. irregular.

VENEZUELA

YV12RM at Maracay on 6,300 is now being heard in the evening hours. Another newcomer who will be on soon is YV9RC at Caracas on 6,400 kc.

TAHITI

An amateur station at Papeete on the French isle of Tahiti in the South Seas is now broadcasting on 7,100 kc. each Tuesday and Friday from 11:00 p.m.-12 m. The station is known as "Radio Oceanie."

HOLLAND

On the 16th of February the Dutch stations commenced a special world-wide short-wave broadcast service on Sundays. These programs take place from 7:30 to 8:30 a.m. for Asia; from 1:00 to 2:00 p.m. for Africa and from 7:00 to 8:00 p.m. for America. The station used is PCJ operating on 9,590 kc. (31.28 meters). These programs are in addition to the normal program of station PHI.

Multipactor Tube

(*Continued from page 715*)

bombarded against a similar metal target at a sufficient velocity, these will initiate a second set of electrons again several times greater in number. The process may be repeated many times, and the resultant electronic flow finally collected may be many times greater than the original initiating beam.

In the practical construction of the electron multipliers they have been called *multipactors*, because the process is the result of multiple electronic impacts. Multipactor tubes take widely varying forms depending upon the use for which they are designed, but in general, the Farnsworth laboratories have evolved two types.

The two types differ in the method that is used to transfer energy to the electrons between impacts. In type No. 1, the electronic impacts progress spatially, and it is arranged that each successive area of impact is kept at a higher d.c. potential.

In type No. 2, the energy is transferred to electrons between impacts by making use of a suitable radio frequency field across the tube.

Many surprising results have been accomplished with electron multipliers. Most of these results are achieved because of the possibility of extremely high multiplication ratios. The electron multiplication factor may be anywhere from a few hundred times to over a thousand billion. For example, in a certain tube constructed with nickel elements, the number of electrons emitted under visible light could not be measured by ordinary methods. It could not have been greater than one hundred electrons per second, and it probably was as low as ten electrons per second. when light from an ordinary 100 watt bulb was allowed to fall on the multipactor tube, and yet the current change which this light produced with the tube acting as an electron multiplier was of the order of six million electrons per second and could be measured on an ordinary laboratory milliammeter, but this does not represent the limit of amplification. If the light is carefully excluded from this particular nickel type multiplier an erratic current variation is obtained in the type, which may be stopped or decreased by screening the tube with lead, giving a strong indication that the initial electrons are ejected by cosmic rays.

Because of the extremely high multiplications obtained in multipactor tubes, the tubes may be used as a source of electrons for purposes *other* than amplification. For example, composite caesium silver oxide surfaces, similar to those used in making photoelectric cells, have an emission of anywhere between 10^{-12} and 10^{-16} amperes per square centimeter at ordinary room temperature. If these currents are multiplied a million million times, an ampere electronic output from cold metal surfaces is obtained.

Currents initiated by this process, and of this order, are now in constant use in the Farnsworth laboratories for many purposes, particularly conversion of direct current voltage to oscillating voltages of from 100,000 cycles to several hundred million cycles per second. Such oscillators start merely by closing a switch in the battery circuit.

Their practical advantages are their simplicity and their very high conversion efficiency which may be as high as 95%. The very great advantage to be gained by this high efficiency is that for a given power output the tubes may be much smaller than corresponding thermionic tubes.

Philo T. Farnsworth states:

"Electron multipliers have been made to perform every function now performed by the thermionic relay. While it is improbable that all functions now performed by the thermionic tube will be replaced by the new *cold-cathode* multipactor, nevertheless, it is fully evident to all of us who have worked with secondary electron multiplication that this new art will have a very revolutionary effect on the science of radio communications."

W2AMN's All-Band Transmitter

(*Continued from page* 732)

chassis and the "B" plus is fed through R.F. chokes to the plates, thus eliminating much constructional detail.

Starting with the first tube, we have a "tritet" crystal controlled oscillator which allows doubling in the plate circuit. The cathode coil and tuning condenser is all one unit. The 100 mmf. midget condenser is mounted inside the coil and tuned to provide maximum output of the crystal. When the crystal is changed from one band to another, the entire tuning unit is changed for one to match the other crystal.

Changing crystals from one end of a band to the other or to any frequency within the band for which the cathode coil is adjusted requires no change in the coil or adjustment of the condenser. It is sufficiently broad so as to require no adjusting. The oscillator tube is shielded with a regular tube shield, although the next tube required no shield. The coil in this stage as in all others of the low power unit, is of the plug-in type. The cathode, oscillator plate and the first buffer plate coils are wound on Hammarlund XP-53 four-prong forms. The last coil of this unit is wound on large Bud transmitting form also having four prongs.

Coils for Different Bands.

For 80 meter operation with a crystal in that band, we have a complete set of coils for that band only. For 40 meter operation with the same crystal we change the plate coils of all three tubes. Then to change to 20 meters it is only necessary to change the plate coil of the output stage the 23 or 802.

The layout of parts for the three stages can be seen in the photo. Starting from left to right the layout is the same as of the diagram-Crystal, cathode coil, oscillator tube, oscillator plate coil, first buffer, its plate coil, the 15 watt pentode and finally its plate coil. On the panel we have on the left the oscillator plate condenser, next the buffer condenser and the last buffer condenser on the right.

The meter on the left reads 0-25 mills, (M.A.), and it measures the oscillator plate current in the first jack (J1) on the left and the last buffer grid current in the next jack (J3) to the right. The 0-100 mill (M.A.) meter on the right measures the first buffer plate current in the left-hand jack (J-2) under it and the last huffer plate current in the right hand jack (J4). On the extreme left of the panel, we have the oscillator and first buffer plate voltage switch (Sw 1) and the last buffer plate switch (Sw 2) on the extreme right. In the center of the panel on the lower edge we have the pilot light which tells us the *heaters* are *on*.

Smooth Operation and Stability Achieved

Plenty of good mica by-pass condensers are used in the exciter and their use is rewarded with stability in operation. There is no sign of *interlocking* of stages and operation is absolutely smooth. This *smooth operation* of course is in a large part due to the use of *screen-grid* tubes. In the low-power stages *fixed battery bias* is used. We may still be a trifle old-fashioned hut there is nothing that can quite take the place of *battery bias* with us.

Screen Voltage—How Provided

Screen voltage for the tubes is obtained with series resistors in the "B" plus lead and these resistors are mounted in the sub-base. To the plates of the oscillator and first buffer we apply around 400 volts and to the last buffer around 500 volts.

This voltage is obtained from a power supply mounted on the back of another 19x8¾ inch panel. Mounting the unit on a small chassis and fastening it flat against the back of the panel is a simpler arrangement and saves much space. In the photo of the power supply we have complete details of its construction.

In the diagram we find a 500 volt transformer with the necessary filament windings. The *filtering* consists of a single 30 henry, 150 milliampere choke and two 2 mf. 1000 volt filter condensers. For the rectifier we have selected the 83V type tube, which may be mounted horizontally without danger of the filament sagging. At the output of the filter there is connected a 25,000 ohm resistor, which serves not only as a bleeder, but as *voltage divider* in order to provide the 400 volts for the oscillator and first buffer tubes. On this panel we also have the A.C. "on-and-off" switch and another switch which cuts off the entire voltage to the exciter stages. The two switches on the exciter panel allow switching "on-and-off" during adjustment, while the "B" switch on the power-supply panel allows the whole R.F. unit to be operated with a single motion.

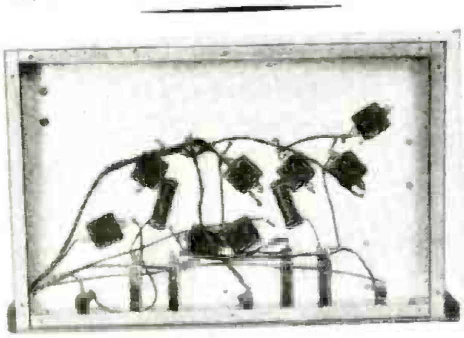
Next month the entire transmitter will be described and illustrated in a number of photos.

Parts List for W2AMN's Transmitter.

10—.001 mf. 1000-volt mica condensers, Aerovox.
2—.0001 mf. 1000 volts mica condensers, Aerovox.
2—2 mf. 1000-volts filter condensers. Aerovox.
2—A.P.C. 100 mmf. midget condensers. Hammarlund.
2—200 mmf. midget variable condensers, Hammarlund.
1—50 mmf. midget condensers double spaced, Hammarlund.
1—10,000-ohm 10-watt resistor, I.R.C.
2—50,000-ohm 20-watt resistors, I.R.C.
1—25,000-ohm 50-watt resistors with slider, I.R.C.
6—2.1 mh. rf. chokes, Hammarlund.
6—4-prong XP53 forms. Hammarlund.
3—jumbo 4-prong coil forms, Bud.
4—single close circuit jacks, Bud.
4—"on"-"off" toggle switches, Bud.
1—jewel light.
4—4-prong isolantite sockets, Hammarlund.
1—5-prong isolantite socket. Hammarlund.
2—6-prong isolantite sockets, Hammarlnd.
1—large 7-prong isolantite socket. Hammarlund.
1—0-25 ma. meter (small), Triplett.
1—0-100 ma. meter (small), Triplett.
3—3¼" silver dials and knobs, I.C.A.
1—500-volt power transformer with filament windings Thordarson.
1—30-henry 150 ma. filter choke. Thordarson.
2—19"x8¾" steel panel, black crackel finish, Wholesale Radio Service Co.
1—17"x11x2½" chassis, Wholesale Radio Service Co.
1—small chassis approximately 7"x10" Wholesale Radio Service Co.
1—Bliley LD2 crystal.

Optional Tube Line-up

6C6, 6D6, 802, for 6.3 volts. For 2.5 volts—57, 58, and RK23.



A bottom view of the 3-tube exciter.

Coil Data

CATHODE COIL

80 meter xtal 20 T. No. 24 D.C. close wound on 1¼" form.
40 meter xtal 10 T. No. 24 D.C. close wound on 1¼" form.

OSCILLATOR AND FIRST BUFFER PLATE COILS

80 meters 28 T. No. 24 close wound 1¼" form.
40 and 20 meters 9 T. No. 16 spaced to 1¼ inches on 1¼ inch form.

LAST BUFFER PLATE

80 meters 33 T. No. 14 tinned on 2½" form, length of winding 3".
40 meters 16 T. No. 14 tinned on 2½" form, length of winding 3".
20 meters 8 T. No. 14 tinned on 2½" form, length of winding 1¾".

An Ultra Short-Wave Burglar Alarm

(*Continued from page 716*)

literally millions of electric waves fill practically every bit of space in the room.

The accompanying diagram shows the basic principle of how the waves zig-zag back and forth across the room between the opposite walls, until they finally reach the receiver. Under normal conditions with no intruder present, the signals of constant intensity are picked up at the receiver, but if a person's body intercepts the waves in any part of the room, it acts the same as a mirror would in connection with a light beam, and the radio waves are reflected in such a manner that the strength of the signal picked up at the receiver is changed or weakened. This change in the strength of the signal intercepted at the receiver can be caused to switch on a warning or signal light in another part of the building such as a watchman's office, or the alarm may take the form of a bell, or again it may be sent through directly to police headquarters.

By using two or more of these transmitters and receiver systems, a criss-cross wave pattern may be employed, so that every part of the room is surely protected by the ultra short waves and even though a person stood in a certain "safe" spot, found by experiment, where the alarm was not sounded—the movement of an arm or a leg would intercept one of the waves and cause the device to function.

By setting up a veritable barrage of ultra short waves in a similar manner to the *burglar detector*, it would be possible to devise a very good aircraft detector. In this case the aircraft would act in a similar manner to the person's body entering the room equipped with the burglar detector and the plane, for example, would act the same as a mirror and reflect the waves back to earth. Sensitive ultra-short wave receivers located on the ground, would intercept the reflected waves, and knowing the distance between the transmitting and receiving stations, and also the angle of the waves as they were radiated from the transmitter, the exact position or location of the airplane could be calculated at once.

Pilot Explains Maneuvers by Short Waves

(*Continued from page 711*)

the announcer on the ground and both ends of the conversation are amplified out over the field by means of loudspeakers.

For example, the announcer asks: "Al, will you please do a dive ending with a vertical loop?"

Williams replies: "I am now 5,000 feet up. I push the stick forward and we go into a dive. I gain speed rapidly. I am now falling at a rate of 260 miles an hour and at about 500 feet above the field I pull back the stick slowly. We climb quickly then slower and finally by returning the stick to a neutral position we are now flying upside down."

Few, if any, channels are available in the longer wave bands, already crowded by a wide variety of uses. Ultra-high frequency radio waves travel in a straight path like light and are particularly efficient for the short-range operation required in Major Williams' demonstrations, during which he will always be within sight of the air field. Use of the ultra-high frequency channel demands extremely sharp tuning and all the units in this radio equipment are crystal-controlled for this purpose.

Our Information Bureau will gladly supply manufacturers' names and addresses of any items mentioned in Short Wave Craft. Please enclose stamped return envelope.

Don't miss W2AMN's Transmitter description in next "HAM" issue!

"Magic Brain" and "Eye" Make S-W Tuning Easy

(*Continued from page* 712)

the electrical shadow. The electronic image thus produced is not only an accurate visual tuning indicator, but also tells at a glance how strong the station's signal is and the amount of interference, if any, that is present, because it registers every radioactive impulse in the antenna.

In the schematic of Figure 1 we see that the detected signal voltage is applied to the grid of the triode section of the 6E5 from point A of the diode-detector circuit. In tuning in a station, as one turns the dial slowly, grid G1, becomes more negative with respect to the Cathode, C. This means that the plate current is decreased so that a decreased voltage will exist across the 1 Megohm plate resistor R. When the station is tuned exactly to resonance the detected signal fed to the grid G1, of the 6E5, is such as to reduce the plate current practically to zero. Note that the ray-control electrode, G2, is connected directly to the plate of the triode and varies with the positive voltage on the plate so that as the signal is tuned in and the drop across R decreases, the voltage on G2 increases, being a maximum at resonance. As one tunes off of resonance the decreased negative voltage at A causes a decreasing grid bias and therefore an increasing triode plate current. This increasing plate current in turn causes an increasing voltage drop in R, thus lowering the positive potential of the ray-control electrode G2.

It is the variation of the voltage thus obtained on the ray-control electrode which controls the displacement of electrons and causes the "Eye" to close as the station is tuned-in and open as the station is tuned-out.

Television Advances In Italy

(*Continued from page* 716)

brush made of very fine litz (stranded) wire would touch the photo-sensitive surface of the photo-electric cell.

It is easy to understand that this "touching" electron beam decreases the "resistance" of the cell vacuum against the radiation of electrons. This trick also increases the speed of the electrons which are radiated by the photo-sensitive layer of the cell, and since electron beam of the cathode-ray tube is used as a kind of "bridge or conductor" for the photo-electrons the sensitivity of the new photocell increases tremendously.

Contrary to the similar devices of Zworykin and Farnsworth, a mechanically operated scanning instrument in the form of a tiny mirror drum is applied to scan the image.

The photo-electrical impulses obtained by the "Telepantoscop" which consists as explained above, of a combination of a photo cell and a cathode-ray tube, are then transmitted to a pre-amplifier of normal design but having surprisingly small dimensions. It might be of interest to notice that this pre-amplifier of small size has an absolutely flat response curve, starting with 25 cycles up to 1,000,000 cycles! Since the "Télépantoscop" has small dimensions, (and also the pre-amplifier is of small size) it was possible to install both parts including some optical devices and a synchronization instrument into a box as large as a normal film camera.

The television receivers made by the Italian Company reproduce an image 8 by 10 inches in size, by means of cathode-ray tubes. An image definition of 180 or 240 lines, with 25 frames per second, may be recreated upon the cathode ray-tube screen. The price of a complete receiver is about $640.00.

Watch for Details of Good A.F. Amplifier in Next Issue!

A 3-Tube Battery Type S-W Receiver

(*Continued from page 714*)

same time this choke offers very high impedance to the audio frequency. The 250,000 ohm resistance is used to eliminate any fringe-howl which might be present. By using impedance coupling instead of resistance, we get almost double the gain in the detector tube.

Audio Stage Uses a 33 Tube

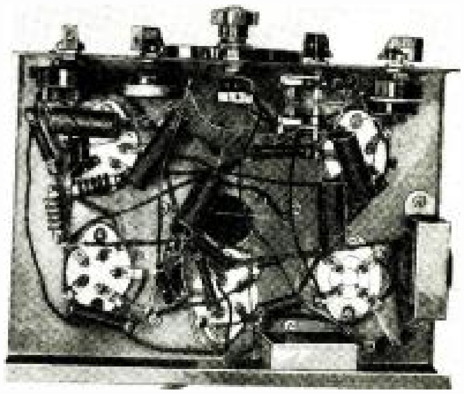
The audio stage uses a *high-gain* pentode, type 33. This gives enough *loud-speaker* volume for all but the weakest stations. Notice should be taken of the type of output circuit used. By this means, all of the plate current is kept out of the speaker, which should be a sensitive magnetic type. Provision is made for earphones, which, when used, cuts out the speaker automatically. A *tone-control* is also used in this set and helps get rid of the background noise on some of the weaker stations.

When building this set, or any set, be sure to use the best of parts. That old saying that "A chain is no stronger than its weakest link," is still very true in the radio field. All the tube sockets are isolantite; the condensers, both the ganged tuning condensers and the 35 mmf. R.F. padding condenser are Hammarlund and have isolantite insulation, and the coils used in this set are the new Hammarlund coils wound on XP-53 fours. These were purchased already wound, but may be wound by hand if the constructor so desires. All fixed condensers should have a voltage rating of 400 volts to insure a large safety factor and should be of any approved type. The resistors should also be of a standard make and should have a rating of ½ of 1 watt. No provision was made in the set for a doublet aerial because there is very little noise in the open "country" anyway. An inverted L type about 75 feet long is being used by the author with very good results.

Arrangement of Parts on Chassis

This set is built on a steel sub-base 11 inches x 7½ inches x 2½ inches and the panel is 12 inches x 7 inches. The following layout was used, and should be used by anyone making this set. In the back left-hand corner is the detector tube and in the front of this is the three-winding detector coil. In the middle of the set in the front is the two-gang 140 mmf. tuning condenser. Back of this is the 700 henry choke and to the rear of this is the type 33 power tube. On the right of the set at the back is the R.F. coil and in front of this is the R.F. tube. Notice that, by placing the R.F. and detector coils in this position, they are as far apart as possible and the R.F. plate lead to the detector coil is as short as possible. Two wing type shields are used and these prevent inter-coupling of the two circuits.

On the panel to the extreme left is the *regeneration control* and one of the battery switches. Next is the *tone control*. Next is the dial, which gives a high ratio and is easy to mount; below this is the earphone jack. The next knob is the R.F. padder and on the extreme right is the R.F. gain control and the other switch. Two switches have to be used, one for the A battery and the second for the B batteries. The entire set is enclosed in a black crackle enamel box with a hinged cover. All wiring, especially the grid and plate leads, should be as short as possible. Perhaps many of you "Hams" and "Fans" interested in this set wonder why the 100 ohm resistor is used in the filament circuit. As the tubes are all two volt type, they are wired in series and thus 4 No. 6 (1½ volts each) dry cells may be used as the "A" supply. Two of these tubes, the type 15, draw .22 amp. each while the 33 needs .26 amp. If the resistor was not used the two 15's would operate at a voltage a little in excess of two volts, while the 33 would run a little under two volts. But by using Ohm's law, we find that 100 ohms at 4 volts will pass .04 amp. which is the difference in current between the 15 and the 33. By shunting the two 15's (as shown in the diagram) with the resistor to the 33, all the tubes will operate at two volts. Although no difference can be noticed by ear, if the resistance is left out, no doubt the tube manufacturer knows best when he said that these tubes should be run at *two volts!* The total "A" current drain is .26 amp. at 6 volts and the "B" drain at 135 volts is about 20 mills.



A bottom view of the receiver.

(M.A.) If the above directions are followed, no trouble should be had in building this set and getting it to work.

Results on Test

This set has been used by the author for the past several months with "swell" results. On the Police, Amateur and short-wave *broadcast* bands, almost all stations come in on the loud-speaker. Some "foreign" stations, such as the South American, English, German, French, Spanish, Mexican, and Canadian stations, come in with more volume that you will need in the average room. Twenty meter phone stations have been received regularly from South America and Europe. Police calls, 80 meter and 160 meter phones, etc., have been received from *all over the country!* And as for C.W.—the *set's "alive" with it!*

Regular broadcast coils may be used in this set, making it a swell *all-wave* job. If broadcast coils are bought, about half of the interwound coil or primary on the detector coil should be taken off or the set will not be very selective and almost all stations will block the detector.

I have had very fine success with this set and I am sure that you Hams or Fans who construct it, will agree with me.

Parts List

C1—2 gang 140 mmf. condenser.
C2—35 mmf. variable.
C3—4—.1 mf. 400 volts.
C4—.0001 mf. mica condenser.
C5—.00025 mf. mica
C6—.25 mf.
C7—.02—400 volt.
C8—1 mf.—400 volt condenser; Cornell-Dubilier.
R1—300 ohms resistor.
R2—25,000 ohm var. and SW1 (switch).
R3—100 ohm resistor.
R4—100,000 ohms resistor.
R5—5 meghom resistor.
R6—50,000 ohm var. resistor and SW2 (switch).
R7—40 000 ohm resistor.
R8—250,000 ohm resistor.
R9—250,000 ohm resistor.
R10—50,000 ohm resistor.
CH1—2—2.1 millihenry R.F. choke.
CH2—700 henry A.F. choke.
CH3—30 henry A.F. choke.
1—Closed-circuit jack.
1—Aerial and ground posts.
1—4-wire cable.
1—twin tip jack.
1—subpanel 7⅛"x11"x2½".
1—panel—7"x12".
1—cabinet—7"x8"x12".
1—set 4-prong coils; Hammarlund (See Jan. Q. Box for data.)
1—set 6-prong coils; Hammarlund.
1—type 33 tube. RCA Radiotron.
2—type 15 tubes. RCA Radiotron.
1—4-prong isolantite socket.
1—6-prong isolantite socket.
2—5-prong isolantite socket.
1—5-prong wafer socket.
Nuts, bolts, hookup wire, etc.
2—tube shields.

Short Waves and Long Raves

(Continued from page 719)

W6ERT'S HAM STATION

Twenty meter phone—Mexico City, Santa Domingo, Eastern Canada, all of the U. S. Districts and Hawaii.

Forty meters CW, all continents several times.

Seventy meter phone, all U.S. Districts, Canada, Mexico, Hawaii, Alaska.

Eighty meters CW, all U.S. Districts, Canada, Cuba, Chile, South America, Hawaii, Guam Australia, Mexico, Alaska.

One hundred and sixty meter phone, all Districts of U.S.A.

Several antennas are used, five of them to be exact. They are as follows:

Five meter Picard vertical for five meters only.

Eighty meter Zepp., for ten, twenty, forty and eighty meters.

Two twenty meter half-wave doublets, one vertical, one horizontal, used in transmitting or receiving.

Forty meter half-wave end-fed Hertz, can be used also as Marconi type (with ground) on several bands, including the one hundred and sixty meter band.

Many thanks for all the fine articles in *Short Wave Craft* and hope you continue to further the art of short-wave radio.

AL GOODYEAR, W6ERT
1917 So. Mesa St.,
San Pedro, Calif.

(Congratulations "Al" and we hope you enjoy SHORT WAVE CRAFT *the coming 12 issues. You have a tip-top station, one that "steps out" and brings home the bacon. Why not write a description of some of your apparatus, both transmitters and receivers; tell how they are built and send a clear photo or two of the apparatus. We're waiting "Al"!—Editor.)*

George Vesely Has "Live" Station

Many of your hookups are used in my station and give excellent results. The "QSL" cards are kept in file because the walls cannot be defaced. Hoping I see my station in "S.W.C." soon.

GEORGE VESELY, W9SKR,
1520 W. 18th St.,
Chicago, Ill.

(Well, George, you get your wish; here she is. Looks like a "live wire" station.—Editor.)

All the Way from South Africa

(3-tube) using two type 30's and one 31.

Am operating on 20 and 40 meters, and so far have worked 6 continents and 34 countries on 20 meters!

The output of my transmitter is 30 to 35 watts. The instrument on the right-hand top shelf is a recorder, and has been in successful use for the recording of messages up to a distance of 2,000 miles.

B. H. BEUKES, ZUIX,
P. O. Box 19, Reitz Street,
Somerset West, C. P., South Africa.

(Fine work, B.H.B., and let's have details of that "Recorder"! Editor.)

Daily Weather Maps By Radio

(Continued from page 715)

be sent to the ships on two different frequencies, one adapted to transmission up to about 1500 miles, and the other suited to transmission over greater distances. The ship operators will thus be able to select the frequency of most efficient reception for their position. Although the service will at first consist largely of weather maps, the facsimile apparatus will also be tested in the reception of type matter and pictures.

HV-475 Transmitter Power Supply

● ALTHOUGH designed as a companion unit for Eilen HF-35 SW transmitter, this compact and well designed power pack may be used with any type transmitter having similar power requirements.

Inspection of the circuit diagram reveals the use of the popular type 83 mercury vapor full-wave rectifier in a well filtered circuit. A power transformer supplying 1200 volts C.T. at 200 M.A., 2½ volts at 7 amp., 5 volts at 3 amp., and 7½ volts at 3 amp. is used. A switch in the primary circuit permits the unit to be turned on and off. The output of the mercury vapor rectifier is fed into a two section filter network having an exceedingly high ripple attenuation. In order to have ample insurance against condenser breakdown, two 8 mf. electrolytic filter condensers are used in *series* at each of the usual condenser locations. The resulting 60 henries of inductance and 12 mf. capacity, results in a filter capable of giving up to 200 m.a. of pure direct current to the transmitter. No ripple whatever is noticeable on the transmitter's carrier when used with this unit.

The entire unit is mounted in a heavy, black shrivel finished metal chassis and cabinet. Cabinet dimensions are such as to fit directly under HF-35 transmitter, presenting an unusually neat and business-like appearance.

List of Parts

1—High voltage 1200 V. sec. C.T. transformer. Thordarson.
6—Condensers—8 mf. Cornell Dubilier.
2—Filter chokes.

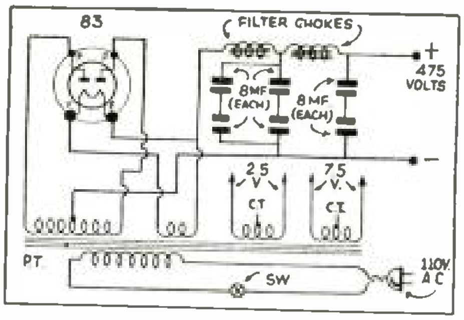


Diagram above shows connections of the HV-475 transmitter power supply.

This article prepared from data supplied by courtesy of Eilen Radio Laboratories.

The power-supply is mounted in a neat and substantial cabinet, provided with a switch as shown.

Steel Tape Now Records Voice For Re-broadcast

(*Continued from page* 711)

part of the program.

The method by which the steel recordings are made is shown in Fig. A. In accordance with current fluctuations caused by a microphone, similar strong or weak magnetic impressions are recorded on the steel wire or tape. How this method actually works may be seen from following description.

If a piece of steel wire or steel tape passes in front of the recording magnet (which in turn is connected with the microphone amplifier) the molecules of the steel will be disarranged because of the magnetic flux emanating from the recording magnet, which moves the tiny iron molecules more or less out of their natural position. When such a piece of steel wire with "disarranged molecules," or magnetic voice and music recordings, is moved in front of the "pickup" magnet, electromagnetic "disturbances" are produced in the pickup magnet, which are an exact replica of the original "disturbances" produced by the microphone current in the recording magnet. Since it is easy to convert electromagnetic flux variations into electrical impulses by winding a coil around the pickup magnet, the reproduction process is quite simply solved.

The minute electrical impulses as furnished by the pickup magnet coil are sent through an amplifier, which in turn is connected with a loudspeaker; or if radiation to the broadcasting listeners is desired, over a preamplifier to the transmitter. Since a steel tape recording can be played back as often as desired *without wearing out*, and the recording time is theoretically unlimited, through the use of a long enough wire, the advantages of this recording method seems to surpass any other sound recording method devised.

However, as it is often the case in science, there are some important disadvantages involved. Only the frequencies between 50 and 2000 cycles may be reproduced if the speed of the steel tape is one meter per second (about 3.29 feet per second). The frequency response curve may be enlarged by *increasing the speed* but then the steel-tape consumption goes up in a tremendous degree, thus shortening the actual recording time to a fraction of the recording time when low speed is applied. That is the main reason why the British Broadcasting Company records only the "news bulletins" on steel-tape, but music exclusively on wax records.

A great advantage of the steel-tape recording is the fact that one and the same steel-tape can be used again and again for recordings. Usually after the tape has been played back, it is led in front of a powerful "extinguishing," or "wipe-off" magnet which "erases" the previous recordings, or in other words bring the molecules back into their natural position. Such an "erased" steel-tape can be used at once for new recordings, without any decrease in reproduction quality.

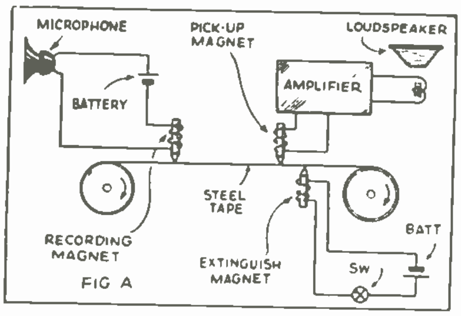


Diagram showing how "recording" and "extinguishing" magnets are arranged with respect to moving steel tape.

$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 (March 15 for the June 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 CRAFT, 99 Hudson St., New York City.

2½ to 10 Meter Receiver

(*Continued from page 729*)

tance) and want a new thrill, try five!

The set pictured with this article shows an extremely simple layout that has given very good results. During the past six months your authors, in common with many other *hams*, have been trying various detector circuits for five-meter work. Colpitts, straight Ultra-audion, the so-called electron-circuit, and several others,—some with the weirdest of circuits, were "put through the mill." Of all that have been tried to date, the set to be described has shown the highest usable combination of selectivity and sensitivity.

The diagram for this super-regenerative set will seem quite unorthodox, but then so are most circuits for five. As will be seen, a metal tube, 6C5, is used for the detector. A type '42 Pentode glass tube is used as audio. If you do not wish to purchase metal tubes, use a type '76 for the detector. You will find it almost as good as the 6C5. Should you want to use 2½ volt tubes, use a '56 as the detector and a 2A5 as the audio tube.

The layout of the chassis, from left to right, is: detector tube, coil condenser arrangement mounted on bakelite strip, and audio tube. Directly in front of the audio tube is the audio transformer.

On the panel, the controls from left to right are: super-regeneration control, tuning dial, and volume control. The switch below the tuning dial is connected in the "B" plus lead and is used to render the receiver inoperative during a transmitting period.

Under the chassis there are only two fixed condensers and one fixed resistor, plus the wiring. The layout of the set is so simple and the wiring so easy that even writing about it makes it seem involved. The best thing to say is that if the wiring diagram is followed carefully, you can't miss.

Now for several pointers about the set itself. Let's start at the antenna and work through the set. A good antenna is quite an important factor for the best u.h. frequency work. A doublet with two four-foot legs, fed in the center with a good make of twisted pair feeder, makes a very efficient antenna. Always be sure to get the antenna vertical. A vertical "sky-hook" catches more of the quasi-optical waves roaming through the air, than a horizontal antenna does. Needless to say, the higher the better! Some very fine results have been obtained by a radio amateur who flies his antenna from a kite three hundred feet in the air!

Coupling the antenna to the set is the next most important step in getting the most out of a five-meter set. The method of coupling a doublet type of antenna is largely a matter of experimentation. Sometimes the "pie" winding gives best results; at others the regular coil arrangement. If a single wire vertical antenna is used, couple it to the grid through a very small "postage-stamp" type variable condenser.

There is one point which cannot be overstressed. That is ***short leads*** in the detector circuit. If you can possibly do it, solder the plate of the tube directly on the condenser.

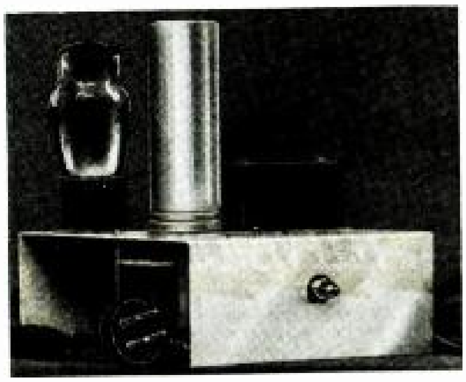
Besides the regular grounds to chassis, use a common ground point to which all returns to ground are made. Ground the .006 plate block condenser right at the cathode connection on the tube.

Just one more thing and we're through with the set itself. If you use an expensive pair of earphones, the output coupling circuit diagrammed will be "insurance" against burning them out. If you use a magnetic speaker, as you probably will, due to the loud signal the set puts out, the output arrangement isn't needed.

The *power-supply* used with the set is a simple unit supplying 6.3 volts for filament and 250 volts for the plate. No trouble was experienced with hum, but should there be any, another filter condenser and an extra choke will fix it up. Another method of eliminating hum, should it arise, is grounding one side of the filament through a .1 mf. paper condenser. Try both sides of the filament circuit, and one side will show a decided decrease in hum level.

In operation the set is extremely simple. Set the super-regeneration control just past the point where a loud hissing noise is heard, and tune slowly over the dial. When you tune in a station, the hiss will either disappear completely or fade into the background, depending on the strength of the signal being received. The volume control is used in normal fashion, and you'll need it, because local stations "blast" the speaker!

This article has been prepared from data supplied by courtesy of Eagle Radio Co.



Eagle Minuteman "power-supply" Unit

Parts List

Eagle Minuteman 2½ to 10 Meter Receiver

1—Minuteman black-crackled chassis and panel—Eagle.
1—Vernier 3 inch dial—Z.
1—Variable midget .000025. Hammarlund Star.
1—Condenser .00005 mf. mica.
1—Condenser .006 mf. pigtail.
1—Condenser .5 mf. 400 volt.
1—Condenser 10 mf. 35 volt.
1—Resistor-range 10 to 20 megohm (fixed).
1—Resistor 1000 ohm. 2 watt.
1—Potentiometer 50,000 ohm.
1—Potentiometer 500,000 ohm.
1—High frequency choke.
1—Audio transformer.
1—Wafer socket, 8-prong.
1—Wafer socket, 6-prong.
1—Wafer socket, 4-prong for power supply.
1—Toggle switch S.P.S.T.
3—Insulated tip jacks.
3—Interchangeable coils 2½, 5, and 10 meters—Eagle.
1—Spiral-wound ant. coupling coil—Eagle.
2—Black bakelite knobs.
Ant-gnd and speaker terminals.
1—5 inch magnetic speaker.
1—Extension coupling with 3 inch shaft.

Parts List

Eagle Minuteman Power Supply

1—Power supply chassis—Eagle Radio.
1—Power transformer.
1—30 hy. 100 mill. choke—Eagle.
1—Toggle switch S.P.S.T.
1—4 prong plug and cable.
1—Double 8 mfd. 450 volt electrolytic (in can).
1—Condenser .1 mf. 400 V.
Hardware, solder, etc.

$50.00 CASH PRIZE CONTEST

First Prize	$20.00
Second Prize	10.00
Third Prize	5.00
Fourth Prize	3.00
Fifth Prize	2.00
Sixth to Fifteenth Prizes each	1.00

Read full details of $50.00 prize contest for "best letter" explaining what Ten Things in Short Waves interest you most Today, page 588, February issue.

RADIO INSTRUCTION

Radio Amateur Course

(Continued from page 731)

the output of the modulator to the input circuit of the modulated amplifier. Such a modulator will modulate any transmitter having a plate input of 50 watts. For higher power inputs, naturally greater modulator power is necessary.

In Fig. 8 we have the type 830B's or push-pull as *drivers*. These tubes will modulate up to a 200-watt power input. The output of such an amplifier is around 100 watts. The speech amplifier in Figure 7 will serve for the average double-button carbon microphone or a crystal microphone. For lower-level microphones, naturally greater amplification is necessary, and in Fig. 9 we have shown three stages of resistance coupled triodes.

In dealing with high-gain speech amplifiers of this sort, sufficient circuit isolation or de-coupling must be employed in order to eliminate feed-back and audio frequency oscillation.

T1 in diagram 9 should be coupled to the driver stage of any modulator. For instance, it would be coupled to the 45's in push-pull of figure 8.

Below is a list of modulators which may be used with various types of power amplifiers. These are all, of course, for plate modulation.

R.F. Amp. Tubes	In put to R.F. Amp.	Modulation Tubes	Mod. Out put
46's, 10, single push-pull or par.	50 W	46's Class B	25 W
801's in push-pull	100 W	10's in Class B	50-60 W
800's in push-pull	150 W	800's in Class B	100 W
211-03A-838-830B	up to 200 W	800's in Class B	100 W
For inputs exceeding	200 W	use 838's or 203A's Class B	200 to 260 W

40 Watt Transmitter Becomes 400 Watter

(Continued from page 728)

mitter for radio telephony, a pair of 838's are used as class B audio modulators. These are driven by a pair of type 42 tubes connected as class A amplifiers, which, in turn, is driven by a pair of 76's in push-pull. The speech amplification is taken care of by a 6C6 resistance coupled into another 6C6. These drive the push-pull 76's previously mentioned.

Needless to say, low-level microphones may be used with this equipment. The power supplies for the low-voltage stages use type 83 rectifiers, while the high-voltage power supply for the 500-watt final amplifier uses 866's.

This transmitter will operate on any two amateur bands with a single crystal. For instance: For operation on 80 and 40 meters an 80-meter crystal would be used. For operation on 20 a 40-meter crystal is used.

The panels and rack are furnished in neat black crackel finish, and the entire transmitter surely presents a business-like appearance.

This article has been prepared from data supplied by courtesy of Thordarson Electric Mfg. Co.

If you wish a wiring diagram of the "All-Star" transmitter, send 25c in stamps or coin to Service Dept., SHORT WAVE CRAFT, 99 Hudson St., New York City, and mention diagram No. 525.

Short Wave Scouts

(*Continued from page* 720)

HJ1ABG—6.04 mc.—Emisora Atlantico. Barranquilla, Colombia.
R. Colonial—15.24 mc.—Radio Colonial, Paris.
R. Colonial—11.89 mc.—Radio Colonial. Paris.
W2XAF—9.53 mc.—General Electric, Schenectady.
W8XK—15.21 mc.—Westinghouse Elect., Pittsburgh, Pa.
W8XK—11.87 mc.—Westinghouse Elect., Pittsburgh, Pa.
CO9JQ—8.66 mc.—Camaguey, Cuba.
HP5J—9.59 mc.—La Voz de Panama, Panama City, Panama.
YV2RC—6.11 mc.—Broad. Caracas, Caracas, Venezuela.
EAQ—9.86 mc.—Transradio Espanola, Madrid. Spain.
2RO—11.81 mc.—E.I.A.R., Rome, Italy.
DJD—11.77 mc.—Berlin, Germany.
DJA—9.56 mc.—Berlin, Germany.
DJN—9.54 mc.—Berlin, Germany.
YV6RV—6.52 mc.—Voz de Carabobo, Valencia, Venezuela.
HC2RL, 6.65 mc.—Quinta Piedad, Guayaquil, Ecuador.
HIZ—6.31 mc.—Voz de los Muchachos. Sto. Domingo, D. R.
HCJB—8.21 mc.—Voz de los Andes, Quito, Ecuador.
RADIO CALI—14.00 mc.—Radio Cali, Cali, Colombia. This station is no more on short waves, changed to bc. band.
CEC—10.67 mc.—Comp. Int. de Tel., Santiago de Chile.
HIX—5.98 mc.—Sec. del Trabajo, Santo Domingo.
YV3RC—6.15 mc.—Radiodif, Venezuela, Caracas, Venezuela.
HJ5ABC—6.15 mc.—Voz de Colombia, Cali. Colombia.
HJ3ABH—6.01 mc.—Voz de la Victor, Bogota, Colombia.
YV5AM—7.10 mc.—Ecos del Llano, San Juan de los Morros, Venezuela. This station being property of a nephew of Gen. Gomez has disappeared.
HJ1ABD—7.28 mc.—Ondas de la Heroica, Cartagena, Colombia.
HJ1ABE—6.11 mc.—Laboratorios Fuentes, Cartagena, Colombia.
COCD—6.13 mc.—La Voz del Aire. Havana. Cuba.
HP5B—6.03 mc.—Estacion Miramar, Panama City.
TI5HH—5.50 mc.—Voz de San Ramon, San Ramon, Costa Rica.
HJ4ABE—5.95 mc.—Voz de Antioquia, Medellin, Colombia.
DJQ—10.29 mc.—Berlin, Germany.
2RO—9.63 mc. E.I.A.R., Rome. Italy
W8XK—6.14 mc.—Westinghouse Elect., Pittsburgh. Pa.
W3XAL—17.78 mc.—N.B.C., Boundbrook, N.J.
CJRX—11.72 mc.—Can. Radio Comm., Winnipeg, Canada.
Radio Nations—9.59 mc.—Radio Nations, Geneva. Switzerland.
Radio Nations—7.79 mc.—Radio Nations, Geneva, Switzerland.
XEBT—6.00 mc.—El Buen Tono, Mexico City, Mexico.
DJC—6.02 mc.—Berlin, Germany.
W3XAU—6.06 mc.—Philadelphia, Pa.
HIH—6.79 mc.—Voz del Higuamo, San Petro Macoris, D. R.
PCJ—15.22 mc.—Phillips Radio, Huizen, Holland.
PHI—17.77 mc.—Phillips Radio, Eindhoven, Holland.
DJB—15.20 mc.—Berlin, Germany.
DJE—17.76 mc.—Berlin, Germany.
HI4D—6.48 mc.—Voz de Quisqueya, Sto. Domingo, D. R.
RNE—12.00 mc.—Radio Central. Moscu.
HJ4ABC—6.45 mc.—Ecos del Combeima. Ibague, Colombia.
PZH—6.99 mc.—A.V.R.O.S., Paramaribo, Surinam.
W2XAD—15.33 mc.—Gen. Electric, Schnectady.
PRF5, 9.50 mc.—Co. Radio Int. do Brazil, Rio Janeiro.
HJ2ABD—5.98 mc.—Radio Bucaramanga. Bucaramanga, Col.
HIL—6.50 mc.—Radiodif. HIL, Sto. Domingo, D. R.
HJ2ABC—5.93 mc.—Voz de Cucuta, Cucuta, Colombia.
Radio Col.—11.71 mc.—Radio Colonial, Paris. France.
YNVA—8.60 mc.—Ruben Dario, Managua, Nicaragua.
HJ4ABG—7.14 mc.—Experimental de Medellin, Colombia.
HI3C—6.90 mc.—Voz de Rio Dulce, La Romana. D. R.
TG2X—5.94 mc.—Policia Nacional, Guatemala City, C. A.
HI1J—5.86 mc.—San Pedro Macoris, D. R.
HAS3—15.57 mc.—Radiolabor, Budapest. Hungary.
CJRO—6.15 mc.—Can. Rad. Comm., Winnipeg, Canada.
OAX4G—6.23 mc.—Talleres Grellaud, Lima, Peru.
CRCX—6.09 mc.—Can. Radio Comm., Bowmanville, Ontario.
HJ1ABK—7.07 mc.—Radiodif. HJ1ABK Barranquilla, Col.
TI8WS—7.55 mc.—Ecos del Pacifico. Punta Arenas, C. R.
W9XF—6.10 mc.—N.B.C., Chicago, Ill.
YV2RC—5.80 mc.—Broad. Caracas, Caracas, Venezuela.
YV8RB—5.88 mc.—Voz de Lara, Barquisimeto. Venezuela.
WIXAL—11.79 mc.—Univ. of the Air, Boston, Mass.

Listener: ANDREITA O. CLOQUELL. Arecibo, Puerto Rico.

The Mono-Tube 5-Meter Transceiver

(*Continued from page* 723)

coils L-1 and L-2 are wound with No. 16 enamel copper wire; both coils have four turns wound on ⅜ dowell stick or drill form. When removed from the form, spread out the winding to leave a 3/64 inch space between each. To mount the coils, solder one terminal to the grid, the other to the plate terminal of socket, while the inner coil leads are soldered to the terminals of the .001 mf. fixed condenser connected directly across and spaced ¼ inch from L-1 and L-2; this mounting aids in maintaining rigidity.

Mounting Details

The transformer and tube socket are mounted on the chassis with studs to eliminate *body capacity*. The small tuning condenser is mounted on a strip of bakelite, which in turn is held above the subpanel by machine screws and kept spaced ½ inch from L-1 and L-2 also spaced ½ inch from panel and cabinet. Bakelite or hard-rubber shaft extensions must be used to connect the condenser to the tuning dial.

Radio frequency choke coils C-1 and C-2 inner leads are soldered as near as possible to the terminals of the main blocking condenser, B-1. A separate single-pole, single-throw toggle switch is used in the filament and mike circuit; a double-pole, double-throw switch is used to change over from *sending* to *receiving*. This transmitter has been designed to operate on a plate potential of 45 volts; if any more were used it would require an increase in grid modulation.

Batteries

Mike and filament current is supplied from No. 950 Eveready flashlight cell; all leads which are shown grounded in the circuit diagram are connected directly to the aluminum chassis to cut down on wiring. A very short antenna is required for ultra short-wave transmission; two No. 15 inch lengths of copper wire one solid the other flexible are connected by means of two pin-jacks.

The microphone input transformer is made from a thousand ohm receiver winding. The primary winding is composed of 200 turns of No. 40 enamel copper wire, wound over the said winding.

To put the set in operation, throw the switch to the *receiving* position, close the filament switch and a loud sh-sh-sh is heard. After locating the proper spot on the dial for reception of a nearby 5 meter transmitter, the dial setting is left alone for both sending and receiving. To operate this or any other radio transmitter you will require an amateur radio operator's license.

New 40 Watt Amateur Transmitter

(*Continued from page 727*)

C; both the grid and plate circuits are tuned. A combination of battery and grid-leak bias is also employed in this stage to protect the tubes when excitation is removed. Neutralization of the amplifier is accomplished by means of a specially-designed adjustable capacitor. Re-adjustment of this capacitor is seldom required when shifting to an adjacent band. This final amplifier is capable of delivering 40 watts to the antenna. Associated with the plug-in plate coil is a variable antenna-coupling coil. The antenna-coupling adjustment need be made but once for each band, so long as the same antenna is used. The grid and plate current readings should be taken during all adjustment.

Power Supply

The *Power Supply* employs an 83 Mercury-Vapor Rectifier Tube, plate transformer, filter choke, oil impregnated filter capacitor, and a filament heating transformer for all tubes. Across the output of the filter circuit is provided a voltage divider to act as a bleeder and to supply reduced voltage for the oscillator tube. All transformers, chokes, capacitors and resistors have ample ratings.

Provision is made for convenient connections on the rear apron of the chassis. These include: (a) terminals for A.C. power source, key leads and crystal oscillator standby switch, battery bias, plate modulation, and safety interlock; (b) convenience outlets to connect A.C. power to the modulator unit, so that it will be controlled by the power switch on the R.F. unit. The front panel controls consist of the following: (a) tuning for oscillator, buffer-doubler, final amplifier; (b) meter switch and D.C. milliammeter with shunts to read various currents mentioned above; (c) main supply switch which simultaneously energizes all filaments, plate transformer switch and auxiliary final-amplifier plate-voltage switch to be used for preliminary tuning and for making neutralizing adjustments; (d) green pilot light which illuminates when filaments are on; (e) screw-driver opening for neutralization adjustment.

The Modulator Unit

The modulator section contains the high-gain speech amplifier, driver, modulator, and power-supply circuits. The input stage uses a 57 to work directly from a crystal, or any other high-impedance microphone. When low-impedance microphones (such as ribbon, magnetic, or carbon types) are used, a coupling transformer is required. This first stage is resistance coupled to the next stage which likewise employs a 57. The driver, using a pair of 45 tubes in push-pull, are fed by resistance coupling from the speech amplifier. The power developed by the 45 tubes serves to drive the 801 modulator tubes in a Class "B" circuit. The secondary winding of the Class "B" output transformer is designed for a 4000-ohm load, such as presented by the final amplifier under normal operating conditions.

A 0-200 milliampere meter in the modulator plate circuit facilitates modulator adjustments and is useful as a guide for speech level. The amplifier gain control is made readily accessible on the lower front panel. A microphone jack is also provided for convenient connection of the microphone.

The built-in power supply system for this unit consists of an RCA-83 rectifier tube, plate transformer, reactor, voltage divider which serves as a bleeder and voltage drop for supply to speech amplifier, filter reactor for speech amplifier power supply, and oil-impregnated and wet-electrolytic filter capacitors. Filament supply is from a separate transformer. Connector cables are integral with this unit to plug into the convenience outlets on the R-F Unit to obtain A.C. power.

The Antenna Unit

The antenna unit is designed for use with a resonant transmission line, single-wire non-resonant line, current or voltage-fed antenna. Two variable capacitors controlled from the front panel are used for either series or parallel tuning of the feeders or antenna. A switch is mounted on the rear of the panel for changing the capacitor connections. Antenna or feeder current is measured by a 0-2.5 ampere thermocouple meter. Antenna connections can be conveniently made to two ceramic bushings at the top center of the front panel.

The Cabinet Rack

The cabinet housing the complete transmitter, has a durable black crinkle finish. A full-sized rear door permits accessibility to the equipment for adjustments. A safety interlock is attached to the door, removing all high voltage from the circuits when the door is opened. The units, being of standard rack design, are then easily removed.

This article has been prepared from data supplied by courtesy of the Amateur Radio Section of the RCA Manufacturing Co.

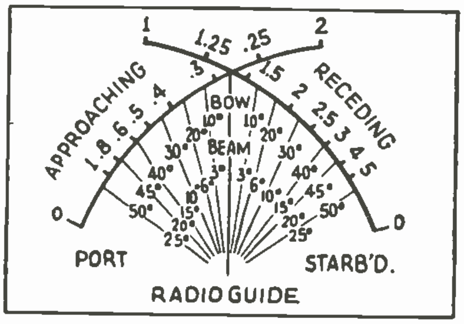
Flying the Broadcast and the "Short-Wave"

(*Continued from page 713*)

rather sensitive to night error, especially when used to obtain directional reading from short-wave stations. Other practical considerations, such as the inability of an ordinary homing device to do more than correctly indicate the direction of the transmitting station when it lies directly ahead or behind, showed the desirability of further refinements in the old methods, and led to new discoveries and the development of a truly practical radio direction finder for aircraft.

The "Radioguide" Focusses on Any Station!

The new Simon "Radioguide" described in these pages is capable of giving a *true bearing* on long, medium, and many short-wave stations—down to less than 50 meters, which includes all airway services. The ultra-short-wave signals, 10 meters and less, do not lend themselves well to exact radio direction finding over long distances, because of the nature of the propagation of their waves (which approach the properties of light waves over short distances, and in long-range reception come reflected from the Heaviside layer, with the consequent distortion of their directivity).



Close-up view of the special calibrated dial of the Simon "course" indicator, over which two needles move so as to show the angle at which the plane is flying.

Station Direction and "Angle of Drift" Indicated

The most significant feature of the new Radioguide is its ability to measure, in degrees, the exact direction of the transmitting station when *off* the airplane's course. The same feature permits the pilot to measure the *angle of drift* of his airplane (see Fig. 1), *without seeing the ground* or *knowing the wind conditions!* This enables him to fly "blind" a true Great Circle course (the shortest distance between two points on a sphere like our Earth). It tells the pilot whether he is flying *towards* or *away* from the transmitting station, and gives him an indication of the *distance travelled.* If he chooses, the pilot may listen to the signal and at the same time observe the *direction* from which the signal comes. The reading of the pointers on the dial of his course indicating instrument remains steady on either modulated or unmodulated waves.

"Blind Landings" Also Possible With the New Instrument

Furthermore, with the loops mounted in the airplane horizontally instead of vertically, he can make "blind" landings in the middle of the airport, approaching the field at the correct gliding angle from any direction and from any altitude.

Principle of Instrument Is Simple

Despite its versatility, the Radioguide is extremely simple in principle. It employs *two* small loops installed within the airplane at an angle of sixty degrees to each other and to the transverse axis of the airplane. When the airplane is heading directly at the transmitting station, both loops receive the station signals equally; but if the airplane veers away from this course, there is an increase in the signal strength in one of the loops, and a corresponding decrease in the other. The *ratio* in the signal strength in the two loops is constant, whatever the distance from the station or the strength of the incoming signal.

Fig. 2 shows a schematic wiring diagram of the instrument. Each of the two loops feeds its own side of a special twin-channel radio receiver, and the final amplification stage of each channel operates one of the two crossed pointers* of the *"course" indicating instrument, deflecting it in proportion to the strength of signal received.* The intersection of the pointers shows on the instrument dial whether the airplane is *on-course*, or what is the true bearing of the transmitting station, in degrees *off-beam* or *off-bow*. (see Fig. 3.)

As the airplane approaches the transmitting station, the strength of the signal *increases*, causing the pointers to be deflected more. Since this increase is inversely proportionate to the distance from the station, the outer scale of the instrument is calibrated to show the ratio of the distance travelled as a factor of the initial distance. Thus, if the pilot sets the pointers at "1" on the "approaching" scale when he begins his flight, by the time he is half-way over, the pointers will rise to show ".5". Inasmuch as an airplane flight is usually but a few hours in duration, minor variations in signal strength do not affect the value of the indication to any great extent.

The *true-direction* of the transmitting station (ahead or behind) is obtained by turning the "sense switch", which swings the pointers to the appropriate scale: *approaching* or *receding.*

Determining the "Drift Angle"

The pilot obtains the drift angle by observing any divergence between his compass (or directional gyro) and the *Radioguide course*, over a short period of time. If there is wind, the airplane will fly in a long curve, drifting with the wind, yet always pointing towards the station. Fig. 1 shows such a condition, and how the Radioguide enables the pilot to fly a *direct course* by pointing his ship into the wind, until both the compass and the Radioguide courses remain the same, giving him the *drift-angle* in degrees.

The manner of operation of the Radioguide is easily seen from Fig. 2. The pilot tunes in his station, and equalizes the gain in the two channels, with the balance switch closed, making both loops operate as one. He then turns the switch to operating position, and the apparatus is functioning directionally: each loop now deflects its own pointer *in proportion to the strength of signal it receives.* When the airplane reaches the station and passes through the "cone of silence" directly above the transmitting antennas, both pointers drop to zero: simultaneously, if the ship passes directly over the exact center of the antenna, or with a noticeable time lag between the drop of the two pointers, telling the pilot to which side of the exact center he is passing—a big help in making approaches for "blind" landings.

"Blind Landings"

Experiments are now under way to perfect "blind" landing technique with the Simon Radioguide. For making instrument landings, the loops are mounted in the airplane in a horizontal plane, instead of vertical. An underground horizontal loop antenna in the middle of the airport sends out horizontally polarized radio waves, and the instrument measures the angle between the horizontal path of level flight and the gliding path best suited for making the landing. When this angle is shown on the instrument, the pilot knows that he is near enough to begin his glide (see Fig. 4). Truly, the Radioguide is a complete radio navigation instrument, and a marked advance over the radio direction finders of the recent past.

Invention and progress go hand in hand. Radio made commercial aviation possible, guiding invisible airplanes to their invisible destinations—yet these wonders of radio which we daily witness are but forerunners of still greater accomplishments. There are many *needed* new inventions, in aircraft radio alone, which must surely come: a reliable radio direction finder for ultra-short-waves; an accurate radio distance meter not affected by variations in signal strength; a truly simple and practical system of landing "blind" by radio; a radio robot to pilot air liners along crowded airways without human aid—these are the coming inventions of the growing generation. And many others, which we, with our limited knowledge, cannot yet imagine. . .

*Similar to needles on a millivoltmeter, with its associated magnet and moving coil mechanism.

New Regen.-Super-Regen. Receiver

(*Continued from page* 728)

as super-regenerative detector, for which purpose it is admirably suited, giving smooth, stable super-regenerative reception to well below five meters. Both detectors feed into a 43 pentode power output tube while a 25Z5 rectifier, well filtered with two 25 mf. condensers and a filter choke, provides plate current for all tubes as well as field excitation.

Effective R.F. Amplification

The untuned stage of R.F. amplification not only provides real "gain" on weak, distant stations, but stabilizes the following detector tube, allowing *smooth regeneration* over all five bands with no "dead-spots." The success of this type of R.F. amplification depends to a great extent on the coupling used between the R.F. and detector tubes. Too large a choke in the R.F. plate circuit will cause broad tuning and interference on the 200 to 550 meter broadcast band and give very poor results on the short waves. The 2.5 millihenry choke which is commonly used here, is much too large for the purpose. About 175 micro-henries is a good all-around value. This combines substantial R.F. amplification with excellent selectivity. Tighter or looser coupling can then be obtained by varying the 100 mmf. semi-variable condenser until the desired degree of selectivity is found.

Band-Switching Down to 15 Meters

Five separate coils are used in the band-switching assembly, tuning from 555 down to 15 meters. This gives a reasonable amount of electrical *band-spread* which, when combined with the mechanical reduction drive of the large airplane dial, provides excellent non-critical tuning control. PHI (Holland) on their 16 meter wave tunes in as precisely and with as smooth, gradual regenerative control as GSA (England) or DJC (Germany) on their 49 meter wave.

Dual Regeneration Controls

It has been said that a regenerative receiver is only as good as its regeneration control. Certainly they are abominations when the regenerative adjustment is not good—*and an awful lot of them are not!*

The R-S-R makes use of a double feedback control in a so-called electron-coupled, regenerative detector circuit. One of these controls is a 2,000 ohm potentiometer between the cathode of the detector and the tap on the tuning inductance. This is strictly a radio-frequency control, limiting the signal energy which is fed back from the plate to the grid circuit. The other regenerative control is the 50,000 ohm potentiometer in the plate and screen-grid circuit. This control acts indirectly on the regeneration by changing the impedance of the tube very gradually (it acts on both plate and screen), and thus can be used as a vernier regenerative control. It also serves as a *volume control* on strong stations. Either of these controls have only a very small effect on the tuning adjustment and their combined action is remarkably smooth and stable.

Super-Regeneration Below 15 Meters

A separate 6C5 tube is used as a super-regenerative detector in a simple, but very stable self-quenching circuit. Super-regeneration can be used on all bands from 15 down to *below* 5 meters, by merely turning the switch knob, which is located just below the speaker on the front panel. Super-regeneration starts immediately and the tuning range covered depends only on the single self-supporting coil, which is plugged into the two pin-jacks in the small bakelite panel on the sub-base. These high-frequency coils are wound from No. 14 tinned copper wire and can be easily wound for any frequency band in a couple of minutes. The ten meter coil consists of 13 turns ¾" in diameter, while the five meter coil is only seven turns of the same diameter.

The separate 15 mmf. variable condenser which is used for tuning on these high frequencies, is controlled by the arrow knob at low center on the panel.

Hiss Reduction Control

It has always been the writer's contention that a properly built *super-regenerative* receiver should be no noisier than a superheterodyne at these high frequencies, for equal sensitivity. True it has a very decided hiss when no station is being received, but so has a sensitive superheterodyne. When a station is tuned in they both quiet down and if there is man-made interference such as automobile ignition disturbance, etc., in the neighborhood (and where can we get away from autos?) then the super-regenerative receiver becomes *quieter* than the superhet.

In the R-S-R, positive hiss control is provided by the same 50,000 ohm potentiometer that gives vernier regeneration and volume control on the lower frequency bands. This control allows the hiss between stations to be reduced to a minimum so that even a fairly weak signal makes it disappear entirely. Incidentally this adjustment is the most sensitive for distant reception. It is an interesting fact that the first 10 meter phone station heard from New York City, on the first model of the R-S-R built, was an amateur in Denver, Colorado, and he came through on the loudspeaker in good shape (being conservatively minded we gave him an R7).

Parts List for R-S-R Receivers

1—Special Black Crackle finish panel and sub-base drilled to proper specifications (Raco).
1—Raco Band-Switch and coil-assembly pre-assembled and wired 15-555 meters.
1—Pilot 140 mmf. variable condenser and bracket.

1—Pilot 15 mmf. variable condenser and bracket.
1—Raco 5" dynamic speaker and escutcheon.
1—S.P.D.T. switch.
1—Centralab Pot. 2,000 ohms.
1—Centralab Pot. 50,000 ohms and switch.
1—Raco R.F. Choke 175 micro-henries.
2—Raco R.F. Chokes 25 micro-henries.
1—Filter Choke 15H-60 MA. (Kenyon).
1—Raco 4" Dial and escutcheon.
1—Raco U. H. F. pin jack coil mounting.
1—Ant.Grd. Binding Post Strip.
1—Resistor power cord and plug (153 ohms).
1—Closed circuit phone jack.
5—Metal tube sockets.
3—Round plain knobs.
2—Arrow knobs.
1—.05 mf. fixed condenser.
3—.002 mf. fixed condensers.
1—.004 mf. fixed condenser.
1—.01 mf. fixed condenser.
1—.0001 mf. fixed condenser.
1—.00025 mf. fixed condenser.
1—.0005 mf. fixed condenser.
4—.1 mf. fixed condenser.
1—Semi Variable 100 mmf. condenser.
1—Electrolytic condenser 25-25-10 mf.
1—600 ohm fixed resistor.
1—25,000 ohm fixed resistor.
1—100,000 ohm fixed resistor.
1—1 megohm fixed resistor.
2—500 000 ohm fixed resistors.
1—2 megohm fixed resistor.
1—300 ohm fixed resistor.
1—10,000 ohm fixed resistor.
2—Grid caps.
1—Roll hook-up wire.
1—Set hardware.
4—Numbered plates.
1—Set 5 and 10 meter plug-in coils.

Tuning The I.F. Amplifier in S-W Super-Hets

(Continued from page 724)

The various ratings of parts are shown for constructing this test oscillator which will improve the simplicity of tuning any type of I.F. Amplifier circuit. The coils are made on insulated forms or tubing and should be a 3" diameter and 2½" long. The winding is of the bank wound type and consists of 190 turns of 34 Ga. D.C.C. wire wound as illustrated. The tap for the cathode in the AC circuit is made at 70 turns from start of winding. The wavechange tap which connects to the switchpoint S1 is made at 150 turns. The finish of the winding then connects to the switchpoint S2. The winding of such a coil is considered rather difficult to make. The illustration shows the method used. We wind on the tubing 60 turns as the first layer. This should be wound as tightly as possible and any solution for holding wires solidly in place may be applied to the first layer of wire. This should be allowed to dry and then winding of the second layer is started by bringing the wire to the position as shown in the illustration. Each additional layer is wound in the same manner, starting a new layer when we have the number of turns on each layer as shown. The entire coil may then be coated with coil dope.

In making the oscillator for battery type tubes the coil is constructed the same and the tap at 70 turns connects to positive lead of the filament circuit, while the wavechange taps connect to the switchpoints as in the AC type. Voltage for the tube which is of the 30 type is from a 3 volt cell for filament and a 22½ volt B battery in the small type. The entire oscillator can very easily be contained in an aluminum cabinet. The complete size of the cabinet will be governed by the size of condenser used and if the batteries are to be enclosed in the cabinet thus making this battery oscillator of portable type, same as the AC model.

The coil in the single layer type is easier to construct and for this the same number of turns are required and the tubing should be to the size 3" diameter and 4.5" long. The wire used is the same and the entire coil should also be lacquered.

When the oscillator is constructed it must be calibrated before it can be used to adjust the I.F. Amplifiers. This is quite simple. With the oscillator in operation bring it near to a broadcast receiver from which calibrations will be made. If we are calibrating for 456 K.C. turn the switch S to switchpoint S1. We must tune the broadcast receiver to a station which is on a harmonic of 456 K.C. This should be on the second harmonic which is 912 K.C. The tuning condenser on the oscillator will be near minimum capacity setting for this calibration. Adjust the oscillator tuning dial until a whistle is heard on the broadcast receiver at 912 K.C. The point on the oscillator dial should then be calibrated for the 456 K.C. For calibrating the 175 K.C. setting of the oscillator we must now adjust the switch S to switchpoint S2 and then proceed as we did for the 456 K.C. calibration. The broadcast receiver, however, must be tuned to the fourth harmonic of 175 K.C. which is 700 K.C., and when the oscillator whistle is heard on the broadcast receiver at 700 K.C. the calibration is made on the oscillator dial for 175 K.C. For the tuning to 175 K.C. the oscillator condenser will be adjusted to the range which brings the condenser to maximum capacity.

In using the oscillator for adjusting the I.F. transformers correctly to the frequency the small Condenser C in Fig. 2, forms the coupling to the receiver. This may be of any rating that we may have as it need not be any exact capacity. One of 250 MMF will be excellent as it is used merely to connect the oscillator radio frequency current to the receiver.

The lead from the coupling condenser is connected to the antenna post of the receiver, after disconnecting the antenna. Or it may be made direct to the grid of the first RF tube or Detector grid.

For amplifiers having transformers of the single, dual, or triple tuned types the adjustments are approximately the same. With the test oscillator in operation and the receiver switch turned on, adjust all I.F. tuning controls until a whistle is heard in the receiver. We now start with the first transformer and assuming it to be of the dual tuned type we adjust the trimmer condenser on the plate coil for loudest signal. The trimmer on the second transformer plate coil is adjusted in the same manner. If we have more than two transformers in the receiver, adjust each plate coil trimmer condenser for loudest signal. We then start on the first transformer grid coil trimmer and adjust this for loudest signal. The trimmer on the second transformer grid is adjusted the same and each of the grid coil trimmers is adjusted in this manner for any number of transformers in the receiver.

Should the transformer be of single tuned type the adjusting is quite simple as we need only tune each transformer trimmer until we hear the loudest signal in the receiver.

The triple tuned type is adjusted similar to the dual tuned type. However, we must first adjust the filter coil to the frequency of the oscillator. This coil is the one which connects to the chassis in the receiver as shown in illustration. Tuning of the other two controls on each transformer is then the same as for a dual type.

Having the transformers now correctly tuned we cannot assume that the receiver is perfect. We can, many times, increase the satisfaction of using a Super-Heterodyne by correcting our screen and cathode voltages.

Girl Operators, Attention!

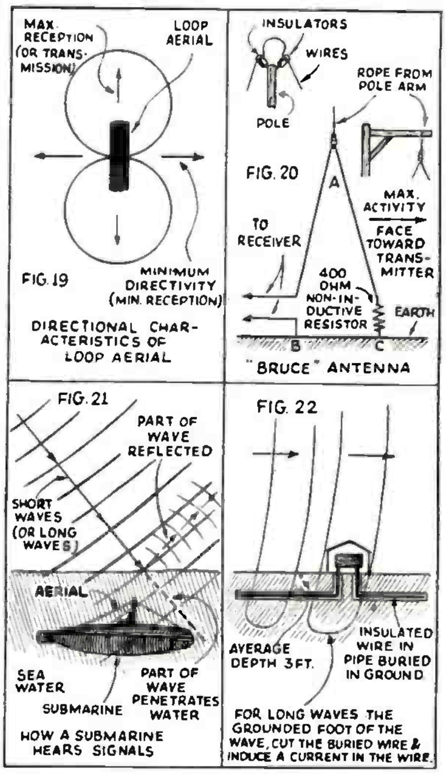
Listen "YL's" and "XYL's"!! Why not send the Editor a good photo of your "Rig"—and don't forget yourself. A separate photo of yourself will do, with a "clear" photo of that station! $5.00 for best "YL" photo.—Editor. See page 649 March issue for details.

How Waves are Radiated from Antennas

(Continued from page 722)

short-wave investigator, between New York and Philadelphia, as well as Baltimore, a distance of about 90 and 140 miles, respectively. A new theory to account for the 750 mile transmission between New York and Chicago on the 5-meter band, suggested by George W. Shuart, W2AMN, is that the ionized reflecting layer happened to be at an abnormally low height and in consequence these short-wave signals were reflected as shown in Fig. 17, so as to reach Chicago, whereas ordinarily they would be reflected at an angle (with the average height of the ionized layer) so as to pass beyond the earth.

On the shorter wavelengths from 5 meters on down, much of the radiation undoubtedly passes straight on through the Heaviside and other ionized layers of the Ionosphere out into space.



Interesting study showing how radio waves travel.

Fig. 18 shows the radiated wave pattern or directional effect of two loops placed at an angle and variations of this directive system are used by airport stations, which send out radio beam signals to direct planes on their course. Fig. 19 shows the directive effect and radiation for a single loop aerial. Fig. 20 illustrates a new form of antenna, strongly recommended for short-wave reception purposes by the British Broadcasting Corp. It is known as the Bruce antenna and is of triangular shape. Its maximum activity is in the direction indicated and the dimensions for various wavelengths are given in the accompanying table.

TABLE I—Inverted "V" Aerial

Where Length of Side = ¾ Wavelength

Wave-length Meters	Hgt. of Mast in feet	Length of Base Line in feet	Length of Wire (CAB) in feet
17	40	28	84
20	44	33	98'6"
25	60	42	125'6"

TABLE II

Length of Side = 5-4 Wavelength

Wave-length Meters	Hgt. of Mast in feet	Length of Base Line in feet	Length of Wire (CAB) in feet
17	58	84	140
20	66	98'6"	164
25	83'6"	125'6"	209

In short-wave transmission, the ground component of the wave attenuates or reduces to practically zero at a relatively short distance from the transmitting antenna, while the space or sky-wave component procedes onward and upward until it is reflected, or as present-day evidence indicates, refracted from the highly ionized layers of the Ionosphere, found 40 miles or more above the earth's surface.

It used to be thought that a submarine for instance, lying submerged in possibly 100 feet of water, picked up radio signals, thanks to the *ground wave* component and this may still be true on the longer waves, but it is now conjectured that with the shorter waves, any signals picked up by a submerged submarine must be due to direct transmission of the downcoming reflected wave through the water.

Speaking of wave transmission phenomena, a very interesting case is that of the Rogers underground or *buried* antennas, which were used extensively by the government during the war. In some cases these aerials were composed of insulated wires placed within iron pipes and buried about three feet underground; see Fig. 22. The maximum long distance reception was obtained in a direction along the axis of the buried antennas and in some cases, several sets of these antennas were built, like the spokes of a wheel, so that a doublet facing, for example, in a certain geographical direction could be used, the various sets of aerials being switched into circuit by means of a suitable switch.

These aerials were useful on the longer waves, but little research apparently has been done with them on the *short* waves. On the long waves, especially those several thousand meters in length, the ground wave component probably is the one that causes a current to be set up in the buried antennas, but on *short* waves, at considerable distances presumably reception must be effected by the sky-waves, which come down and strike the earth and penetrate it, at least for some distance, similar to the action taking place with the submarine, as illustrated in Fig. 21.

De Luxe 3-Tuber

(Continued from page 721)

of constructing a *good* superhet, we can highly recommend this three-tube T.R.F. job. The entire receiver is built around a National PW-2 tuning unit. This consists of a special vernier *band-spread* dial and two special variable condensers. This is the same dial and the same type condenser used in the famous National HRO receiver. Using conventional *general-coverage* coils, there is sufficient band-spread to make tuning really a pleasure in either the *amateur* or S.W. *broadcast* bands. The forty meter *ham* band for instance occupies 180 degrees of a rotation of the dial. Of course if greater band-spread is desired, then the National band-spread coils may be used. In this case the forty meter band would be covered by *six or seven rotations of the dial*—band-spread?—We'll say so—and How!

We used National *general-coverage* coils in this receiver and four sets are necessary to obtain good coverage. While these coils are designed to work with a 90 mmf. tuning condenser, no cramped tuning is encountered with the 150 mmf. condensers used in this receiver. In fact the great overlap provided with this combination is advantageous under certain conditions. On some

(Continued on page 761)

De Luxe 3-Tuber

(Continued from page 759)

bands we can have *high-C* with one set of coils and *low-C* with another set of coils.

Metal Tubes Employed

In order to make the set simple and up-to-date metal tubes were used, although regular glass tubes may be used providing proper shielding is used with them. The circuit of the receiver is much the same as the well known SW3. In the T.R.F. stage we have a 6K7 pentode. This is inductively coupled to the regenerative detector. In order that the detector tube may always be run below the overloading point, a suitable gain control is incorporated in the cathode circuit of the R.F. stage. This is a 25,000 ohm variable resistor which, even when all the resistance is in the circuit, is not sufficient to cut down the stronger signals. To make it more effective we have arranged to apply a positive potential to the cathode as the resistance in the cathode circuit is increased. A 100,000 ohm fixed resistor connected between one side of the volume control and the "B" plus serves this purpose. Even on a moderate strength signal the volume control must be set to minimum volume in order to prevent overloading of the detector, so sensitive and efficient is the R.F. stage.

Feed-back Method and Audio Stage

It was a "toss up" really, whether we should have the feed-back coil (tickler) connected in the plate circuit of the detector tube, or in the cathode circuit. Merely for simplicity's sake we decided upon the cathode method, which allows the output circuit of the detector tube to be relatively free of R.F. And we believe *greater gain* is obtained in this manner.

Coupling between the detector and the audio stage is accomplished with resistors and a capacitor. This combination may be replaced with a high impedance audio choke coil for a slight increase in audio volume. For the audio stage we selected a triode, the 6C5. A pentode may be used in its place with even a further increase in audio volume. In this case we would need some sort of output coupling device so that the plate current of the A.F. amplifier would not pass directly through the phones and so shorten the useful life of them. Then again if we use a pentode we should incorporate an audio volume control in the pentode stage—with the triode it was not deemed necessary.

Power Supply

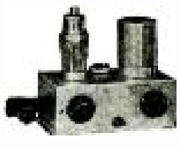
For those who do not possess a suitable *power-supply* for this receiver, a diagram of one is given. It should furnish 6.3 volts for the heaters and 250 volts for the plates of the tubes.

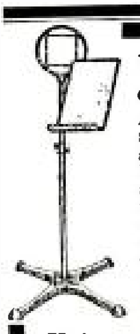
Returning to the diagram we see that padding in the R.F. stage is provided by tuning the *interwound* coil. This is the winding which, on the detector coil, is used in the plate of the R.F. tube for coupling. This coil naturally imposes a load on the detector grid circuit and thus detunes it. We do exactly the same thing in the R.F. circuit. We tune the third winding and thus impose upon it the same load as on the detector coil and in this manner obtain very nearly perfect "tracking" between the detector and R.F. stages when they are tuned together.

Plenty of by-pass condensers are used to insure maximum stability, which is obtained only when all traces of R.F. are kept at or near the zero point.

One very important part of the construction of any receiver is the layout or placement of parts. We used an SW3 cabinet and placed the parts of each stage where undesired coupling would be at a minimum. The dial and condenser assembly is placed in the center. The R.F. stage is placed to the left of the cabinet and the detector is on the right. In the center, to the rear, we have the audio amplifier tube. Between the two high frequency stages we have two aluminum shields. Why use two when one would have separated them? Well, one was

(Continued on page 763)





• • • SHORT WAVE ESSENTIALS
FOR MEMBERS OF THE SHORT WAVE LEAGUE • • •

Application for Membership SHORT WAVE LEAGUE

SHORT WAVE LEAGUE 4-36
99-101 Hudson Street, New York, N. Y.

I, the undersigned, herewith desire to apply for membership in the SHORT WAVE LEAGUE. In joining the LEAGUE I understand that I am not assessed for membership and that there are no dues and no fees of any kind. I pledge myself to abide by all the rules and regulations of the SHORT WAVE LEAGUE, which rules you are to send to me on receipt of this application.

I consider myself belonging to the following class (put an X in correct space): Short Wave Experimenter ☐ Short Wave Fan ☐ Radio Engineer ☐ Student ☐

I own the following radio equipment:

Transmitting ....

Call Letters..........

Receiving ....

Name ....

Address ....

City and State..........

Country ....

I enclose 10c for postage and handling for my Membership Certificate.

A FEW WORDS AS TO THE PURPOSE OF THE LEAGUE

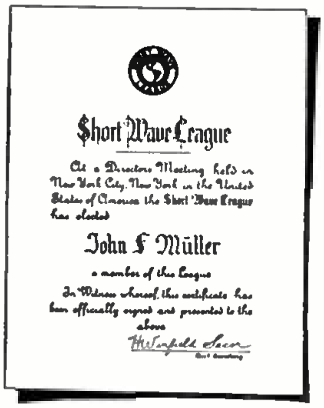
The SHORT WAVE LEAGUE was founded in 1930. Honorary Directors are as follows: Dr. Lee de Forest, John L. Reinartz, D. E. Replogle, Hollis Baird, E. T. Somerset, Baron Manfred von Ardenne. Hugo Gernsback, Executive Secretary.

The SHORT WAVE LEAGUE is a scientific membership organization for the promotion of the short wave art. There are no dues, no fees, no initiations, in connection with the LEAGUE. No one makes any money from it; no one derives any salary. The only income which the LEAGUE has is from its short wave essentials. A pamphlet setting forth the LEAGUE'S numerous aspirations and purposes will be sent to anyone on receipt of a 3c stamp to cover postage.

FREE MEMBERSHIP CERTIFICATE

As soon as you are enrolled as a member, a beautiful certificate with the LEAGUE'S seal will be sent to you, providing 10c in stamps or coin is sent for mailing charges.

Members are entitled to preferential discounts when buying radio merchandise from numerous firms who have agreed to allow lower prices to all SHORT WAVE LEAGUE members.


Short Wave League

At a Directors Meeting held in New York City, New York in the United States of America the Short Wave League has elected

John F Müller

a member of this League

In Witness whereof, this certificate has been officially signed and presented to the above

Illustration of engraved free membership certificate

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**

OFFICIAL SHORT WAVE LISTENER MAGAZINE

The finest magazine of its kind ever published—totally different in get-up and contents from any other. Contains the largest listing of short wave stations in the world, up-to-the-minute, including "Police," "Television" and short-wave stations, as well as a special list of the star short-wave stations with their frequencies and call letters. Also contains photos and descriptions of short-wave broadcasting stations in various parts of the world with photos of short wave studio artists—How to locate "weak" distance stations, and other hints for the "short-wave listener"—Question and Answer Department for the "listener"—Silver Cup Trophy for best photo of readers' listening "Posts," etc

B—Official Short Wave Listener Magazine..........Prepaid **15c**

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**

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.

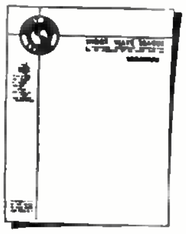
F—SHORT WAVE Map of the World..........Prepaid **25c**

PLEASE NOTE THAT ABOVE ESSENTIALS ARE SOLD ONLY TO MEMBERS OF THE LEAGUE—NOT TO NON-MEMBERS WITH EXCEPTION OF ITEM B.

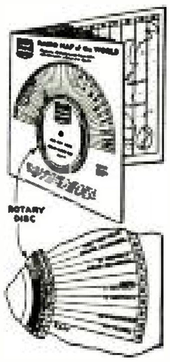
Send all orders for short wave essentials to SHORT WAVE LEAGUE, 99-101 Hudson Street, New York City.

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.


A—50c per 100

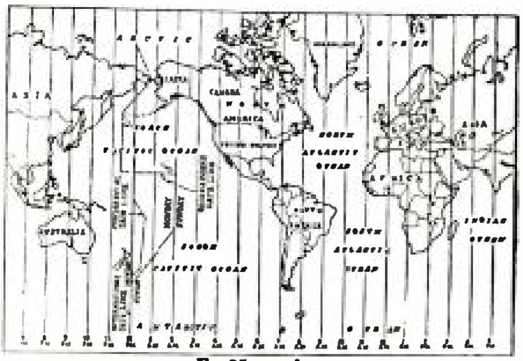
B—15c per copy



C—25c each


D—89c each

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:

....

for which I enclose $.......... herewith.

(The LEAGUE accepts money order, cash or new U. S. Stamps in any denomination. Register cash and stamps.)

Name..........

Address..........

City and State..........

Country..........

4-36

De Luxe 3-Tuber

(*Continued from page* 761)

tried and while it appeared to serve, tests demonstrated that it had very little effect insofar as R.F. shielding is concerned; *two were absolutely necessary!* The regeneration control is on the left of the dial and the R.F. padding or trimmer condenser is to the left. The R.F. volume control is placed on the left side of the cabinet; there was no space for it on the front panel.

Either a doublet or a plain single wire may be used for the antenna. If a single wire is used, one around 75 feet will be found to be most efficient when operation is desired over the entire short-wave spectrum.

Parts List for De Luxe Receiver

1—PW2 dial and condenser combination, National.
1—100 mmf. variable condenser, National.
4—.1 mf. fixed condenser, Cornell-Dubilier.
3—.0001 mf. mica condensers, Cornell-Dubilier.
1—.006 mf. mica condenser, Cornell-Dubilier.
1—1 mf. by-pass condenser, Cornell-Dubilier.
1—4 mf. by-pass condenser, Cornell-Dubilier.
1—300 ohm ½-watt resistor, I.R.C.
3—¼ meg. ½-watt resistors, I.R.C.
1—2 meg. ½-watt resistor, I.R.C.
1—20,000-ohm ½-watt resistor, I.R.C.
All Resistors of the Insulated Type.
1—25,000-ohm potentiometer, Electrad.
1—50,000 potentiometer, Electrad.
3—Octal isolantite sockets, National.
2—special 6-prong coil sockets, National.
1—2.5 mh. R.F.C., National.
Two Each of National Nos. 61, 62, 63, and 64, "General Coverage" Coils (National "Band Spread" coils can be used, which will provide extraordinary spreading of the stations over the dial; more than the average listener will require.)
1—6W3 cabinet, National.
1—6K7 tube R.C.A.
1—6J7 tube, R.C.A.
1—6C5 metal tube, R.C.A.

Police Radio Alarm Stations

(*Continued from page* 736)

KNFI	Mt. Vernon, Wash.	2414 kc.
KNFJ	Pomona, Cal.	1712 kc.
KNFK	Bellingham, Wash.	2490 kc.
KNFL	Shuksan, Wash.	2490 kc.
KNFM	Compton, Cal.	2490 kc.
KNFN	Waterloo, Iowa	1682 kc.
KNFO	Storm Lake, Iowa	1682 kc.
KNFP	Everett, Wash.	2414 kc.
KNFQ	Skykomish, Wash.	2490 kc.
KNFR KNFS KNFT KNFU KNFV KNFW	Mobile in State of Wash.	2490 kc.
KNFX	Alpowa Camp, Wash.	2490 kc.
KNFY	Ilwaco, Wash.	2490 kc.
KNFZ	Hells Crossing Camp, Wash.	2490 kc.
KNGA	Satus Pass Camp, Wash.	2490 kc.
KNGB	Yakima, Wash.	2490 kc.
KNGC	Vancouver, Wash.	2490 kc.
KNGD	Walla Walla, Wash.	2490 kc.
KNGE	Cleburne, Tex.	1712 kc.
KNGF	Sacramento, Cal.	2422 kc.
KNGH	Dodge City, Kans.	2474 kc.
KNGJ	El Centro, Cal.	2490 kc.
KNGK	Duncan, Okla.	2450 kc.
KNGM	Rapid City, S. Dak.	2450 kc.
KNGN	Norfolk, Nebr.	2490 kc.
KNGO	Portable, Okla.	2450 kc.
KNGP	Shreveport, Pa.	2430 kc.
KNGQ	Wenatchee, Wash	2490 kc.
KNGR	Spokane, Wash.	2490 kc.
KNGT	Muskogee, Okla.	2450 kc.
KNGU	Yakima, Wash.	2414 kc.
KNGV	Salina, Kans.	2422 kc.
KNGW	Brownwood, Tex.	2458 kc.
KNGX	Portable, Los Angeles	1712 kc.
KNGY	Lodi, Calif.	2414 kc.
KNGZ	Ephrata, Wash.	2490 kc.
KNHA	Mobile, Wash.	2490 kc.
KNHB	Green Bay, Wis.	2382 kc.
KNHC	Ada, Okla.	2450 kc.
KNHD	Redwood Falls, Minn.	1658 kc.
KNHE	Fort Smith, Ark.	2406 kc.
KNHF	Denton, Tex.	1712 kc.
KNHG	Prescott, Ark.	2430 kc.
KNHM	Fargo, N. Dak.	2442 kc.
KSW	Berkeley, Cal.	1658 kc.
KVP	Dallas, Tex.	1712 kc.
VDM	Halifax, N.S.	1690 kc.

VYR	Montreal, Can.	1706 kc.
VYW	Winnipeg, Man.	2396 kc.
WCK	Belle Island, Mich.	2414 kc.
WEY	Boston, Mass.	1630 kc.
WKDT	Detroit, Mich.	1630 kc.
WKDU	Cincinnati, Ohio	1706 kc.
WMDZ	Indianapolis, Ind.	2442 kc.
WMJ	Buffalo, N.Y.	2422 kc.
WMO	Highland Park, Mich.	2414 kc.
WMP	Framingham, Mass.	1666 kc.
WNFP	Niagara Falls, N.Y.	2422 kc.
WPDA	Tulare, Cal.	2414 kc.
WPDB	Chicago, Ill.	1712 kc.
WPDC	Chicago, Ill.	1712 kc.
WPDD	Chicago, Ill.	1712 kc.
WPDE	Louisville, Ky.	2442 kc.
WPDF	Flint, Mich.	2466 kc.
WPDG	Youngstown, Ohio	2458 kc.
WPDH	Richmond, Ind.	2442 kc.
WPDI	Columbus, Ohio	2430 kc.
WPDK	Milwaukee, Wis.	2450 kc.
WPDL	Lansing, Mich.	2442 kc.
WPDM	Dayton, Ohio	2430 kc.
WPDN	Auburn, N.Y.	2382 kc.
WPDO	Akron, Ohio	2458 kc.
WPDP	Philadelphia, Pa.	2474 kc.
WPDS	St. Paul, Minn.	2430 kc.
WPDT	Kokomo, Ind.	2490 kc.
WPDU	Pittsburgh, Pa.	1712 kc.
WPDV	Charlotte, N.C.	2458 kc.
WPDW	Washington, D.C.	2422 kc.
WPDX	Detroit, Mich.	2414 kc.
WPDY	Atlanta, Ga.	2414 kc.
WPDZ	Fort Wayne, Ind.	2490 kc.
WPEA	Syracuse, N.Y.	2382 kc.
WPEB	Grand Rapids, Mich.	2442 kc.
WPEC	Memphis, Tenn.	2466 kc.
WPED	Arlington, Mass.	1712 kc.
WPEE	New York, N.Y.	2450 kc.
WPEF	New York, N.Y.	2450 kc.
WPEG	New York, N.Y.	2450 kc.
WPEH	Somerville, Mass.	1712 kc.
WPEI	E. Providence, R.I.	1712 kc.
WPEK	New Orleans, La.	2430 kc.
WPEL	W. Bridgewater, Mass.	1666 kc.
WPEM	Woonsocket, R.I.	2466 kc.
WPEP	Kenosha, Wis.	2450 kc.
WPES	Saginaw, Mich.	2442 kc.
WPET	Lexington, Ky.	1706 kc.
WPEV	Portable (in Mass.)	1666 kc.
WPEW	Northampton, Mass.	1666 kc.
WPFA	Newton, Mass.	1712 kc.
WPFC	Muskegon, Mich.	2442 kc.
WPFE	Reading, Pa.	2442 kc.
WPFG	Jacksonville, Fla.	2442 kc.
WPFH	Baltimore, Md.	2414 kc.
WPFI	Columbus, Ga.	2414 kc.
WPFJ	Hammond, Ind.	1712 kc.
WPFK	Hackensack, N.J.	2430 kc.
WPFL	Gary, Ind.	2470 kc.
WPFM	Birmingham, Ala.	2382 kc.
WPFN	New Bedford Mass.	1712 kc.
WPFO	Knoxville, Tenn.	2474 kc.
WPFP	Clarksburg, W.Va.	2490 kc
WPFQ	Swarthmore, Pa.	2474 kc.
WPFR	Johnson City, Tenn.	2470 kc.
WPFS	Asheville, N.C.	2474 kc.
WPFT	Lakeland, Fla.	2442 kc.
WPFU	Portland, Me.	2422 kc.
WPFV	Pawtucket, R.I.	2466 kc.
WPFW	Bridgeport, Conn.	2466 kc.
WPFX	Palm Beach, Fla.	2442 kc.
WPFY	Yonkers, N.Y.	2442 kc.
WPFZ	Miami, Fla.	2442 kc.
WPGA	Bay City, Mich.	2466 kc.
WPGB	Port Huron, Mich.	2466 kc.
WPGC	S. Schenectady, N.Y.	1658 kc.
WPGD	Rockford, Ill.	2458 kc.
WPGF	Providence, R.I.	1712 kc.
WPGG	Findlay, Ohio	1596 kc.
WPGH	Albany, N.Y.	2414 kc.
WPGI	Portsmouth, Ohio	2430 kc.
WPGJ	Utica, N.Y.	2414 kc.
WPGK	Cranston, R.I.	2466 kc.
WPGL	Binghamton, N.Y.	2442 kc.
WPGN	South Bend, Ind.	2490 kc.
WPGO	Huntington, N.Y.	2490 kc.
WPGP	Muncie, Ind.	2442 kc.
WPGQ	Columbus, Ohio	1596 kc.
WPGS	Mineola, N.Y.	2490 kc.
WPGT	New Castle, Pa.	2482 kc.
WPGU	Cohasset, Mass.	1712 kc.
WPGV	Boston, Mass.	1712 kc.
WPGW	Mobile, Ala.	2382 kc.
WPGX	Worcester, Mass.	2466 kc.
WPGZ	Johnson City, Tenn.	2474 kc.
WPHA	Fitchburg, Mass.	2466 kc.
WPHB	Nashua, N.H.	2422 kc.
WPHC	Massillon, Ohio	1596 kc.
WPHD	Steubenville, Ohio	2458 kc.
WPHE	Culver, Ind.	1634 kc.
WPHF	Richmond, Va.	2450 kc.
WPHG	Medford, Mass.	1712 kc.
WPHI	Charleston, W.Va.	2490 kc.
WPHJ	Fairmont, W.Va.	2490 kc.
WPHK	Wilmington, Ohio	1596 kc.
WPHL	Portable in Ohio	1682 kc.

WPHM	Orlando, Fla.	2442 kc.
WPHN	Tampa, Fla.	2466 kc.
WPHO	Zanesville, Ohio	2430 kc.
WPHP	Jackson, Mich.	2466 kc.
WPHQ	Parkersburg, W.Va.	2490 kc.
WPHS	Culver, Ind.	1634 kc.
WPHT	Cambridge, Ohio	1596 kc.
WPHU	Jasper, Ind.	1634 kc.
WPHV	Bristol, Va.	2450 kc.
WPHY	Elizabethton, Tenn.	2474 kc.
WPHZ	Oil City, Pa.	2482 kc.
WPSP	Harrisburg, Pa.	1674 kc.
WQFA	New Haven, Conn.	2406 kc.
WQFB	Macon, Ga.	2414 kc.
WQFC	Gainesville, Fla.	2466 kc.
WQFD	Columbia City, Ind.	1534 kc.
WQFE	Seymour, Ind.	1634 kc.
WQFF	Monessen, Pa.	2482 kc.
WQFG	Roanoke, Va.	2450 kc.
WQFH	Lynchburg, Va.	2450 kc.
WQFI	Petersburg, Va.	2450 kc.
WQFJ	Oneonta, N. Y.	2414 kc
WQFK	Clearwater, Fla.	2466 kc.
WQFM	Wilkes-Barre, Pa.	2442 kc.
WQFN	Winter Haven, Fla.	2442 kc.
WQFO	Lancaster, Ohio	2430 kc.
WQFP	Springfield, Ill.	1610 kc.
WQFQ	Lafayette, Ind.	2442 kc.
WQFR	Portable, N. Y.	1658 kc.
WQFS	Hibbing, Minn.	2382 kc.
WQFT	Portable, Ohio	1596 kc.
WQFU	Sharon, Pa.	2482 kc.
WQFV	Augusta, Ga.	2414 kc.
WRBH	Cleveland, Ohio	2458 kc.
WRDQ	Toledo, Ohio	2474 kc
WRDR	Grosse Pt. Village, Mich.	2414 kc.
WRDS	E. Lansing, Mich.	1642 kc.
W1XAO	Boston, Mass.	1712 kc.

Short Wave Scout News

(*Continued from page 737*)

few months, although I have been able to catch a few stations. But I must say that the 20 meter amateur band has been very good; I have heard 14 countries and 26 states.

Report of Commercial Stations
Dec. 7, 1935

YVC—Maracay, Venezuela, S.A., 13,345 kc. Works U.S. Good.
HJ4ABA—Medellin, Colombia, S.A., 11,710 kc. 6:25 P.M. Fair.
XEFT—Vera Cruze, Mexico, 9,600 kc. 6:45 P.M. Good.
CT1AA—Lisbon, Portugal, 9,625 kc. 6:50 P.M. Fair. Tuesdays, Thursdays, Saturdays, 4:30 to 7 P.M., this station at times is very strong and clear.

December 8, 1935

RNE—Moscow, U.S.S.R., 12,000 kc. 8:45 A.M. Very good.
HAS3—Budapest, Hungary, 15,370 kc. 9 A.M. Good.
KAY—Manila, P.I., 14,980 kc. 9:10 A.M. Fair. QRM code.

December 9, 1935

LSX—Monte Grande, Argentina, S.A., 10,-350 kc. Fair.
TIDG—San Jose, Costa Rica, 6,410 kc. Good.

December 12, 1935

TGS—Guatamala City, Guatamala, 5,713 kc. Fair.

December 14, 1935

CTIGO—Parede, Portugal, 12,000 kc. Good.
HIZ—Santo Domingo, D.R., 6,316 kc. Good.

January 10, 1936

PCV—Kootjwick, Holland, 17,810 kc. Fair.

ADOLPH B. RICE,
3432 Hanover Ave.,
Richmond, Va.,
U.S.A.

"South Americans"—Report from A. Centanino

VP3MR in Georgetown, Guiana, is on 7.08 meg., at 4:40 to 8:40 P.M.. They are not heard very well on account of code interference. HK1Z on 13.99 meg. between 3:00 and 4:00 (*Continued on page 767*)

CLASSIFIED

Advertisements are inserted at 5c per word to strictly amateurs, or 10c a word to manufacturers or dealers. Each word in a name and address is counted. Cash should accompany all orders. Copy for the May issue should reach us not later than March 5.

BOOKS

ARMY-NAVY GIVES FREE radio operators' training for service on aircraft, ships. Salary, expenses paid. Information pamphlet, how to apply, 20c. Continental, Box 344, Dept. 4, Indianapolis, Ind.

GENERATORS

TURN SCRAP INTO MONEY. Autopower shows you how easily and economically auto generators can be converted into A.C. or D.C. generators and D.C. motors, 2 to 1000 volts; for sound, radio, power, light, or welding. No previous experience necessary—complete information all in new book, with simple instructions and illustrations. Endorsed by thousands. Only $1.00 postpaid. Autopower, Inc., 414 S. Hoyne Ave., Chicago.

"HAM" OFFERS AND WANTS

MOTOR-GENERATOR, BARGAIN 110 D.C., Output 600 Volts, 830 Mils. Good sturdy job. Complete with Automatic Starter. $25 takes it. Menier, 563 West 181th Street, New York.

WANTED COPY OF LODGE'S "Signalling Through Space Without Wires." State price and condition. H. W. Secor, % Short Wave Craft, 99 Hudson St., New York City.

SELLING STATION 250 WATT transmitter complete, including power supply, tubes, 17 jewel meters, etc., $75. ExW9EPY, Fred Kramer, 211 So. 21 Ave., Maywood, Ill.

UNIVERSAL MICROPHONE MODel BB never used $9.00 or trade, want genemotor, 6v. to 300v. 100-120 milliamperes. Neice, 3725—64 St., Woodside, N.Y.

SKYRIDERS CHEAP—SELL OR trade—Can use cameras, lenses, binoculars, etc. Wells-Smith Radio Corp., 26 N. Wells St., Chicago.

USED ALL STAR JR. COMPLETE with tubes like new $17.50. W9ARA, Butler, Missouri.

INSTRUCTION

AMATEUR LICENSES, COMPLETE training. $1.50 weekly. Resident and correspondence courses. Students licensed this month: W2JAN, W2JBD, W2JCU, W2JDJ, W2JDQ, W2JDR, W2JGS, W2JGV, W2JGX, W2JGY, W2JHF, W2JHV, W2JIE, W2JII, W2JIW, W2JKL. New York Wireless School, 1123 Broadway, New York.

LEARN RADIO, $1.00 PER LESSON. All subjects. Revolutionary successful individual method. Equipment loaned and rented. University Expert Instructors. Information free, or send $1.00 for first lesson. Missouri Technical School, 3907-B North 25th, St. Louis.

RADIO ENGINEERING, BROADcasting, aviation and police radio. Servicing. Marine and Morse Telegraphy taught thoroughly. All expenses low. Catalog free. Dodge's Institute, Colt St., Valparaiso, Ind.

CALCULATE RESISTANCES—series, parallel. Voltages, current, watts. Valuable formulas, fully explained. Copy 25c. H. A. Mueller, 217-A Washington Blvd., Oak Park, Illinois.

MISCELLANEOUS

OHM'S LAW CALCULATOR—Lightning Slide Rule: solves all problems of Voltage, Current and Resistance, Power, Wire Sizes, etc. Range: 1 micro-amp. to 1000 amps.; 1 micro-volt to 10,000 volts; 1 micro-ohm to 10 megohms; 1 micro-watt to 10 megawattts; wire sizes 0 to 36 B. & S. gauge. Introductory price $1.00 prepaid. The Dataprint Co., Box 322, Ramsey, N.J.

FOR SALE: L. C. SMITH TYPEwriter in good condition. Dealers are asking $45.00 for this model. Will sacrifice for cash $22.50 F.O.B. N.Y. D.K., % Popular Book Corp., 99 Hudson St., New York.

PATENTS & INVENTIONS

PATENTS, REASONABLE TERMS. Book and advice free. L. F. Randolph, Dept. 714, Washington, D. C.

QSL—CARDS—SWL

SHORT WAVE LISTENER'S QSL Cards. Attractive. Reply Getters. Samples (Stamps). W-8-E-S-N, 1827 Cone, Toledo, Ohio.

QSL CARDS, NEAT, ATTRACtive, reasonably priced, samples free. Miller, Printer, Ambler, Pa.

RADIO ENGINEERING

EXACT COPIES OF APPARATUS described in this magazine or any other radio equipment—custom built with parts bought at lowest prices anywhere! Expert workmanship. Results guaranteed. Quotations cheerfully given. Custombuilders, Dept. A, 113 West 57th, New York City.

SHORT WAVE COMPONENTS

IRON CORE I. F. TRANSFORMers, 175 or 456 K.C. 85c each. United Coil Co., 2220 So. Kedzie, Chicago, Ills.

PLUG-IN COILS. WRITE FOR catalogue. Noel, 728 Birch, Scranton, Pa.

SHORT WAVE RECEIVERS

IMMEDIATE DELIVERY—Shipped Prepaid on ten day trial: PR-16s $95.70, Breting 12s $93.00, Silver 5Ds $109.80. All National, Hammarlund, Hallicrafters, RCA, Collins receivers and transmitters. Code machines rented. Write. Henry Radio Shop, Butler, Missouri.

INSTRUCTIONS 18 DISTANCE Crystal Sets—record 2100 miles; "Radiobuilder" year; 25c. Laboratories, 151-C Liberty, San Francisco.

TELEVISION

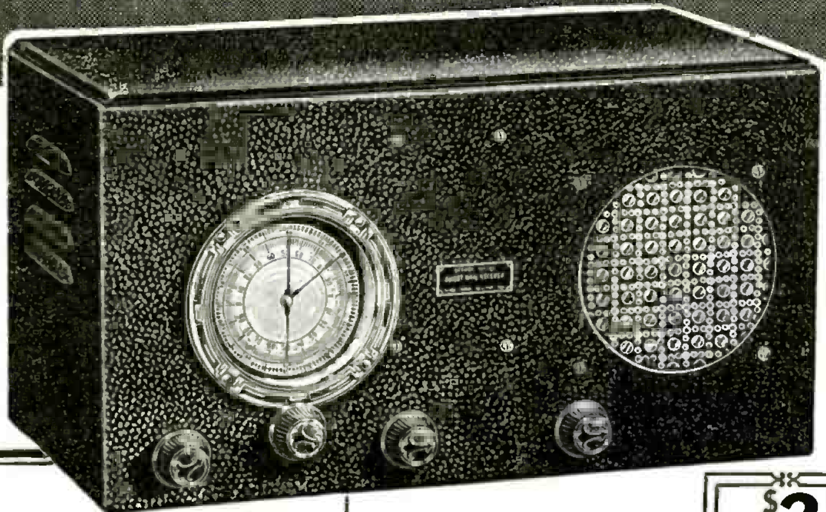
TELEVISOR $6.00. KIT $4.00. Arthur Pohl, 2134 Palms, Detroit, Mich.

TRANSMITTING EQUIPMENT

NEW CATALOG JUST OFF THE press. Monitors. Power packs of every size. Modulators, phone transmitters, power transformers, condensers and everything for the Amateur Station. Get your copy now. Stamp appreciated. General Engineering Corporation, Charlotte, Michigan.

CRYSTALS, 80 AND 160 METER bands, 95c. A stock of 1,000 crystals insures you prompt delivery. New type shielded holder 60c. Fits five or seven prong socket. Specify type. White Radio Laboratory, Sandpoint, Idaho.

The DOERLE 5-TUBE DELUXE A.C. SHORT-WAVE RECEIVER features CONTINUOUS BANDSPREAD on All Bands!



★ USES DOUBLET OR STANDARD ANTENNA.
★ 8 LOW-LOSS PLUG-IN COILS.
★ RANGE 15 to 200 METERS.
★ MICROMASTER BANDSPREAD DIAL.
★ MAGNAVOX DYNAMIC SPEAKER.
★ BEAUTIFUL CRACKLE CABINET
★ HEADPHONE RECEPTION IF DESIRED.
★ SENSITIVE REGENERATIVE CIRCUIT.
★ TONE CONTROL.

Nation-Wide Testimonials PRAISE THIS SET!

Dear Sirs:

This is the first opportunity that I have to write to you since my receipt of your Doerle 5 Tube DeLuxe AC Receiver, last September.

In three months' time I have had ample opportunity to try, test, tune, and to even compare this wonderful set, with receivers selling four times its price. In the regenerative type of receivers, A.C. of course, to date, it has no equal here, and this is the consensus of opinion around my shack. And, furthermore, it is not bold for me to say that this Doerle AC 5 will perform a good deal better than many Super Hets.

I am an invalid for over four years, and between your Short Wave Craft, (yes, I get it before I get my smoke every month), and this last receiver of yours, you are responsible for my spending many wonderful hours, in DX and now, CW. I would appreciate the receipt of your 1936 Catalog No. 31. I am in line to build a Transmitter as soon as I pass my ticket. I intend to add gradually on a Rack and Panel Xmitter, by Geo. W. Shuart, in your March, April and May issue of this year.

L. A. RAYMOND
631 Blvd. Cremazie East,
Villeray, Montreal, Que.

Gentlemen:

Here is a list of Short-Wave stations I have received in a short time with my "Doerle AC5," with a very poor aerial for short-wave work. EAQ—MADRID, SPAIN; W1XAZ—Springfield, Mass.; W2XAF—Schenectady, N.Y.; COH—Havana, Cuba; COC—Havana, Cuba; VE9GW—Bowmanville, Ontario, Canada; CT1AA—Lisbon, Portugal; PRF5—Rio De Janeiro, Brazil; HJ1ABB Barranquilla, Col., S.A.; PRADO—Riobamba, Ecuador, S.A.; DJC—Berlin, Germany; XEBT—Mexico City, Mexico; YV5RMO—Maracaibo, Venezuela, S.A.; CRJO—Winnipeg, Canada; W2XF—New York, N.Y.; W8XK—Pittsburgh, Pa.; HP5B—Panama City, Panama; FYA—Paris, France; GSC-GSL—Daventry, England. EAQ—Madrid, Spain, and COD—Havana, Cuba, come in every night on the loud speaker regardless of weather conditions. This is the third and best receiver I have owned in the short time I have been interested in Short Waves.

EMERALD H. DELBRUGGE,
Rose-Mary Dahlia Gardens,
Martins Ferry, Ohio.

Original Letters Plus Others May Be Seen At Our Office

$27.54 READY TO OPERATE
Less 2 B'cast. coils—$1.75 extra

EVERYBODY'S talking about the new *5-Tube Doerle DeLuxe Short-Wave Receiver.* If you are interested in short-waves, avail yourself of this opportunity to listen to this remarkable set with no obligation to buy it unless you are absolutely satisfied with its performance. **Use the coupon below for fast service.**

USES ANY TYPE AERIAL

Regardless of what type aerial you have, this receiver makes provisions for using it. Either the standard inverted-L type or noise-free doublet type may be utilized. This means that this receiver can be used in ALL localities.

SENSITIVE REGENERATIVE CIRCUIT

Two tuned stages, regenerative detector, three A.F. stages with powerful '41 pentode output and perfectly matched dynamic speaker—all these features contribute to the great power and fine performance of this receiver. A special antenna-trimming scheme permits perfect alignment of both antenna and detector tuning circuits without affecting the setting of the tuning dial.

CONTINUOUS BAND-SPREAD

Continuous bandspread on the entire range from 15 to 200 meters is obtained through the use of a very ingenius dial having a ratio of 125 to 1 and two pointers. Furthermore, two knobs are provided, making possible fast and slow tuning. No longer are the foreign broadcast stations crowded on two or three scale divisions of the dial. They are now spread out over a goodly portion of the dial thereby greatly simplifying tuning.

8-LOW-LOSS PLUG-IN COILS

The use of plug-in coils is still the most efficient method of changing from one band to another. That is why they are used in this Doerle receiver. 8 coils are provided to cover the range of from 15 to 200 meters in 4 bands, viz: 20, 40, 80 and 160 meter bands. These coils are of the 3-winding 6-prong type and are used 2 at a time. Wound on ribbed bakelite forms and designed especially for the Doerle receiver, they are highly efficient.

EXQUISITE WORKMANSHIP

All parts are mounted on a single, cadmium-plated chassis and contained in a large, handsomely-finished black crackle cabinet. The dial and speaker grill are practically the same diameter and are symetrically centered on the front panel of the cabinet thereby presenting a professional and dignified appearance.

Provisions are made for using headphones if desired with switch to cut out the dynamic speaker. A tone control is provided which not only varies the tone but helps materially to reduce back ground hiss.

FAMOUS FOR DX RECEPTION

Hundreds of testimonials in our files attest to the superlative performance of this world-famous receiver. Several of these testimonials are printed on this page. Set measures 17¼"x8"x8¾" high. Net weight 23 lbs., shipping weight 35 lbs. Designed for 110-120 volt, 50-60 cycle, A.C. operation.

No. 5000—Doerle 5-Tube DeLuxe A.C. Short-Wave Receiver complete with 5 matched tubes and 8 coils. Completely wired and tested (NOT SOLD IN KIT FORM).
Your price........ **$27.54**
Set of 2 broadcast coils $1.75 additional. Add $2.50 for 110 volt 25 cycle model or 220 volt 60 cycle model.

FREE

64 page Buying Guide for the Radio Serviceman, Dealer and Experimenter. Contains thousands of well illustrated items; and a wealth of radio information, formulas, tables, short-wave hints, radio suggestion contest and other useful data.

DO NOT DELAY WRITE TODAY

Enclose 2c U. S. stamp or coin in letter for postage. Buying Guide sent by return mail. It's Free.

Send COUPON TODAY

5-DAY FREE TRIAL

RADIO TRADING CO., 101A HUDSON ST., NEW YORK

Gentlemen: 4-36

I enclose .... dollars........cents, for your new Doerle 5-tube DeLuxe Short-Wave receiver on a five day free trial basis. If, at the end of five days after receipt of radio, I am not perfectly satisfied, I will write you for return shipping instructions. Upon receipt of the radio, you will refund me the full purchase price. I agree to pay express charges one way, and you the other.

C.O.D. SHIPMENT. I enclose........dollars........cents deposit, balance of........dollars........cents C.O.D.

PRINT Name ....
Address ....
Town........................ State........

RADIO TRADING CO., 101A Hudson St., New York City

• 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.)

Hi!! Hams

Don't miss the "HOT" 5 and 10 Meter set construction articles in the MAY Number! We'll be seeing You!—Editor.

S-W Scout News

(*Continued from page 765*)

P.M., this is an amateur, but he has been broadcasting irregularly at the given time.

HJ2ABD in Bucaramanga, is on 5.98 meg., 7:30 to 10:30 P.M. They have 500 watt power.

HJ1ABC in Quibdo, is on 6:00 meg., Wednesdays and Sundays at 9 to 11 P.M.

Central Americans

TI2M in San Jose is on 6.70 meg., at 10:15 to 11:00 P.M.

TI6PH in San Jose, is on 5.82 meg., 8:00 to 11:00 P.M.

HRP1, San Pedro Sula, Honduras, is on 6.35 meg. at 6:30 to 9:00 P.M.

XECR, Mexico City, is on 7.38 meg., Sundays at 6:00 to 7:00 P.M.

West Indies

HIL, Santo Domingo, D.R., is on 6.50 meg., 6:00 to 7:00 P.M.

HIZ, Santo Domingo, D.R., is on 6.31 meg. Daily at 5:50 P.M. They also work amateurs at other times.

HIX, Santo Domingo, D.R., is on 50.17 meters or 5.98 meg. Sundays 7:40 to 10:40 A.M., Tuesdays and Fridays 4:40 to 5:40 P.M.

HI5N on about 6.13 meg. was heard between 6:00 and 8:00 P.M. They are known as "La Voz del Almocen."

HIH on 6.81 meg. is on daily 7:30 to 9:00 P.M. They are generally always covered up by C. W. (code).

HI1A on 6.19 meg. comes in fine on their time (7:40 to 8:40 P.M.).

ANGELO CENTANINO,
Box 516,
Freeport, Pa.

Official Report from South Amboy, N.J.

12/27—CO9JQ—8,665, 8:12 P.M., Camaguey, Cuba. Fair to Good.

12/27—WQD-WEA—2:55 P.M., relaying NBC program to Argentina.

12/31—HVJ—15,120—10:32 A.M., Vatican City. Very good, steady.

12/31—HRN—5.875—9:10 P.M., Tegucigalpa, Honduras. Very good.

1/1—YV1ORSC—5,720—10:04 P.M., San Cristobal, Colombia. Good, steady.

1/2—VE9HX—6,110—6:00 P.M., Halifax, N.S. Broadcasts daily from 10:30 A.M. to 1:30 P.M., except Saturdays and Sundays, and from 5:00 to 11:00 P.M. daily, Fridays from 1:00 to 8:00 P.M., Saturdays and Sundays from 2:00 to 11:00 P.M.

1/2—DZB—10.042—2:40 P.M., Berlin, Germany, broadcasts from 2:00 to 4:00 P.M.

1/3—HJA—5.900—8:45 P.M., Bogota, Colombia. Fair to good, steady.

1/4—GSL—6.110—10:47 P.M., Daventry, England. Poor, heavy static and interference.

1/11—VK3ME—9.518—6:55 A.M., Melbourne. Fair.

1/11—GSF—15.140—7:46 A.M., Daventry, England. Good.

1/11—KEE—7,715—10:23 P.M., Bolinas, Calif. Very good, relaying NBC prog.

1/11—YV4RC—6.375—10:50 P.M., Caracas, Venezuela. Good.

1/12—GSI—15,260—1:11 P.M., Daventry, England. Poor.

1/12—KEJ—9,010—9:40 P.M., Bolinas, Calif. Fair, heavy fading.

1/13—ZFB—10.055—3:36 P.M., Hamilton, Bermuda. Talking to WNC, very good.

1/13—HI1A—6,185—9:18 P.M., Santiago, D.R. Good.

1/14—VK3LR—9.580—7:03 A.M., Melbourne, Australia. Poor to fair.

1/14—GSG—17,790—7:34 A.M., Daventry, England. Good.

1/14—DJE—17,760—8:08 P.M., Berlin, Germany. Very good.

1/15—HIH—6.814—6:45 A.M., San Pedro, D.R. Good, heard several times at this hour.

1/18—HJU—9,060—9:54 P.M., Buenaventura, Colombia. Good.

1/18—HCJB—8.214—10:19 P.M., Quito, Ecuador. Good, some code interference.

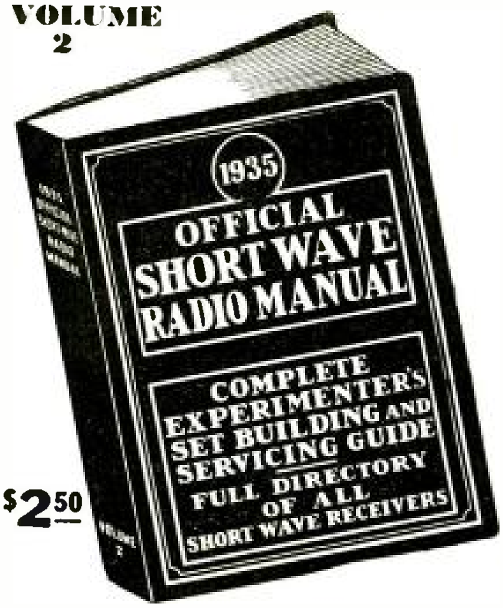
1/18—HI1S—6,400—10:36 P.M., Santo Domingo, D.R. Good.

FLETCHER W. HARTMAN,
365 John Street,
South Amboy, N.J.

The only SHORT-WAVE RADIO MANUALS *in the radio field—and every "fan" needs them!*

THERE has been tremendous progress made in short-waves during the past few years, and only in the OFFICIAL SHORT-WAVE RADIO MANUALS you will find a true picture of the important developments. No other book today tells in accurate detail about the changes that have come from time to time. Whether the advancement has been in set design and construction, servicing all-wave receivers or tube changes, or new scientific discoveries in the short-wave field, all are published chronologically in the OFFICIAL SHORT-WAVE RADIO MANUALS. The OFFICIAL SHORT-WAVE RADIO MANUALS are edited by Hugo Gernsback, Editor of SHORT WAVE CRAFT and H. W. Secor, Managing Editor.

VOLUME 2



$2.50

1935 Official Short-Wave Radio Manual

29 ★ FEATURES

- ★ 1—**Short-Wave Beginners' Section**—Dozens of new simplified circuits for 1-2 and 3 tube receivers, including famous "Doerle" and "Oscillodyne," etc.
- ★ 2—**Short Wave Receivers**—All types discussed with diagrams and pictures—The best types only, which have "stood the test" of actual operating service. Full details for constructing them, etc., "Band-Spreading" the Doerle, 5-tube T.R.F. Receivers, etc.
- ★ 3—**Battery Short-Wave Receivers**— 1-2, & 3 tube sets—all the way up to special 5-tube superheterodyne, designed especially for battery operation.
- ★ 4—**"5-Meter" Department**—All the latest "dope"—including newest transmitters, "Long Line" oscillators, improved "high sensitivity" receivers, 5-meter transceivers, look-ups, etc.
- ★ 5—**Short-Wave "Artificial Fever" Apparatus**—also newest therapeutic and other allied applications of ultra short waves.
- ★ 6—**Short-Wave Experimenter's Section**—filled with Short-Wave Kinks, Short-cuts, etc., of interest to every experimenter.
- ★ 7—**Ultra Short Waves**—Newest circuits, apparatus, and results obtained in this field.
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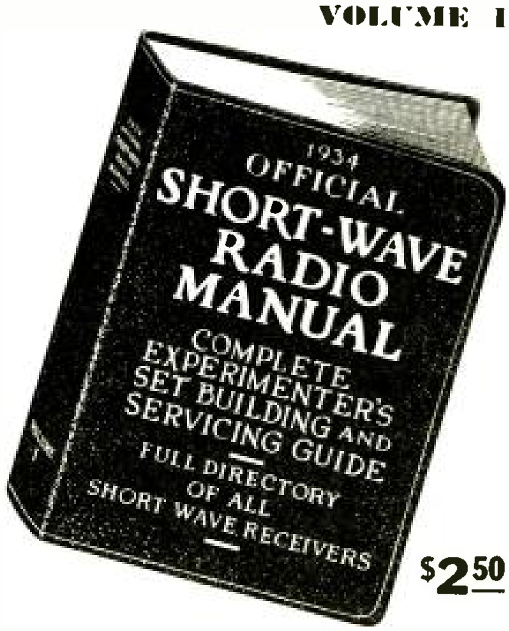

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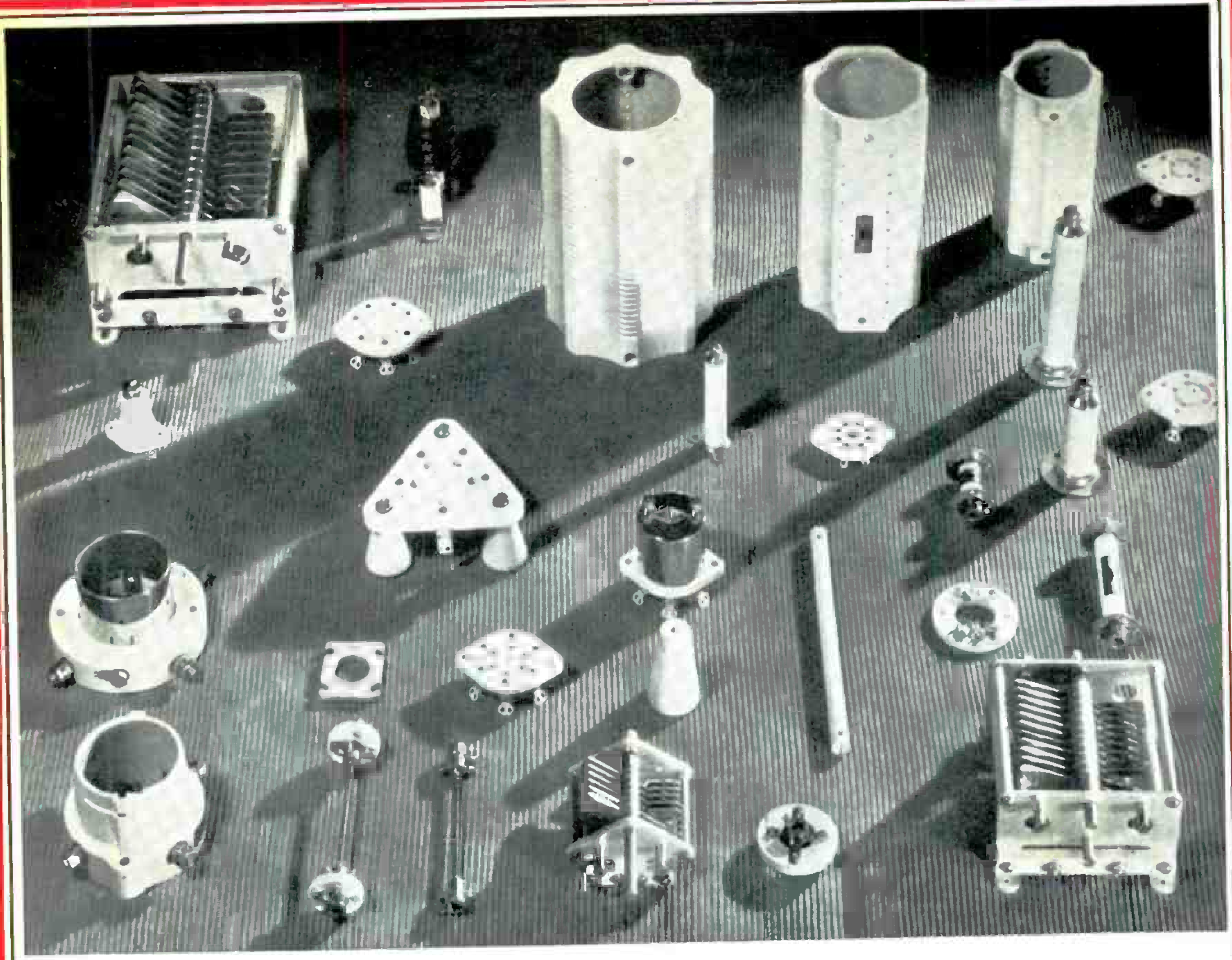

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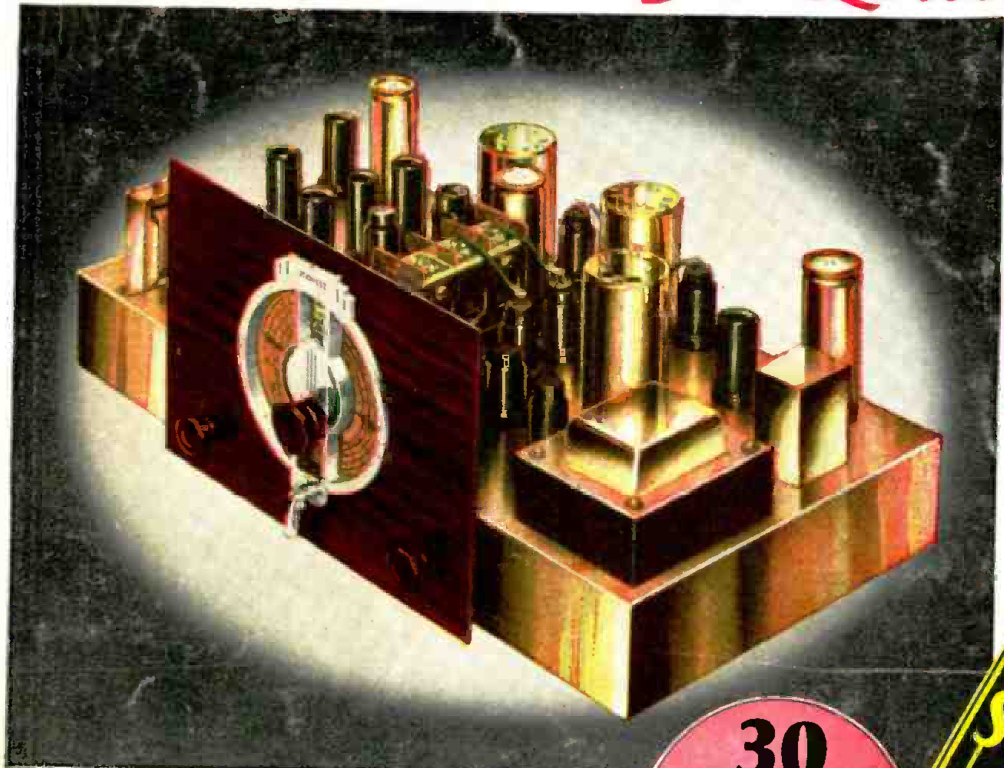

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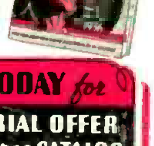

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