Mar. '36

ALL-WAVE RADIO

noise Silencer p. 106 indexed

15 CENTS U.S.A. and Canada

MARCH 1936

Vol. 2 No. 3

CONSTRUCTING A NOISE SILENCER

A New Volume Expander
New High-Frequency Tubes
Micro-Wave Transmitter
Amateur Radio In The USSR
Operation of R-F Pentodes
The New ALL-WAVE RADIO

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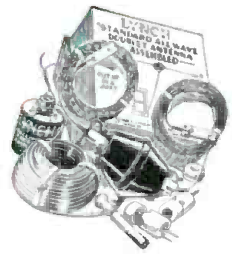

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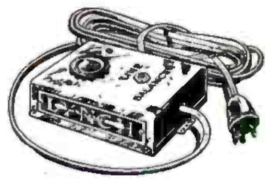

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ALL-WAVE RADIO

VOL. 2 — M. L. MUHLEMAN, EDITOR — NO. 3

CONTENTS FOR MARCH, 1936

Cover Illustration

BLACKSTONE, THE MAGICIAN, MAKES HIGHBALL SING IN GLASS, BRINGING FORTH WITH HIS WAND A PROGRAM FROM WLW. IT'S USUALLY THE DRINKER WHO SINGS.

Features

Departments

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Our New EDITOR

M. L. MUHLEMAN, FORMERLY EDITOR OF RADIO ENGINEERING, COMMUNICATION and BROADCAST ENGINEERING, AND SERVICE MAGAZINES, TO TAKE OVER COMPLETE EDITORIAL CONTROL OF ALL-WAVE RADIO

M. L. MUHLEMAN

PUBLISHERS' ANNOUNCEMENT

WE TAKE GREAT pleasure in announcing the appointment of Mr. M. L. Muhleman to the post of Editor of ALL-WAVE RADIO. Judging solely from his past accomplishments, we are confident that Mr. Muhleman will contribute immeasurably to the growth and continued success of the magazine.

It is doubtful if any man associated with the radio field has had so wide and varied an experience in editorial work as has Mr. Muhleman. He commenced his career in 1922 as Associate Editor of *Radio News*. Later he became associated with the Phenix Radio Corporation, as Vice President and Assistant Engineer, but after a few years he returned to *Radio News* as Managing Editor.

In 1927 he took over the Editorship of *Radio Engineering* and again demonstrated his ability by making this publication the outstanding journal in its field. Subsequently he added to his duties the editorship of the magazine *Service* and once more met with success. More recently Mr. Muhleman added further to his duties and instituted the publication *Communication and Broadcast Engineering*. This engineering journal, too, has progressed steadily from the very first issue.

Mr. Muhleman's experience with radio dates from 1910. During the World War he served in the U. S. Marine Corps and was in charge of a group of radio stations in Santo Domingo. After his discharge he spent two years at sea as a commercial radio operator. There followed periods of activity in amateur radio.

We consider ourselves exceptionally fortunate in being able to obtain Mr. Muhleman's services. We welcome him to his new office.

THE PUBLISHERS

EDITOR'S ANNOUNCEMENT

THE MOST IMPORTANT announcement I have to make is this: *The fundamental editorial policies of* ALL-WAVE RADIO *will not be altered in the least.* It is my opinion—and I know it to be the opinion of many readers—that ALL-WAVE RADIO could not have a better set of policies.

What I have wished to do, and what the publishers and myself have agreed to do, is to make further improvements in the general character of the text and the format. I want these changes so that ALL-WAVE RADIO will express in every one of its pages the intense and rapid growth of radio, and the intense spirit of the people, such as yourself, who derive pleasure and inspiration from one or more of its various phases.

Further than this, I want ALL-WAVE RADIO to be as accurate, as authoritative and as comprehensive as I and my associates are able to make it. The panorama of world radio as it is today is a wide one, embracing diverse interests; many departments of it have been ignored; many interests have been passed up; much data of technical value and wide appeal is allowed to become stale, or is left static in a rarefied atmosphere of engineering for want of proper interpretation.

The publishers have agreed with me that ALL-WAVE RADIO cannot be considered complete so long as any of these phases are ignored editorially. Consequently, beginning with the April issue, ALL-WAVE RADIO will be a larger and, we hope, a much more interesting publication.

The issues of ALL-WAVE RADIO will continue to be published *for the reader*. It will continue to be your magazine, and we want you to have a voice in it.

THE EDITOR

ALL-WAVE RADIO

FOR MARCH, 1936

THE AUTO-EXPRESSIONATOR

A New Type Volume Expander For Radio Receivers

By HERBERT B. ROESE

THE AUTO-EXPRESSIONATOR, a development of the Crosley radio engineering laboratory, is one of the newest developments in man's quest for perfect reproduction of music by radio. The goal of radio engineers has long been high-fidelity reproduction of broadcast programs. Great strides have been made in this direction by the development of circuits and apparatus which have greatly extended the frequency range of receiving equipment. However, this is not the entire problem.

Volume Range

When a musical selection is rendered the loudest tones are many times (often 40 to 100 db) more powerful than the softest tones. Because of the inherent electrical limitations of broadcasting equipment it has been impossible to broadcast music with such a volume range. Ordinarily the loudest tones transmitted by radio are no more than one hundred times (40 db) as great as the softest tones. This tends to level off the volume range and the *expression* of the music is seriously impaired.

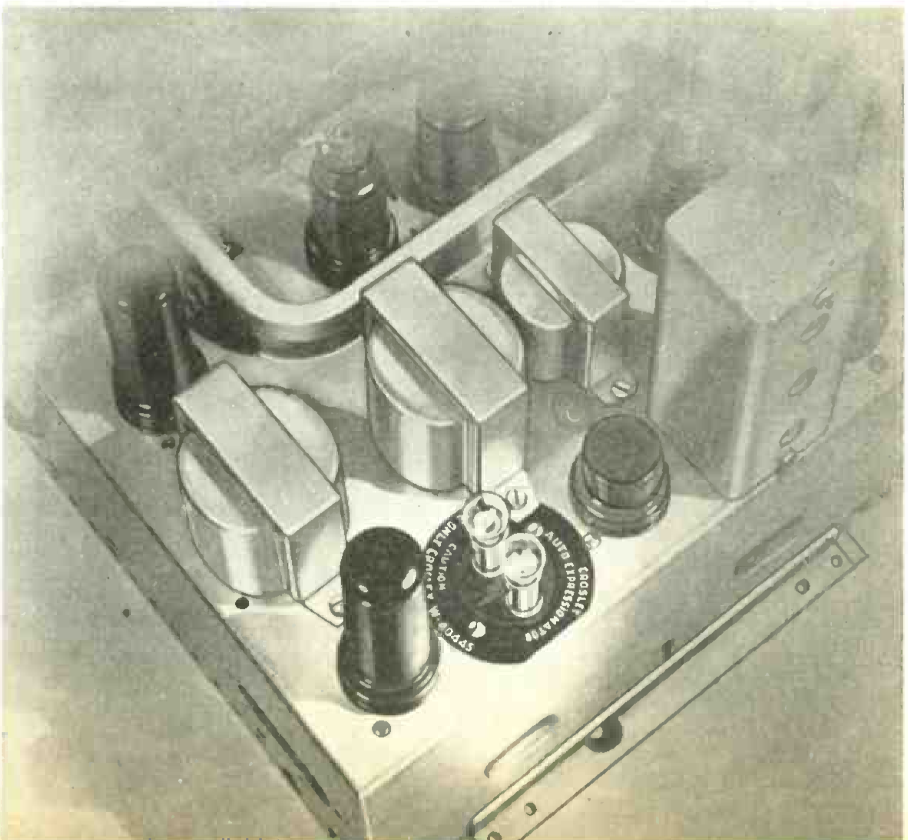
Now, if we compress the volume range in the transmitter through monitoring or otherwise it will be necessary for us to expand it in the receiver if we are to hear the natural rise and fall in volume as the musical selection is rendered by the artist. This is especially desirable in music of a symphonic nature because in such music the expression range is greatest. Unless the expression range is limited in the transmitter overmodulation on the high level end or abnormal transmission of the noise level on the low modulation end will result.

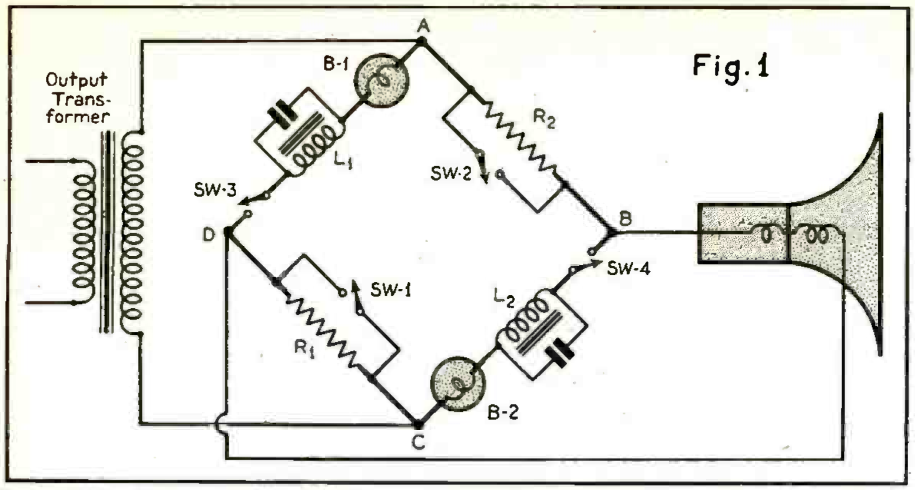
Volume Expander

To understand how this restoration of expression is accomplished by means of the Auto-Expressionator let us analyze the circuit in Fig. 1. The component parts of this circuit are arranged to form a Wheatstone bridge. At most frequencies the impedance of L_1 and L_2 is so low that for purposes of explanation we may for the moment consider them to be short circuited. The two expressionator bulbs, B_1 and B_2, because of their special thermal characteristics cause an increase in current through the resistor legs, R_1 and R_2, of the bridge as the volume increases, thereby effecting a much greater increase in the speaker output.

When the Auto-Expressionator is turned on the expressionator bulbs operate continuously but will not become illuminated except at high volume levels. In other words, their expressionating ef-

Expressionator bulbs used to provide volume expansion in the loudspeaker circuit.





The circuit of the volume expander or "Auto-Expressionator" and the automatic bass compensator.

fect is entirely automatic. The radio may be operated with or without the Auto-Expressionator by means of a control knob on the front panel of the receiver.

Operation of Circuit

When the Auto-Expressionator control knob is in the "off" position Sw_1 and Sw_2 are closed, shorting out R_1 and R_2 and Sw_3 and Sw_4 are open which connects the output transformer directly to the voice coil of the speaker. When the control knob is in the "On" position Sw_1 and Sw_2 are opened and Sw_3 and Sw_4 are closed, making it necessary for the current flowing from the output transformer to flow through the bridge circuit before reaching the voice coil of the speaker. The resistances of R_1 and R_2 are slightly less than the cold resistances of B_1 and B_2, so that the bridge is permanently out of balance by a slight amount. Now, as the signal from the output transformer increases, the resistance of the expressionator bulbs B_1 and B_2 increases quite rapidly due to their change in temperature thereby throwing the bridge further out of balance. The effect is accumulative since when the bridge is thrown out of balance a greater portion of the total signal will be heard at the speaker.

In order to make expression smooth and pleasing a definite amount of time lag in the heating and cooling of the expressionator bulbs is necessary. If they heat and cool too fast, their change in resistance and the corresponding change in the balance of the bridge will actually take place within a low-frequency cycle thereby introducing distortion predominately of a third harmonic nature. However, if the time lag of the filament is within the range of 1/10 to 1/5 second, this distortion is completely eliminated. Furthermore, in any volume expander it is desirable to have a slight amount of time lag so that the expansion is not of a harsh, abrupt nature. The thermal inertia of the expressionator bulbs governs the time lag and is controlled by using specially processed bulbs.

As music becomes softer and softer the lowest frequency tones drop below the range of audibility before the higher frequency tones. To counteract this effect the Auto-Expressionator incorporates an automatic bass compensator which does not permit the volume suppression of extremely low-frequency tones. This will permit all the instruments of a symphony orchestra, for example, to be heard even at low volumes. As the volume level increases the compensation gradually disappears so that there is always a pleasing balance between the low and high-frequency tones.

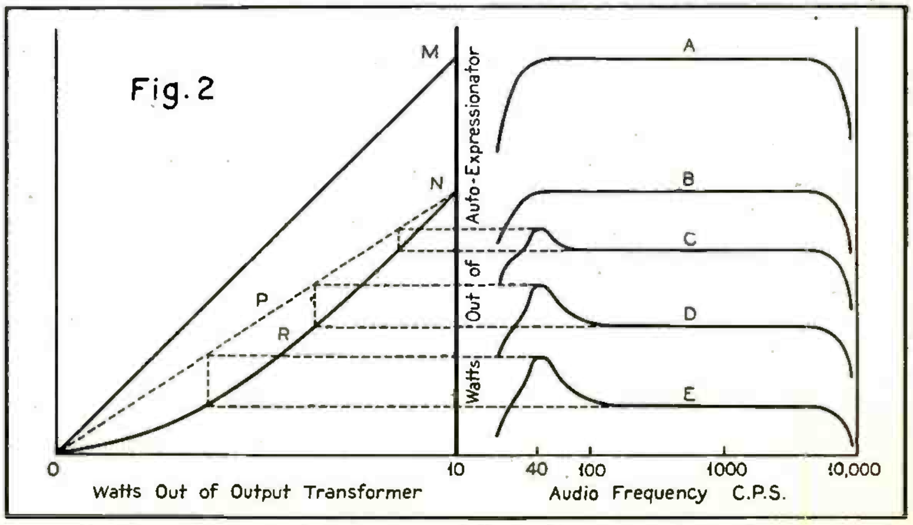
Automatic Bass Compensator

Referring now to L_1 and L_2 and their respective tuning condensers in Fig. 1, it will be seen that their purpose is to provide permanent unbalance of the bridge independent of the expressionator bulb temperature at a low frequency of about 40 cycles. The result is that when the Auto-Expressionator is switched "On" there is a decided boosting of extreme bass apparent at low volume levels.

Fig. 2 graphically represents the action of the automatic bass compensator. In the left-hand quadrant Watts out of Expressionator are plotted against Watts out of output transformer. The straight line "OM" shows that the input to the speaker voice coil is equal to the output of the output transformer corresponding to conditions when the Auto-Expressionator control is in the "Off" position. The broken straight line "OPN" represents the input to the speaker with the Expressionator control turned to the "On" position but with the expressionator bulbs open-circuited. The curved line "ORN" represents the actual performance with the expressionator bulbs operating.

Frequency Curves

Turning to the right-hand quadrant we see a series of hump-back curves which level off at high volumes. These curves are a comparison of the output of the Auto-Expressionator circuit at various audio frequencies and demonstrate the performance of the automatic bass compensator. When the receiver is operating at maximum output the high resistance of the bulbs throws the bridge so far out of balance that any change in the impedance of the tuned transformer near resonance has no effect upon the circuit. The output at all frequencies within the audio-frequency range of the receiver is consequently uniform as illustrated by the curve "B." This curve is similar to curve "A" which illustrates the normal fidelity at any level without the use of the Auto-Expressionator. Curves "C", "D" and "E" illustrate the boosting effect of the compensator in the region of 40 cycles. The humps in these curves illustrate the amount of very low bass tone compensation delivered by the automatic bass-compensator feature. This means that these low-frequency tones will be heard along with the middle tones even at low volume levels.



Frequency curves illustrating the action of the volume expander and automatic bass compensator.

TINIEST MICRO-WAVE TRANSMITTER

O. B. Hanson, Chief Engineer of the National Broadcasting Company, holds in his hands the world's smallest micro-wave transmitter, capable of covering a distance of four miles. The transmitter operates on wave-lengths of one meter or less. Note the "acorn tube."

Developed By NBC Engineers

DEVELOPMENT OF the world's smallest micro-wave transmitter for use in broadcast circuits was announced by O. B. Hanson, chief engineer of the National Broadcasting Company.

Distances up to four miles were attained by the midget "radio station," which can be held in the palm of the hand, in exhaustive tests of the first working model completed by NBC's research laboratory.

For Pick-Up Work

The new device is not intended for broadcasts direct to listeners' radio sets, but for actual program service at any point of origin, to extend the scope of pick-up for present radio networks.

Announcement of the midget transmitter marks the first NBC disclosure of results of more than two years' experiment in the micro-wave field, as part of the extended series of ultra-short wave propagation tests conducted in the field and from the tops of skyscrapers.

The new micro-wave unit, Hanson reveals, is the result of a two-year search for a "coat-pocket transmitter" to enable foot-loose announcers to carry a microphone to any desired point, or circulate at will among large assemblages, for purposes of broadcasting or to feed a public-address system from the floor.

"Investigations in the micro-wave field," Hanson explained, "suggested that work in this band of 300,000,000 cycles and more would permit the midget antenna equipment necessary for the compactness we sought. Micro-waves also offered a phenomenal degree of penetration through intervening structures, so the tiny waves were employed in developing the new portable transmitter."

Earlier units of portable type, more cumbersome in size and operating on "longer" waves of the order of 7 to 10 meters, were tested by NBC during the Horse Show at Madison Square Garden last fall, where they worked with marked success in relaying instantaneously to the gallery the decisions of the judges on the floor.

"Coat-Pocket" Size

The new micro-wave transmitter proves the possibility of a practical "coat-pocket" size unit, and further laboratory work is now in progress to rush completion of the still smaller-size design.

In its present stage, the micro-wave set is a three-inch cube, with two ten-inch rods as antenna to release the tiny radio waves. It transmits at a power of two-tenths of a watt, employing the latest type of tiny "acorn" tube developed by RCA.

Battery Operated

Current is fed to the midget set by an extremely small battery unit of 90 volts, also newly-developed in cooperation with NBC. The complete battery unit weighs less than 4 pounds, and the transmitter proper, less than a pound!

THE NOISE SILENCER ADAPTER

How It Is Constructed, Adjusted and Operated

By G. S. GRANGER

A COMPLETE explanation of the operation of the Lamb Noise-Silencer circuit appeared in the February issue of ALL-WAVE RADIO. A résumé of this article seems unnecessary, but it may be well to refresh your memory on one point which bears relation to the application of the Silencer Adapter to be described.

Anology of Operation

The point is that the noise silencer is merely a special form of supplementary automatic volume control operated in parallel to the second intermediate-frequency amplifier stage in the receiver. Much like any type of delayed automatic volume control circuit, it is operated at comparatively high negative bias so that the tubes constituting the control circuit will function only when the input signal or noise voltage exceeds the negative bias voltage. To that extent, it may be said to function much in the same way as a safety valve on a steam boiler: the valve will open and release steam only when the pressure of the steam exceeds the mechanical pressure on the valve.

In the noise silencer, this back pressure—equivalent to the mechanical pressure on the steam valve—is adjusted by the threshold potentiometer to a value about equal to the constant amplitude of the signal. As a result, the noise silencer will "pop off" only when the pressure or voltage is greater than the constant signal amplitude.

IMPORTANT

IT is absolutely essential that the noise-silencer diode i-f transformer, T, shown in the accompanying circuit diagram and illustration of the adapter, be of a type that can be tuned to the exact intermediate frequency of the superheterodyne receiver with which the silencer adapter is to be used.

If you do not know what frequency the i-f transformers in your receiver are tuned to, your parts supplier can more than likely inform you. Otherwise forward us a self-addressed post-card with the make of your receiver, its model number and the year of its manufacture written on the reverse side, and the card will be mailed back to you with the i-f peak of the receiver noted thereon.—EDITOR.

Operating Conditions

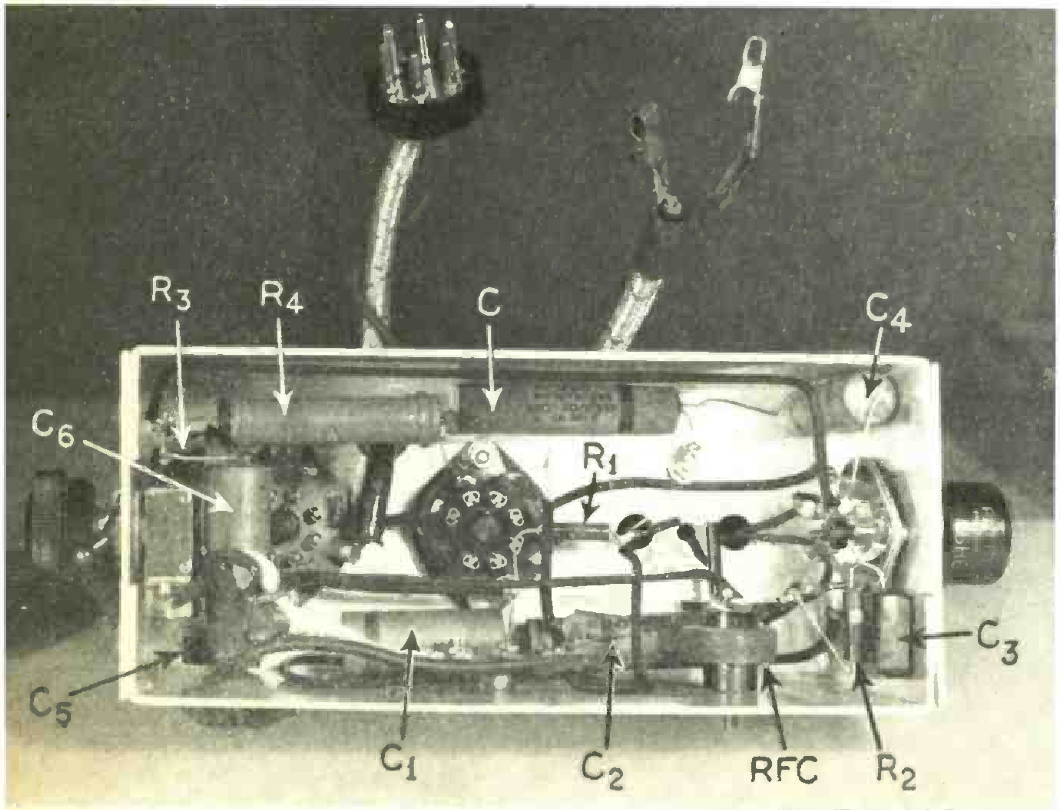
Certain conditions must be met if the noise silencer is to function satisfactorily. The first condition is that of gain—and this is the principal reason why the 3-tube silencer will not operate satisfactorily in conjunction with a receiver having only one stage of intermediate-frequency amplification. This is so for the reason that the noise impulses must have a fairly high amplitude in order to produce a negative voltage in the load circuit of the noise silencer diode of a value sufficient to bias the 6L7 silencer tube to near or absolute cut-off. If the bias voltage is low, the gain of the 6L7 tube will not be reduced sufficiently to actually silence the receiver during the short intervals of noise disturbance.

The answer to this would appear to be the addition of another stage of amplification to the noise silencer adapter. But as soon as this is done a number of complications are apt to arise. For one thing, the silencer circuit is no longer phased properly with the intermediate-frequency amplifier in the receiver, and the desired results cannot be obtained unless proper precautions are taken. For another thing, the addition of a second amplifier stage to the noise silencer is apt to create oscillation and other conditions of instability that will prove difficult to eliminate, unless the adapter is well engineered.

The AVC Circuit

Another condition that must be met to a certain degree is the maintenance of a signal level of fairly constant amplitude at the input to the diode noise rectifier. It is obvious that if the threshold

Fig. 3. Under-chassis view of the completed noise silencer adapter, showing location of parts. See Legend on page 108 for designations.



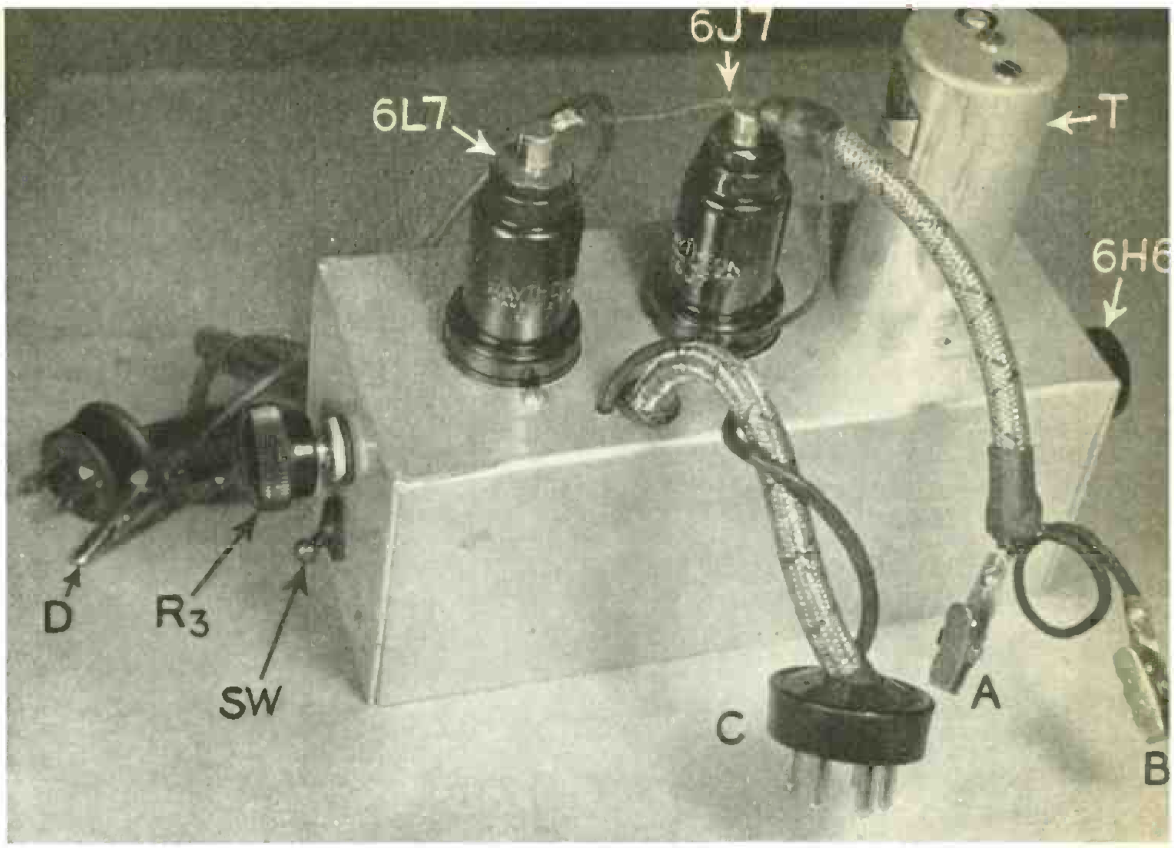


Fig. 2. Top view of the completed noise silencer adapter. Note the thick shielded cable used for the connections A, B and C. See text for explanation.

potentiometer is adjusted to accommodate the noise rectifier to a signal of a certain level, a large change in the signal level will cause trouble. If the signal exceeds this certain level, the signal peaks, if not the whole signal, will be cut off. If the signal level takes a considerable drop, the silencer will still function only on peaks of noise greater than the original threshold setting. What happens in this instance is entirely dependent upon avc action and how it is used.

This point of avc action is very important and should not be overlooked in applying the noise-silencer adapter to a receiver. Let us cite a few examples so that it will be clear just what conditions should prevail for the best operation of the silencer system.

Let us assume, first of all, that the adapter is applied to a receiver in which avc control is placed on the second i-f amplifier as well as other tubes in the set. In this case, the avc bias developed by a signal will also be placed on the grid of the 6J7 noise amplifier tube, since the grid of this tube is connected to the grid of the 6L7 silencer tube which replaces the second i-f tube in the receiver.

Now, if the receiver picks up a *strong* signal accompanied by noise, the gain of the receiver is automatically reduced so as to hold the signal at a constant level. This means that the gain of the 6J7 noise amplifier tube and the gain of the 6L7 silencer tube are also reduced. We know that it is necessary to hold down the level of a strong signal so that it will not be cut off by action of the silencer circuit. Consequently, avc in at least a portion of the receiver is a necessity. But avc on the 6J7 is not required, for in that event a strong signal will reduce the gain of the tube and as a result also cut down amplification of the noise impulses—which is not desirable.

Change in AVC Circuit

It is preferable, therefore, in receivers having avc on the second i-f tube, that this control voltage be removed by disconnecting the grid return of the secondary of the second i-f transformer and connecting it directly to ground. This, unfortunately, will reduce the avc action of the receiver, but will improve the noise-silencing action.

An alternative, as yet untried, would be to insert a fixed condenser in series with the lead to the grid of the 6J7 tube and connecting the grid to ground through a fixed resistor. This would leave the avc bias on the 6L7 tube but would remove it from the 6J7 noise amplifier.

Now, assuming the same conditions as previously, let us see what happens when a *weak* signal accompanied by noise is picked up by the receiver. If the signal is very weak, then the receiver will be operating at maximum gain or amplification. This means, then, that both the signal and the noise will be amplified tremendously. But, if the signal is very weak, the noise will be amplified more than the signal. Under these conditions,

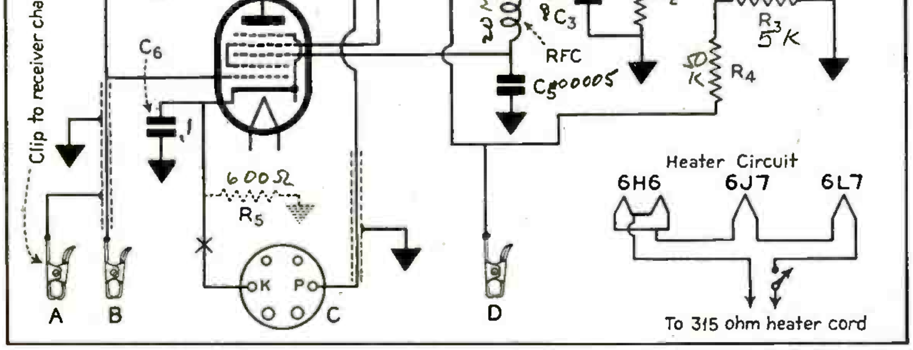


Fig. 1. The circuit of the noise silencer adapter. Cathode resistor R-5 is explained in the text.

the silencer circuit will be most effective, providing the adjustment of the threshold potentiometer is re-set to a point just above the weak signal level.

As you will see, the conditions in this case are satisfactory for the silencing of the receiver during noise impulses, but to obtain the maximum results, it is necessary to re-set the noise threshold adjustment to accommodate the low signal level.

The ideal arrangement would be an automatic threshold adjustment, similar in operation to the usual avc circuit, that would always maintain the bias on the 6J7 and 6H6 tubes at the proper level for the signal being received. It may be that such a system could be made to function properly, although such wide excursions of bias voltage would be required that it might be quite difficult to accomplish without the addition of a supplementary avc amplifier.

LEGEND

R —IRC 1000 ohm, ½ watt
R1—IRC 50,000 ohm, ½ watt
R2—IRC 100,000 ohm, ½ watt
R3—Electrad 5000-ohm potentiometer
R4—IRC 50,000 ohm, 2 watt
R5—IRC 600 ohm, ½ watt
C, C4—Aerovox 0.1 mfd, 200 volt
C1, C2, C6—Aerovox 0.1 mfd, 400 volt
C3—Aerovox .00025 mfd midget mica
C5—Aerovox .00005 mfd midget mica
T —Sickles single tuned full-wave diode i-f transformer
RFC—Leeds 20 M.H. r-f choke

3—Franklin octal wafer sockets
1—Toggle switch
1—Leeds 315-ohm heater cord
1—Blan 3" x 3" x 7" metal chassis
3—Blan midget clips
2—Blan grid clips for tubes
1—Blan adapter plug (C)
1—Raytheon 6H6
1—Raytheon 6J7
1—Raytheon 6L7
Shielded high-frequency single conductor cable

Application of Adapter

Now as to the application of the noise silencer adapter to your own receiver, it will not be necessary at the outset to worry about whether or not there is avc on the second i-f tube. For that matter, it is well worth the while to try out the silencer under various circuit conditions and determine from the results obtained which is the most suitable arrangement.

One may also proceed with the construction of the adapter just as it is shown in the circuit of Fig. 1 and without regard to the resistor R-5 drawn in dotted lines. This resistor need be used only in the event that the bias supplied to the second i-f tube in the receiver is not correct for the 6L7 tube. If the bias is not correct, then the lead shown in Fig. 1 running from the cathode of the 6L7 to prong K on the plug C should be dispensed with and the cathode connected to the adapter chassis through the resistor R-5. In this case, R-5 will supply the bias for the 6L7 tube.

The clip A connects directly to the receiver chassis. This not only grounds the wire shielding at the receiver point, but also supplies the necessary B supply return circuit from the adapter chassis to the receiver chassis. Since the wire shield is grounded to the adapter chassis as well, the circuit is completed.

Clip B connects to the grid clip on the secondary winding of the second i-f transformer in the receiver. This transformer, then, feeds the control grids of both the 6L7 and 6J7 tubes.

The plug C is inserted in the socket in the receiver originally occupied by the second i-f tube.

The clip D is attached to either the B plus side of the output transformer in the receiver, or at any other point in the receiver where the high voltage may be picked off. This clip, however, should not be attached directly to a screen or plate terminal. The high voltage should be obtained from a point at or near the voltage divider across the output of the power supply.

The three heaters of the adapter tubes are wired in series with a 315-ohm heater cord and an On-Off switch so that the heaters may be operated directly from the power line. Only the B voltage is obtained from the receiver.

Construction Details

An illustration of the completed adapter is shown in Fig. 2. The 6L7 and 6J7 tubes, as well as the diode i-f transformer, are mounted on top of the chassis. The 6H6 noise rectifier tube is mounted on the right end of the chassis, and the On-Off switch and threshold potentiometer, R-3, mounted on the left end. This leaves the front of the chassis free of components so that it may be mounted right up against the receiver chassis. This is important as it is necessary to have all leads from the adapter to the receiver just as short as it is possible to make them.

An underside view of the chassis is shown in Fig. 3. The position of each part is clearly marked. It is not necessary, of course, to follow this layout exactly. It may be desirable, for instance, to have the threshold potentiometer, R-3, mounted on the right endplate of the chassis, in which case the general wiring and placement of parts can be altered to suit the requirements.

A working plan of the chassis is shown in Fig. 4. It is made from a single sheet of aluminum cut to the proper size and shape. The four "flaps" are bent down, as indicated by the dotted lines, to form a box. All necessary dimensions are given in the drawing.

We repeat; it is highly important that the grid lead B and the plate lead attached to the plug C be as short as possible—in no case over 6 inches in length. If it is necessary to mount the adapter upside down, or with the tubes in a horizontal position in order to make these leads short, then mount it in one of these two ways.

It is also important that the shielding on the leads B and C be of large diam-

(Turn to page 141)

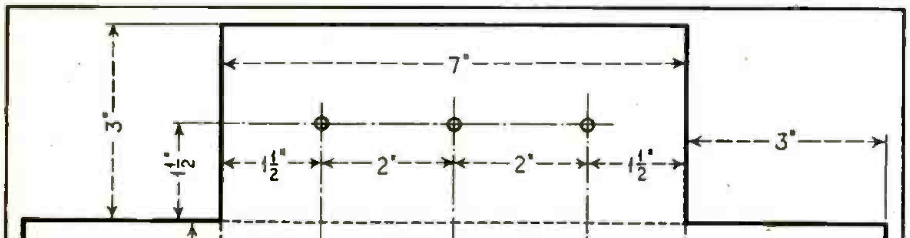
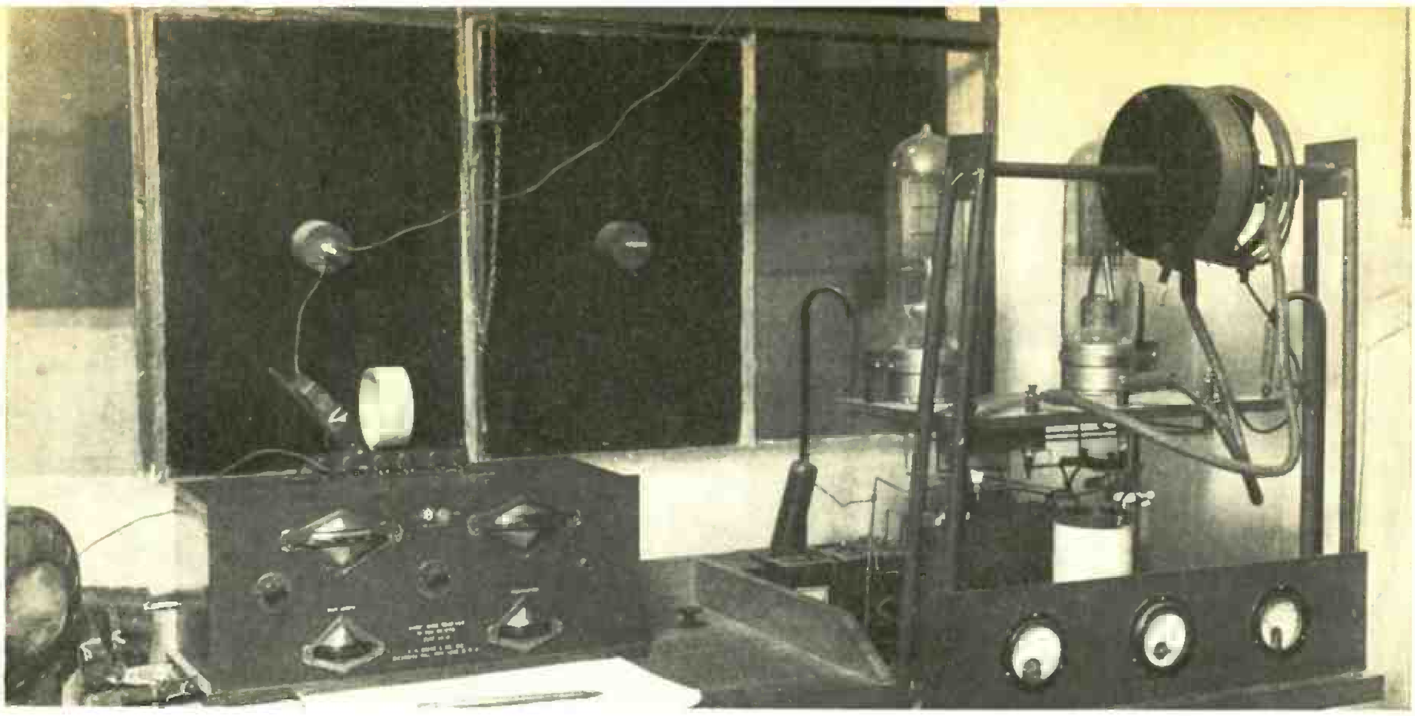


Fig. 4. Working drawing of the chassis for the noise silencer adapter.



This rig was owned and operated by the late Al Grebe, around 1924, and was known to thousands of Hams throughout the country as 2ZV. One of the more elaborate 10 to 200-meter amateur receivers was the Grebe CR-17, shown on the table. The transmitter employed a couple of Western Electric 212-D tubes in a self-excited push-pull oscillator.

The Story of Amateur Radio—II

AT THE SEVENTEENTH Anniversary Banquet of the Radio Club of America, held in 1926, the late Professor Pupin, always a friend of the radio amateur, said to the gathering, "You love this art for its own sake and not for what profit it brings you. If I thought otherwise I would not be with you this evening."

The Amateur-Scientist

And there are other great men of radio who have thought if they have not remarked, that the amateur of the old school, and many amateurs of more recent generations, are not only true scientists but have much the same viewpoints as the typical scientist.

I recall reading some years ago the absorbing book titled "Microbe Hunters." The author told of the astonishing patience of these scientists who had dedicated their lives to tracking down and defeating the germs that create the vast array of dreaded human illnesses. He told of the hardships these scientists endured, of the long hours they put in at their work and of their many heartbreaking failures in the early stages of their battles against man's most potent enemies.

There have been many books since that were patterned after "Microbe Hunters," and there is not a single one that does not in a broad way tell the story common to all scientists.

Yet there are few people who would place the radio amateur in the same category. No book has ever been written about the radio amateur. No book has ever told of the unswerving purpose of a group of boys and men to reach out greater distances into space; nor has any book ever told the story of how the radio amateur blasted new channels of communication through frequencies thought to have been absolutely worthless—frequencies, incidently, into which he was dumped with his home equipment because the higher wavelength bands which he had opened up to communication were required for other purposes.

Onward and Upward

The radio amateur had made remarkable progress by 1915. Interstate communication had become commonplace and there were few members of the fraternity who did not hold in their hearts the keen desire to span the continent. Power seemed to be the thing to do it with, but there was a group who thought that efficiency alone might prove to be the answer.

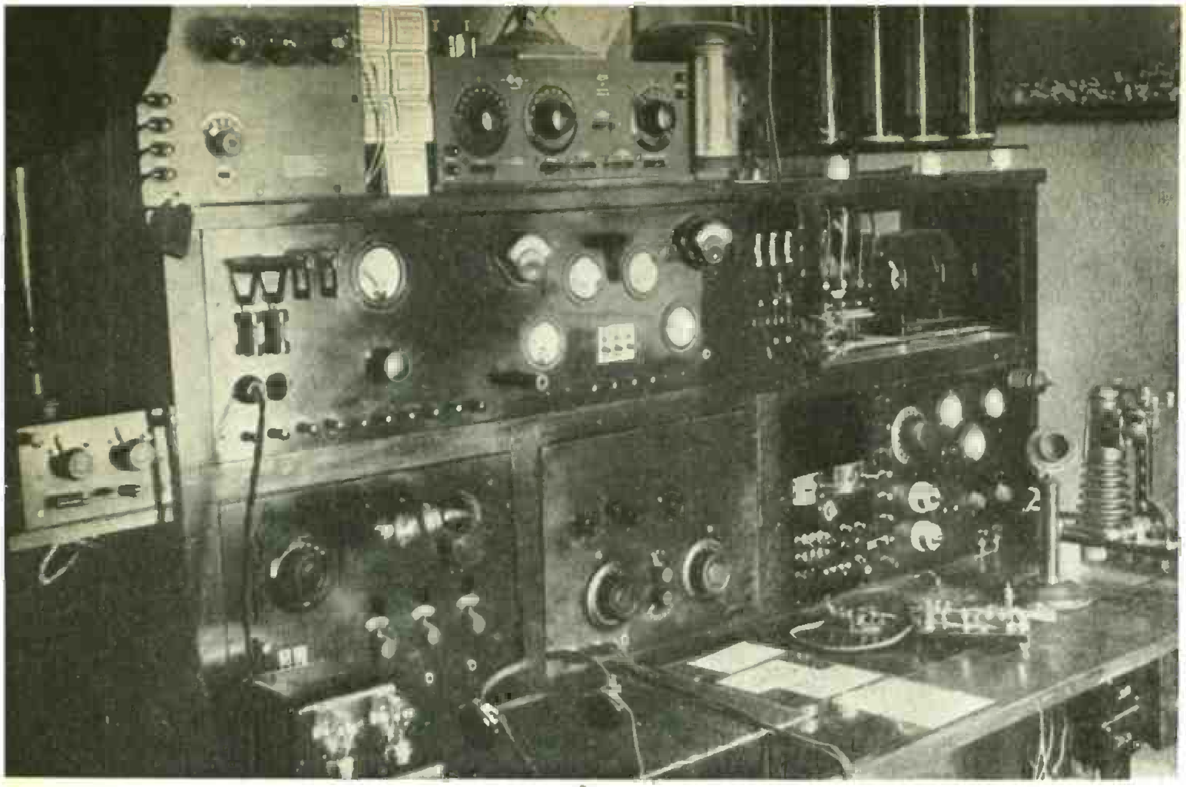
There was something to this idea of making every bit of available power do what it should. But it was necessary first to learn just what was happening to the power. There was also something to the idea of making the most of the feeble voltages developed in the receiving antenna. Again it was necessary to learn what was happening to these voltages before any progress could be made.

Up until that time it may be said that the amateur was little more than a technical experimenter with a tremendous amount of ambition and initiative. But the radio amateur became a true scientist the day he first questioned the work of the professional and decided to seek the answers himself. From that day on the amateur has never ceased to treat radio from the scientific and engineering viewpoint.

And then came the entrance of the United States into the World War. Our Government was in sore need of trained radio men—and who did they turn to? The radio amateur. In the majority of instances the amateurs themselves were used to train new men in the art of radio communication, and many amateurs of the old school were given rank immediately upon their induction into the Army Signal Corps, the Navy and the Marine Corps.

And in the meantime, amateur radio was banned in the United States for the duration of the war.

It was not until 1919 that the ban was finally lifted, but amateur radio suffered no set-back because of the two and one-half years of inactivity. The old timers in their line of duty had learned a great deal and developed a great deal. Major Armstrong, one of the early members of the Radio Club of



Receiving position at old station 2GL, owned and operated by Ed. Fink and Earl W. Dannals. This equipment was in use in 1923 and 1924. Note the honeycomb coil type regenerative receiver, and next to it the home-made short-wave receiver. On the upper shelf is a Western Electric power amplifier and a Grebe CR-9 receiver. This was a layout what was a layout!

America, developed the now universally used superheterodyne receiving circuit while working on new signalling equipment in the laboratories in the Eiffel Tower. Special audio-frequency amplifiers using vacuum tubes were developed to pick up the sounds of enemy sappers. Vacuum tubes formed the basis of small, portable transmitters. Loop aerials were employed for direction finding.

The amateurs of the old school came back from the war with new conceptions as to what amateur radio should be, and it was not long before continuous-wave vacuum tube transmitters were competing with the old rotary spark "rock crushers."

Enter the Tube Transmitter

One cannot pass this phase in the development of amateur radio without admitting that there were many die-hards who refused to admit the supremacy of the vacuum-tube c-w transmitter. But it wasn't pig-headedness that made them fight the newcomer tooth and nail. It was something far deeper than that. It was their love for the song of the spark . . . the pleasure they received from the characteristic tones of the old rock crushers they worked regularly, that made them stubborn. To many of these old timers it seemed that the bottom would drop right out of amateur radio if the sweet song of the spark were obliterated by the sharp mechanical peanut whistle of the c-w vacuum tube transmitter.

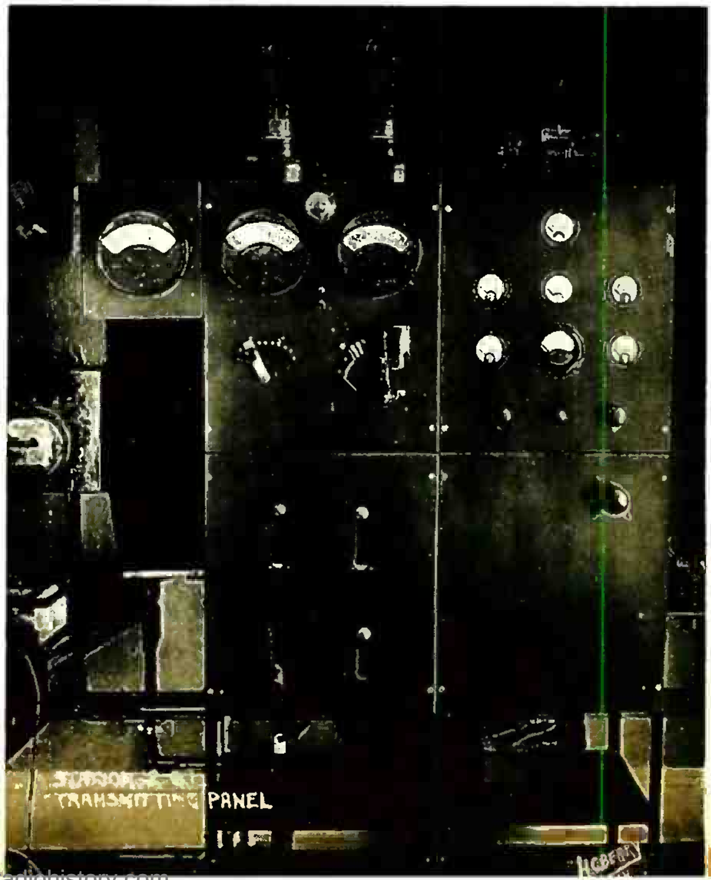
It did kill the sport for a lot of the old timers, and they dropped out of the game, but the fact remained that with a fraction of the power of the spark transmitter, the amateur could cover far greater distances with one or a couple of small vacuum tubes. No one could talk that down. Nor could anyone talk down the obvious advantage of the c-w transmitter in so far as interference was concerned. A spark transmitter took up a lot of space in the ether. The signal was as broad as the side of a barn. But the c-w transmitter cut no such capers. The signal was so sharp that you had to tune carefully or you'd miss it entirely.

This was just what the amateurs needed. A whole raft of c-w signals could be fitted into the same channel space as previously occupied by a single spark transmitter. That was something in a band already jammed to the limit. It meant that the channel could be sufficiently cleared so that the weak distant signals could be pulled through without being messed up or entirely lost in local interference.

So the majority of the fellows took to c-w like a duck takes to water. The spark boys were driven off the air by the sheer weight of numbers. They couldn't reach out like the c-w boys, anyhow—so they gave up. They either turned to c-w or gave up amateur radio altogether.

Europe Is Reached

And so it was that the second and most important phase of amateur radio commenced. It wasn't long before east and west coast amateurs were chewing the rag on 200 meters. In 1921, Major Armstrong, Walker Inman, E. V. Amy, John Grinan, Minton Cronkhite and George Burghard set up a c-w transmitter in Greenwich, Connecticut, and went after Europe. The signals from this station were heard in Scotland, England, Holland, Germany, Puerto Rico, Van-



The business end of the old transmitter at 2GL. The transmitting tubes can be seen mounted above the large meters on the control panel with the motor-generator starting switch.

Bill Reuhmann owned this rather elaborate looking rig in 1922. It was operated under the call letters of 2RB. On the desk, to the left, is the three-circuit tuner and one of the first Western Electric power amplifiers. The transmitter is at the right. It was rated at approximately 150 watts. This station later became WWRL and is still on the air as such.

couver, B. C., and in every state in the Union.

In the meantime, the American Radio Relay League had sent Paul Godley to Scotland with an impressive array of receiving equipment, to see what he could do in the way of picking up signals from U. S. amateur stations. Godley picked up thirty of them. And that was only the beginning.

In 1922 European amateurs were heard in this country, and in 1923 Fred Schnell and John Reinartz both carried on a two-way communication with an amateur station in France.

This was real progress and it didn't miss the ears of the commercial companies. Amateurs were covering unbelievable distances with low power on wavelengths between 100 and 200 meters—wavelengths that were thought to be useless for anything but local communication purposes. The amateur had progressed so far, in fact, and done so well in revealing the worth of these low wavelengths, that he lost them in 1924.

Certain of these bands or channels were required for public use; as a matter of fact, they were being filled up quite rapidly by commercial and governmental agencies. But the A.R.R.L. retained a hold on a narrow channel at 160 meters and in addition obtained for the amateur bands at 80, 40, 20, 10 and 5 meters . . . all in unexplored regions.

But what good were these new bands? No one, of course, knew; but it may be assumed that there were many wise heads who figured if there were anything to them, the amateur would find out, if anyone could. And this wasn't poor logic, for it was evident enough then, as it is now, that you can't kill an amateur. Give him a centimeter channel and he'll make something out of it before he is through.

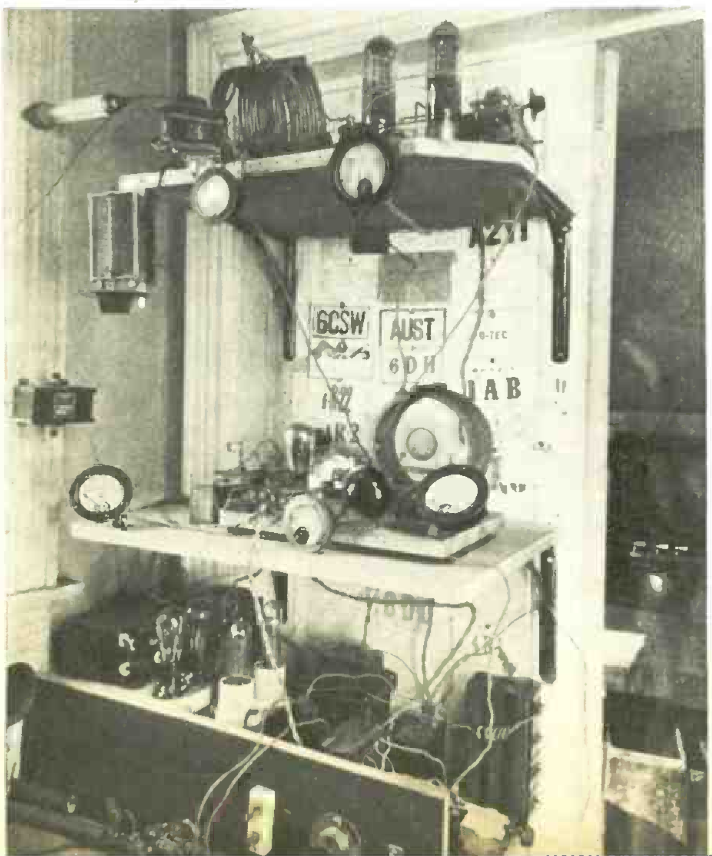
Australia Contacted

And he made plenty out of the new bands. What he did at 100 and 200 was nothing compared to what he did first at 80, later at 40 and recently at 20. What he did, without first knowing it, was to run right smack up against the peculiarities of radio sky waves. All he did know at first was that he could push out a signal from New York and lay it right down in New Zealand and Australia, with even less power than it had taken him to span the Atlantic.

But it wasn't enough that he was able to do this. There had to be a reason for it and, moreover, it occurred to him that since the property seemed to bear some relation to the wavelength used, that even shorter waves might do even more. And as a result, the amateur made a huge laboratory out of the surface of the earth in his attempt to learn just why the signals carried so much further on shorter wavelengths and why they were erratic.

When I say that the amateur made a laboratory out of the surface of the earth, I mean it. By his very number, the amateur accomplished in a short space of time what no commercial agency could have learned without a huge expenditure of time, money and manpower. The amateur learned what he did for the simple reason that every city and practically every town in the entire country had its corps of zealous workers from whom immediate reports could be had. He learned what he did because

(Turn to page 140)



An early transmitter owned and operated by S. P. Mcminn, W2WD. A pair of 211-D tubes were used. This was one of the first crystal-controlled c-w rigs.

GLOBE GIRDLING

CONDUCTED BY J.B.L. HINDS

THE NEW ZEALAND DX Radio Association recently released data on fake reception reports and from the details given out, one would think that quite a few persons were resorting to this unfair practice. From a study of this data it would seem that quite a few reports of this nature have been received. It appears that reports of reception (both long and short waves) are being filed of stations supposed to be on the air at stated times. In one particular case some thirty DX listeners made detailed reports of having heard a certain station which had been off the air for a period of two months while undergoing repairs. As a test case the DX organization mentioned listed the details of a program to be broadcast by a station on a particular date (which broadcast was not made) and some sent in glittering reports of their reception of the broadcast in question and made request for the usual verification.

"Cheating At Solitaire"

While possibly this practice may be resorted to by some unprincipled persons, I am inclined to minimize the number who resort to such a practice. I still like to believe that the great majority of people are honest in their deeds and practices and would rather consider all people to be honest until proven otherwise.

MR. J. B. L. HINDS

Really, I cannot imagine the make-up of one who would take delight in displaying on his walls a verification procured under these circumstances. But it is said that it takes all kinds of people to make this world. But let us believe that the percentage of this particular class is of infinitesimal quantity.

While this practice is to be deplored, yet there might be cases where the reports were filed in good faith; where the listener clearly heard a program on a given frequency and even thought he heard the call letters of a particular station known to be on that frequency and felt in his own heart that he had a right to file the report. So let us hope that the greater share of such reports occurred in this manner.

A blue and white card from Suva, Fiji, "The Garden of the Pacific."

Hurricane Stations

As a matter of information, stations WTDV-WTDW and WTDX in the Virgin Islands (4295 kc) were originally 250-watt telephone transmitters taken over by the Government of Virgin Islands from the Prohibition Customs at Porto Rico. They were installed for the purpose of inter-island communication and storm warning signals because these are hurricane countries. These installations, however, have recently been removed and turned over to the Marine Corps and in their places, under the same call letters, three new 50-watt Coast Guard type radiotelephone transmitters have been installed. The schedules have been changed as listed.

Mr. H. N. McKenzie, Superintendent of Public Works at Christiansted, St. Croix, in charge of WTDW, states that the signals from the old transmitters were picked up by listeners as far away as England to the east, Mexico to the west, the northern countries of South America to the south, and as far north as Chicago in the United States. They would welcome reception reports on these new transmitters and state that the most interesting period for DX would be from July 1st to November 1st when hurricanes are most prevalent. Many listeners in non-hurricane sections should receive a thrill out of the interesting conversations and various warnings, as they operate up to the moment the hurricane strikes and as long thereafter as possible. . . .

RCA Communications Stations

The frequency of radiophone and experimental stations of the RCA Communications, Inc., located at Rocky Point, New York; Bolinas, California; Manila, P. I.; and Kahuku, Hawaii, have been revised in the station lists of this issue. There were formerly a few code stations listed which have been eliminated, and a number of phone and experimental stations added.

It is not the intention to include code stations in the lists as those who can read code can spot them for calibration purposes without the aid of a list. While leaving code stations in the list might assist some, it is deemed best to leave them out as the majority of listeners would not use them. It is appreciated that the phone and experimental stations are of material benefit to the short-wave listener in the way of calibration, very few of these stations verify reception reports.

XEBT Reports

In the January issue the statement was made that reception reports to station XEBT should be hand written. I find the meaning of their letter was misinterpreted. Either typed or hand-written reports will be accepted and verified by them. The meaning that they wished to convey was that only hand-written verifications *issued by them* were considered legal ones. In other words, any one might obtain a blank XEBT card and fill it in on the typewriter.

A nice one from Mexico, with a circular mosaic imprint in the center.

The British Broadcasting Corporation have added three more frequencies to their assignments: GSN—11,820 kc (25.83 meters); GSO—15,180 kc (19.76 meters); GSP—15,310 kc (19.60 meters). The first two mentioned are listed in the regular broadcasts from Daventry, along with GSJ 21,530 kc, GSG 17,790 kc, GSI 15,260 kc, GSF 15,140 kc, GSE 11,860 kc, GSD 11,750 kc, GSC 9,580 kc, GSB 9,510 kc GSL 6,110 kc, and GSA 6,050 kc. All of these may be used in March broadcasts.

Advice from our friend, Amando Cespedes Marin, of TIRCC, San Jose, Costa Rica, is that the famed T14-NRH will not return to the air on 31 meters. The voice of his son may be heard on amateur station TI4AC on 14,450 and 7250 kc.

The following frequencies are to be used by Germany in regular broadcasts in March: DJE 17,760 kc, DJR 15,340 kc, DJQ 15,200 kc, DJL 15,110 kc, DJO 11,795 kc, DJD 11,770 kc, DJA 9560 kc, DJN 9540 kc, DJM 6079 kc, and DJC 6020 kc.

TGX, Guatemala, listed on 5941 kc, is reported by that station as testing on 6130 kc.

OXY Frequencies

Mr. Harold J. Rud, Press Secretary, Statsradiofonien, Copenhagen, Denmark, has furnished the present frequencies of OXY which is revised in this issue. OXY has three short-wave frequencies, namely; 15,300 kc, 9495 kc, and 6060 kc, and is at present using the last named frequency (49.40 meters).

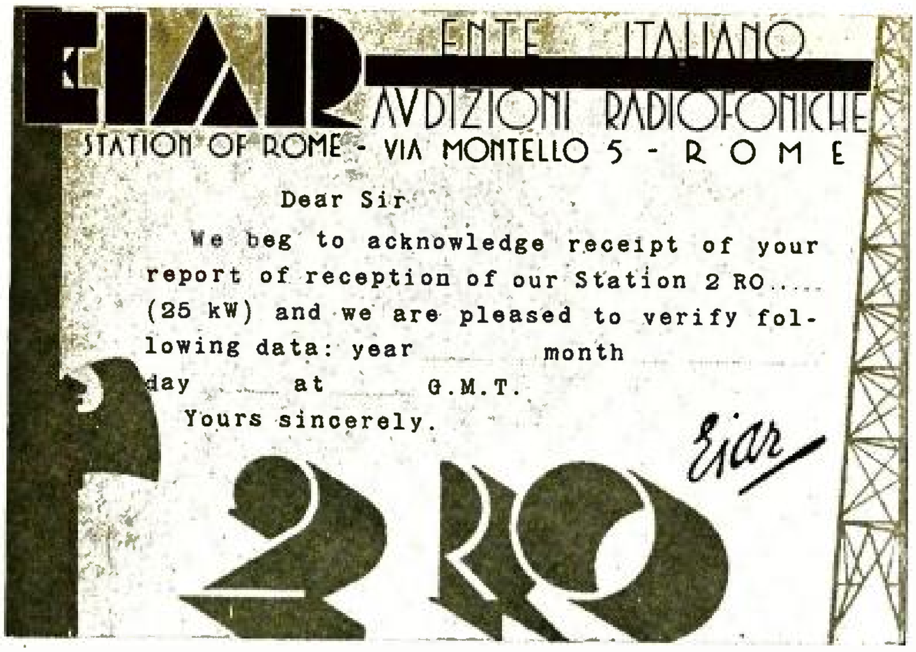
These transmitters are located on the western coast of the island of Zealand, and rebroadcast the programs of long-wave stations from Copenhagen and Kalundborg. The reports received indicate that these rebroadcasts are heard particularly in the southern and western part of the world, owing to the fact that 49.40 meters is considered a typical "night" wavelength. It appears, however, that the reception of OXY is far from constant, because of the low power of the transmitter . . . 500 watts.

The Cuban station reported in the February issue as Radiodifusora Pilot, Santiago de Cuba, on 9600 kc, turns out

IN APPRECIATION

The editorial staff of ALL-WAVE RADIO *wishes to extend their appreciation to the following readers who have been kind enough to send in station data. Mr. Hinds is particularly appreciative of their assistance.*

R. Neyland, Erie, Pa.
J. Wendell Partner, Tacoma, Wash.
I. C. Morgan, Montreal, Can.
W. C. Dukes, Jr., Mobile, Ala.
R. L. Weber, West McHenry Ill.
Joseph H. Miller, Brooklyn, N. Y.
Chas. Nick, Philadelphia, Pa.
Edward Wait, Chicago, Ill.
W. H. Stark, Wauwatosa, Wisc.
R. M. Peck, Freeport, N. Y.
W. T. Siddle, Birmingham, Ala.
Richard Rodgers, Westwood, Mass.
G. W. Twomey, Minneapolis, Minn.
H. W. Prahl, Painesville, Ohio
A. G. King, Woodhaven, N. Y.
W. W. Sinclair, Wardner, B. C., Can.
Alden Fowler, Greensburg, Ind.
Dellner Sopher, Steger, Ill.
Carl Goulet Dalhousie, N. B., Can.
J. R. McAflister, Struthers, Ohio
Leroy Waite, Ballston Spa, N. Y.
D. I. Gross, W. Asheville, N. C.
Max Horlick, Youngstown, Ohio
Enrico Scala, Jr., Bronx, New York
W. W. Smith, Louisville, Ky.
James Waters, Cleveland, Ohio
Fermin Alveraz, Santiago, Chile
R. S. Seaward, Jacksonville, Fla.
Walter Berger, Short Hills, N. J.
William Berg, San Francisco, Cal.
A. J. Connors, Maynard, Mass.
Ralph Evert, Jr., Philadelphia, Pa.
Donald Adams, Walla Walla, Wash.
Rochester Clarke, Lake Charles, La.
George Graham, Bronx, New York
Henry A. Cook, Riverside, R. I.
Howard Muir, Racine, Wisc.
Edward Cash, Detroit, Mich.
Alfred D. Seals, Atlanta, Ga.
G. H. Sutton, Willard, Ohio
Edward Couples, Cleveland, Ohio
Robert S. Crowell, Nutley, N. J.
Robert C. Wordel, Jr., Chicago, Ill.
Mrs. Kate Randall, Ballston Spa, N. Y.
R. B. Clark, Chicago, Ill.
Philip Held, New York City
Donald Guy, Newton, Kansas
Charles G. Gilson, Burlington, Iowa
Dhan Unvala, Nice, France
Raymond H. Leeson, Auburn, N. Y.
Herbert Morganstern, Buffalo, N. Y.
G. T. Magee, Birmingham, Ala.
Thomas J. Taaffe, Jr., Elmsford, N. Y.
Harley G. Slough, Vancouver, B. C., Can.
A. T. Hull, Jr., Buckroe Beach, Va.
R. B. Oxrieder, State College, Pa.
Wm. S. Look, Secaucus, N. J.
Wm. John Peterson, Brooklyn, N. Y.
A. E. Flock, New Albany, Ind.
George Derosier, Dayville, Conn.
John Boehm, Baltimore, Md.
Clement Van Velsor, Irvington, N. J.
Mills Van Bergen, Syracuse, N. Y.
Bob Morrison, Vancouver, B. C., Can.
Charles W. J. Havlena, Washington, D. C.
A. F. Bechtold, Buffalo, N. Y.
Charles J. Neff, Yonkers, N. Y.
Frank Emery, New Castle, Pa.
E. B. Drake, Pittsburgh, Pa.
Thomas R. Dunn, Yonkers, N. Y.
Charles Miller, Covington, Ky.



A very impressive veri from 2RO, Rome, done in the modern style.

to be Pilot, located at Santiago, Chile, with call CB960.

If you wish to listen to another English broadcast south of the Equator, tune in HC2JSB (7854 kc or 38.19 meters) at Guayaquil, Ecuador, which is now running a race with HRN, Tegucigalpa; on a late appreciation hour, reading the letters of short-wave listeners. This station has improved its plant and is getting out with a real consistent carrier. Verification cards of a very pretty design are sent out promptly.

Station CO9WR Sancti-Spiritus, Cuba, listed on 11,800 kc, has been testing around 6300 kc and reported on 6270, 6300 and 6315 kc.

HJ3ABD, Bogota, Colombia, known more familiarly as Colombia Broadcasting, which has been on 7400 kc or 40.50 meters, has been testing on 6050 kc. The station is retained in station list under its old frequency, until definite information is received as to its final assignment.

CFU Rossland, B.C., Canada, broadcasts news items nightly on 5712 kc from 8:30 to 8:45 P.M. E.S.T. Quite a little interference on this frequency but a fairly strong signal.

Frequency Changes

The following stations have changed frequencies and the necessary changes made in the station lists:

LKJ1—9570 to 9515 kc.
CQN—6020 to 9490 kc.
HCJB—8214 to 8775 kc.
HJ4ABC—6460 to 6541 kc.
XEXA—6180 to 6130 kc.
HJ2ABC—5900 to 5970 kc.
YV8RB 5880 to 5900 kc.

New stations have been authorized in Venezuela as follows: YV7RMO, 5810 kc (51.64 meters); YV11RMO, 6128 kc (48.95 meters), and YV13RV, 6330 kc. (47.39 meters), the first two to be located at Maracaibo and the latter at Valencia.

A number of listeners have been hearing a station testing around 12,000 kc and from the announcements made, were of the opinion that it was CO9GC (6150 kc) as listed, as they gave address as P. O. Box 137, Santiago de Cuba.

Thomas J. Taffee, Elmsford, New York, however, has a card from them stating that the call letters are COKG and information to the effect that in the near future they will begin broadcasting commercial programs under the call last mentioned. It is understood to be a new station. Further particulars later.

New Stations

The following stations are listed for the first time in this issue of ALL-WAVE RADIO: LRU, (15,290 kc) Buenos Aires, Argentina; XEFT, (9600 kc) Vera Cruz, Mexico; CB960, (9600 kc) Santiago, Chile; HH3W, (9595 kc) Port-au-Prince, Haiti; HJU, (9063 kc) Buenaventura, Colombia; XEME, (8090 kc) Merida, Yucatan, Mexico; HIT, (6630 kc) Santo Domingo, R.D., HI1S(6420 kc) Puerto Plata, R.D., HJ4ABP, (6135 kc) Medellin, Colombia; HI9B, (6050 kc) Santiago de los Caballeros, R.D., CB615, (6150 kc) Santiago, Chile; VE9CA, (6030 kc) Calgary, Alberta, Canada; HH2S, (5920 kc) Port-au-Prince, Haiti; ZBW, (5410 kc) Hong Kong, China; HIG, (6280 kc) Santo Domingo, R.D.

New stations reported heard and not listed are as follows: HI1F, (6140 kc) Santiago de los Caballeros, R.D.; XECK (6130 kc) Tijuana, Mexico; YV9RC, (6400 kc) Caracas, Venezuela; HCBT, (6580 kc) Ambato, Quito, Ecuador; XEDQ, (9520 kc) Guadalafara, Mexico; HII, (6030 and 10,040 kc) Santo Domingo, R.D.; (call not known) Madrid, Spain (6330 kc); VE9EW, (8670 kc) Bowmanville, Ontario, Canada; HRY, (6350 kc) La Ceiba, Honduras; HCIPM, (5750 kc) Quito, Ecuador; HIQ8, (6385 kc) Santiago de los Caballeros, R.D.; TI2M, (6700 kc) San Jose, Costa Rica; YNE (9250 kc) Puerto Cabezas, Nicaragua; XEXL, (9400 kc) Mexico, D.F.; VP3BG, (7220 kc) British Guiana; HRL5, (14,485 kc) La Lima, Honduras.

Backward Stations

We are again listing certain stations which do not seem to verify or reply to reports addressed to them regardless of whether International Reply Coupons are enclosed or not. The principal offenders are: HJ3ABI, Bogota, Colombia; HJ1ABJ, Santa Marta, Colombia; HJN, Bogota, Colombia; HJ3ABD,

Another Italian card. This one is in red and blue.

Medelin, Colombia; HKV, Bogota, Colombia; HC2CW, Guayaquil, Ecuador; HC24AT; Guayaquil; HCETC, Quito, Ecuador; HC2ET, Guayaquil; YNVA, Managua, Nicaragua.

Attention is also called to the fact that CT1AA, Lisbon, Portugal, seems to be ignoring requests of late when formerly they were prompt. It would also seem that HRN, Tegucigalpa, Honduras, should take steps to make a delivery of the verifications they have promised so long.

Recent verifications received by the writer include IQA and IRY, Rome, Italy; PDM Kootwijk, Holland, a pretty new card showing the long-wave building and four single side-band transmitters in one of the short-wave buildings. HH3W, Port-au-Prince cards are very unique ones—pink and white cards, done in silver background. Another from OPM, Belgian Congo, covering their last musical program of 1935 on August 3. YV12RM, Maraca, Venezuela; HRP1, San Pedro Sula, Honduras; HSP and HSJ, Bankok, Siam; YV8RB, Barquisimeto, Venezuela. A late one from VPD, Fiji Islands showing a very pretty harbor fishing scene, and two from Germany, DJI and DJJ, Zeesen.

The elaborate veri card sent out by PCJ. The colors are red, black and blue.

New Colombian Station

Mr. E. J. Shields, the genial Editor of QRC-Short Wave Reporter, Hendersonville, N. C., advises that a new Colombian station at Bogota (6122 kc) has been authorized to test upon installation and if approved will be assigned a call. Since Bogota is in the 3rd district and all Colombian calls of private commercial short-wave stations are usually AB—something or other, it is reasonable to believe that the call will be HJ3AB(?). Their license required them to test within 90 days, and it is not known if the time limit has expired or not. At least no reports have been received as yet. Has any one heard this one?

There still seems to be considerable confusion in the location and calls of stations in Colombia due mostly to the continual change of frequencies without notice. The writer is in hopes of securing a correct list of short-wave transmitters in operation in that country so as to improve the present condition.

ZTJ Veri

Inasmuch as I never had the pleasure of looking at a bona-fide verification of my own from ZTJ, Johannesburg, South Africa, I was sure pleased to gaze upon one sent me (stamped envelope and all) by my friend J. R. McAllister, Struthers, Ohio. This verification was given in the form of a letter on the letterhead of The African Broadcasting Company, Limited, dated at Connaught Mansions 217, Bree Street, Johannesburg, on November 5, 1935, and is verification of Mr. McAllister's reception of ZTJ on Wednesday, September 11, 1935. The letter is signed by Rene S. Caprara, Broadcast Manager, who congratulates Mr. McAllister on his success and fine report, and well he might. And now I will return it to Struthers, Ohio, and hope that some day I may have one of my own. Congratulations to you "Mack."

Again referring to HRN, Tegucigalpa, Honduras . . . The last word is from Mr. R. B. Oxrieder, State College, Pa., who states that this station has finally decided to stay on its former frequency of 5875 kc, so there it remains in our station list.

In Appreciation

I wish at this point to thank Mr. Oxreider for his valuable assistance in the way of information on frequency checks of various stations and to congratulate him on the record of stations received by him in a short period of time as listed to me. His efficiency in DX work is due to the fact that he has system, combined with persistency and initiative.

The writer is also very grateful for similar reports and information from Mr. Harley G. Slough, Vancouver, B.C., Canada; Wilfred T. Siddle, Birmingham, Alabama; Ian C. Morgan, Montreal, Quebec, Canada; Roy Waite, Ballston Spa, New York; G. T. Magee, Birmingham, Alabama; Robert L. Weber, West McHenry, Illinois; and James Waters, Cleveland, Ohio.

Also for the exceptionally fine letters of encouragement from Mr. E. P. W. Kearsley, Springfield, Mass.; R. Neyland, Erie, Pa.; and Ed. Wait, Chicago, Ill., and the many others who have paid tribute to this department and expressed their appreciation of the worth of ALL-WAVE RADIO as a magazine.

Station Data

When requesting information as to the identity of stations unknown to you, please be as explicit as possible. In your letter of request to this department, please furnish the approximate kilocycles as stated in our station lists, between what station you heard the broadcast, the time of day or night, and sufficient details of what was heard. This data will materially assist in the determination, and save time and postage in procuring information.

Address all letters regarding reception and station matters in general to me at 85 St. Andrews Place, Yonkers, New York, enclosing self-addressed stamped envelope in case a reply is desired. All matters of a technical nature should be forwarded to the Queries Editor, ALL-WAVE RADIO, 16 East 43rd Street, New York City.

◆

HOW TO KNOW WHEN JAPAN SAYS "HELLO!"

"Odeni narimashita; ohanashi kudasai," meaning when translated, "The connection is made; kindly converse."

Short-wave fans tuning over the low bands frequently hear the above strange expression and are elated when they find that they have tuned to a short-wave telephone station located in Tokyo, Japan. Ernest H. Roy, *Buffalo News.*

THE FOOTLOOSE REPORTER

A "shot" of the V.W.O.A. banquet. Mr. and Mrs. "Footloose Reporter" are directly in front of "Haile Selassie."

V. W. O. A. CRUISE

THE ELEVENTH annual dinner and dance cruise of the Veteran Wireless Operators Association got under way February eleventh, at the Hotel Montclair in New York. The corridor, where the elevators disgorged members and guests, was a bedlam of noise, greetings and cat-calls, and was further complicated by a floor committee trying to say hello to friends, and still attend to their numerous duties.

As usual, when old friends, who have not seen each other for a long time, get together, there were many reminiscences. Everyone talking at once, trying to cram the events of months or years into as many minutes.

Among the arrivals, I saw Carl Petersen, of Antarctic fame, who was with Rear Admiral (then Commander) Richard E. Byrd on both of his expeditions to Little America; George H. Clark, the President of the Association, who was chasing back and forth trying to welcome each member personally; William McGonigle, their energetic secretary whose impressive beard caused much comment; Charles W. Horn, vice-president of the V.W.O.A. who is also a well known member of the National Broadcasting Corporation; also Fred Muller, past president; O. B. Hanson; and E. J. Quinby, of the Western Electric Co.

Later in the evening, I saw John F. Rider, the King of the Radio Servicing Field; J. V. L. Hogan, a very well-known figure in the radio field; Arthur J. Costigan, Traffic Superintendent of Radio Marine Corporation of America; A. A. Isbell of R.C.A. Communications, and a host of other notables in radio.

The nautical decorations of the dining room carried out the idea of a cruise. The entrance was a gang plank; there were signal flags strung about the walls, and the dance orchestra and radio shack were located where the bow of a ship would be.

All seven chapters of the Association had dinners that night and were in communication with each other at specified times, through the courtesy of the Army Amateur Radio System. The Collins Transmitter, used by the New York Chapter, was operated by Captain David Talley, Signal Reserve Radio Aide of the Second Corps Area; using call letters W2PF. Colonel Alvin C. Voris, Signal Officer, Second Corps Area at Governor's Island, was present during the contact.

The Collins Transmitter, while equipped for both phone and c-w, was used only on c-w for this schedule. They successfully contacted the Chapters at Boston, Chicago, New Orleans, Miami and Omaha; and through relays with the Chapters in San Francisco and Honolulu. All Chapters reported almost full attendance and agreed everyone was having a good time.

The receiving section of station W2PF consisted of a Hammerlund Super-Pro; one of the new R.C.A. short-wave receivers and a National HRO. They were all used during the evening and the shrill notes of code signals were clearly audible above the music and noise of the party.

After the schedule had been kept, several telegrams and cables were read from members who were unable to attend. Guglielmo Marconi sent a cable from Italy (doesn't he trust radio?) in which he regretted being unable to attend and wished the Association the best of luck. Dr. Lee DeForest, who is in California, sent a phonograph record (he evidently doesn't trust either radio or cable) with his message to the Association.

A short skit on the present near war in Ethiopia, written and produced by the president, George H. Clark, was next on the program. In it Fred Muller played Benito Mussolini and William McGonigle played Haile Selassie. Just a lot of good, clean fun.

Several medals and scrolls were awarded radio operators for distinguished service. The V. W. O. A. Gold Medal was posthumously awarded to Russel L. MacDonald, late Chief Radio Officer aboard the S. S. *Mohawk*, for Sacrificial Service in the line of duty. This statement seemed rather blunt to me, so I got a story from the president about MacDonald's heroism.

On the night of January 24, 1935; the S. S. *Mohawk*, a passenger vessel, was steaming southward along the Jersey coast. It was about 9.30 P.M. Inside, the ship's orchestra was playing "I Saw Stars"; and on deck the temperature was trying to see how far below zero it could go. To make matters worse there were intermittent snow squalls, and visibility was terrible.

Just off the coast of Sea Girt the *Mohawk* overtook the Norwegian freighter *Talisman*. As they were passing each other, a misunderstanding of signals caused the two ships to swing together, the bow of the *Talisman* ripping a huge hole in the side of the *Mohawk*.

MacDonald, who was on watch in the Radio Room, was joined by his Assistant, Ernest H. Cole, who had been awakened by the crash and the shrieking whistles of both ships. Half dressed in the bitter cold night, Cole carried messages from his Chief to the Captain on the bridge.

MacDonald had sent the SOS and contacted several ships. He advised them of the *Mohawk's* position and received the information that they were under way at full speed to assist in the rescue. The *Mohawk* by this time was racing under forced draught for the beach.

On Cole's last trip from the bridge to the Radio Room, he saw that the decks, which had assumed a dangerous list, were clear of passengers. MacDonald had carried on in the best tradition of the Marine Radio Profession, and did not abandon his post until the ship was rapidly sinking.

He then ordered Cole to his life-boat position, and they left the Radio Shack together. It was the last time he was seen alive. By delaying his own departure so that others might have every possible chance of rescue, he sacrificed his life. It is evident that either the slope of the decks, coated with ice, caused him to slip into the sea, or that he was trapped in some way and went down with the ship.

Cole and the others in his life-boat were picked up by the S. S. *Algonquin*.

Both MacDonald and Cole were awarded Testimonials at last year's V. W. O. A. dinner; MacDonald's Testimonial was forwarded to his parents in Seattle.

On Memorial Day, 1936, a tablet, in commemoration of MacDonald, will be placed on the Radio Operators Monument. The Monument is in Battery Park overlooking New York Bay, and is dedicated to the memory of operators who have lost their lives in performance of duty. Annual services are held there on Memorial Day. In addition, the entire Radio Communications System observes a one minute silent period immediately following the noon-time signal.

At last year's services a Special Bronze Medal was presented to the widow of Ernest Edwin Dailey, Radio First Class, U. S. Navy. The Navy Department cooperated by having present Commander Kenworthy, Executive Officer of the ill-fated *Macon*, three Naval planes dipping overhead, a firing squad and a color guard. The National Broadcasting Company broadcast the services over a nation-wide network.

Dailey was Senior Radioman on the dirigible U.S.S. *Macon* which cracked up February 12, 1935. It had been gliding along about 110 miles from Point Sur, California, when it suddenly started rearing and plunging and finally sank in the Pacific.

An SOS was sent immediately, and as soon as it became apparent that the ship was doomed, the Commander gave orders to "abandon ship." Lieutenant H. N. Coulter, Communications Officer, went to the Radio Room to inform Dailey of the ship's position and ordered him to leave as soon as he had despatched details.

Dailey replied that he would stay there to send direction signals, which he did. When he finally did leave, on orders, he went to the bow of the ship, which was about 150 feet above water as the ship was sinking astern first, and jumped into the sea. His body was seen to sink and was never recovered.

His superior officer said of him, "Dailey's calmness and courage in sticking to his key constitutes another incident of the unflagging devotion to duty long a heritage of sea-going radio men. It was an example of duty well done, in accordance with the highest traditions of naval service."

In addition to the Gold Medal awarded to MacDonald, which, by the way, has been given only twelve times. Anne Lindbergh being the only woman to ever receive it, six Testimonial Scrolls were awarded at the dinner.

The Scrolls of the V. W. O. A. are given to those radio men "who have rendered service of merit in line of duty and who have carried out the glorious traditions of radio men at sea." They were presented to the following men:

Robert Hewitt, whose refusal to leave the S. S. *Calmar*, which was in a sinking condition after being rammed by the M. S. *Koryu Maru*, six miles off the San Francisco main channel entrance buoys, on July 23, 1935, later resulted in the saving of the vessel, which was towed into port by a Coast Guard vessel summoned by radio. The report of Captain A. M. Michelson of the *Calmar* said, in part: "So extensive was the damage that I felt certain the ship would sink in a few minutes, and the crew was ordered to leave the ship in life boats. The chief mate, the boatswain and the radio operator refused to leave until I should do so. It was largely due to Mr. Hewitt's cool and steady behavior, and his ability as an operator, that contact was established with the Coast Guard, and that assistance was so promptly secured."

Thomas S. McKenzie, radio operator of the Coast Guard flying lifeboat *Arcturus*, "whose heroic work and risk of life, during a rescue at sea in heavy seas and high winds, on January 1, 1933, earned for him a United States gold lifesaving medal. In effecting the rescue the sea plane sustained damage and, despite the sharks seen hovering nearby, it was necessary for someone to jump overboard to clear the wing tip float. Radio operator McKenzie volunteered, promptly went overboard, and successfully accomplished the task. McKenzie performed the heroic act in the course of his duty as a radio operator, while as-

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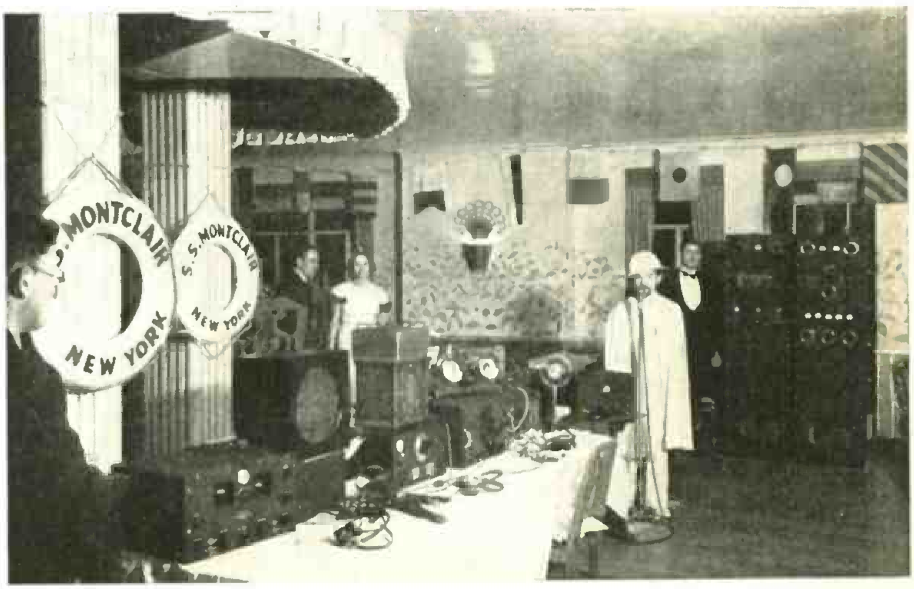
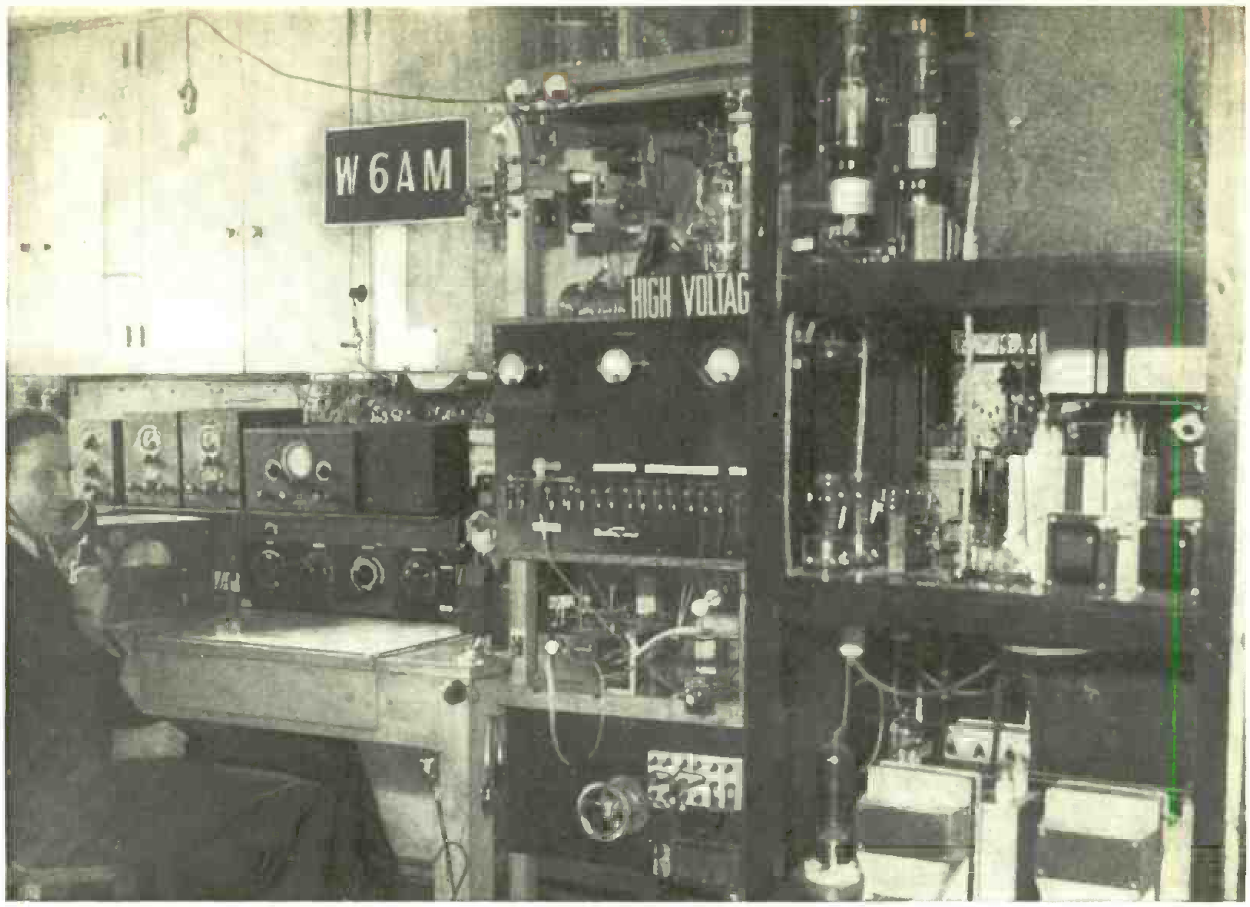


William McGonigle as Haile Selassie. In the foreground; the receivers used for intercepting reports from out-of-town V.W.O.A. Chapters.

W6AM.



Don C. Wallace, W6AM, at the operating position. Main transmitter at right. Receivers on table.

"Like 6 A.M. in the morning"—

THE STATION OF DON C. WALLACE — A HAM OF WORLD FAME — AT LONG BEACH, CALIFORNIA

By C. F. MULLEN

THERE ARE FEW radio amateurs in this world who do not know of Don C. Wallace. If they have not heard his clean-cut fist in one of the bands, or heard him on 'phone saying "W6AM . . . like 6 A.M. in the morning," they have at least heard of him.

Don Wallace has been an ardent amateur for 25 years and has never lost his intense interest in the game, and he has told me that from the looks of things there will be no diminishing of this interest for the next 50 years—he hopes. And so do we.

When you hear Don's call biting into the ether, you may picture the usual single transmitter and antenna system. If you do, you're wrong. There are seven transmitters at W6AM and a total of fourteen transmitting antennas! And all this equipment, plus the antenna arrays, are located at his home in Long Beach, California.

Main Transmitter

The main transmitter at W6AM is a one-kilowatt crystal-controlled job. Thirty Bliley Crystals are used and these are so arranged that they can be switched readily throughout each commonly used band. The crystal oscillator feeds a 50-watt doubler buffer. The buffer feeds an 860 and the output of this tube drives a Federal Type F328-A, which is a high-frequency water-cooled tube.

When used for c-w work, the primary of the power transformer is operated through a group of resistances which tend to reduce the shock on the power line.

Two power lines are run in to the transmitter; one a three-phase 220-volt line and the other a single-phase, 3-wire, 220-volt line. This means there are six power lines running into the operating room. The six blades of the power-line switch are ganged so that they all may be thrown at once.

Class B Modulator

In the right foreground of the accompanying picture of the operating room may be seen the new Class B modulator which winds up with a pair of 204-A's. The 185-pound Franklin Class B transformer is shown in the upper right of the picture in its shielded case. It is thoroughly impregnated with compound to prevent "talk" during transmission.

The intermediate choke and power supplies for this equipment are all mounted on the same rack, which has one-ton casters under it so that it can be wheeled out into the center of the room.

There are four of these racks in all, although the photograph shows but two of them. Three more are under construction.

The entire transmitter is controlled by relays which have a time delay action so that they all go into action in the proper order and come out in the reverse order.

The Receivers

The automatic tape calling mechanism is shown in the foreground of the picture, and to the left of this can be seen the receivers generally used. From left to right, they consist of an RME 69, a Peak Monitor, two Peak Pre-Selectors used on the McCullough receiver, and below the shelf containing this equipment the all battery-operated receiver with five stages of tuned r-f originally used for DX c-w work.

To the left of the operator, but overflowing the picture, is the 5-meter equipment.

W6AM also has a 50-watt mobile transmitter in his car, the antenna of which is shown in the accompanying picture. This antenna is both plug-in and spring hinged. A special spring hinge is used so that when the overhanging limb of a tree is hit the antenna folds over and snaps back in place when clear of the obstruction.

The Antenna Systems

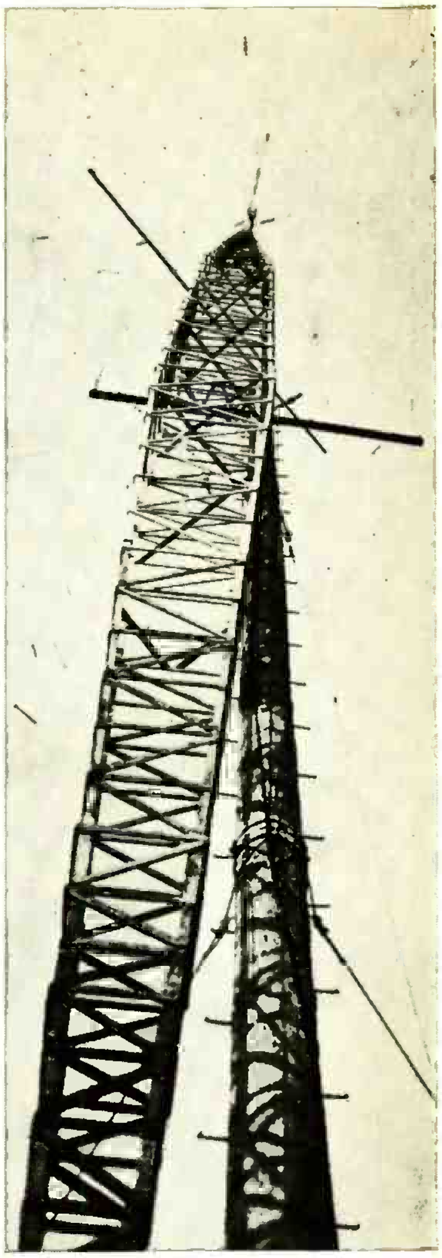
Outside the house are several antenna masts, the tallest of which is 171 feet! This is shown in the picture and consists of a wooden tower constructed by W6LFC and W6AM, and raised in place with the help of W6CGW. It was put up one Saturday morning, using the 90-foot telephone pole as a gin pole, and now the telephone pole is used to support the 171-foot tower.

The numerous feed lines are carried up through the center of the tower and connect to the various diamond and beam antennas which are supported from this main tower. The wires extend over distances of three or four hundred feet in every direction.

There are fourteen transmitting antennas used for different frequencies and for different directions. The switching of these takes place right in the station itself. Of course, the beams are used for reception as well, and help considerably in getting through the usual noise level which exists in Long Beach.

The other main pole is only 107 feet high, and some of the poles are as low as 30, 40 and 50 feet. These merely serve to support the outlying sections of the long wire "V" beams, diamond antennas and arrays of special types.

There is constant operation available at W6AM at all hours of the day on the following bands: 5, 10, 20, 40 and 80 meters. Both 'phone and c-w are used with impartiality except during the time when W6AM is on a trip up and down the coast, when c-w is used from a 200-watt suitcase portable, or 5-meter 'phone when the car is used.



The 171-foot tower and beams at W6AM.

Showing the unique radiator used with 6AM's 50-watt mobile equipment.

Schedules

W6AM has worked out satisfactory schedules which interfere very little with business and make amateur operating a real pleasure. The schedules are as follows:

Daily (between business calls): 50-watt mobile on 5 meters.

Monday evenings: Home station; 5-meter 'phone and 40-meter, 1 kilowatt c-w, mostly on eastern schedules.

Tuesday, early mornings: 40-meter c-w to the Orient.

Tuesday afternoons: 20-meter, 1 kilowatt Class B 'phone, eastern schedules mostly.

Tuesday evenings: 75-meter 'phone, north and east schedules mostly.

No schedules are made the balance of the week and all bands are used, depending upon the time available.

AMATEUR RADIO IN THE USSR

By INNA MARR • RADIO CENTRE • MOSCOW

THE ENORMOUS potentialities of short-wave communication are fully realized by the Soviet Government. Soviet Amateurs are encouraged in every way to extend and use their knowledge. All this is necessary in order that they may obtain a license that will prove they are technically capable of operating a station.

License Exams

This is done by passing a test, which may be done in a recognized short-wave club. The examination is open to all people over 18 years and is free of charge, as is also the license granted by the Government. In exceptional cases, even persons below the age of 18 may be granted a license.

How is short-wave communication organized in the Soviet Union? Amateurs are divided into three categories. In the third category are beginners. They only need pass an easy test requiring elementary, theoretical and practical knowledge, and must be able to send Morse at a rate of 30 letters per minute.

Those with more experience in short-wave radio and with a speed of at least 50 letters per minute, may pass a test for acceptance into the second category. The test for those wanting to enter the first category is more difficult. The main requirement is, however, practical experience rather than theoretical knowledge. People belonging to this group must have a speed of at least 80 letters per minute. They are allowed to operate on all amateur bands without any restrictions as regarding wavelengths, time of transmissions and power. They may also make radiophone experiments. This category, therefore, includes the most capable Amateurs, able to solve any problems set by the Central Short-Wave Department, whether of an experimental or of a practical nature.

Role of Amateurs

The number of short-wave transmitters in the whole of the Soviet Union is at present about 600. These stations, however, do not merely exist on paper; all of them are actively engaged in communication and are regularly on the air. Amateurs of the highest category are frequently invited by the State or by State institutions to perform special tasks. Such special tasks include the accompaniment of ships and airplanes. Amateurs take part in all expeditions and prospecting trips. In this way, these expeditions remain in constant touch with the outside world.

Everyone remembers the remarkable rescue of the Chelyuskin expedition. It is not generally known, however, that most of the radio communications of the Chelyuskin were handled by Amateurs. Amateurs also took an active part in the voyage of the icebreaker *Krassin* sent by the Soviet Government to the rescue of the members of the Nobile Arctic Expedition. Further expeditions in which radio Amateurs took part are; the automobile run through the Kara Kum Desert, the prospecting parties in the Ural Mountains, the White Sea Expeditions, the ascent of Mount Elbruss, etc. In the Arctic circle nearly 60 short-wave stations are being operated by Soviet Technicians all the year round. These stations are extremely important to the Arctic shipping. Ships going to Siberia by the North-Eastern Sea Route, determine their course with their help. The successful trip of the *Graf Zeppelin* in Arctic regions was possible thanks to the Arctic short-wave transmitters. Their importance as meteorological stations is enormous since the weather in Europe depends a great deal on atmospheric conditions in the Arctic. It is therefore imperative for all meteorological institutions in Europe to be constantly informed about temperature, wind velocity, humidity, etc., in the Arctic. It is interesting to note that Arctic short-wave transmissions are carried through for the greater part by radio Amateurs. Not a few of them have been awarded high decorations by the Soviet Government in acknowledgement of their services.

Now why, precisely, have short-wave Amateurs succeeded in obtaining achievements which formerly were considered impossible even by professionals?

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5 METERS AT AIR RACES

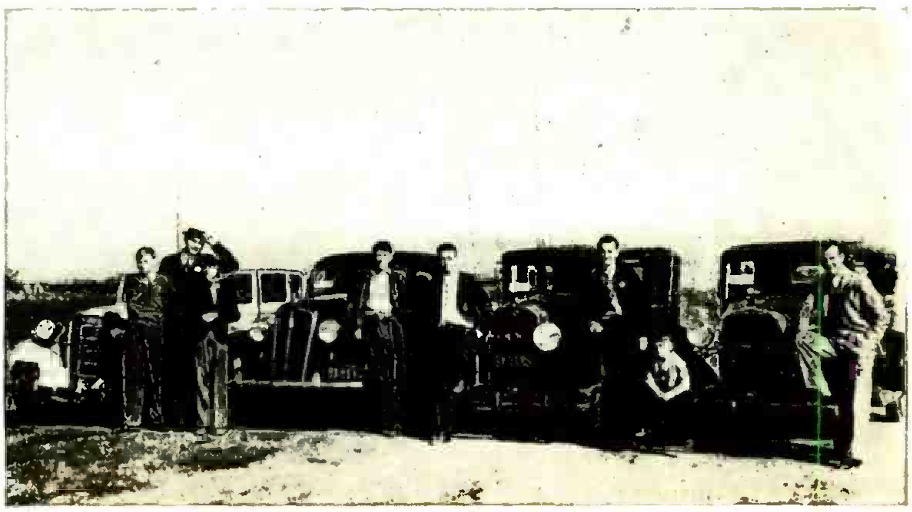
DURING THE National Women's Air Races handled in Long Beach, California, the Committee requested the 5-meter amateurs to furnish the communication from the pylons.

Larry Lynde, W6DEP, took charge and soon had a number of amateurs co-operating.

The photograph shows typical equipment used, and although quite a number of amateurs helped, the ones most prominent were the following: W6MNT, W6ERT, W6IVG, W6DJC, W6EWK and W6AM.

Most of these chaps had substantial mobile outfits in their cars, ranging all the way from 5 watts to 50 watts and ranging all the way from the 2.5 watts used by W6DEP to the 50 watter used by W6AM.

All of these were either permanent or semi-permanent installations in the cars. The communication system was worked so the judges at the different pylons and the judges at the stand were constantly in communication with what went on, as fast as the planes rounded the various pylons.



Left to right: 6AM (and two sons); 6MNT; 6DEP; 6ERT; 6IVG.

CHANNEL ECHOES

BY ZEH BOUCK

PROBABLY THE longest and certainly the most impressive program ever broadcast carried the obsequies of the late King George the Fifth to the four corners of the globe. This solemn pageantry, that echoed through uncounted millions of speakers, did honor to Daventry and England as well as to his departed Majesty.

And just to show that we can do big things too—that our own imaginations, aflame with our own glorious traditions, can ride these slaveling waves in warped hyperbolic space—a week later we broadcast the emergence of the ground hog from his subterranean quarters.

The ground hog retired to his hole in disgust.

◆

THE FIRST AND only fan letter we ever wrote was to Roxy—a good many years ago. Just what the occasion was, we don't remember. Perhaps it was because he had broadcast a poem of ours on a New Year's Eve program. We had always admired Roxy's good taste anyway.

The letter led to a meeting between Roxy and ourself—and a casual association that continued until his death a month or so ago. We met in his office in the Capitol Theater, New York City, and afterwards drove down to Greenwich Village—to what was then Casertas Royal Gardens, where Caruso used to hang out and after a few bottles of Chianti toss gratuitously a thousand bucks worth of song. It was a sleety winter night, and we were held up by traffic at Broadway and Forty-Second Street. A pretty girl, attempting to cross, slipped on the icy pavement, landing in the gutter. As several pedestrians assisted her to her feet, I called Roxy's attention to the fact that the girl had slipped.

Roxy turned to me with a wry smile and said—"She's not the first girl who's slipped on Broadway."

We returned to the Capitol Theater after dining, and in one of the private projection rooms, I was privileged to watch Roxy indicate the score for the following week's feature picture. This, of course, was in the days of the silent screen, and the photoplays were accompanied with appropriate music. Roxy was no musician, but possessed a marvelous feeling for music, and a memory that was virtually a melodic library. He would stop the picture every few moments or so with a buzzer signal to the

ZEH BOUCK

World's first radio critic.

projection booth, and patch together a musical continuity from a dozen or more numbers—popular and classic.

Later that same evening, in Roxy's office, where we were having a wee doch-an-dorris of super-excellent Scotch, I met Major Bowes. This was shortly before Roxy quit the Capitol, as it was evident, from the little I overheard without so intending, that Roxy's departure was in the offing, and that the Major was about to be launched on his broadcasting career.

A month or so ago—only a few weeks before Roxy's death—the Major was a guest star on (as we recall) one of Rudy Vallee's programs, the occasion being some sort of an anniversary of the Major's broadcasting debut. The genial Major accepted the encomiums showered upon him as graciously as he did credit that should have gone to Roxy—the man who, both directly and indirectly, made it possible for Major Bowes to realize three-quarters of a million dollars a year from his amateur racket.

It was some Sundays later that the Major lost a large portion of his audience—when the Columbia network was simultaneously broadcasting the memorial program to Roxy. Remnants of the old gang were there—Yascha, Gladys Rice, Wee Willie Robin. But we listened in vain for Douglas Stanbury, Gamby, Caroline Andrews—and others. We are not in a particularly good location for reception from any of the Columbia stations, and had compromised on WIBT, Charlotte, N. C. A neighboring NBC station broke through occasionally, and, ironically enough, we heard the genial Major's "All right—all right"—and once, the gong. *Sic transit*—etc.

◆

WE HAVE received numerous letters from short-wave enthusiasts complaining of code interference on the broadcast bands—particularly in the 6 megacycle region. We have had occasion to investigate some of these complaints, and have found that whenever the interference existed within the internationally allocated band, it had been due invariably to an image frequency. Outside of the band much direct code interference is experienced, but such code stations have a right there—for the present—and they are the 'phone stations that are trespassing.

It is very important to discriminate between direct and image-frequency interference, not merely as a matter of fairness, but because the validity of a complaint to official quarters, and its weight as a whole, will be affected if it is immediately evident to an expert that the complainant is wailing about something for which his receiver is to blame and for which the transmitter is quite guiltless. (A surprisingly small number of complaints from listeners—in reference to amateurs, heterodynes, code interference, off-frequency transmission, etc.—are legitimate. The fan who is not a good technician with a fair knowledge of code calls wolf so consistently that little attention is paid to him when a lupine visitor actually bares his fangs. We, who would like to untangle this megacyclic mess at the Cairo Conference next year, must know whereof we speak!)

It is very easy to determine whether you are receiving image-frequency interference or direct interference by the simple expedient of detuning slightly. If the interference is direct, the intensity of the interferring signal will change but without variation in the pitch or whistle. On the other hand, if it is image-frequency, the note or pitch will ride the scale. (This holds for 'phone or code as long as there is interference.)

Better radio laws, with some means of enforcing them, is the answer to direct interference. Better receivers are the only cure for image frequencies.

◆

SOMEHOW THE "Shadow" fails to perturb us. Similarly, we fail to appreciate

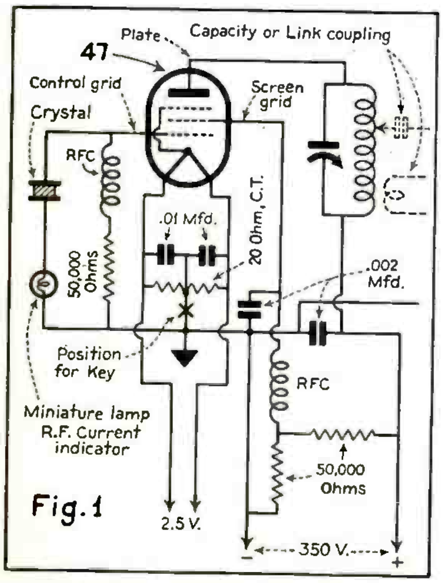
(Turn to page 142)

R-F OPERATION OF

NOTES ON THE APPLICATION OF TETRODES AND PENTODES TO AMATEUR TRANSMITTERS

SCREEN-GRID tubes are old in amateur practice as anyone who made use of the 865 at its introduction will testify. The general use of the screen-grid tube in the amateur transmitter did not become common, however, until the advantages of the 47 as a crystal oscillator were discovered, and the greatest step of all came with the introduction of suppressor-grid modulation to American amateurs by James Lamb in the early part of 1934. The Tritet oscillator using a 59 and the advantages of a pentode screen-grid tube such as the 59 had already been made known by Lamb and are important steps in the history of amateur transmitter development. Screen-grid tubes of both the tetrode and pentode types were in common use in Europe before their introduction here and suppressor-grid modulation was first introduced there. The application of the tubes and this type of modulation to amateur radio can be credited to amateurs on this continent.

Tetrode tubes differ from triode types in that a grid known as a screen is inserted in the tube structure between the control grid and the plate. This grid, of relatively fine pitch in tubes used solely for r-f amplification, is normally by-passed to the filament or cathode so that the screen circuit contains no r-f impedance. Under these conditions the screen is an efficient electrostatic shield between the grid and plate and through the elimination of electrostatic lines of force from plate to grid, the control grid to plate capacitance is made a very small fraction of its value without the screen grid. It has been pointed out in numerous texts that a tetrode with the screen by-passed so that it has no impedance in the external circuit is equivalent to a triode. An equivalent triode would be far beyond anything we now have along lines of conventional tube construction, however.

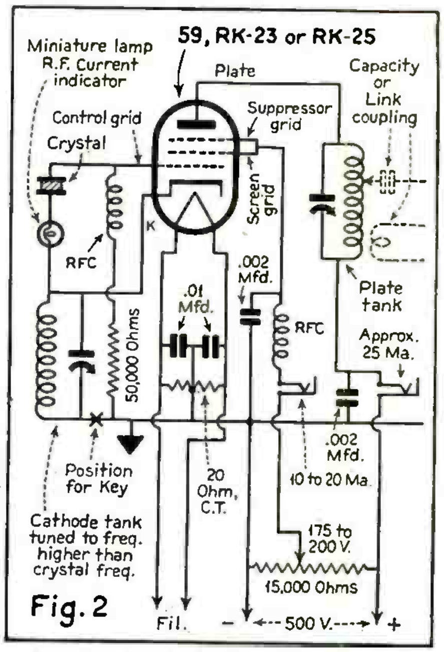


SIMPLE PENTODE CRYSTAL-CONTROLLED OSCILLATOR

An examination of the family of plate-current curves for a tetrode (the old type 224 is a good example) will show that, for a fixed value of screen-grid voltage, there is little change in plate current after a plate voltage somewhat higher than the screen voltage is reached. Through the region where the plate voltage passes from a value less than the screen-grid voltage to a value above it a dip will be observed in the plate current curve for each value of control-grid bias voltage.

Secondary Emission

This characteristic of the tetrode tube is caused by secondary emission from the plate surface and is made to serve a useful purpose in the dynatron oscillator. Under these conditions where the screen voltage is higher than the plate voltage, the electrons passing through the screen grid to the plate dislodge electrons at the plate. These secondary electrons thus made free from the plate metal are more attracted by the screen than by the plate because of the higher screen-grid voltage. Therefore, the secondary electrons flow inward to the screen. In receivers, secondary emission cannot be tolerated. To eliminate



THE TRITET PENTODE CRYSTAL OSCILLATOR CIRCUIT

this characteristic in tetrodes, those already designed were changed, principally by the substitution of carbonized nickel for bright nickel in the plate. As a result of this and other corrective changes, there are few tubes available today for dynatron oscillator use.

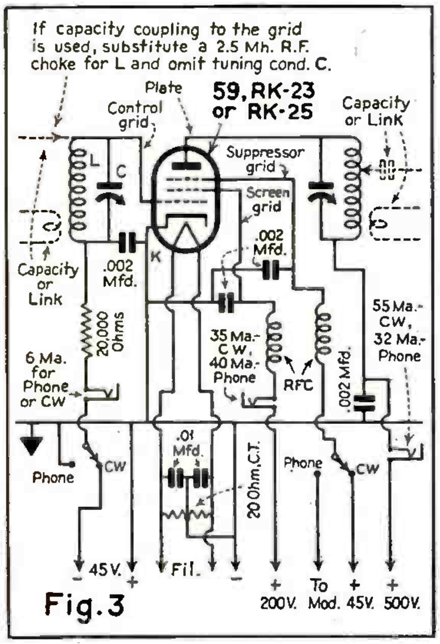
One very important advantage gained by the insertion of a screen grid between the plate and control grid of a tube is an enormous gain in the voltage amplification of the tube. This applies to the tetrode as well as the pentode.

The Pentode

The pentode is the familiar tetrode with an additional grid placed between the screen grid and the plate. This third grid is usually connected to the cathode, as in the 2A5, 41 and 42, or to the filament, as in the 47 and 33. The primary purpose of the third grid is to reduce secondary emission from the plate by placing a zero voltage barrier in front of the plate. The pitch of a suppressor grid, as the third grid is called, is necessarily coarse to limit the effect of the grid on the flow of electrons from filament or cathode to the plate. In other words, the addition of the third grid at cathode potential does not greatly affect the plate resistance.

In suppressor-grid modulation, the possibility of changing the plate resistance over wide limits is used. The suppressor-grid, if by-passed to the cathode, or if connected directly to the cathode, aids the screen grid in shielding the con-

Screen-Grid Tubes



LOW POWER R-F PENTODE AMPLIFIER

By R. M. PURINTON
— W2ICU —

trol grid from the plate and so makes a further reduction in the control grid to plate capacitance.

In a receiver, with the conditions strictly Class A, the control grid of a tetrode or pentode is never positive and in general remains slightly negative on signals which provide the widest grid swing. Here, the screen-grid current averages not more than 15% to 20% of the plate current. In oscillator or r-f amplifier service under Class C conditions where the control grid becomes positive for a fraction of a cycle the ratio of screen-grid current to plate current increases so that the screen current may be 50% to 60% as great as the plate current. In both of these cases, the screen grid operates at a voltage from one-half to one-third the plate voltage.

The discussion of the circuits shown can be limited because all of them are familiar to most amateurs and all have been shown from time to time in construction articles. It is hoped that the comments which follow may be of some value in the practical operation of the screen-grid tubes shown in the diagrams.

Straight 47 Crystal

Fig. 1 shows a type 47 pentode connected in the conventional straight crystal oscillator circuit. As indicated, the circuit is not adapted to frequency doubling. A variation, used successfully over a long period of time by W1GBE, has an additional plate tank tuned to twice the crystal frequency placed in series with the regular plate tank which, of course, tunes approximately to the crystal frequency. A tap from the plate end of the harmonic tank provides excitation at double frequency. It will be noted that a miniature lamp is shown connected directly in series with the crystal. This lamp, which can be a flashlight lamp or dial lamp of the brown bead type (6 v., 150 ma) should be precalibrated by passing battery current through it and noting the brilliancy for steps of current in milliamperes up to approximately 100 ma. When in circuit in series with the crystal, the lamp will provide a sufficiently accurate measure of r-f crystal current to warn against crystal overloading. This arrangement has been used by many amateurs and the lamp resistance does not seem to affect crystal performance appreciably.

The Tritet

Fig. 2 shows the familiar Tritet circuit introduced by James Lamb. A great deal has been written about the Tritet and it stands out as an ideal arrangement among the circuits available for amateur use. If used as a frequency-multiplying oscillator, the 59 works satisfactorily. Where operation as a straight oscillator is desired, with the plate tank tuned to approximately the crystal frequency, tubes having less grid-plate capacitance must be used. Such tubes were not available when the Tritet circuit was announced but they are today and are recommended over the 59 unless type 59 tubes tested for r-f ouput are available.

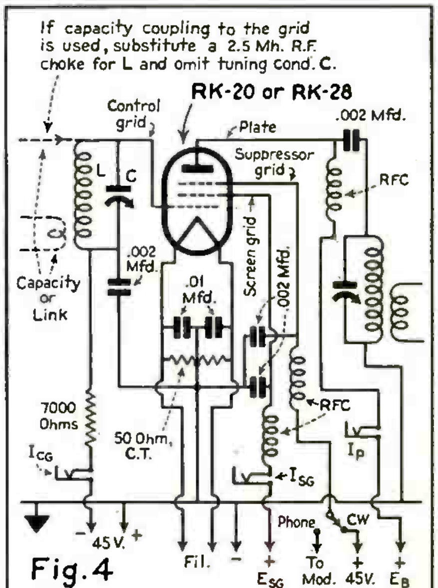
Trouble with this circuit can almost invariably be traced to a 59 tube which may be perfectly satisfactory in an audio circuit. The r-f losses due to getter material deposited on the stem, or even to the type of getter used may be responsible. It will be noted that the cathode is "hot" or carries an r-f potential. Across the cathode tuned circuit is the capacity between the heater and the cathode, but this amounts to only 4 to 5 micromicrofarads and is of little consequence. Heater-cathode leakage, if large, would affect operation and an inactive 59 should be checked for this defect.

It will be noted that a miniature lamp is shown in series with the crystal. Since the adjustment of the cathode tank circuit is used to control excitation, it is highly desirable to have some knowledge of the crystal current and the lamp will be found helpful.

R-F Amplifiers

Figs. 3, 4, 5 and 6 show arrangements in which pentodes are used as r-f amplifiers. All of the tubes can be used as doublers but the 59 is not recommended for buffer service because of its relatively high grid-plate capacitance.

The approximate values of current which should flow in each circuit are shown on the diagrams. The excitation should be sufficient to produce at least the current shown for the control-grid



CW	E_B	I_P	E_{SG}	I_{SG}	I_{CG}	
RK-20	1250	92	300	32	7	
RK-28	2000	140	400	60	11	
SUPP. MOD. PHONE						SUPP. G.V.
RK-20	1250	43	300	36	7	−45
RK-28	2000	80	400	85	11	−50

POWER R-F PENTODE AMPLIFIER

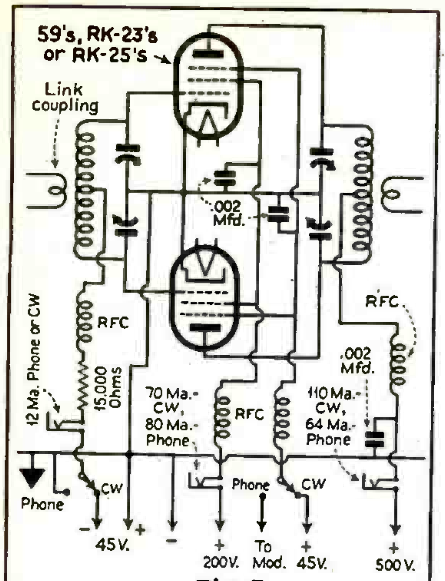


Fig.5

PUSH-PULL LOW POWER PENTODE AMPLIFIER

circuit. With this excitation, the screen-grid current will have a value approximately as shown and it should be possible to load the plate circuit to the current value indicated.

Over-excitation is fully as bad as under-excitation in a pentode used as an r-f amplifier. This is true because the screen-grid circuit contains no impedance to r-f and over-excitation increases the flow of screen current to values which cause overheating of the screen and the waste of considerable power. The most noticeable effect of over-excitation is a loss of power in the plate circuit due to the diverting of more than the proper share of the available filament or cathode electrons to the screen circuit. Thus, it may be seen that the screen-grid current is a good indicator of proper excitation.

Biasing

In Figs. 3 and 5, a switch is shown in the control-grid return circuit arranged to connect the grid leak either to ground for 'phone or to 45 volts negative for CW. The purpose is to bring the plate and screen current to zero when the excitation is removed as in oscillator keying. Where the plate and screen voltage is cut off by the key, the grid leak can be connected direct to ground. Figs. 4 and 6, which show power arrangements, call for a fixed negative bias of 45 volts in addition to the bias developed across the grid leak. This is advisable since high voltages are used on the plate and loss of excitation would permit an undesirably high plate and screen current. While covering the subject of control-grid bias, it might be pointed out that the bias voltage required is determined by the *screen-grid voltage* rather than the plate voltage. Practically all of the r-f pentodes now available to the amateur are so designed that the best control-grid bias is approximately 100 volts negative.

The coupling of the load to the plate circuit should be adjusted so that a noticeable dip occurs when the plate tuning condenser is adjusted through resonance. If the control-grid current and screen-grid current values are about as shown in the diagrams, indicating ample excitation, and the plate current fails to dip when the tank circuit is tuned through resonance, the load coupling is too tight. Loosening the plate load coupling together with retuning the plate tank will provide higher r-f output at a lower plate current.

Shielding

Fig. 7 shows one desirable way to shield the input circuit of a pentode from the output circuit. With either link or capacity coupling, the plate circuit of the driver stage must be considered *a part of the input circuit of the following stage.* Therefore, the plate tank of the driver should be shielded from the field around the plate of a power pentode. This electrostatic field surrounding the plate is strong enough to light a neon lamp within three inches and to produce feedback effects at a much greater distance. The higher the operating frequency, the stronger this coupling effect becomes.

The collar surrounding the lower part of the tube and extending up to the lower internal shield should clear the bulb wall by at least one-sixteenth inch. No shielding of any kind should be placed close to the plate or at the plate end of the tube. Close shielding at these points would interfere with heat radiation and might cause destruction of the tube if a flashover from plate to shield should occur.

While the baffle shield shown in Fig. 7 may not be required on frequencies below 15 megacycles, such a shield would be of value at ten meters.

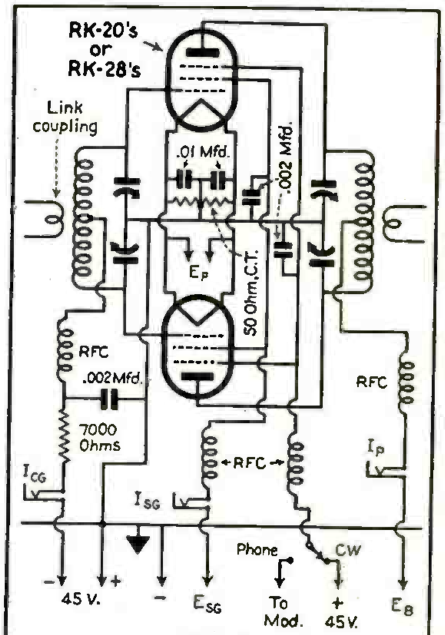


Fig.6

PUSH-PULL POWER R-F PENTODE
Values of Icg, Isg and Ip are twice corresponding current values shown in the Tables of Fig. 4. All voltages the same.

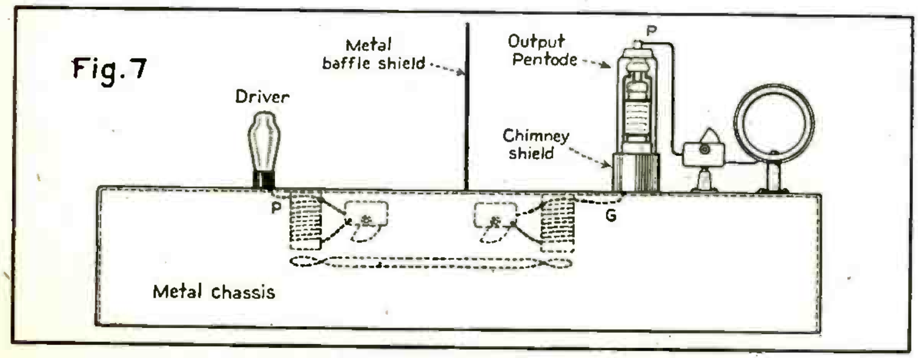
The by-pass condensers and r-f chokes associated with the screen grid and suppressor circuits should be mounted at the tube socket.

Oscillation Troubles

In closing this discussion of screen-grid tube circuits it might be well to suggest that suppressor-grid modulation is difficult to control at frequencies above 30 megacycles and is not recommended above this frequency. Also, oscillation trouble can almost always be traced to poor shielding, insufficient control-grid bias, defective r-f chokes, or the use of electrolytic or paper bypass condensers instead of mica.

The r-f pentodes for amateur use have simplified the amateurs' problems in eliminating neutralization and in reducing the number of stages required. However, the amateur will be well repaid for time spent in gaining familiarity with the tetrode-pentode screen-grid family through the study of texts and articles covering these tubes.

Fig.7



PENTODE AMPLIFIER SHIELDING

By BEAT NOTE

HIRAM PERCY MAXIM passed away on February 17th, in La Junta, Colorado, after a short illness.

He will be remembered as the Father of Amateur Radio.

No one will ever be able to take his place. His death will remain an everlasting loss to all Amateurs.

He was a Grand Old Man.

Mrs. Maxim followed him to the grave nine days later.

May they rest in peace.

◆

AN EMPIRE listener recently asked the BBC why there were so many gaps in the programs, to which the BBC replied that there were no gaps *in* programs but *between* them.

To the BBC the answer was not a quibble. It is their belief—and ours—that the distinction is of great importance. As they say, every announcer knows that to have any but the smallest gaps between items or groups of items in a program, makes the whole program sound slovenly and shapeless to listeners who hear no applause and have no vision of the performance to attract their attention. He takes the greatest care to prevent such gaps taking place.

To the BBC, gaps between programs are a different story altogether. The BBC definitely aims at having a brief interval between each program. The reason is an artistic and positive one. The listener who has just heard the final dramatic lines of a broadcast play does not want to hear the unemotional voice reading the weather forecast five seconds later. Nor does he want to hear the final notes of a symphony concert blended in his mind by an announcement of a variety program or a fashion talk.

The BBC remarks that there is one danger inherent in having intervals between programs, which is particularly applicable to short-wave broadcasting from the Empire Service. A listener may switch on his set during an interval, hear nothing, and presume that his set, or the transmitter, has broken down. For this reason an interval signal, the famous Bow Bells, has been adopted. This signal is intended to serve the purely utilitarian purpose of assuring the listener in an inoffensive way that all is well with his set and the transmission; criticism of it on the score that it is not an entertainment in itself is beside the point.

The attitude of the officials of U. S. broadcast chains is quite different. Gaps between programs are abhorred. Every effort is made to provide a continuous flow of entertainment from morning to night.

Interval signals are not used for the purpose of advising the listener that all's well, but rather as a cue signal to notify network stations that the program has ended and the time has arrived for them to make their local station announcements. The signals are also used for cueing the telephone company's switching stations in making the transfers of supplementary networks from one basic network to another. That is, the interval signals are functional and form a part of the technique of broadcast chain operation.

Both methods of program presentation have their points. But it is a question if Americans would prefer the contrast induced by intervals of comparative silence. The average Englishman tends towara the phlegmatic, whereas the average American functions in high gear. To the Englishman silence is golden; to the American it is positively nerve-wracking.

We are inclined to believe that, aside from any commercial considerations, program presentation in both England and the United States is geared to public preference. To say that one technique is superior to the other is to disregard the living habits of a people.

◆

WHILE GLANCING through a copy of *RCA Radio Service News*, we came upon an illustration of the most bewitching young lady seated in an equally as bewitching a posture beside one of the new RCA sets.

The real surprise came when we glanced at the caption under the illustration, which read: *New Export Model.*

We sent in our order for one immediately.

◆

AND SPEAKING of RCA, are you good at finding out what's wrong with pictures? Okay, then—see if you can find out what's wrong in the advertisement on the second cover of the *Saturday Evening Post* for February 29th.

◆

WE HAVE LEARNED, much to our sorrow, that there is a limit to the amount of listening we can stand. We recently put in a six-hour stretch at the receiver and ended up a total loss.

Possibly everything would have been all right if we hadn't followed a lengthy conversation between two Hams on the subject of antenna systems. In any event, we spent the night dreaming that we were trying to light a cigarette from an impedance match.

◆

WE MEAN NO sarcasm, but we simply must remark that, after years of research work, a new goal has been achieved . . . it is now both possible and practical to transmit radio programs into the home over wires.

◆

SERIOUS NOTE: Don't buy television stock without first consulting someone who has a thorough knowledge of the radio field.

Television is going to be a gold mine, and there are hundreds of promoters all set to offer Fool's Gold to the public.

Watch your step.

◆

WE HAVE PASSED a resolution declaring ourself neutral on all subjects that would ordinarily set us off like a stick of dynamite. And so it is that we are both neutral and undisturbed by the sight of the power load graphs of the Public Utility Companies showing what happens to the Nation's power houses when the President broadcasts.

What happens, of course, is that as soon as the President comes on the air the Nation's consumption of electricity for that period goes up a few hundred percent: so many people turn on their radios that the power houses grunt under the load.

Now, here is a fine kettle of fish, and you can have them. The President can't talk without boosting the Public Utilities business, and, conversely, if ever the Public Utilities had a friend, it's when the President has a Fireside Talk.

Maybe it's all one great big game we don't understand.

◆

WE CAN READILY perceive that the day will come when voting will be conducted by radio. All those favoring Senator Blank for President will listen (please) to his speech at nine o'clock. All those favoring Governor Dash for President will listen (please) to his speech at ten o'clock.

The power load will tell the story.

The one difficulty, as we see it, is that people will start all the electrical equipment they have in order to make a good showing at the proper time, and thus blow every fuse and trip every circuit breaker from coast to coast.

◆

BUT THERE IS no doubt that radio will elect the next President. It will also elect to put lots of people to sleep before their usual bed time, if we know our political speeches.

NEW HIGH-FREQUENCY TUBES

For Amateur Transmitters

RCA RADIOTRON has introduced two new triodes which will be of particular interest to amateurs after efficiency and real power output at low cost on the 5 and 10-meter bands.

The 830-B

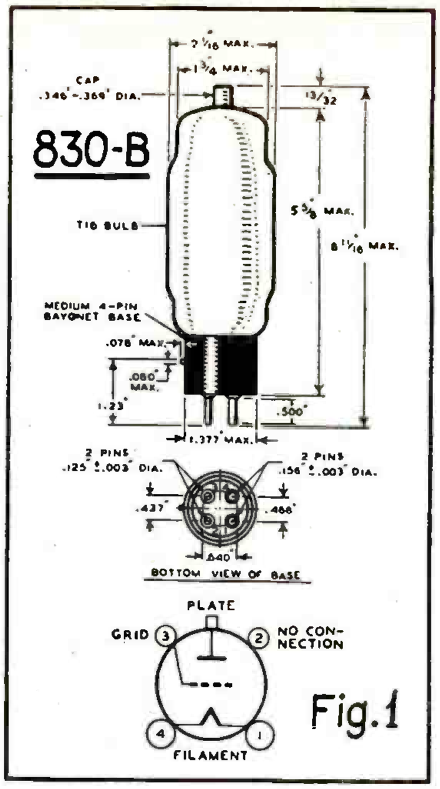
The first of these tubes, the 830-B, is designed for use as a Class B modulator, radio-frequency power amplifier or oscillator. It can be operated at maximum ratings at frequencies as high as 15 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced as the frequency is raised. Thus, at 30 megacycles the rating should be 75 per cent of maximum, and at 60 megacycles the ratings should be 50 per cent of maximum.

When used in Class C telegraph and Class B services, the 830-B has a maximum plate dissipation of 60 watts. A pair of them used as Class B modulators will provide a power output of approximately 175 watts at plate voltage of 1000.

The physical dimensions, socket connections and element dispositions of the type 830-B are shown in Fig. 1. Maximum ratings and typical operating conditions as a plate-modulated r-f power amplifier in Class C telephony are given in Table I.

The 834

The 834 triode is for use as a radio-frequency power amplifier or oscillator. As shown in Fig. 2, the grid and plate



DIMENSIONAL DRAWINGS

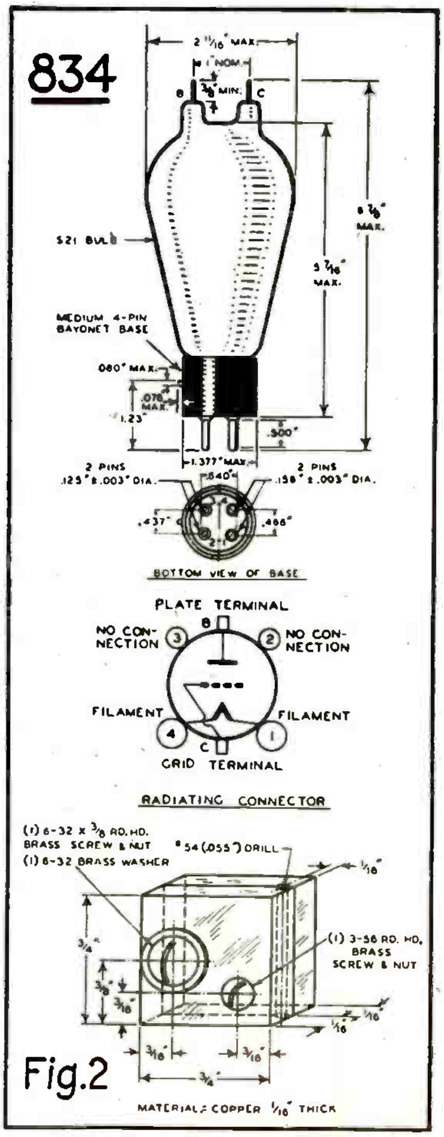


TABLE I

TENTATIVE CHARACTERISTICS—830-B

Filament Voltage (A.C. or D.C.)	10	Volts
Filament Current	2	Amperes
Amplification Factor	25	
Direct Interelectrode Capacitances (Approx.):		
Grid-Plate	11	mmfd
Grid-Filament	5	mmfd
Plate-Filament	1.8	mmfd
Bulb (For dimensions, see Fig. 1)	T-16	
Cap (For connections, see Fig. 1)	Small Metal	
Base (For socket connections, see Fig. 1)	Medium 4-Pin Bayonet	

As Plate-Modulated R-F Power Amplifier—Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage		800 *max.*	Volts
D-C Grid Voltage		-300 *max.*	Volts
D-C Plate Current		100 *max.*	Milliamperes
D-C Grid Current		30 *max.*	Milliamperes
Plate Input		80 *max.*	Watts
Plate Dissipation		40 *max.*	Watts
Typical Operation:			
Filament Voltage (A.C.)	10	10	Volts
D-C Plate Voltage	600	800	Volts
D-C Grid Voltage (Approx.)	-140	-150	Volts
Peak R-F Grid Voltage (Approx.)	255	265	Volts
D-C Plate Current	95	95	Milliamperes
D-C Grid Current (Approx.)	30	20	Milliamperes
Driving Power (Approx.)	7	5	Watts
Power Output (Approx.)	38	50	Watts

are supported from the top of the glass bulb by individual leads which are brought out of the tube through separate seals. This construction insures low interelectrode capacities and minimum lead inductance, the grid-plate capacity being of the order of 2.6 mmfd, grid-filament capacity 2.2 mmfd, and the plate-filament capacity 0.6 mmfd.

The 834 may be operated at maximum ratings at frequencies as high as 100 megacycles, and at reduced ratings as high as 350 megacycles. The maximum plate dissipation for Class C telegraph and Class B services is 50 watts. Typical operating conditions of this tube as a plate-modulated r-f power amplifier in Class C telephony and as an r-f power amplifier or oscillator in Class C telegraphy are given in Table II.

Due to the high circulating r-f current in the plate-grid circuit, it is necessary to provide a means for cooling the lead tips and their seals. A recommended method of doing this is to increase the radiating surface of each lead by means of a copper clamp connector having a cross-sectional area of at least ¾ square inch. Details of the clamp are given in Fig. 2. Each lead wire should be connected to its copper clamp before the clamp is placed on the terminal tip. The clamp should be slightly sprung so that it can easily be slipped over its terminal. When the clamp is in place, carefully tighten the smaller bolt to insure good electrical contact.

Connections should never be soldered to the tube terminal tips as the heat of the soldering operation may result in the cracking of the lead seals. The tube terminal tips should not be used to support coils, condensers, chokes, or other circuit parts.

TABLE II

TENTATIVE CHARACTERISTICS—834

Filament Voltage (A.C. or D.C.)	7.5	Volts
Filament Current	3.25	Amperes
Amplification Factor	10.5	
Direct Interelectrode Capacitances (Approx.):		
Grid-Plate	2.6	mmfd
Grid-Filament	2.2	mmfd
Plate-Filament	0.6	mmfd
Bulb (For dimensions, see Fig. 2)	S-21	
Base (For socket connections, see Fig. 2)	Medium 4-Pin, Bayonet	

As Plate-Modulated R-F Power Amplifier—Class C Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

D-C Plate Voltage		1000 *max.*	Volts
D-C Plate Current		100 *max.*	Milliamperes
D-C Grid Current		20 *max.*	Milliamperes
Plate Input		100 *max.*	Watts
Plate Dissipation		35 *max.*	Watts
Typical Operation:			
Filament Voltage (A.C.)	7.5	7.5	Volts
D-C Plate Voltage	750	1000	Volts
D-C Grid Voltage (Approx.)	-290	-310	Volts
Peak R-F Grid Voltage (Approx.)	415	435	Volts
D-C Plate Current	90	90	Milliamperes
D-C Grid Current (Approx.)	20	17.5	Milliamperes
Driving Power (Approx.)	7.5	6.5	Watts
Power Output (Approx.)	42	58	Watts

As R-F Power Amplifier and Oscillator—Class C Telegraphy

Key-down conditions per tube without modulation

D-C Plate Voltage			1250 *max.*	Volts
D-C Plate Current			100 *max.*	Milliamperes
D-C Grid Current			20 *max.*	Milliamperes
Plate Input			125 *max*	Watts
Plate Dissipation			50 *max.*	Watts
Typical Operation:				
Filament Voltage (A.C.)	7.5	7.5	7.5	Volts
D-C Plate Voltage	750	1000	1250	Volts
D-C Grid Voltage (Approx.)	-175	-200	-225	Volts
Peak R-F Grid Voltage (Approx.)	300	325	350	Volts
D-C Plate Current	90	90	90	Milliamperes
D-C Grid Voltage (Approx.)	20	17.5	15	Milliamperes
Driving Power (Approx.)	5.5	5	4.5	Watts
Power Output (Approx.)	42	58	75	Watts

PETERSON'S ANTARCTIC LECTURE BROADCAST ON FIVE METERS

ON FEBRUARY 5th, 1936 at 8 P. M., Lieut. Carl O. Petersen, U. S. N. R., member of both Byrd Antarctic Expeditions—on the first as Radio Engineer and on the second as Paramount News Cameraman—presented before 500 employees of the New York Telephone Company in the Auditorium of the Long Island Telephone Headquarters Building at 101 Willoughby Street, Brooklyn, N. Y., a movie and lecture titled "Little America," under the auspices of the Telcoli Radio Club and the Telephone Camera Club of Long Island.

The demand for tickets for this feature far exceeded the seating capacity of the auditorium and in order not to disappoint many amateurs who had learned of the presentation from the broadcasts over Arthur Lynch's 5 meter station at 40 Wall Street, the idea of broadcasting the lecture on 5 meters was decided upon.

In addition to the regular condenser microphone, part of the public-address system in the auditorium, the remarks of Lieut. Petersen were picked up by a single-button handset type carbon microphone and carried over a tie-line from the auditorium on the first floor to the twenty-fifth floor of the building where the picked up energy was fed into a speech amplifier consisting of two 57's in cascade and thence into two 45's in push-pull. The radio-frequency portion of the transmitter consisted of a push- pull parallel long-lines oscillator incorporating two 45's in push-pull. Class "B" modulation was employed. The antenna consisted of a telescopic 5-meter antenna mounted on a pole and held away from the front of the building in a vertical position and fed by a section of transmission cable with an impedance matching section 49¼ inches long with about 1½ inches spacing between feeders.

The call of the club President, William J. McGonigle, W2ASN was employed, operating portable. The transmissions were picked up by W2DKJ and re-broadcast to many five-meter amateurs and short-wave listeners.

Reports of reception of this feature were received from many sections of the metropolitan area. Additional data on the reception of the re-broadcast as well as the original transmission are desired and will be appreciated by the club. Correspondence in connection with this may be mailed to the club President at 112 Willoughby Avenue, Brooklyn, N. Y.

FOREIGN NEWS

REVIEWING THE MARCH OF WORLD TOPICS

RADIO DEVICES IN MEXICAN MINES

PACHUCA, Hidalgo: To Prevent "high grading" (stealing) of precious metals by dishonest employees, a progressive company at Pachuca has installed one of the most modern and unique radio theft protective systems.

In general, the device consists of a door-casing constructed without nails and which serves as a support for holding a coil of wire on the outer part of the casing. The coil is energized by a connection to a balanced (zero-beat) high-frequency oscillator. A pair of telephone receivers attached to the oscillator output terminals detects, by an audio-frequency tone, the slightest deviation from the zero-beat setting. In operation, the coil on the door-casing sets up an electrical field which is distorted by the presence of the most infinitesimal piece of metal. Workers are required to divest themselves of all clothing in one room and then to pass in a single file through the door-casing, pausing momentarily for an approving nod from the instrument operator, thence to pass to a dressing room to don their work clothes. This procedure is repeated each time the men pass to and from work. At intervals the work clothes are burned in a retort to recover any particles of metal ore that may have become lodged in the seams of the clothing.

After months of operation, the company officials claim that no matter what artifice the mind may conceive to conceal the precious metals, the device has yet to fail in its detection.

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GERMAN RESTRICTIONS

BERLIN: According to an official bulletin from the Reich's Music Chamber, the German government has more than 6,990,750 subscribers. Approximately one-half million listeners are not required to pay the tax of 2 Marks (80c) levied each month; those exempt are the jobless who have no dependents and those who earn nothing at all.

Broadcasting restrictions are such that German propaganda has preference over any other broadcasts, and it is quite common to have an excellent program interrupted by political "lather." Jewish music is absolutely banned, and Negro so-called "jazz" is placed in the same category—modern dance rhythm is considered moronic and degrading. German military music, Bavarian peasant tunes and Tyrolean yodels are etherized 99.9% of the time stations are on the air—the remaining .1% is probably for time out.

It is reported that German radio technicians practically force the sale of the "Volksempsaenger" (peoples radio), a receiver which sells for 76 Marks ($30). The receiver incorporates such a design that it is almost impossible to pick-up non-German programs.

An oddity in Germany is that news broadcasts and timely "flashes" are sometimes broadcast one to three days after the information has been gathered. Reports state that listeners are apparently satisfied! (Broadcasters in U. S. take note.)

◆

DEVELOPMENTS IN CHECHO-SLOVAKIA

PRAGUE: As yet, short-wave programs are not broadcast in Czechoslovakia. However, a short-wave broadcasting station is nearing completion in Pobebrady (about 30 miles east of Prague). The station is being equipped by the British Marconi Company for wavelengths from 13 to 100 meters. One of the purposes of this station is to reach the Czechs and Slovaks in the United States. The definite wavelength of the Podebrady station has not yet been determined and, although the equipment is fully installed, program broadcasting is scheduled to begin in May 1936. Broadcasts to the United States and other overseas countries will consist of snappy and interesting programs of a maximum length of 1 to 2 hours which will be transmitted around 2 or 3 A.M. Central European Time, making use of Marconi steel band records for the transmissions. The station will also be used for telegraphic purposes and for simultaneous broadcast with other stations.

Television: Czechoslovakia, as a small country, is waiting for the larger nations to conclude the experimental work with television before tackling the problem directly. It is believed that no serious effort will be made in this country to commercialize and use television until a reliable, synchronized receiver can be retailed in the neighborhood of $100 to $120. It is felt that this price limit will be necessary to make the erection of transmitting stations (with short visibility range) a paying proposition. Another obstacle in the development of television is the policy of the local Government not to permit broadcast advertising and to hold to the radio fee scheme. Thus, private initiative in the selection of programs and in the popularization of both radio and television equipment is held in check and, moreover, the accumulation of capital reserves for research work and scientific development is made virtually impossible. (Commercial Attache Sam E. Woods, Prague).

◆

STEEL-TAPE RECORDING USED IN ENGLISH BROADCASTS

LONDON: The British Broadcasting Company records programs on magnetized steel-tape for use in their short-wave transmitters so that listeners in far-away Australia, due to the difference in time, may enjoy programs of English origin which were broadcast while Australians were sleeping.

The recording apparatus is of the Lorenz A. G. manufacture, a German product. The tape is about 3 mm. wide and about 0.8 mm. thick. It is of very high quality. The tape is wound on drums, similar to motion picture reels, and it passes through a magnetizer co-ordinated with sound oscillations; in other words, the magnetic sound recording principle is based on the fixation of sound oscillations, converted into electric oscillations, on a steel-tape by magnetism. The tape is long enough to record a 30-minute program, and can be extended by lengthening or by immediate connection with other steel-tape drums. The recording lasts indefinitely, or it can be demagnetized and the same

(Turn to page 144)

QUERIES

"REVERSED HARMONIC" EFFECTS

Question Number 4.

This is a general question that has been asked by several readers. We are all familiar with the usual harmonic effect—that of receiving a low-frequency station at a higher frequency that is some multiple of the lower frequency. For instance, a broadcasting station operating on 250 meters, or 1200 kilocycles, may, through improper operation, radiate a powerful second harmonic and be heard at 2400 kc—right in the police band. However, the reverse is rather an unusual phenomenon. One will seldom receive a police station on the long-wave broadcast band—or experience any similar reversal of the harmonic effect.

R. A. C., an amateur in Canajoharie, N. Y., writes: "I have noticed a peculiar phenomenon with my transmitter and receiver. On many occasions I work duplex with a neighboring Ham—he transmitting in the 40-meter band, and I in the 20-meter band. I discovered, accidentally, that I could monitor my 14-megacycle transmitter on the 7-mc band! Of course I realize that there would be nothing uncommon about monitoring a 40-meter transmitter on 20 meters—but how come I get my 20-meter transmitter on 40 meters? Another funny thing about it is I can monitor only code—not 'phone!"

Answer.

"R. A. C." has put his finger on the answer in his observation that he can hear the "reversed harmonic" only on code. In receiving code he normally has his receiver oscillating— in all probability, a t-r-f circuit with a regenerative detector. Such detectors, when oscillating, are rich in harmonics, which necessarily exist in the plate circuit of the detector. Regardless of shielding and selectivity, it is almost certain that some signal from the powerful transmitter located only a few feet away will find its way to the detector circuit, and a beat will be heard between this signal and the second harmonic of the oscillating detector.

This effect, incidentally, provides an interesting and practical method of checking higher frequencies against lower frequency standards. Higher harmonics than the second can be used, but, needless to say, the harmonic must be identified. The calibration of the receiver itself should not be employed in making this check if high accuracy is necessary, due to the fact that when regeneration is pushed sufficiently to produce a generous supply of harmonics, the tuning dial may be slightly off calibration. The actual frequency of the receiver should be checked against a frequency meter after tuning to zero beat.

THE primary purpose of the Queries Dept. is to solve the technical and semi-technical problems of our readers who feel they require such assistance. However, questions, so long as they are related to radio, need not be of a technical nature. Every question will be answered personally—by mail. A self-addressed and stamped envelope should be included. Rather than publish the answers to many questions each month—in a necessarily abbreviated form — we shall select only one or two of general interest which will be elaborated upon and answered in detail. These questions will be numbered, an index will be published periodically, and, in time, your files of this department should prove a valuable reference work.

You may ask as many questions as you wish. Aside from exceptional instances, this service is free to all readers, subscribers or otherwise. Where special circuits are required, or considerable research involved, the inquirer will be sent an estimate of the cost before the work is started.

This effect will seldom be encountered with a superheterodyne, due to superior selectivity, usually better shielding and the fact that a correct frequency harmonic from the beat-frequency oscillator, which beats against the i-f, would be too high—therefore too weak—to be usable. However, the superheterodyne oscillator will occasionally generate the necessary harmonics which, under propitious conditions, will mix with the local signal. Under such circumstances, it should be possible to monitor 'phone as well as c-w. This type of oscillator can be made to set up more powerful harmonics by over-biasing the oscillator tube.

It is less practical to use this effect with a super for checking higher frequencies. However, when tuned to zero beat, the higher frequency will be close to the sum of the frequency to which the super is tuned and the intermediate frequency multiplied (the sum) by the number of the harmonic (assuming that the super-het oscillator frequency is higher than the signal frequency) to which product is added the intermediate frequency. As implied, this check is only an approximation. However, greater accuracy will obtain if the beat-frequency oscillator is tuned exactly to the intermediate frequency, and it is established whether the oscillator harmonic is beating above or below the higher frequency signal.

OFF-FREQUENCY RECEPTION

Question Number 5.

G. J. K. of the Bronx, N. Y., reports the same effect but caused by a somewhat different phenomenon. "I purchased an Emerson Model 36, which is a five-tube superheterodyne. I use no aerial—only a ground—as I seem to obtain better results without the antenna. However, that is not my problem.

"This Emerson is supposed to tune from 540 to 3200 kc in two bands. Dialing on the short-wave band, I was surprised to receive stations way above the frequency range of my receiver. For instance. I received stations W1XK, that is on 9570 kilocycles, WEA, that is around 10,058 [WEA, Rocky Point, N. Y., transmits on 10,610 kilocycles—Ed.] and W2XAF on 9530 kilocycles. I receive these stations quite consistently, and I should like to know what is making my set, which tunes from 540 to 3200 kilocycles, receptive to these much higher frequency signals. I receive these stations between 2700 and 3200 kc."

Answer.

It is fairly obvious that the third harmonic of the oscillator is beating within the intermediate frequency of these higher frequency stations. The intermediate frequency of the Emerson 36 is 456 kc. This would place the oscillator frequency range, when the receiver is tuned from 2700 to 3200 kc, at from 3156 to 3656 kilocycles, with the third harmonic range from 9468 to 10,968. Assuming a fairly straight tun-

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RADIO PROVING POST

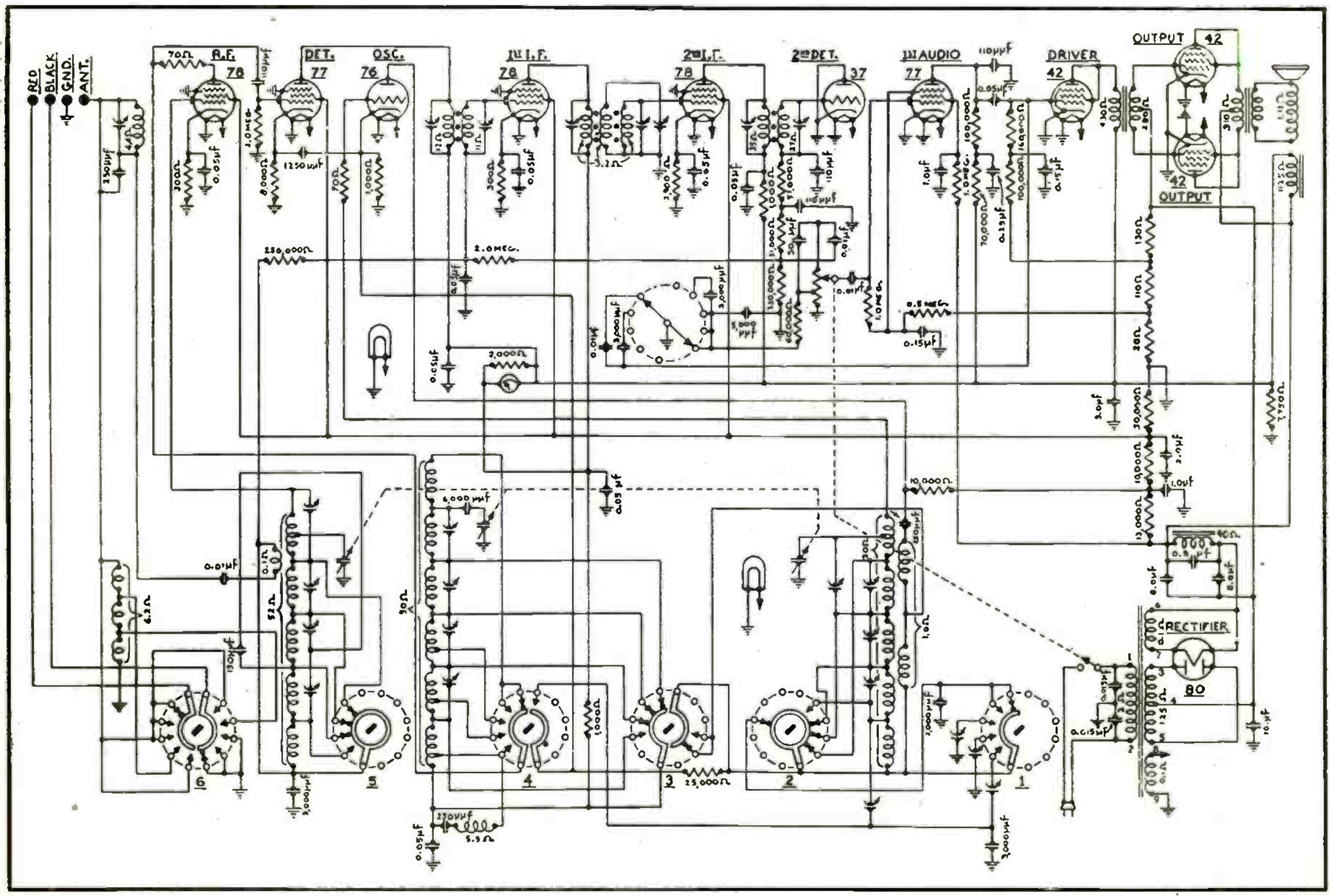
THE PHILCO MODEL 116-B

THE PHILCO 116-B table model receiver employs a total of eleven glass-type tubes in a superheterodyne circuit. There is a radio-frequency amplifier stage, using a type 78, which functions on all bands. This tube feeds a type 77 which is employed as the first detector or mixer. A type 76 tube is used as the conversion oscillator. The 77 mixer is followed by two stages of intermediate-frequency amplification, both of these stages using type 78 tubes. The second detector and automatic volume control tube is a type 37 which is connected to function as a diode. The rectified signal output of this tube is amplified in an audio frequency stage employing a type 77 tube. This tube is resistance coupled to a type 42 audio-frequency driver which is coupled by a transformer to the grids of two type 42 tube connected as triodes and operated Class AB push-pull. The output of these tubes to the dynamic loudspeaker is 10 watts.

Receiver Controls

The receiver is illustrated in Fig. 1. The lower left knob is the volume control and On-Off switch. The center knob is the waveband selector switch, which has five positions. The lower right knob is the program control. This also has five positions. The double knob in the center of the panel, directly below the tuning scale, is the station selector.

The tuning scale carrying the calibrations for the five separate wavebands is indirectly illuminated from the rear. The scale itself moves rather than the pointer so that the calibration readings are always in a vertical position and in proper line with the eye. The five separate scales are arranged one above the other, the lowest scale, which has the



Circuit diagram of the Philco Model 116-B.

shorter arc, being the lowest frequency or highest wavelength scale.

A rotation of the waveband selector switch alters the tuning range of the receiver. There is an arrow of bright light that automatically ascends or descends in a vertical direction as the waveband selector switch is turned. The arrow of light comes to rest on the waverange scale to which the receiver is set by the selector switch. The pointer of light remains in this position, and in tuning the receiver from station to station in the selected wave-length, the dial scale travels across the arrow of light.

The lowest, or long-wave weather forecast band, extends from 150 to 390 kc. The second, or standard broadcast band, extends from 540 to 1500 kc. The third range, extending from 1.5 to 4.1 megacycles, covers police and amateur bands. The fourth range extending from 4.1 to 10 megacycles, covers the night-time short-wave bands. The fifth range covers the day-time bands from 9.7 to 22.5 megacycles.

The larger of the two tuning knobs in the center of the panel is the high-speed control, used for tuning in the weather or standard broadcast bands, or for rapid change from one end of a scale to the other. The ratio of this main drive is 10 to 1. The smaller knob is the slow-speed control, having a ratio of 80 to 1, used for tuning in the short-

wave bands and for making precise tuning adjustments in any of the bands.

Shadow Tuning Indicator

Directly above the tuning scales, and enclosed by the scale escutcheon, is the shadow tuning meter. The screen of this meter is lighted from the rear by a small projector, and with the receiver in operation, but tuned between stations, the center of this illuminated screen is occupied by a broad shadow band. As the receiver is brought into resonance with a signal, the width of this band decreases. The receiver is tuned to exact resonance with the frequency of the desired signal when the shadow band is narrowest. Since this meter functions on the signal carrier, the width of the shadow when the receiver is tuned to resonance with the signal is some indication of the signal strength. For the same reason, the shadow width will indicate signal fading for, with the receiver tuned to exact resonance, the width of the shadow band will increase as the signal fades and decrease as the signal strength increases. A fading signal is not, of course, noticeable otherwise—unless the fading is very deep—as the automatic volume control in the receiver maintains the volume output at a constant level. The main purpose of the shadow tuning meter, however, is to inform the listener when the receiver is tuned to exact resonance with the incoming signal. This prevents mis-tuning and its consequent poor tone quality.

The program control knob to the right of the waveband selector switch is not continuously variable. Instead it has five steps or positions, each step or position being suitable for some particular type of reception. The lowest step provides mellow tone. The next step provides brilliant tone. The third step is for speech. The fourth step is for normal foreign reception, and the fifth step for noise reduction during reception of foreign stations. Each step has been worked out to have the proper balance of audio frequencies for the types of reception enumerated.

Operation Report

The two tuning control knobs are just about perfect. The high-speed and the slow-speed ratios are just what they should be to make tuning easy on all bands. Both knobs are minus play and backlash and are positive in action. The slow-speed knob works about as easily as the volume control knob.

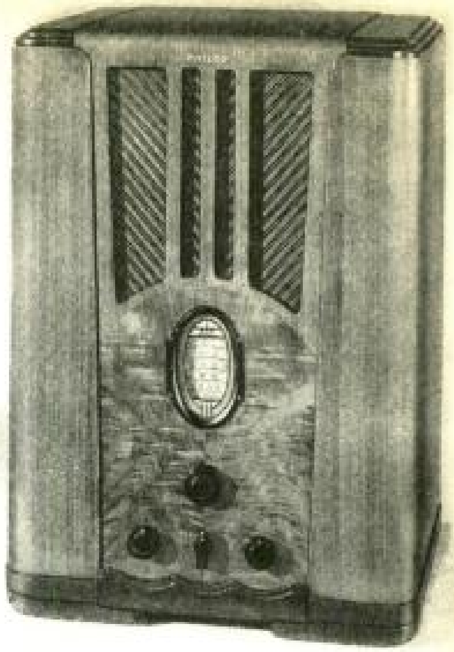
The dial scales have what one might term a "high readability factor." Prolonged tuning does not induce eye strain, and there are a sufficient number of clear-cut calibrations to make station logging an easy matter.

The shadow tuning meter is quite sensitive and operates effectively on most any signal slightly above the noise level. It is a distinct help in tuning, and since it indicates the presence of practically every station, silent tuning is possible.

The receiver is well calibrated: stations are found where they should be on the tuning scales. Most of them are right on the nose. The various amateur, police and short-wave broadcast bands are marked off on the scales so that they are easy to find.

The receiver has good sensitivity and selectivity. The image ratio could be a bit better than it is on the short-wave bands, but on the whole it is satisfactory. The automatic volume control action is also good.

There is no hum from the loudspeaker and no blasting on high volume levels.



Front panel view of the Philco Model 116-B.

Tone quality is better than excellent for a table model receiver: considering the size of the speaker and the baffle, the tone is really remarkable. No doubt much of this is due to rubber cushioning of chassis and components and to the semi-fixed biased Class AB power output stage in the receiver.

The Receiver Circuit

The circuit of the Model 116-B is shown in Fig. 1. There are a number of points of interest here.

There is a wavetrap in the antenna circuit for the purpose of eliminating any possible interference from commercial code stations operating at frequencies at or near to the frequency to which the i-f amplifier stages are tuned.

The various sections of the waveband selector switch have additional contact points for shorting unused coils. This arrangement presents the possibility of there being dead spots in the wave-range of the receiver.

The second intermediate-frequency transformer has three windings instead of the usual two. This arrangement provides greater selectivity without introducing sideband cutting and consequent reduction in tonal range.

Automatic volume control is placed on the radio-frequency amplifier tube and on the first intermediate-frequency amplifier tube. The manual volume control is of the compensated type; that is, low tones are maintained at low volume positions of the control knob.

All the audio-frequency amplifier tubes—the 77 and the three type 42 tubes—are semi-fixed biased. This arrangement provides a greater undistorted volume output.

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In Writing For Veries . . .

ADDRESSES OF PRINCIPAL SHORT-WAVE STATIONS BY COUNTRY

AFRICA

Call	Address
CNR	Director General des Postes, Rabat, Morocco.
CR6AA	Estacao Radio Difusora, Caixa Postal 103, Lobito. Angelo, Portuguese West Africa.
ETA-ETB ETD-ETG	Thore Bostrom, Chief Engr., Ministere Postes Intercontinental Radio Station, P. O. Box 283, Addis Ababa, Empire D'Ethiopia.
OPL-OPM	Radio Leopoldville, Congo Belge, Africa.
SUV-SUX	Post Office Box 795, Cairo, Egypt.
VQ7LO	P. O. Box 777, Nairobi, Kenya Colony, Africa.
ZSS	Overseas Communications, Kodak House, Shortmarket St., P. O. Box 962, Capetown. So. Africa.
ZTJ	African Broadcasting Co., Ltd., P. O. Box 4559, Johannesburg, Transvaal, South Africa.

ASIA, OCEANIA AND FAR EAST

Call	Address
CQN	Government Broadcasting Station CQN, Postmaster General, Post Office Bldg., Macoa, (Portuguese), China.
FZS	Postale Boite 238, Saigon, Indo-China.
HSJ-HSP	Government Post & Telegraph, Radio Technical Section, Bangkok, Siam.
Java Stations	H. Van der Veen, Engineer, Java Wireless Stations, Bandoeng, Java.
"JV" & "JZ" Stations	International Wireless Telephone Company of Japan, Osaka Bldg., Kojimachiku, Tokio, Japan.
"JY" Stations	Radio JYR, Kemikawa-Cho-Chiba, Ken, Japan.
KAY et al.	Philippine Long Distance Telephone Co., Manila, P. I.
PMY	Radio Station PMY, Nillmy Bldg., Bandoeng, Java, Netherlands Indies.
RV15	Far East Radio Station RV-15, Khabarovsk, U.S.S.R.
VK2ME	Amalgamated Wireless Ltd., Wireless House, 47 York St., Sidney, N.S.W. Australia.
VK3LR	Australian Broadcasting Commission, GPO Box 1686, Melbourne, C. I. Australia.
VK3ME	Amalgamated Wireless Ltd., P. O. Box 1272-L, Melbourne, Australia.
VPD	Amalgamated Wireless, Ltd., Suva, Fiji Islands.
VUC	Indian State Broadcasting Service, 1 Garstin Place, Calcutta, India.
VUY-VUB	Indian State Broadcasting Service, Irwin House, Sprott Road, Ballard Estate, Bombay, India.
XGW	Radio Administration, Sassoon House, Shanghai, China.
YBG	Radio Service, Serdangweg 2, Sumatra, Dutch East Indies.
YDA	H. Van der Veen, Engineer, Java Wireless Stations, Bandoeng, Java.
ZBW	Station ZBW, Hong Kong Broadcasting Committee, P. O. Box 200, Hong Kong, China.
ZGE	Radio ZGE, Kuala Lumpur, Malaya States.
ZHI	Radio Service Company, Broadcast House, 2 Orchard Road, Singapore, Malaya.
ZHJ	Radio Station ZHI, Radio Society of Penang, Penang, Malay Straits.
ZLT-ZLW ZLR	Supt. Post & Telegraph, GPO, Wellington, New Zealand.

CANADA

Call	Address
CGA-CJA, et al.	Marconi Station, Drummondville, Quebec, Canada.
CJRX-CJRO	Royal Alexander Hotel, Winnipeg, Manitoba, Canada.
VE9BJ	Capitol Theatre, St. Johns, N. B. Canada.
VE9CS	743 Davie St., Vancouver, B. C. Canada.
VE9DN	Canadian Marconi Co., Box 1690, Montreal, Quebec, Can.
VE9CA	Toronto General Trusts Building, Calgary, Alberta, Canada.
CRCX	Rural Route No. 4, Bowmanville, Ontario, Canada.
VE9HX	Post Office Box 998, Halifax. N. S., Canada.

CUBA, MEXICO, CENTRAL AMERICA AND WEST INDIES

Call	Address
CMA-3 CMB-2	Cuba Transatlantic Radio Corp., Apartado No. 65, Havana, Cuba.
CO9GC	Laboratorio Radio-Electrico, Grau y Caminero, Apartado 137, Santiago, Cuba.
CO9JQ	Estacion Experimental de Onda Corta-CO9JQ, Calle del General Gomez, No. 4, Camaguey, Cuba.
CO9WR	P. O. Box 85, Sancti-Spiritus, Santa Clara, Cuba.
COCO	Post Office Box 98, Havana Cuba.
COCD	"La Voz del Aire, S. A.", P. O. Box 2294, 25 y. g. Vedado, Havana, Cuba.
COCH	Estacion COCH, Calle B No. 2 Vedado, Havana, Cuba.
HI1A	Radiodifusora HI1A "La Voz del Yaque," Santiago de los Caballeros. R. D.
HI3C	Radiodifusora HI3C, Sr. Roberto Bernado, Prop., La Ramona. R. D.
HI3U	Radiodifusora HI3U, Puerto Plata, R. D.
HI4D	Radiodifusora HI4D, "La Voz de Quisqueya," Dominican Republic.
HI4V	Radio HI4V La Voz de la Marina, Santo Domingo. R. D.
HI5E	Radiodifusora Ozama, Santo Domingo, R. D.
HI5N	Radio HI5N, La Voz del Almacen Dominicano, Santiago de los Caballeros, R. D.
HH2T HH2S	Societe Haitienne de Radiodiffusion, P. O. Box 103, Port-au-Prince, Haiti.
HH3W	Radiodifusora HH3W P. O. Box A-117, Port-au-Prince, Haiti.
HIH	Radio HIH, "Las Voz del Higuamo," San Pedro de Macoris, R. D.
HIL	Radio HIL, Apartado 623, Santo Domingo City, R. D.
HIX	Radio HIX, J. R. Saladin, Director of Radio Communication, Santo Domingo, R. D.
HI1J	Radiodifusora HI1J, Apartado 204, San Pedro de Macoris. R. D.
HIT	La Voz de la RCA-Victor, Apartado 1105, Santo Domingo, R. D.
HIZ	Radiodifusora HIZ, Calle Duarte No. 68, Santa Domingo, R. D.
HP5B	Radio HP5B, P. O. Box 910, Panama City. Panama
HP5F	La Voz de Colon, Hotel Carlton, Colon, Panama.
HP5J	La Voz de Panama, Apartado 867, Panama City, Panama.
TGS	Radio TGS. Casa de Presidencial, Guatemala City, Guatemala.
TGX	Radiodifusora TGX, Director M. A. Mejicano Novales, 11 Avenue N. 45, Guatemala City, Guatemala.
TGW	Radiodifusora Nacional TGW, Republic de Guatemala.
TG2X	Direccion general de la Polica Nacional, Guatemala City, Guatemala.
TIPG	Radio TIPG, Perry Girton, Prop., Apartado 225. San Jose. Costa Rica, C. A.
TI8WS	Radio TI8WS, "Ecos de Pacifico, Sr. Abel Salazar F, Apartado 75, Puntarenas, Costa Rica.
TIEP	"La Voz del Tropico," Apartado 257, San Jose, Costa Rica, C. A.
TIGPH	Radiodifusora TIGPH "Alma Tica." Apartado 775, San Jose, Costa Rica.
TIRCC	Radioemisora Catolica Costaricense, Apartado 1064, San Jose, Costa Rica, C. A.
HRN	Radio HRN, La Voz de Honduras, Tegucigalpa. Honduras
HRP1	Manuel Escota, Director y Gerente, San Pedro Sula, Honduras.
VPN	Station VPN, Nassau, Bahama Island.
WTDV-WTDX	Donald S. Boreham, Supt. of Public Works, St. Thomas, Virgin Islands.
WTDW	H. N. McKenzie, Supt. of Public Works, Christiansted, St. Croix, Virgin Islands.

XAM	Director General de Correos, Merida, Yucatan, Mexico.
XBJQ	Radiodifusora XBJQ, P. O. Box 2825, Mexico D. F., Mexico.
XDA-XDC	Secretaria de Communicaciones, Mexico, D. F.
XEBT	El Buen Tono, S.A., Apartado 79-44, Mexico, D. F.
XECR	Estacian XECR Secretaria de Relaciones Exteriories, Mexico, D. F.
XECW	Radio XECW, Del Caballero Santokan, Bajio 120, Mexico, D. F.
XEFT	Radio XEFT, La Voz de Vera Cruz, Av. Independencia 28, Vera Cruz, Mexico
XEUW	Radiodifusora XEUW. Av. Independencia 98, Vera Cruz, Mexico.
XEME	Radiodifusora XEME. Calle 59 Num. 517, Merida, Yucatan, Mexico.
XEVI	Estacion Difusora XEVI, P. O. Box 2874, Mexico, D. F.
XEXA	Secretaria de Educacion Publica, Mexico, D. F.
YNA	Tropical Radio Telegraph, Managua, Nicaragua, C. A.
YNIGG	La Voz de Los Lagos; Radiodifusora YNIGG, Managua, Nicaragua, C. A.
YNLF	Radiodifusora YNLF, c/o Ing, Moises Le Franc Calle 15 de Set No. 206, Managua, Nicaragua.
YNVA	Radiodifusora YNVA, Managua. Nicaragua.

EUROPE

Call	*Address*
2RO	5 Via Montello, Rome, Italy
CSL	Radio CSL, Emissora National, Lisbon, Portugal.
CT1AA	Antonio Augusto de Aguair, 144, Lisbon, Portugal.
CT1CT	Oscar G. Lomelino, Rua Gomez Freire 79-2 D, Lisbon, Portugal.
CT1GO	Portugese Radio Club, Parede, Portugal.
SPW	Radio SPW, Polski Radio Warsaw, Warsaw, Poland.
DAF	Hauptfunkstelle Nordeich, Norden-Land, Germany.
DJA, et al.	German Short Wave Station, Broadcasting House, Berlin, Germany.
Dutch Phones	Parkstaat 29, S'Gravenhage, Holland.
EAQ	P. O. Box 951, Madrid, Spain.
EA8AB	Radio Club Tenerefe, Alvarez de Lugo 1, Santa Cruz de Tenerife, Canary Islands.
EHY-EDM	Piy Margall 2, Madrid, Spain.
English Phones	Engineer-in-Chief's Office (Radio Branch) G.P.O. Armour House, London, EC1.
English Ships	Connaught House, 63, Aldwych, London W.C. 2, England.
TFJ	Icelandic State Broadcasting Service, P. O. Box 547, Reykjavik, Iceland.
French Phones	166 Rue de Montmartre, Paris, France.
G6RX	Rugby Radio Hillmorton, Warwickshire, England.
GSA-GSH, et al.	British Broadcasting Corporation, Broadcasting House, London, W.1, England.
HAS-HAT	Director Radio, Hungarian Post, Gyali St. 22, Budapest, Hungary.
HB9B	Radio Club, Box 1, Basle, Switzerland.
HBL-HBP et al.	Information Section, League of Nations, Geneva, Switzerland.
HVJ	Radio HVJ, Castine, Pio IV, Vatican City, Vatican.
IAC	Coltano Radio, Piza, Italy.
IRM-IRW IRGIQA	Italo Radio, Via Calabria N. 46/48, Rome, Italy.
LKJ1	Ministere Du Commerce, Administrator des Telegraphes, Oslo, Norway.
OER2	Radio OER2, Vienna, Austria.
ORK-ORG	Director de Communications, Bruxelles, Belgium.
OXY	Statsradiofonien Heibergsgade 7, Copenhagen, Denmark.
PCJ	Philips Radio PCJ, Eindhoven, Holland
PHI	Phillips Radio PHI, Huizen, Holland.
PI1J.	Radio Station PI1J, Dr. M. Hellingman, Owner and Operator, Dordrecht, Holland.
Pontoise	Minister des Postes, 193 Rue de Grenelle, Paris, France.
RNE-REN RV59	Radio Centre, Solianka 12, Moscow, U.S.S.R.

SOUTH AMERICA

Call	*Address*
CEC	CIA Internacional de Radio, Casilla 16-D. Santiago, Chile.
CB960	Radiodifusora CB960, Casilla 1342, Santiago, Chile.
CP5	Radio CP5, Casila 637, La Paz, Bolivia.
El Prado	Apartado 98, Riobamba, Ecuador.
HC2AT	Radiodifusora HC2AT, P. O. Box 872, Guayaquil, Ecuador.
HC2ET	Radiodifusora del Telegrafo, Casilla 249, Guayaquil, Ecuador.
HC2CW	Radiodifusora HC2CW Casilla 1166, Guayaquil, Ecuador.
HC2JSB	Ecuador Radio Station HC2JSB, Juan S. Behr, Prop., Guayaquil, Ecuador.
HC2RL	P. O. Box 759, Guayaquil, Ecuador.
HCJB	Casilla 691, Quito, Ecuador.
HCK	Radiodifusora Del Estado, HCK, Quito, Ecuador.
HJA7	Radio HJA7, Cucuta, Colombia.
HJ1ABB	Apartado 715, Barranquilla, Colombia.
HJ1ABC	Radiodifusora HJ1ABC La Voz de Quibdo, Quibdo, Columbia
HJ1ABD	Estacion HJ1ABD, Cartagena, Colombia.
HJ1ABE	Apartado 31, Cartagena, Colombia.
HJ1ABG	Apartado 674, Barranquilla, Colombia.
HJ1ABJ	"La Voz de Santa Marta," Radio HJ1ABJ, Santa Marta, Colombia.
HJ1ABK	Radiodifusora HJ2ABK, Apartado 580, Barranquilla, Colombia.
HJ2ABA	"La Voz Del Paiz," Tunja, Boyaca, Colombia.
HJ2ABC	Pompilio Sanchez, Cucuta, Colombia.
HJ2ABD	Hector McCormick Prop., Radiodifusora HJ2ABD, Calle 2A #1205, Bucaramanga, Colombia.
HJ3ABD	Colombia Broadcasting, Apartado 509, Bogota, Colombia.
HJ3ABF	Apartado 317, Bogota, Colombia.
HJ3ABH	"La Voz de La Victor," Apartado 565, Bogota, Colombia.
HJ3ABI	Apartado 513, Bogota, Colombia.
HJ4ABA	Emisora HJ4ABA, "Ecos de la Montana," Medellin, Colombia.
HJ4ABB	Radio Manizales, Apartado 175, Manizales, Colombia.
HJ4ABC	Radiodifusora HJ4ABC "La Voz de Pereira," Pereira-Caldas, Colombia.
HJ4ABD	Radiodifusora HJ4ABD La Voz de Citia, Medellin, Colombia.
HJ4ABE	Radiodifusora de Medellin, Medellin. Colombia.
HJ4ABC	Radiodifusora HJ4ABC, Ecos del Combeina, Apartado 39, Ibague, Colombia.
HJ4ABL	"Ecos de Occidente," P. O. Box 50, Manizales, Colombia.
HJ5ABC	"La Voz de Colombia," Radiodifusora HJ5ABC, Cali, Colombia.
HJ5ABD	"La Voz del Valle," Cali, Colombia.
HJ5ABE	Radiodifusora HJ5ABE, Apartada 50, Cali, Colombia.
HJB	Marconi Telegraph Co., Apartado 1591, Bogota, Colombia.
HJN	Ministero de Correos y Telegraph, Bogota. Colombia.
HJU	La Voz del Pacifico, Buenaventura, Colombia.
HJY	All-America Cables, Inc., Bogota, Colombia.
HKE	Observatoria Nacional de San Bartolome, Bogota, Colombia.
HKV	Radiodifusora HKV, Radio Dept.—War Ministry, Government of Colombia, Bogota, Colombia.
LSN-LSL, et al.	Compania Internacional, 143 Defensa, Buenos Aires, Argentina.
LSX	Transradio Internacional, San Martin 329, Buenos Aires, Argentina.
OAX4D	Radiodifusora OAX4D, All- American Cables, Inc., (L. N. Anderson, Mgr.) Calle de San Antonio, 677; Casilla 2336, Lima, Peru.
OAX4G	Radiodifusora OAX4G, Roberto Grellaud, Avda. Abancay 915-923 Lima, Peru.
OCI-OCJ	All-America Cables, Inc., Lima, Peru.
PPU-PPQ, et al.	Caixa Postal 500 Rio de Janeiro, Brazil.
PRA8	Radio Station PRA8, Radio Club of Pernambuco; "The Voice of North," Pernambuco, Brazil.
PRF5-PSK	Comp. Radio Internacional Do Brazil, P. O. Box 709, Rio de Janeiro, Brazil.
VP3MR	Radio Station VP3MR, No. 1 Wellington St., Georgetown, British Guiana.
YV2RC	Apartado Correos 2009, Caracas. Venezuela

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SHORT-WAVE STATION LIST

STAR BROADCASTERS INDICATED BY BOLD TYPE; PHONE (P); EXPERIMENTAL (E); TIME, E.S.T.

KC	Meters	Call	Location	Time
21540	**13.92**	**W8XK**	**Pittsburgh, Pa.**	**7-9 A.M.**
21530	**13.93**	**GSJ**	**Daventry, England**	**6:00-8:45 A.M.**
21520	**13.94**	**W2XE**	**Wayne, N. J.**	**10-11 A.M. Daily**
21500	13.95	NAA	Washington, D. C.	(E) Time signals regularly
21420	14.01	WKK	Lawrenceville, N. J.	(P) Phones LSN-PSA daytime; HJY-OCI-OCJ irregular
21160	14.19	LSL	Buenos Aires, Arg.	(P) Phones GAA mornings; DFB-DHO PSE-EHY irregular
21140	14.19	KBI	Manila, P. I.	(P) Tests and relays P. M. irregular
21080	14.23	PSA	Rio de Janerio, Brazil	(P) Phones WKK-WLK daytime
21060	14.25	KWN	Dixon, Calif.	(P) Phones afternoon irregular
21020	14.29	LSN	Buenos Aires, Arg.	(P) Phones WKK-WLK daily; EHY, FTM irregular
20860	14.38	EHY	Madrid, Spain	(P) Phones LSM-PPU-LSY mornings
20860	14.38	EDM	Madrid, Spain	(P) Phones LSM-PPU-LSY mornings
20835	14.40	PFF	Kootwijk, Holland	(P) Phones Java days
20830	14.40	PFF	Kootwijk, Holland	(P) Phones Java days
20825	14.41	PFF	Kootwijk, Holland	(P) Phones Java days
20820	14.41	KSS	Bolinas, Calif.	(P) Phones Far East mornings
20380	14.72	GAA	Rugby, England	(P) Phones LSL mornings; LSY-LSM-PPU irregular
20040	14.97	OPL	Leopoldville, Belgian Congo, Africa	(P) Tests with ORG mornings and noon
20020	14.99	DHO	Nauen, Germany	(P) Phones PPU-LSM-PSA - LSL - YVR mornings
19987	15.01	CFA	Drummondville, Que.	(P) Phones North America irregular
19980	15.02	KAX	Manila, P. I.	(P) Phones KWU evenings; DFC-JVE A. M.; early A. M.
19820	15.14	WKN	Lawrenceville, N. J.	(P) Phones GAU mornings
19720	15.21	EAQ	Madrid, Spain	(P) Relays and tests in A.M.
19680	15.24	CEC	Santiago, Chile	(P) Phones OCI-HJY afternoons
19600	15.31	LSF	Buenos Aires, Arg.	(P) Phones and tests irregularly
19530	15.36	EDR2	Madrid, Spain	(P) Phones LSM-PPU-YVR mornings
19530	15.36	EDX	Madrid, Spain	(P) Phones LSM-PPU-YVR mornings
19520	15.37	IRW	Rome, Italy	(P) Phones LSM-PPU mornings. Broadcasts irregularly
19500	15.40	LSQ	Buenos Aires, Arg.	(P) Phones daytime irregularly
19355	15.50	FTM	St. Assise, France	(P) Phones LSM-PPU-YVR mornings
19345	15.52	PMA	Bandoeng, Java	(P) Phones PCK-PDK early mornings
19270	15.57	PPU	Rio de Janerio, Brazil	(P) Phones DFB-EHY-FTM mornings
19235	15.60	DFA	Nauen, Germany	(P) Phones HSP-KAX early mornings
19220	15.61	WKF	Lawrenceville, N. J.	(P) Phones GAS-GAU mornings
19200	15.62	ORG	Brussells, Belgium	(P) Phones OPL mornings
19140	15.68	LSM	Buenos Aires, Arg.	(P) Phones DFB-FTM-GAA-GAB mornings
18970	15.81	GAQ	Rugby, England	(P) Phones ZSS mornings
18960	15.82	WQD	Rocky Point, N. Y.	(E) Tests LSY irregularly
18950	15.83	HBF	Geneva, Switzerland	(E) Phones So. America mornings
18920	15.85	WQE	Rocky Point, N. Y.	(E) Program work; irregular
18910	15.86	JVA	Nazaki, Japan	(P) Phones and tests irregular with Europe
18890	15.88	ZSS	Kliphcuvel, So. Africa	(P) Phones GAQ-GAU mornings
18830	15.93	PLE	Bandoeng, Java	(P) Phones PCV mornings early. KWU evenings. Music at times mornings.
18680	16.06	OCI	Lima, Peru	(P) Phones CEC-HJY days; WKK-WOP noon
18620	16.11	GAU	Rugby, England	(P) Phones VWY-ZSS early A.M.; Lawrenceville, daytime
18545	16.18	PCM	Kootwijk, Holland	(P) Relays and phones Java early a.m.
18540	16.19	PCM	Kootwijk, Holland	(P) Relays and phones Java early a.m.
18535	16.20	PCM	Kootwijk, Holland	(P) Relays and phones Java early a.m.
18480	16.23	HBH	Geneva, Switzerland	(E) Relays to N. Y. mornings irreg.
18440	16.25	HJY	Bogota, Colombia	(P) Phones CEC-OCI noon; music at times
18410	16.29	PCK	Kootwijk, Holland	(P) Phones PLE-PMC early a.m.
18405	16.30	PCK	Kootwijk, Holland	(P) Phones PLE-PMC early A.M.
18400	16.31	PCK	Kootwijk, Holland	(P) Phones PLE-PMC early a.m.
18350	16.35	FZS	Saigon, Indo-China	(P) Phones FTK early mornings
18340	16.36	WLA	Lawrenceville, N. J.	(P) Phones GAS mornings
18310	16.38	GAS	Rugby, England	(P) Phones WLA-WMN mornings
18295	16.39	YVR	Maracay, Venezuela	(P) Phones DFB-EHY-FTM mornings
18270	**16.42**	**ETA**	**Addis Ababa, Ethiopia**	**Daily 7 A.M. - 3 P.M. Wednesdays 4:50-5:30 P.M.**
18250	16.43	FTO	St. Assise, France	(P) Phones LSM-LSY mornings
18220	16.46	KUS	Manila, P. I.	(P) Phones Bolinas nights
18200	16.48	GAW	Rugby, England	(P) Relays and phones N. Y. irreg.
18190	16.49	JVB	Nazaki, Japan	(P) Phones Java early mornings
18180	16.51	CGA	Drummondville, Que.	(P) Phones GBB mornings
18135	16.54	PMC	Bandoeng, Java	(P) Phones PCK-PCV and broadcasts early mornings irregular
18115	16.56	LSY3	Buenos Aires, Arg.	(E) Phones DFB-FTM GAA-PPU A. M.; evening broadcasts occasionally
18075	16.59	PCV	Kootwijk, Holland	(P) Phones PLE early mornings
18070	16.60	PCV	Kootwijk, Holland	(P) Phones PLE early mornings
18065	16.61	PCV	Kootwijk, Holland	(P) Phones PLE early mornings
18060	16.61	KUN	Bolinas, Calif.	(P) Phones Manila afternoons and nights
18040	16.63	GAB	Rugby, England	(P) Phones LSM noon
18020	16.65	KQJ	Bolinas, Calif.	(P) Phones afternoons; irregular
17980	16.69	KQZ	Bolinas, Calif.	(E) Tests and relays to LSY irreg.
17940	16.72	WQB	Rocky Point, N. Y.	(E) Tests with LSY mornings
17920	16.74	WQF	Rocky Point, N. Y.	(P) Phones Ethiopia irregular
17900	16.76	WLL	Rocky Point, N. Y.	(E) Relays to Geneva and Germany mornings
17850	16.81	LSN	Buenos Aires, Arg.	(P) Phones S. A. stations irreg.
17790	**16.86**	**GSG**	**Daventry, England**	**6-8:45 A.M. 9:00 A.M.-12:00 noon**
17780	**16.87**	**W3XAL**	**Bound Brook, N. J.**	**9 A.M., 5 P.M. daily**
17760	**16.89**	**W2XE**	**Wayne, N. J.**	**11 A.M.-1 P.M. Daily**
17760	**16.89**	**DJE**	**Zeesen, Germany**	**8:05-11:00 A.M. and experimental**
17750	16.91	IAC	Piza, Italy	(P) Phones and Tests to ships A.M.
17740	16.91	HSP	Bankok, Siam	(P) Phones DFA-DGH KAY early mornings
17710	16.94	CJA-3	Drummondville, Que.	(P) Phones Australia and Far East early A. M.
17699	16.95	IAC	Piza, Italy	(P) Phones and tests to ships A.M.
17545	17.10	VWY	Poona, India	(P) Phones GAU-GBC-GBU mornings
17520	17.12	DFB	Nauen, Germany	(P) Phones PPU-YVR KAY mornings
17480	17.16	VWY	Poona, India	(P) Phones GAU-GBC-GBU daytime
17260	17.37	DAF	Nordenland, Germany	(P) Phones ships mornings
17120	17.52	WOO	Ocean Gate, N. J.	(P) Phones ships daytime
17120	17.52	WOY	Lawrenceville, N. J.	(P) Phones England irreg.
17080	17.56	GBC	Rugby, England	(P) Phones ships daytime
16910	17.74	JZD	Nazaki, Japan	(P) Phones ships irregular
16305	18.39	PCL	Kootwijk, Holland	(P) Special relays and phones irreg.
16300	18.44	WLK	Lawrenceville, N. J.	(P) Phones England irreg.
16240	18.47	KTO	Manila, P. I.	(P) Phones JVE-KWU evenings
16214	18.50	FZR	Saigon, Indo-China	(P) Phones FTA-FKT early A.M.
16117	18.62	IRY	Rome, Italy	(P) Phones Cairo, Asmara and others, broadcasts music A. M. and early P. M.
16050	18.69	JVC	Nazaki, Japan	(P) Phones Hong Kong early A. M.

KC	Meters	Call	Location	Time
16030	18.71	KKP	Kahuku, Hawaii	(P) KWU afternoons and evening. Tests JVF - KTO - PLE mornings
15930	18.83	FYC	Pontoise, France	(P) Phones 9:00 A.M. and irreg.
15880	18.89	FTK	St. Assise, France	(P) FZR-FZS-LSM-PPU-YVR mornings
15860	18.90	JVD	Nazaki, Japan	(P) Phones Shanghai early A.M.
15860	18.90	CEC	Santiago, Chile	(P) Phones OCJ mornings
15810	19.02	LSL	Buenos Aires, Arg.	(P) Phones GAA mornings; PSE-PSF afternoons
15760	19.04	JYT	Kemikawa-Cho, Japan	(E) Tests KKW-KWE-KWU evenings
15740	19.06	JIA	Chureki, Japan	(P) Phones Nazaki early A.M.
15700	19.11	WJS	Hicksville, L. I., N. Y.	(P) Phones Ethiopia irregular
15670	19.15	WAE	Brentwood, N. Y.	(E) Tests afternoons
15660	19.16	JVE	Nazaki, Japan	(P) Phones PLE early A. M.; KTO evenings.
15625	19.20	OCJ	Lima, Peru	(P) Phones CEC daytime
15620	19.21	JVF	Nazaki, Japan	(P) Phones KWO-KWU after 4 P.M.
15595	19.24	DFR	Nauen, Germany	(E) Tests and relays mornings irreg.
15505	19.36	CMA-3	Havana, Cuba	(P) Phones and tests irregularly
15490	19.37	KEM	Bolinas, Calif.	(P) Phones Java and China; irregular
15475	19.39	KKL	Bolinas, Calif.	(P) Phones Manila and Japan; irregular
15460	19.41	KKR	Bolinas, Calif.	(P) Phones Manila and Japan irregular
15430	19.44	KWE	Bolinas, Calif.	(P) Tests JYK-JYT-PLE evenings
15415	19.46	KWO	Dixon, Calif.	(P) Phones JVF evenings
15410	19.47	Prado	Riobamba, Ecuador	5:00-7:00 P.M. Sunday
15370	19.52	HAS3	Budapest, Hungary	Sunday 9-10 A.M.
15360	19.53	DJT	Zeesen, Germany	11 P.M.-1 A.M.
15355	19.54	KWU	Dixon, Calif.	(P) Phones Japan, Manila and Java evenings
15340	19.56	DJR	Zeesen, Germany	1:30-3:30 A.M.
15330	19.56	W2XAD	Schenectady, N. Y.	2-3 P.M. Weekdays-Sunday 10:30 A.M.-4 P.M.
15305	19.60	CP7	La Paz, Bolivia	(E) Relays CP4 tests daytimes
15290	19.62	LRU	Buenos Aires, Argentina	(E) Tests 4-7 P. M.
15280	19.63	DJQ	Zeesen, Germany	12 A.M.-3 A.M.
15270	19.64	W2XE	Wayne, N. J.	1-6 P.M.
15260	19.66	GSI	Daventry, England	12:15 P.M.-5:45 P.M.
15252	19.67	RIM	Tashkent, U.S.S.R.	(P) Phones RKI early mornings
15243	19.68		Pontoise, France	7-11 A.M.
15220	19.71	PCJ	Eindhoven, Holland	Sunday 8:30-11:00 A.M. Tues. 3-6 A.M. Wed. 7-11 A.M.
15210	19.72	W8XK	Pittsburgh, Pa.	9 A.M.-7 P.M.
15200	19.74	DJB	Zeesen, Germany	3:50-11 A.M.
15180	19.76	GSO	Daventry, England	12:15-5:45 P.M.
15140	19.82	GSF	Daventry, England	9 A.M.-12 noon
15121	19.84	HVJ	Vatican City, Vatican	10:30-10:45 A.M.
15110	19.85	DJL	Zeesen, Germany	4-6:00 A.M.
15055	19.92	WNC	Hialeah, Fla.	(P) Phones daytime
15040	19.95	RKI	Moscow, U.S.S.R.	(P) Phones RIM early A.M.
15040	19.95	HIR	Santo Domingo, R. D.	(P) Phones WNC daytime
14980	20.03	KAY	Manila, P. I.	(P) Phones DFC-DFD-GCJ early A.M.; KWU evenings
14940	20.06	HJB	Bogota, Colombia	(P) Phones WNC-PPU YVQ days
14935	20.07	PSE	Rio de Janeiro, Brazil	(P) Phones LSL-WLK day irreg; EDM-EHY 8 a.m.
14920	20.11	KQH	Kahuku, Hawaii	(P) Tests irregularly
14910	20.12	JVG	Nazaki, Japan	(P) Phones Formosa irregular
14845	20.19	OCJ2	Lima, Peru	(P) Phones HJY and others daytime
14800	20.27	WQV	Rocky Point, N. Y.	(E) Tests Europe irreg.
14770	20.31	WEB	Rocky Point, N. Y.	(E) Tests with Europe; irregular
14730	20.37	IQA	Rome, Italy	(P) Phones Japan and Egypt; sends music at times
14710	20.39	IRG	Massawa, Eritrea, Africa	(P) Tests with JVH 5 to 7 A. M.
14690	20.42	PSF	Rio de Janerio, Brazil	(P) Phones LSL-WLK-WOK daytime
14653	20.47	GBL	Rugby, England	(P) Phones Nazaki, early A.M.
14620	20.52	EHY	Madrid, Spain	(P) Phones LSM mornings irreg.
14620	20.52	EDM	Madrid, Spain	(P) Phones PPU-PSA-PSE mornings
14600	20.55	JVH	Nazaki, Japan	(E) Phones DFB-GTJ-PCJ-TYB early mornings and B.C. music
14590	20.56	WMN	Lawrenceville, N. J.	(P) Phones England daytime
14550	20.60	HBJ	Geneva, Switzerland	(E) Relays to Riverhead daytime
14530	20.65	LSN	Buenos Aires, Arg.	(P) Phones PSF-WLK-WOK irreg.
14485	20.71	TIR	Cartago, Costa Rica	(P) Phones WNC daytime
14485	20.71	TIU	Cartago, Costa Rica	(P) Phones WNC daytime
14485	20.71	YNA	Managua, Nicaragua	Phones WNC daytime
14485	20.71	HPF	Panama City, Panama	(P) Phones Daytime
14485	20.71	HRM	Tela, Honduras	(P) Phones WNC daytime
14485	20.71	TGF	Guatemala City, Guatemala	(P) Phones WNC daytime
14470	20.73	WMF	Lawrenceville, N. J.	(P) Phones England daytime
14460	20.75	DZH	Zeesen, Germany	12-2 P.M.
14440	20.78	GBW	Rugby, England	(P) Phones Lawrenceville daytime
14410	20.80	DIP	Zeesen, Germany	(E) Experimental; 12-4:30 P. M.
14236	21.07	HB9B	Basle, Switzerland	Monday, Thursday, Friday 4-6 P.M.
14200	21.20	W10XFB	The Schooner "Morrissey"	(E) Irregular
14100	21.25	HJ5ABE	Cali, Colombia	11:00 A.M.-12 noon daily ex. Sun. 6:00-10:30 P.M.
13900	21.58	WOP	Rocky Point, N. Y.	(E) Test daytime
13820	21.70	SUZ	Cairo, Egypt	(P) Phones DFC-DGU-GBB daytime
13780	21.77	KKW	Bolinas, Calif.	(P) Special relays; tests afternoon and evening
13745	21.83	CGA-2	Drummondville, Que.	(P) Phones Europe irregular
13738	21.82	RIS	Tiflis, U.S.S.R.	(P) Tests with Moscow irregular
13720	21.87	KLL	Bolinas, Calif.	(P) Special relays; tests afternoon and evening
13690	21.91	KKZ	Bolinas, Calif.	(E) Tests Japan and Java early A. M.; days Honolulu
13667	21.98	HJY	Bogota, Colombia	(P) Phones CEC afternoons
13635	22.00	S.P.W.	Warsaw, Poland	11:30 A.M.-12:30 P.M.
13610	22.04	JYK	Kemikawa-Cho, Japan	(E) Tests irregular A.M.
13585	22.08	GBB	Rugby, England	(P) Phones CGA3-SUV-SUZ daytime
13560	22.12	JVI	Nazaki, Japan	(P) Phones Manchukuo irregularly
13465	22.28	WKC	Rocky Point, N. Y.	(E) Tests and relays; irregular
13435	22.33	WKD	Rocky Point, N. Y.	(E) Tests and relays; irregular
13415	22.36	GCJ	Rugby, England	(P) Tests with JVH afternoons
13390	22.40	WMA	Lawrenceville, N. J.	(P) Phones GAS-GBS-GBU-GBW daily
13380	22.42	IDU	Asmara, Eritrea, Africa	(P) Phones Italy; early A. M. and sends music
13345	22.48	YVQ	Maracay, Venezuela	(P) Phones WNC-HJB days
13285	22.58	CGA3	Drummondville, Que.	(P) Phones England days
13240	22.66	KBJ	Manila, P. I.	(P) Phones nights and early A. M.
13220	22.70	IRJ	Rome, Italy	(P) Phones Japan 5-8 A. M., and works Cairo days
13180	22.76	DGG	Nauen, Germany	(P) Relays to Riverhead days
13075	22.95	VPD	Suva, Fiji Islands	Mon. to Fri. inc. 12:30-1:30 A.M.
13020	23.04	JZE	Nazaki, Japan	(P) Phones ships irregular
13000	23.08	FYC	Paris, France	(P) Phones CNR mornings
12985	23.11	DFC	Nauen, Germany	(P) Phones KAY-SUV-SUZ early A. M.
12865	23.32	IAC	Piza, Italy	(P) Phones ships irregular
12840	23.36	WOO	Ocean Gate, N. J.	(P) Phones ships days
12830	23.37	HJC	Barranquilla, Colombia	(P) Phones HJB-HPF-WNC days
12830	23.38	HJA-3	Barranquilla, Colombia	(P) Phones HJB-HPF-WNC days
12830	23.38	CNR	Rabat, Morocco	Special broadcasts irregular.
12830	23.38	CNR	Rabat, Morocco	(P) Phones FYB-TYB-FTA irreg. days
12800	23.44	IAC	Piza, Italy	(P) Phones ships and tests Tripoli, irreg.
12780	23.47	GBC	Rugby, England	(P) Phones VWY early A.M.
12396	24.20	CT1GO	Parede, Portugal	Sun. 11:30 A.M.-1 P.M.; 7:15-8:30 P.M. Tues. to Fri. 7:15-8:30 P.M.
12394	24.21	DAF	Nordenland, Germany	(P) Phones ships irreg. mornings
12300	24.39	PLM	Bandoeng, Java	(P) Phones 2ME near 6:30 A.M.
12295	24.40	ZLU	Willmigton, N. Z.	(P) Phones ZLJ early A.M.
12290	24.41	GBU	Rugby, England	(P) Phones Lawrenceville days
12280	24.43	KUV	Manila, P. I.	(P) Phones early A.M.
12250	24.49	TYB	Paris, France	(P) Phones JVH-XGR and ships irreg.
12235	24.52	TFJ	Reykjavik, Iceland	(P) Phones England days
12235	24.52	TFJ	Reykjavik, Iceland	English broadcast each Sunday, 1:40-2:00 P.M.
12220	24.55	FLJ	Paris, France	(P) Phones ships irreg.
12215	24.56	TYA	Paris, France	(P) Algeria, days—"Inverted Speech"
12130	24.73	DJS	Zeesen, Germany	7-9 P.M.
12060	24.88	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings

KC	Meters	Call	Location	Time
12055	24.89	PDV	Kootwijk, Holland	(P) PLE-PLV-PMC early mornings
12050	24.90	PDV	Kootwijk, Holland	(P) PLE-PLV-PMC early mornings
12035	24.93	HBO	Geneva, Switzerland	(E) Relays programs & phones irreg.
12020	24.95	VIY	Rockbank, Australia	(P) Tests CJA6 early A.M. and evenings
12100	24.79	CJA	Drummondville, Que.	(P) Tests VIY early A.M. and evenings
12000	25.00	RNE	Moscow, U.S.S.R.	Sundays 6-7 A.M., 10-11 A.M. Wed. 6-7 A.M.
12000	2500	TGWA	Guatemala City, Guatemala	Daily Ex. Sun.-12-2 P.M. 8-9 P.M. 10 P.M.-12 A.M. Sunday 12 A.M.-5 A.M.
11991	25.02	FZS	Saigon, Indo-China	(P) Phones FTA-FTK early A.M.
11955	25.09	ETB	Addis Ababa, Ethiopia	Wednesday 4:50 - 5:30 P.M. and irregular
11950	25.11	KKQ	Bolinas Calif.	(P) Relays programs to Hawaii eve.
11940	25.13	FTA	St. Assise, France	(P) Phones FZS-FZR early A.M.
11935	25.14	YNA	Managua Nicaragua	(P) Cent. and S. A stations, days
11885	25.23		Pontoise, France	4-5 A.M., 11:30 A.M.-6 P.M.
11870	25.26	W8XK	Pittsburgh, Pa.	5-9 P.M.
11860	25.29	GSE	Daventry, England	9 A.M.-12 noon
11855	25.31	DJP	Zeesen, Germany	2-4 A.M.
11830	25.36	W2XE	Wayne, N. J.	6-10 P.M. Daily
11820	25.38	GSN	Daventry, England	2:15 A.M.-4:20 A.M.
11810	25.40	2RO4	Rome, Italy	8:15-9 A.M. 9:15-11 A.M. 11:30 A.M.-12:15 P.M.
11800	25.40	HJ4ABA	Medellin, Colombia	11:30 A.M.-1 P.M. 6:30-10:30 P.M.
11800	25.42	CO9WR	Sancti-Spiritus, Cuba	4-6 P.M. 9-11 P.M.
11795	25.43	DJO	Zeesen, Germany	5-7 A.M.
11790	25.43	W1XAL	Boston, Mass.	Sunday 3-4:45 P.M. Mon. to Fri. inc. 5-6 P.M.
11770	2549	DJD	Zeesen, Germany	11:35 A.M.-4:25 P.M.
11750	25.53	GSD	Daventry, England	2:15-4:20 A.M., 12:15-5:45 P.M., 6-8:05 P.M. 10-11:10 P.M.
11730	25.57	PHI	Huizen, Holland	Sat. & Sun. 8:30-11 A.M. Mon. Thurs. Fri. 830-10:30 A.M.
11720	25.60	CJRX	Winnipeg, Manitoba	Week days 8:00 P.M.-12 midnight; Sunday 3-10 P.M.
11713	25.62		Pontoise, France	6:15-9 P.M. 11 P.M.-1 A.M.
11680	25.68	KIO	Kahuku, Hawaii	(P) Phones Far-East early A.M.
11660	25.73	PPQ	Rio de Janerio, Brazil	(P) Phones WCG-WET LSX evenings
11660	25.73	JVL	Nazaki, Japan	(P) Phones Taiwan evenings
11570	25.93	HH2T	Port-au-Prince, Haiti	(P) Evenings; irregular
11538	26.00	XGR	Shanghai, China	(P) Tests irregularly
11500	26.09	XAM	Merida, Mexico	(P) Phones XDF-XDM XDR irreg.
11495	26.10	VIZ3	Rockbank, Australia	(P) Tests CJA4 early A.M.
11413	26.28	CJA4	Drummondville, Que.	(P) Phones VIZ3 early A.M.
11385	26.35	HBO	Geneva, Switzerland	(E) Phones and relays irregular
11275	26.61	XAM	Merida, Mexico	(P) Phones XDR-XDM irregular
11000	27.27	ZLT	Wellington, N. Z.	(P) Phones VLZ early mornings
11000	27.27	PLP	Bandoeng, Java	(P) Phones early A.M.; broadcasts 6:30-10 A.M.
11000	27.26	XBJQ	Mexico D. F., Mexico	8:15 P.M.-10:30 P.M. irregular
10975	27.35	OCI	Lima, Peru	(P) Phones CEC-HJY days
10975	27.35	OCP	Lima, Peru	(P) Phones HKB early evenings
10910	27.50	KTR	Manila, P. I.	(P) Phones DFC early A.M. irreg.
10850	27.63	DFL	Nauen, Germany	(P) Relays programs afternoons irreg.
10840	27.68	KWV	Dixon, Calif.	(P) Phones Japan, Manila, Hawaii, mornings
10790	27.80	YNA	Managua, Nicaragua	(P) Phones So. America days, irreg.
10770	27.86	GBP	Rugby, England	(P) JYS and XGR irreg.; Phones VLK early A.M. and eve.
10740	27.93	JVM	Nazaki, Japan	4-7:30 A.M. irregular 12-1 A.M. Daily Mon & Thurs. 4-5 P.M.
10675	28.10	WNB	Lawrenceville, N. J.	(P) Phones ZFB daytime
10670	28.12	CEC	Santiago, Chile	(P) Phones HJY-OCI daytime
10670	28.12	CEC	Santiago, Chile	Daily except Thurs. and Sat. 7-7:20 P.M. Thurs. and Sunday, 8:30-9:00 P.M.
10660	28.14	JVN	Nazaki, Japan	(P) Phones JIB early A.M.; Relays JOAK irreg.
10660	28.14	JVN	Nazaki, Japan	4-7:30 A.M. Irregular. Daily 12-1 A.M. Mon. & Thurs. 4-5 P.M.
10620	28.25	WEF	Rocky Point, N. Y.	(E) Relays program service irregularly
10620	28.25	EHX	Madrid, Spain	(P) Phones CEC and EHZ afternoons

KC	Meters	Call	Location	Time
10610	28.28	WEA	Rocky Point, N. Y.	(E) Tests Europe irreg.
10550	28.44	WOK	Lawrenceville, N. J.	(P) Phones LSN-PSF-PSH-PSK evenings
10535	28.48	JIB	Tawian, Japan	(P) Phones JVL-JVN early mornings
10520	28.52	VK2ME	Sydney, Australia	(P) Phones GBP-HVJ early A.M.
10520	28.52	VLK	Sydney, Australia	(P) Phones GBP-HVJ early A.M.
10520	28.52	CFA-4	Drummondville, Que.	(P) Phones: No A. M. days
10440	28.74	DGH	Nauen, Germany	(P) Phones HSG-HSJ-HSP early A.M.
10430	28.80	YBG	Medan, Sumatra	(P) Phones PLV-PLP early A.M.
10420	28.79	XGW	Shanghai, China	(P) Tests GBP-KAY early A.M.
10420	28.79	PDK	Kootwijk, Holland	(P) Phones PLV A.M. and special programs irreg.
10415	28.80	PDK	Kootwijk, Holland	(P) Phones PLV in a.m. and special programs irreg.
10410	28.82	PDK	Kootwijk, Holland	(P) Phones PLV in a.m. and special programs irreg.
10410	28.82	KES	Bolinas, Calif.	(P) Phones S. A. and Far East irreg.
10400	28.85	KEZ	Bolinas, Calif.	(P) Phones Hawaii and Far East irreg.
10390	28.87	KER	Bolinas, Calif.	(P) Phones Far East, early evening
10380	28.90	WCG	Rocky Point, N. Y.	(E) Special program service irreg.
10375	28.92	JVO	Nazaki, Japan	(P) Manchuria and Dairen early A.M.
10370	28.93	EHZ	Madrid, Spain	(P) Phones EHX daytime
10350	28.98	LSX	Buenos Aires, Arg.	Near 10 P.M. irregular. 6-7:15 P.M. daily
10335	29.03	ZFD	Hamilton, Bermuda	(P) Phones afternoons
10330	29.04	ORK	Brussels, Belgium	2:30-4:00 P.M.
10310	29.10	PPM	Rio de Janeiro, Brazil	(P) Tests New York and Buenos Aires evenings.
10300	29.13	LSQ	Buenos Aires, Arg.	(P) Phones GCA-HJY-PSH afternoons
10300	29.13	LSL	Buenos Aires, Arg.	(P) Phones GCA-HJY-PSH afternoons. Broadcasts irregularly
10290	29.15	DIQ	Zeesen, Germany	(E) Phone and pgm. service irreg.
10290	29.15	DIQ	Zeesen, Germany	Used irregularly.
10290	29.15	HPC	Panama City, Panama	(P) Phones C. A. and S. Am. daytime
10260	29.24	PMN	Bandoeng, Java	(P) Tests VLJ early A. M.; broadcasts 6:30-10 A. M.
10250	29.27	LSK3	Buenos Aires, Arg.	(P) "Inverted Speech" afternoons
10220	29.35	PSH	Rio de Janerio, Brazil	(P) Phones LSL-WOK evenings; special pgm. service irreg.
10170	29.50	RIO	Bakou, U.S.S.R.	(P) Phones RIR-RNE early A.M.
10169	29.50	HSG	Bankok, Siam	(P) Phones DGH early A.M. irreg.
10140	29.59	OPM	Leopoldville, Belg-Congo	(P) Phones ORK afternoons
10080	29.76	RIR	Tiflis, U.S.S.R.	(P) Phones RIO-RNE early A.M.
10070	29.79	EHY	Madrid, Spain	(P) Phones YVR afternoons
10055	29.84	ZFB	Hamilton, Bermuda	(P) Phones WNB daytime
10055	29.84	SUV	Cairo, Egypt	(P) Phones DFC-DGU-GCA and GCB daytime
10042	29.87	DZB	Zeesen, Germany	2-4 P.M.
10040	29.88	HJA3	Barranquilla, Colombia	(P) Tests early evenings irreg.
9990	30.03	KAZ	Manila, P. I.	(P) Phones JVQ-KWX-PLV early A.M.
9966	30.08	IRS	Rome, Italy	(P) Tests irregularly
9950	30.13	GBU	Rugby, England	(P) Phones WNA evenings
9930	30.21	HKB	Bogota, Colombia	(P) Phones CEC-OCP PSH-PSK afternoons
9930	30.21	HJY	Bogota, Colombia	(P) Phones LSQ afternoons
9890	30.33	LSN3	Buenos Aires, Arg.	(P) Phones WOK-WLK; broadcasts evenings irregular
9870	30.40	WON	Lawrenceville, N. J.	Phones and tests; Eng. irregularly
9870	30.40	JYS	Kemikawa-Cho, Japan	4-7 A.M. irregular
9860	30.43	EAQ	Madrid, Spain	Saturday 12.2 P.M. Daily 5:15 to 9:30 P.M.
9840	30.47	JYS	Kemikawa-Cho, Japan	(E) Tests irregular
9830	30.50	IRM	Rome, Italy	(P) Phones JVP-JZT-LSX-WEL mornings
9810	30.58	DFE	Nauen, Germany	(P) Relays and tests afternoons irreg.
9800	30.59	GCW	Rugby, England	(P) Phones Lawrenceville eve. and nights
9800	30.59	LSI	Buenos Aires, Arg.	(P) Relays very irreg.
9760	30.74	VLJ	Sydney, Australia	(P) Phones PLV-ZLT early A.M.
9760	30.74	VLZ	Sydney, Australia	(P) Phones PLV-ZLT early A.M.
9750	30.77	WOF	Lawrenceville, N. J.	(P) Phones GCU irreg.

KC	Meters	Call	Location	Time
9710	30.88	GCA	Rugby, England	(P) Phones LSL afternoons
9700	30.93	LQA	Buenos Aires, Arg.	(P) Tests and relays early evening
9675	31.00	DZA	Zoesen, Germany	5-7 P.M.
9650	31.09	CT1AA	Lisbon, Portugal	Tues, Thurs., Sat., 4:30-7 P.M.
9635	31.13	2RO3	Rome, Italy	Daily 1:30-5 P.M. Friday and Sunday to 5:30 P.M. Mon., Wed., Fri., 6-7:30 P.M.—American Hour, Tues., Thurs., Sat., 6-7:45 P.M. South American hour.
9630	31.15	CFA5	Drummondville, Que.	(P) Phones North America days
9620	31.17	DGU	Nauen, Germany	(P) Phones SUV A.M. Tests and relays irreg.
9620	31.17	FZR	Saigon, Indo-China	(P) Phones Paris early A.M.
9600	31.25	CB960	Santiago, Chile	7 P.M.-12 Midnight
9600	31.25	XEFT	Vera Cruz, Mexico	Same as 6120 KC.
9595	31.27	HBL	Geneva, Switzerland	Saturday 5:30-6:15 P.M. First Monday each month 4-6 P.M.
9595	31.27	HH3W	Port-au-Prince, Haiti	1-2 P.M., 7-8:30 P.M. Sunday 12-1 P.M.
9590	31.28	W3XAU	Philadelphia, Pa.	12-8 P.M.
9590	31.28	VK2ME	Sydney, Australia	Sundays { 1 A.M.-3 A.M. 5:00-9.00 A.M. 9:30-11:30 A.M.
9590	31.28	HP5J	Panama City, Panama	11:30 A.M.-1 P.M. 7:00-10 P.M. Sundays 6:30-10:30 P.M.
9580	31.31	GSC	Daventry, England	12:15-5:45 P.M. 6-8:05 P.M. 10-11:10 P.M.
9580	31.31	VK3LR	Melbourne, Australia	Mon. Tues. Wed. Thurs. 3:15-7:30 A.M. Fri. 10:30 P.M.-2 A.M. Sat. 5-7:30 A.M.
9570	31.33	W1XK	Boston, Mass.	Week days 7 A.M.-1 A.M. Sunday 8 A.M.-1 A.M.
9565	31.36	VUY VUB	Bombay, India	11:30 A.M.-12:30 P.M Wed. & Sat. Sunday 7:30-8:30 A.M.
9560	31.40	YDB	Soourbaya, Java	5-8 A.M. with Music
9560	31.38	DJA	Zeesen, Germany	12 A.M.-3:50 A.M. 8:05 A.M.-11 A.M. 4:55 P.M.-10:45 P.M.
9545	31.44	HH2R	Port-Au-Prince, Haiti	Evenings irregular
9540	31.45	DJN	Zeesen, Germany	12 A.M.-3:00 A.M. 3:50-11 A.M. 4:55-10:45 P.M.
9530	31.48	W2XAF	Schenectady, N. Y.	Week days 4 P.M.-12 midnight Sundays 4:15 P.M.-12 midnight
9515	31.53	LKJ1	Jaloy, Norway	5-8 A.M. Daily
9510	31.55	GSB	Daventry, England	2:15-4:20 A.M. 12:15-5:45 P.M, 6-8:05 P.M.
9510	31.55	VK3ME	Melbourne, Australia	Mon. to Sat. 4:30-7:00 A.M.
9501	31.56	PRF5	Rio De Janeiro, Brazil	4:45-5:45 P.M. daily 9-10:45 P.M. irreg.
9490	31.61	KEI	Bolinas, Calif.	(P) Phones Indo-China and China A. M.
9490	31.61	CQN	Macoa, China	Mon. and Friday 5-8 A.M.
9480	31.65	PLW	Bandoeng, Java	(P) Phones Australia early A.M.
94.80	31.65	KET	Bolinas, Calif.	(P) Phones WEL evenings & nights
9470	31.68	WET	Rocky Point, N. Y.	(E) Tests LSX-PPM-ZFD evenings
9460	31.71	ICK	Tripoli, Africa	(P) Phones Italy mornings.
9450	31.75	TG1X	Guatemala City, Guatemala	Sched. same as TGWA 6000 and 12000 KC when regular. Off temporarily.
9430	31.80	YVR	Maracay, Venezuela	(P) Tests mornings
9428	31.81	COCH	Havana, Cuba	Week days 8A.M.-12 mid. night. Sundays 12-1 P.M. 8-10 P.M.
9415	31.86	PLV	Bandoeng, Java	(P) Phones PCV-PCK-PDK-VLZ-KWX and KWV early mornings
9400	31.92	XDR	Mexico City, Mexico	(P) Phones XAM irreg. days
9385	31.97	PGC	Kootwijk, Holland	(P) Phones East Indies nights
9375	32.00	PGC	Kootwijk, Holland	(P) Phones East Indies nights
9370	32.02	PGC	Kootwijk, Holland	(P) Phones East Indies nights
9330	32.15	CGA4	Drummondville, Que.	(P) Phones GCB-GDB-GBB afternoons
9280	32.33	GCB	Rugby, England	(P) Phones Canada afternoons
9240	32.47	PDP	Kootwijk, Holland	(P) Phones East Indies nights
9235	32.49	PDP	Kootwijk, Holland	(P) Phones East Indies nights
9180	32.68	ZSR	Klipheuvel, S. Africa	((P) Phones Rugby afternoons seasonally
9170	32.72	WNA	Lawrenceville, N. J.	(P) Phones GBS-GCU-GCS afternoons
9147	32.79	YVR	Maracay, Venezuela	(P) Phones EHY afternoons
9120	32.88	HAT4	Budapest, Hungary	6:00-7:00 P.M. Sundays
9110	32.93	KUW	Manila, P. I.	(P) Tests and phones early A.M.

KC	Meters	Call	Location	Time
9091	33.00	CGA-5	Drummondville, Que.	(P) Phones Europe days
9063	33.10	HJU	Buenaventura, Colombia	Tues, Thurs. and Sat. 5-11 P.M.
9020	33.26	GCS	Rugby, England	(P) Phones Lawrenceville afternoons
9010	33.30	KEJ	Bolinas, Calif.	(P) Relays programs to Hawaii eve.
8975	33.42	CJA5	Drummondville, Que.	(P) Phones Australia nights and early A. M.
8975	33.43	VWY	Poona, Ind.	(P) Phones GBC-GBU mornings
8950	33.52	WEL	Rocky Point, N. Y.	(E) Tests with Europe irreg.
8950	33.52	W2XBJ	Rocky Point, N. Y.	(E) Tests irregularly
8930	33.59	WEC	Rocky Point, N. Y.	(P) Phones Ethiopia irregular
8900	33.71	ZLS	Wellington, N. Z.	(P) Phones VLZ early mornings
8830	33.98	LSD	Buenos Aires, Arg.	(P) Relays to N. Y. early evenings
8790	34.13	HKV	Bogota, Colombia	(E) Tests early evenings and nights
8790	34.13	TIR	Cartago, Costa Rica	(P) Phones Central America daytime
8790	34.13	HKV	Bogota, Colombia	6:00-11:00 P.M. irregular
8775	34.19	HCJB	Quito, Ecuador	Sunday 4-10:45 P.M. Tues. to Sat. inc., 7-10 P.M. or later.
8775	34.19	PNI	Makasser, D. E. I.	(P) Phones PLV early mornings
8760	34.35	GCQ	Rugby, England	(P) Phones ZSR afternoons
8750	34.29	ZBW	Hong Kong, China	Sun. Tues. Wed. Fri. Sat. 5:30-8:30 A.M. Mon. Thurs. 5:30-7 A.M.
8740	34.35	WXV	Fairbanks, Alaska	(P) Phones WXH nights
8730	34.36	GCI	Rugby, England	(P) Phones VWY afternoons
8680	34.56	GBC	Rugby, England	(P) Phones ships and New York daily
8665	34.62	CO9JQ	Camagney, Cuba	7:45-9:00 P.M. Week days
8657	34.54	YNVA	Managua, Nicaragua	7:30-10 P.M. Daily
8650	34.68	WVD	Seattle, Wash.	(P) Tests irregularly
8560	35.05	WOO	Ocean Gate, N. J.	(P) Phones ships daytime
8500	35.29	JZF	Nazaki, Japan	(P) Phones ships irregularly
8470	35.39	DAF	Nordenland, Germany	(P) Phones ships irregularly
8400	35.71	HC2AT	Guayaquil, Ecuador	8:00-11:00 P.M. ex. Sunday
8400	35.71	HC2CW	Guayaquil, Ecuador	8-11 P.M. ex. Sunday
8380	35.80	IAC	Piza, Italy	(P) Phones ships irregularly
8190	36.65	PSK	Rio de Janerio, Brazil	(P) Phones LSL-WOK evenings and special programs
8155	36.79	PGB	Kootwijk, Holland	(P) Phones Java irreg.
8140	36.86	LSC	Buenos Aires, Arg.	(P) Tests evenings and nights irreg.
8120	36.95	KTP	Manila, P. I.	(P) Phones KWX-KWV-PLV-JVQ mornings
8110	37.00	ZP10	Ascunsion, Paraquay	8:00-10:00 P.M.
8090	37.08	XEME	Merida, Yucatan, Mex.	11 A.M.-11 P.M.
8075	37.15	WEZ	Rocky Point, N. Y.	(E) Program service P. M.; irregular
8035	37.33	CNR	Rabat, Morocco	(P) Phones France nights
8035	37.33	CNR	Rabat, Morocco	Special broadcasts irreg.
7970	37.64	XGL	Shanghai, China	(P) Tests early mornings
7968	37.65	HSJ	Bankok, Siam	(P) Tests and phones early A.M.
7960	37.69	VLZ	Sydney, Australia	(P) Phones ZLT early A.M.
7920	37.88	GCP	Rugby, England	(P) Phones VLK irreg.
7900	37.97	LSL	Buenos Aires, Arg.	(P) Phones PSK-PSH evenings
7890	38.02	CJA-2	Drummondville, Que.	(P) Phones Australia nights
7880	38.05	JYR	Kemikawa-Cho, Japan	(E) Tests and relays irregularly
7860	38.17	SUX	Cairo, Egypt	(P) Phones GCB afternoons
7855	38.19	LQP	Buenos Aires, Arg.	(P) Tests evening irreg.
7854	38.19	HJ2JSB	Guayaquil, Ecuador	9 A.M.-1:30 P.M. 6-11:15 P.M.
7840	38.27	PGA	Kootwijk, Holland	(P) Phones Java irreg.
7835	38.29	PGA	Kootwijk, Holland	(P) Phones Java irreg.
7830	38.31	PGA	Kootwijk, Holland	(P) Phones Java irreg.
7797	38.47	HBP	Geneva, Switzerland	5:30-6:15 P.M. Saturdays First Monday each month 6-7 P.M.
7790	38.49	YNA	Managua, Nicaragua	(P) Phones Cent. & So. America daytime
7780	38.56	PSZ	Rio de Janerio, Brazil	(P) Tests LSX early evenings
7770	38.61	PDM	Kootwijk, Holland	(P) Special relaps to E. Indies
7760	38.66	PDM	Kootwijk, Holland	(P) Special relays to E. Indies
7740	38.76	CEC	Santiago, Chile	(P) Inverted speech, irregular, and phones evenings to 8:30 P. M.
7735	38.78	PDL	Kootwijk, Holland	(P) Special relays to E. Indies
7730	38.81	PDL	Kootwijk, Holland	(P) Special relays to E. Indies
7765	38.63	PDM	Kootwijk, Holland	(P) Special relays to Dutch Indies
7715	38.89	KEE	Bolinas, Calif.	(P) Relays programs to Hawaii seasonally

KC	Meters	Call	Location	Time
7669	39.11	TGF	Guatemala City, Guatemala	(P) Phones TIU-HPF daytime
7626	39.31	RIM	Tashkent, U.S.S.R.	(P) Phones RKI early mornings
7620	39.37	ETD	Addis Ababa, Ethiopia	Irregular
7610	39.42	KWX	Dixon, Calif.	(P) Phones KKH nights; KAZ-KTP-PLV-JVT-JVM mornings
7565	39.66	KWY	Dixon, Calif.	(P) Phones Shanghai, early mornings
7550	39.74	TI8WS	Puntarenas, Costa Rica	5:30-6:30, 7:30-9:30 P.M.
7520	39.89	KKH	Kahuku, Hawaii	(P) Tests KEE evenings; Phones KWX-KWV nights
7518	39.90	RKI	Moscow, U.S.S.R.	(P) Phones RIM early mornings
7510	39.95	JVP	Nazaki, Japan	Tests Point Reyes early A. M.; broadcasts Monday and Thursdays, 4-5 P. M.
7500	40.00	CFA-6	Drummondville, Que.	(P) Phones: no A. M. days
7470	40.16	JVQ	Nazaki, Japan	(P) Relays and phones early A.M.; broadcasts Monday and Thursday, 4-5 P.M.
7470	40.16	HJP	Bogota, Colombia	(P) Phones HJA3-YVQ early evenings
7445	40.30	HBQ	Geneva, Switzerland	(E) Relays Special B.C evenings irreg.
7430	40.38	ZLR	Wellington, N. Z.	(P) Phones VLJ early mornings
7400	40.45	WEM	Rocky Point, N. Y.	(E) Special relays evenings.
7400	40.50	HJ3ABD	Bogota, Colombia	12 noon-2 P.M. 8:00 11:00 P.M.
7390	40.60	ZLT-2	Wellington, N. Z.	(P) Phones Sydney 3-7 A.M.
7385	40.62	OEK	Wein, Austria	(P) Tests early evenings very irreg.
7380	40.65	XECR	Mexico City, Mexico	Sundays 7-8 P.M. Occasionally later
7370	40.71	KEQ	Kahuku, Hawaii	(P) Relays programs evenings
7282	41.20	HJ1ABD	Cartagena, Colombia	11:15 A.M.-1:15 P.M Sunday. Weekdays 7:15-9:15 P.M.
7211	41.60	EA8AB	Santa Cruz, Canary Is.	Mon. Wed. Fri. 3:15-4:15 P.M.
7177	41.80	CR6AA	Lobito, Angola, Africa	2:30-4:30 P.M. Wed. & Sat.
7118	42.13	HB9B	Basle, Switzerland	Mon., Thurs., Fri. 4-6 P.M.
7100	42.25	HKE	Bogota, Colombia	Monday 6-7 P.M. Tues. and Friday 8-9 P.M.
7080	42.37	PI1J	Dordrecht, Holland	Saturday 10:10-11:10 A.M.
7080	42.37	VP3MR	Georgetown, Br. Guiana	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. Thurs. 5-6:45 P.M. Sat. 4:45-7:45 P.M.
7074	42.48	HJ1ABK	Barranquilla, Colombia	3-6 P.M. Sunday
7000	42.86	PZH	Parmaribo, Dutch Guiana S. A.	Sun. 9:45-11:45 A.M., Mon. & Fri. 5:45-9:45 P.M. Tuesday and Thurs. 2:45-4:45 P. M. 8:45-10:45 P.M. Wed. 3:45-4:45, 5:45-9:45 P.M. Sat. 2:45-4:45 P.M.
6990	42.92	JVS	Nazaki, Japan	(P) Phones China mornings early
6950	43.17	WKP	Rocky Point, N. Y.	(E) Relays programs evenings
6905	43.45	GDS	Rugby, England	(P) Phones WOA-WNA-WCN evenings
6900	43.48	HI5E	Santo Domingo, R.D.	6-10 P.M.
6900	43.48	HI3C	LaRomana, R. D.	Daily 12-2 P.M. 5-9 P.M. Sat. 12 Midnight-2 A.M.
6895	43.51	HCETC	Quito, Ecuador	8:15-10:30 P.M. ex Sunday
6890	43.54	KEB	Bolinas, Calif.	(P) Tests KAZ-PLV early A. M.
6880	43.60	CGA-7	Drummondville, Que.	(P) Phones Europe days
6860	43.73	KEL	Bolinas, Calif.	(P) Tests KAZ-PLV early A.M.
6845	43.83	KEN	Bolinas, Calif.	(P) Used irregularly
6830	43.92	CFA	Drummondville, Que.	(P) Phones: No A. M. nights
6796	44.15	HIH	San Pedro de Macoris, R.D.	Sunday 3-4 A.M. 12:30-3 P.M. 4-5 P.M. Week days 12:15-2 P.M. 7-8:30 P.M.
6760	44.38	CJA-6	Drummondville, Que.	(P) Phones Australia early A. M.
6755	44.41	WOA	Lawrenceville, N. J.	(P) Phones GDW-GDS-GCS evenings
6750	44.44	JVT	Nazaki, Japan	(P) Phones JOAK irregular; Phones Point Reyes at times
6750	44.44	JVT	Nazaki, Japan	1:45-2:15 A.M. 4-7:45 A.M. 5-5:20 P.M. 7-7:15 P.M. 9:45 P.M. 11:45 P.M.
6725	44.60	WQO	Rocky Point, N. Y.	(E) Tests evenings irreg
6720	44.64	YVQ	Maracay, Venezuela	(P) Phones and relays N. Y. evenings
6720	44:64	YVQ	Maracay, Venezuela	8-9 P.M. Saturdays
6718	44.66	KBK	Manila, P. I.	(P) Phones A. M. seasonally
6701	44.71	TIEP	San Jose, Costa Rica	7:00-10:00 P.M. daily
6690	44.84	CGA-6	Drummondville, Que.	(P) Phones Europe irregularly
6680	44.91	DGK	Nauen, Germany	(P) Relays to Riverhead evenings irreg.
6650	45.11	IAC	Piza, Italy	(P) Phones ships irregularly
6635	45.00	HC2RL	Guayaquil, Ecuador	5:45-7:45 P.M. Sunday, 9:15-11:15 P.M. Tuesday
6630	45.25	HIT	Santo Domingo, R.D.	6:30-8:45 P.M.
6620	45.31	Prado	Riobamba, Ecuador	Thursday 9:00-11:15 P.M.
6610	45.38	REN	Moscow, U.S.S.R.	1:00-5:00 P.M. irregular
6590	45.50	HI4D	Santo Domingo, R.D.	12:15-2:00 P.M. 5:00-8:00 P.M. except Sunday
6550	45.81	TIRCC	San Jose, Costa Rica	Daily 12-2 P.M. 6-7 P.M. Thurs. Extra 7-10 or 11 P.M. Sunday 11 A.M.-1 P.M. 8-10 P.M.
6520	46.01	YV6RV	Valencia, Venezuela	11:30 A.M.-12:30 P.M. 5:30-10:00 P.M. except Sunday
6503	46.10	HIL	Santo Domingo, R.D.	12-2 P.M. 6-8 P.M.
6490	46.30	HJ5ABD	Cali, Colombia	7:00-10:00 P.M. ex. Sunday
6475	46.34	HI5N	Santiago de los Caballeros, R.D.	7-10 P.M.
6451	46.50	HJ4ABC	Ibague, Colombia	7-10 P.M. ex. Sunday
6450	46.51	HI4V	Santo Domingo, R.D.	11:40 A.M.-1:40 P.M. 5-7 P.M.
6447	46.51	HJ1ABB	Barranquilla, Colombia	11:45 A.M.-1:00 P.M. 5:30-10:00 P.M Daily
6425	46.69	VE9AS	Fredericton, N.B.	Occasional broadcasts — not regular
6425	46.69	W9XBS	Chicago, Ill.	Not regular. Usually Tuesday and Thursday 1:00-5:00 P.M.
6420	46.70	HI1S	Puerto Plata, R.D.	11:40 A.M.-1:40 P.M. 5:40-7:40 P.M.
6420	46.70	W3XL	Bound Brook, N. J.	No regular schedule maintained
6415	46.77	HJA3	Barranquilla, Colombia	(P) Phones HJA2 evenings
6400	46.88	YN1GG	Managua, Nicaragua	Daily 1:00-2:30 P.M. 7:00-10:00 P.M.
6385	46.99	TIPG	San Jose, Costa Rica	6:00-11 P.M.
6380	47.02	HI3U	Puerto Plata, R.D.	6-9:30 P.M.
6375	47.10	YV4RC	Caracas, Venezuela	4:30-10:30 P.M.
6357	47.19	HRP1	San Pedro de Sula, Honduras	8 P.M.-12 A.M.
6330	47.39	JZG	Nazaki, Japan	5:00-7:00 A.M. irregular
6315	47.50	HIZ	Santo Domingo, R.D.	Daily 11:30 A.M.-2:45 P.M. 5:30 P.M.-9 P.M. Saturdays to 10 & 11 P.M.
6300	47.62	YV12RM	Maracay, Venezuela	8-11 P.M.
6280	47.77	HIG	Santo Domingo, R. D.	7-10 P.M.
6275	47.81	HJ1ABH	Cienaga, Colombia	Broadcasts and phones. Irregular evenings.
6235	48.10	OCM	Lima, Peru	(P) Phones afternoons
6235	43.00	OAX4G	Lima, Peru	7-10 P.M. Daily
6230	48.15	HJ4ABJ	Ibague, Colombia	8:00-11 P.M.
6198	48.40	CT1GO	Parede, Portugal	Sunday 11:30-1:00 P.M. 7:15-8:30 P.M. Tues. to Fri. inc. 7:15-8:30 P.M.
6185	48.50	HI1A	Santiago de Caballeros, R.D.	11:45 A.M.-1:45 P.M. 7:45-9:45 P.M. ex Sunday
6170	48.62	HJ3ABF	Bogota, Colombia	11 A.M.-2 P.M. 6-11 P.M.
6165	48.66	YV3RC	Caracas, Venezuela	10:30 A.M.-1:30 P.M. 4:30-10:00 P.M.
6150	48.78	HJ5ABC	Cali, Colombia	Daily 11:00 AM.-12 noon; 7:00 P.M.-10:00 P.M. Sunday 12-2 P.M.
6150	48.78	HJ2ABA	Tunja, Colombia	1:00-2:00 P.M. & 7:00-10:00 P.M.
6150	48.78	CJRO	Winnipeg, Manitoba	Weekdays 7:30 P.M.-12 noon. Sundays 3:00-10:00 P.M
6150	48.78	CB615	Santiago, Chile	12-1 P.M. 8:30-9:30 P.M. Daily
6150	48.78	CO9GC	Santiago, Cuba	12:00 A.M. Sat.-2:00 A.M. Sunday. Friday 7:30 A.M.-11 P.M.
6150	48.78	CSL	Lisbon, Portugal	7:30-8:30 A.M. 2:30-7:00 P.M.
6140	48.86	W8XK	Pittsburgh, Pa.	9:00 P.M.-1:00 AM. daily
6135	48.90	HJ4ABP	Medellin, Colombia	6-10:30 P.M.
6130	48.92	ZGE	Kuala Lumpur, S.S.	Sun. Tues. Fri. 6:40-8:40 A.M.
6130	48.92	XEXA	Mexico City, Mexico	8-11:30 A.M. 3-6 P.M. 7-11 P.M.
6130	48.92	COCD	Havana, Cuba	Sunday 11 A.M.-2:00 P.M. 7:00-10 P.M. Weekdays 11:30 A.M. to 11 P.M.
6130	48.92	LKJ1	Jeloy, Norway	10:00 A.M.-6:00 P.M. daily
6120	49.02	XEFT	Vera Cruz, Mexico	Mon. to Fri. 11 A.M.-4 P.M. 7:30 P.M.-12 Midnight. Sat. 11 A.M.-4 P.M. 6:30 P.M.-12 Midnight. Sun. 11 A.M.-4 P.M. 9 P.M.-Midnight
6120	49.02	W2XE	Wayne, N. J.	10-11 P.M.
6115	49.06	HJ1ABE	Cartagena, Colombia	Daily 11 A.M.-12:30 P.M. 4-5 P.M. Monday 7-9:30 P.M. 10:30-11:30 P.M. Tues. to Fri. 7-9:30 P.M. Sat. 6-8 P.M. Sunday 9 A.M.-2 P.M.
6110	49.10	HJ4ABB	Manizales, Colombia	11:00 A.M.-1:00 P.M. 5:00-8:00 P.M.

KC	Meters	Call	Location	Time
6110	49.10	VUC	Calcutta, India	Mon. 8-9 A.M. Wed. 10:30-11:30 A.M.
6110	49.10	VE9HX	Halifax, Nova Scotia	4-10 P.M.
6110	49.10	GSL	Daventry, England	10-11:10 P.M.
6100	49.18	W9XF	Chicago, Illinois	Sun. Tues. Thurs. Fri. 9 P.M.-2 A.M. Mon. Wed. Sat. 1-2 A.M.
6100	49.18	W3XAL	Bound Brook, N. J.	Mon. Wed. Sat. 4:00 P.M. 12:00 A.M.
6095	49.22	CRCX	Bowmanville, Ont.	Sun. 12 noon-12 A.M. Mon. to Sat. 6 P.M.-12 A.M.
6090	49.26	VE9BJ	St. John. N.B.	5:00-11:00 P.M.
6090	49.26	ZTJ	Johannesburg. S. Africa	11:45 P.M.-12:30 A.M. 3:30-7:00 A.M. 9 A.M.-4:45 P.M.
6085	49.30	2RO1	Rome, Italy	Mon. Wed. Fri. 6-7:30 P.M. American Hour
6080	49.34	W9XAA	Chicago, Ill.	Daily 11 A.M.-9 P.M.
6080	49.34	ZHJ	Penang. S.S.	6:40-8:40 A.M.
6080	49.34	HJ4ABC	Pereira, Colombia	9:30-11 A.M. 7-9 P.M. ex. Sun.
6080	49.34	CP5	LaPaz, Bolivia	8:00-9:00 P.M. daily
6080	49.34	HP5F	Colon, Panama	Daily ex. Sunday 11:45 A.M.-1 P.M.; 7:45-10 P.M.; Sunday 10:45 A.M.-11:30 A.M.; 4-6 P.M.
6079	49.35	DJM	Zeesen, Germany	3-4:55 P.M.
6070	49.42	VE9CS	Vancouver. B.C.	6:00-7:00 P.M. Sunday 1:45 P.M.-1:00 A.M.
6070	49.42	HH2S	Port-Au-Prince. Haiti	7:30-11 P.M.
6070	49.42	OER2	Vienna. Austria	9:00 A.M.-5:00 P.M. Saturdays until 6:00 P.M
6065	49.45	HJ4ABL	Manizales, Colombia	11:00 A.M-12 noon Sat to 5:30. 5:30-7:30 P.M.
6060	49.50	W8XAL	Cincinnati, Ohio	Daily Ex. Sunday 6:30 A.M.-8 P.M. 11 P.M.-2 A.M. Sundays 8 A.M.-8 P.M. 11 P.M.-1:30 A.M.
6060	49.50	HJ4ABD	Medellin. Colombia	6-11 P.M. ex. Sun. 10:30 A.M.-1 P.M.
6060	49.50	W3XAU	Philadelphia. Pa.	8-11 P.M.
6060	49.50	VQ7LO	Nairobi, Kenya Colony. Africa	5:45-6:15 A.M. 11 A.M.-2 P.M.
6060	49.50	OXY	Skamleback. Denmark	1-6:30 P.M. Sunday 10 A.M.-6:30 P.M.
6050	49.59	GSA	Daventry, England	6-8:05 P.M.
6050	49.59	HI9B	Santiago de los Caballeros, R.D.	Sundays 12-1 A. M. 6:30-10 P.M.
6043	49.65	HJ1ABG	Barranquilla, Colombia	11:30 A.M.-2 P.M. 5:30-11 P.M. Sat. to 12:30 A.M. Sunday 11 A.M.-3 P.M 5-8 P.M.
6040	49.67	PRA8	Pernambuco. Brazil	9:30-11:30 A.M. 2:30 8:30 P.M.
6040	49.67	YDA	Tandjongpriok, Java	5:45-6:45 P.M. 10:30 P.M.-1:30 A.M.
6040	49.67	W4XB	Miami. Florida	Sun. 11:30 A.M.-2:30 P.M. 9:30-10:30 P.M. Mon. Wed. Sat. 12-2:30 P.M. 8:30-10:30 P.M. Tues., Thurs. 12-2:30 P.M. 9:30-10:30 P.M. Friday 12-2:30 P.M. 9-10:30 P.M.
6040	49.67	W1XAL	Boston, Mass.	Sun. 5-7 P.M. Mon., Tues., Thurs. 7-9 P.M.
6030	49.75	HP5B	Panama City, Panama	12 noon-1 P.M. 8-10:30 P.M.
6030	49.75	PGD	Kootwijk. Holland	(P) Phones Java and E. Indies irreg.
6030	49.75	VE9CA	Calgary. Alberta. Canada	7 P.M.-1 A.M.
6025	49.79	PGD	Kootwijk. Holland	(P) Phones Java and E. Indies irreg.
6020	49.83	PGD	Kootwijk. Holland	(P) Phones Java and E. Indies irreg.
6020	49.83	DJC	Zeesen. Germany	11:35 A.M.-4:55 P.M. 4:55 P.M.-10:45 P.M.
6020	49.83	XEUW	Vera Cruz. Mexico	10 P.M.-1 A.M. Daily
6012	49.85	HJ3ABH	Bogota. Colombia	11:30 A.M.-2 P.M. 6-11 P.M. Sunday 4-11 P.M.
6011	49.89	HJ1ABC	Quibdo. Colombia	Sun. 3-5 P.M. 9-11 P.M. Mon. to Sat. 5-6 P.M. Wed. 9-11 P.M.
6010	49.92	ZHI	Singapore, S.S.	Mon. Wed. Thurs. 5:40-8:10 A.M. Sat. 10:40 P.M.-1:10 A.M.
6010	49.92	COCO	Havana, Cuba	Week Days 10:30 A.M.-1:30 P.M. 4 P.M.-7 P. M. Sunday 10:30 A.M.-1:30 P.M. 4-10 P.M.
6006	49.95	HJ1ABJ	Santa Marta, Colombia	11 A.M.-1 P.M. 7-9 P.M Sunday 1-2 A.M.
6005	49.96	VE9DR	Montreal. Que.	Used very irregular
6005	49.96	VE9DN	Montreal. Que.	Used very irregular
6000	50.00	TGWA	Guatemala City, Guatemala	Daily Ex. Sun. 12-2 P.M. 8-9 P.M. 10 P.M.-12 A.M. Sundays 12-5 A.M.
6000	50.00	XEBT	Mexico City. Mexico	10 A.M.-12 midnight and later at times
6000	50.00	RV59	Moscow, U.S.S.R.	Sun., Mon., Wed., Fri., 4-6 P.M.
5985	50.13	XEVI	Mexico City. Mexico	Sun. 1-2:15 P.M. Mon. Wed. 3-4 P.M. Tues. & Thurs. 7:30-8:45 P.M. 10:30 P.M.-12 A.M. Fri. 3-4 P.M. 9 P.M.-12 A.M. and Sat. 9-10 P.M.
5980	50.17	HJ2ABD	Bucaramanga. Colombia	Daily 11:30 A.M.-12:30 P.M. 6-10 P.M.
5980	50.17	HIX	Santo Domingo, R.D.	Mon. to Sat. 11:10 A.M.-12:40 P.M. 4:40-5:40 P.M. Tues. & Fri. also 8:10-10:10 P.M. Sunday 7:40-9:40 A.M.
5980	50.17	XECW	Mexico City, Mexico	4-4:45 P.M. 10-12 M.
5970	50.25	HJ2ABC	Cucuta, Colombia	11 A.M.-12 noon 6:30-9:00 P.M.
5969	50.26	HVJ	Vatican City, Vatican	2-2:15 P.M. Sunday 5-5:30 A.M.
5960	50.30	YNLF	Managua, Nicaragua	6-11 P.M.
5950	50.42	HJN	Bogota, Colombia	8-10:45 P.M. Irregular
5941	50.50	TGX	Guatemala City, Guatemala	8-10 A.M. 2-4 P.M. 8 P.M.-12 A.M.
5940	50.51	TG2X	Guatemala City, Guatemala	Daily 4-6 P.M. Mon. Thurs. Sat. 9-11 P.M.
5930	50.60	HJ4ABE	Medellin, Colombia	11 A.M.-12 noon. 6-10:30 P.M.
5920	50.68	HH2S	Port-au-Prince Haiti	7-10 P.M.
5900	50.85	YVBRB	Barquisimeto, Venezula	12-1 P.M. 6-10 P.M.
5885	50.98	HCK	Quito, Ecuador	Mon. and Fri. 9-11 P.M.
5880	51.02	ETG	Addis Ababa, Ethiopia	Used irregularly.
5875	51.11	HRN	Tegucigalpa. Honduras	Week Days 12-1:30 P.M. 6-7:30 P.M. 8-9:30 P.M. Sunday 3-5 P.M. 6-7:30 P.M. 8-10:00 P.M. and later
5865	51.15	HI1J	San Pedro de Macoris SD	Daily Ex Sunday 12:15-1:45 P.M. 6:15-8:45 P.M. Saturdays until 10 P.M.
5853	51.20	WOB	Lawrenceville. N. J.	(P) Phones ZFA P.M.
5850	51.28	YV5RMO	Maracaibo. Venezuela	11:30 A.M.-1 P.M. 5:30 to 10 P.M.
5845	51.33	KRO	Kahuku, Hawaii	(P) Tests early mornings
5825	51.50	HJA2	Bogota. Colombia	(P) Phones HJA3 afternoons irreg.
5820	51.50	TIGPH	San Jose. Costa Rica	7 P.M.-12 Midnight
5800	51.72	KZGF	Manila, P. I.	(P) Tests mornings irregularly
5800	51.72	YV2RC	Caracas, Venezuela	8:30 A.M.-9:30 P.M. Sundays. 11:15 A.M.-1:30 P.M. 4:30-9:30 P.M. Week days
5790	51.81	JVU	Nazaki. Japan	(P) Phones JZC early mornings
5780	51.90	CMB-2	Havana, Cuba	(P) Phones and tests irregularly
5780	51.90	OAX4D	Lima. Peru	9-11:30 P.M. Wed. Sat.
5760	52.08	HJ4ABD	Medellin, Colombia	10:30 A.M.-1 P.M. 6-11 P.M.
5750	52.17	XAM	Merida, Mexico	(P) Phones XDR-XDF early evenings
5730	52.36	JVV	Nazaki, Japan	(P) Phones JZC early A. M.
5720	52.45	YV10RSC	San Cristobal. Venezuela	11 A.M.-12 noon. 6-8:30 P.M.
5713	52.51	TGS	Guatemala City. Guatemala	6-9 P.M.
5712	52.54	CFU	Rossland. Canada	(P) Phones CFO and CFN evenings
5670	52.91	DAN	Nordenland, Germany	(P) Phones ships irreg.
5500	54.55	TI5HH	San Ramon. Costa Rica	3:30-5 P.M. 8-9:30 P.M. Daily.
5445	55.10	CJA7	Drummondville, Que.	(P) Phones Australia early A. M.
5435	55.20	LSH	Buenos Aires. Arg.	(P) Relays LR4 and tests evenings
5410	55.45	ZBW	Hong Kong, China	4-10 A.M. 11:30 P.M.-1:15 A.M. irreg.
5400	55.56	HJA7	Cucuta, Colombia	Phones irregularly; broadcasts music in eveing at times
5400	55.56	HJA7	Cucuta. Colombia	Monday 4-8 P.M.
5395	55.61	CFA7	Drummondville. Que.	(P) Phones: No Am.; irregular
5260	57.03	WQN	Rocky Point, N. Y.	(E) Program service; irregular
5170	58.50	PMY	Bandoeng. Java	(E) Phones and relays programs early mornings
5110	58.71	KEG	Bolinas. Calif.	(P) Phones irregularly evenings
5080	59.08	WCN	Lawrenceville, N. J.	(P) Phones GDW evenings seasonally
5025	59.76	ZFA	Hamilton. Bermuda	(P) Phones WOB evenings
5040	59.25	RIR	Tiflis. U. S. S. R.	(P) Phones afternoons irregular
5015	59.82	KUF	Manila. P. I.	(P) Phones Bolinas; irregular
4975	60.30	GBC	Rugby. England	(P) Phones ships afternoon and nights
4905	61.16	CGA8	Drummondville. Que.	(P) Phones GDB-GCB afternoons
4820	62.20	GDW	Rugby. England	(P) Phones WCN-WOA evenings
4810	62.37	YDE2	Solo. D.E.I.	4-8:15 A.M. Irregular.
4790	62.63	VE9BK	Vancouver. Canada	Week days 11:30-11:45 A.M. 3-3:15 P.M. 8:00-8:15 P.M. Sat. 7:30-7:45 P.M.
4752	63.13	WOY	Lawrenceville, N. J.	(P) Tests very irregular
4752	63.13	WOO	Ocean Gate, N. J.	(P) Phones ships irreg.
4752	63.13	WOG	Lawrenceville, N. J.	(P) Phones Rugby irregular
4600	65.22	HC2ET	Guayaquil. Ecuador	9:15-10:45 P.M. Wed. and Sat.
4555	65.95	WDN	Rocky Point, N. Y.	(P) Tests Rome and Berlin evenings
4550	65.93	KEH	Bolinas. Calif.	(P) Irregular phone service
4510	66.52	ZFS	Nassau. Bahamas	(P) Phones WND daily; Tests GYD-ZSV irregular

4470	67.11	YDB	Socrabaja, D.E.I.	Broadcasts early mornings.
4465	67.19	CFA2	Drummondville, Que.	(P) Phones: No Am.; irregular days
4348	69.00	CGA9	Drummondville, Que.	(P) Phones ships and Rugby evenings
4320	69.40	GDB	Rugby, England	(P) Phones CGA8 and tests evenings
4295	69.90	WTDV	St. Thomas, Virgin Is.	(E) Weather reports, 8 A.M.-12 Noon; 3-6 P. M.
4295	69.90	WTDW	St. Croix, Virgin Is.	(E) Weather reports, 8 A.M.-12 Noon; 3-6 P.M.
4295	69.90	WTDX	St. John, Virgin Is.	(E) Weather reports, 8 A.M.-12 Noon; 3-6 P.M.
4272	70.20	WOO	Ocean Gate, N. J.	(P) Phones ships afternoons and eve.
4272	70.20	WOY	Lawrenceville, N. J.	(P) Tests evenings
4250	70.65	RV15	Khabarovsk, U.S.S.R.	1:30-9:00 A.M.
4002	75.00	CT2AJ	Ponta Delgada, Azores	Wed. and Sat. 5-7 P.M.
3770	79.60	HB9B	Basle, Switzerland	Mon. Thurs. Fri. 4-6 P.M.
3310	90.63	CJA8	Drummondville, Que.	(P) Phones Australia. A.M.
3027	99.10	CFA8	Drummondville, Que.	(P) Phones: No Am.

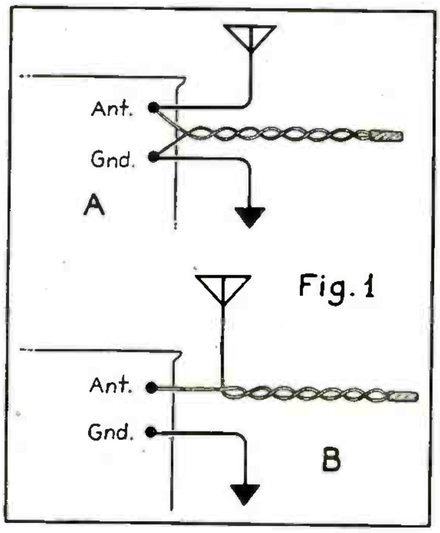
QUERIES

(Continued from page 129)

ing line from 2700 to 3200 kilocycles, and drawing a rough graph, W2XAF should come in on the dial at about 2880 kc, W1XK at around 2900 kc. and WEA at approximately 2930 kilocycles.

The question really is how do these off-frequency stations get into the set to be mixed with the third harmonic of the oscillator and passed through the intermediate-frequency amplifier. Inspection of the Emerson circuit discloses two coils in the antenna and first grid circuits which are "floating" or open on one end, and provide capacitative coupling between the antenna and input circuit. It seems probable that these coils afford direct transfer from the antenna circuit to to the grid of the first tube, and that the antenna circuit, without the load and capacity of an aerial, is tuned to the high-frequency band which is being spuriously received. If the high-frequency signals are heard even with the antenna connected, the effect is probably due to a similar resonance in the open-end coils. With an aerial of the correct dimensions it is doubtful that these off-range signals would be heard.

When signals are received better with the antenna disconnected, it is due either



Showing the parallel and series connections, A and B respectively, for a condenser of small capacity in the antenna circuit. This condenser is made of twisted wires. The free ends are taped, but not connected.

to the use of an aerial having a detuning effect on the input circuit, or increased regeneration with the antenna disconnected, due to a change in circuit conditions favorable to regeneration. Probably the first consideration is responsible in G. J. K.'s case. We advise trying a longer or shorter aerial, or alter the characteristics of the present antenna by connecting a very small capacity across the antenna and ground posts. Sometimes connecting the capacity in series with the lead-in is more effective. Try both connections. This capacity, or condenser, can be easily made by twisting together a foot or two of bell wire (or any other well insulated wire) as shown in Fig. 1. Two separate pieces of wire are used, and they are not connected together in any way other than by the natural capacity between them and the connection through the antenna circuit. The free ends should be taped or so twisted that they cannot make electrical contact.

The use of such a condenser, in either series or parallel connection, will often improve the operation of many receivers, and occasionally has been known to cure instability.

◆

AMATEUR RADIO

(Continued from page 111)

the fellow transmitting from, say, New York, was heard at times in Chicago and at times only in San Francisco, and not at all by other amateurs no more than 20 to 40 miles distant. The only conclusion that could be drawn from this was that in some peculiar manner the signals skipped over certain areas at certain times.

The Ionosphere

And so it was through this co-ordination of effort that the amateur became aware of the sky wave that radiated upward and was bounced back to earth again by reflection or refraction from some unknown stratum in outer space.

The discovery of this stratum and its character was made simultaneously by Kennely and Heaviside, not amateurs to be sure, but whose work in this direction was prompted more or less by the extraordinary amateur transmissions in the short wavelength bands.

It cannot be said that the amateur did all the work, nor that he made all the discoveries, for commercial engineers were at work on these short-wave channels as well. But the amateur did contribute materially to the opening of these frequencies for communications purposes.

(To be continued)

THE NOISE SILENCER

(Continued from page 108)

eter, with the lead itself supported in the center. The proper type to use is shown in the illustration of Fig. 2.

It is preferable to have no shielding whatsoever on the lead B, if you can get away with it. Without the shielding, the 6J7 tube may break into oscillation. It depends a great deal on how short this lead can be made. If shielding is required, use the same type as shown in Fig. 2 on the plate lead C. If no shielding is required, then remember that the connection A will be dispensed with and it will be necessary to complete the circuit between the receiver and adapter chassis. If the adapter chassis is well fastened to the receiver chassis, that will be sufficient. Otherwise connect the two chassis together with a length of wire.

Silencer Adjustments

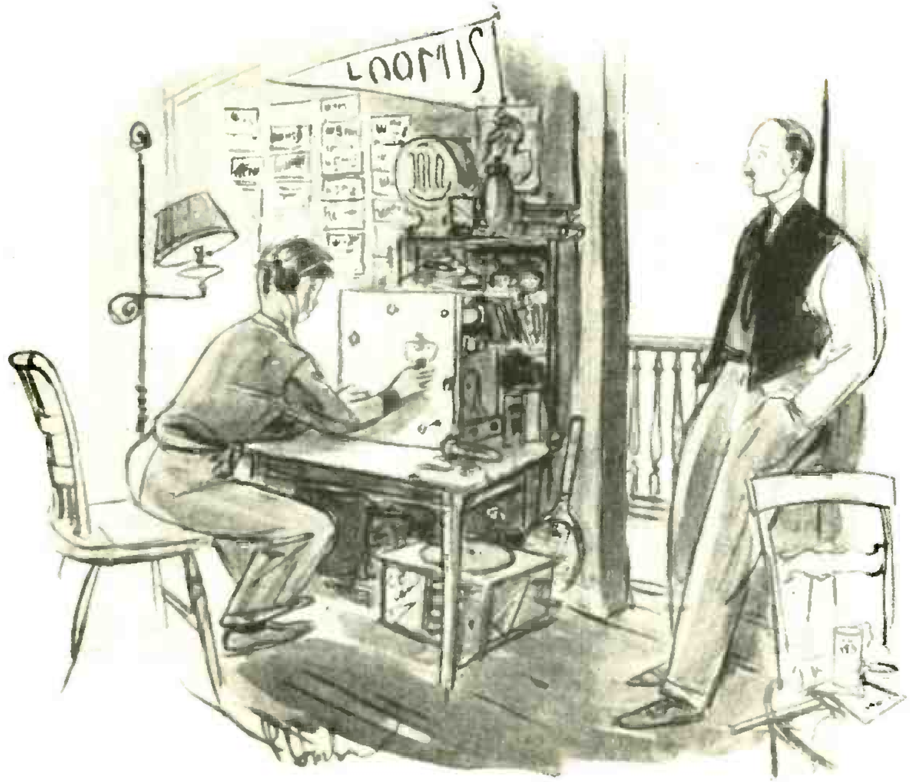
There are adjustments to be made before the adapter can be placed in operation. Connect it up to the receiver as previously explained, plug in the heater cord and turn on both the receiver and adapter. Set the threshold potentiometer to the "off" position so that all the resistance is in the circuit, and then give the receiver and adapter about five minutes to get warmed up.

The next procedure is to re-align the second and third i-f transformers in the receiver to make up for the added capacity introduced in these circuits by the addition of the adapter connections B and C. This is best accomplished by the use of a signal generator and an output meter, but if these instruments are not available, the alignment may be done fairly accurately by ear. Proceed by tuning the receiver to a point between stations where there is fair noise background. Then readjust the condenser trimmer on the secondary of the second i-f transformer for maximum noise response. Follow up by adjusting the condenser trimmer on the primary of the third i-f transformer for maximum noise response.

This is all the adjustment required in the receiver. If the alignment has been carried out properly and the i-f transformers are again in actual resonance, the receiver should function just as well as it did before the silencer adapter was installed.

The next move is to adjust the silencer adapter. First turn the threshold potentiometer knob in the opposite direction so that resistance is cut out of the circuit and the bias reduced on the 6J7 and 6H6 tubes. Continue turning this knob until a point is reached where there is a reduction in background noise. The silencer tubes are now working.

Next set the threshold potentiometer just above this point of noise reduction



By Perry Barlow; from The New Yorker

"He says why don't we line up a couple of dames the next time his ship is in."

and then tune in a weak signal on the receiver. Follow by adjusting the condenser trimmer on the diode transformer, T, until a point is reached where the signal volume is *reduced.* This is the point of resonance.

Using the Adapter

The silencer is now ready for use, and in order to become acquainted with the threshold adjustment, it is a good idea to tune in a fairly strong signal and then feed some form of local noise into the receiver. A certain point on the adjustment of the threshold potentiometer will be found where the noise will be silenced. If the signal is loud and the threshold control is turned too far in the "on" direction, the signal itself will be cut off. But you will get the hang of this control with a bit of practice.

After the silencer adapter has been made to operate satisfactorily without or with shielded leads, as necessary, and it has been determined whether or not the additional bias resistor R-5 is required, it is advisable to replace all clip connections with good soldered joints. After the permanent installation is made, it would be well to re-align all three i-f transformers, following the procedure outlined previously.

CHANNEL ECHOES

(*Continued from page 121*)

the general consternation that has been exhibited concerning the "Shadow's" activities. As we all know, the "Shadow" is a radiation (no longer mysterious since it has been identified) from diathermal apparatus—the latest gadget in electrical therapy. It is characterized by a saw-tooth buzz that just goes on and on for hours at a stretch.

Somehow, we can find nothing evil or sinister in the "Shadow." Rather he is a friendly creature, for whom we cherish feelings bordering on the tender. He is the most thoroughly innocuous thing on the air. He never plays "Eeny meeny miny mo" or "There's Rhythm in My Nursery Rhymes." Never has he once claimed that he is the best "Shadow" manufactured—the only "Shadow" with the correct Stygian hue that will never fade and cannot hurt the hands. Never once has he told the radio listener that he is the "Shadow" preferred by the stars in Hollywood. Nor has he asked you to send in a box top, carton, label or wrapper—not even so much as a facsimile of himself! His note is less agonizing than the wails of a saxophone, and infinitely less attrite on the nerves than the voice of a woman speaking on a household hour. Once, the shadow succeeded in completely obliterating one of the interminable speeches from Pontoise, France, on 11.7 megacycles—an achievement in itself.

◆

WE CANNOT let the month pass without tossing orchids to the finest sponsored program on the air—The General Motors Hour. (Sunday evenings at 10:00, over the NBC-WEAF network.) The advertising is confined to a few dignified remarks at the beginning and close of the hour-long program—not so much as a burp at the half hour mark! The program is announced by that veteran and peer among announcers, Milton J. Cross.

THE FOOTLOOSE REPORTER

(*Continued from page 117*)

sisting in a sea rescue, and therefore merits this recognition."

Clinton E. Herring, for "expeditious radio work in several trying instances—while under fire during the World War on the U. S. Submarine L-9, September, 1918; upon the grounding of the S. S. *Westford* on the Florida Coast, February 11, 1921; at the time of the S. S. *Oskaloosa* being rammed by the *S. S. Winnieconie* at sea, March 30, 1921; twice when the S. S. *Oskaloosa* was disabled at sea and assistance was obtained by radio, June 30, and September 12, 1921, and when the S. S. *Schoodic* grounded off the coast of France, January 21, 1922."

James W. Hodges, Chief Operator, and Richard Schroeter, Second Operator, S. S. *Dixie,* and Henry Treger, ex-operator and now an NBC Radio Engineer, a passenger aboard the *Dixie,* "for meritorious radio work aboard that ship at the time of grounding on the Florida Coast during a heavy gale, September 2, 1935."

With the awards made, guests and members settled down to the serious business of having a good time.

PHILCO 116-B

(Continued from page 131)

Reception Reports

The 150 to 390-kc weather band brought in the local stations such as WWU, at Elizabeth, N. J.; WWHB, at Harrisburg, Pa., and numerous transmissions between planes and ground stations . . . to say nothing of the aircraft beacon signals.

A run through the standard broadcast band in the late morning brought through 41 stations. A similar trial in mid-evening brought in 58 stations, or approximately one station per 1.6 dial divisions. Of these 58 stations, ten of them were too badly heterodyned to be of value for entertainment purposes.

The police, aircraft and upper amateur wavelength bands were, as usual, alive with signals, and the receiver gave excellent performance in these ranges.

In the vicinity of 21 megacycles, during late morning, we picked up W2XE. DHO and PSA. In the vicinity of 18 megacycles we had W3XAL, WLA, GSG, PCM and YVR. At 15 megacycles, W2XAD, W8XK, DJB, HII, PCJ and Pontoise. KKL-KKG was also picked up at 13.70 mc.

In the vicinity of 12 megacycles we found 2RO, CJA, CO9WR, HJ4ABA, KKQ, Pontoise, TFJ. WOK and numerous locals.

Average listening in the 9-megacycle band brought in COCH, CO9JQ, DJA, DJN, EAQ. HCJB, HC2CW, HH3W, HKV, HP5J and the usual locals.

In the 6-megacycle band we picked up 42 stations at one sitting. Included in this batch were: CO9GC, HH2S. HI9B. HIH, ten HJ's, HP5F, OAX4G, TGS. TIPG, XEXA. YNLF and YV6RV.

Batches of 4's, 5's, 6's and 9's were hauled in on the 20-meter amateur band. Some of the out-of-towners were: K6LJB, CO2LL, CO3WZ, CO4GX, CO6OM, CO8IQ, CO8YB, HI5X, HI7G, HJ1G, NY2AE, TI2AV, XE1HH and XE1G.

Receiving conditions were decidedly poor during the listening tests on this receiver. Our receiver standard was not able to do much better. At certain periods there was a total absence of VE's, W7's and VK's on all receivers. Under normal conditions the Philco 116-B would show up admirably. As it was, we had no difficulty in hauling in KKL and K6LJB on this set.

VERIES

(Continued from page 133)

YV3RC	Radiodifusora Venezuela YV3RC, Caracas. Venezuela.
YV4RC	Estacion S.A.R.. Apartado 983, Caracas, Venezuela.
YV5RMO	Box 214, Maracaibo, Venezuela.
YV6RV	"La Voz de Carabobo," Radio YV6RV, Valencia, Venezuela.
YV8RB	Radiodifusora YV8RB, "La Voz de Lara," Barquisimeto, Venezuela.
YV10RSC	Radiodifusora YV10RSC "La Voz del Tachira," San Cristobal, Venezuela
YV12RM	Emisora 24 de Julio, Maracay, Venezuela.
YVQ-YVR	Servicio Radiotelegraphico, Maracay, Venezuela.
ZP10	Radio Prieto ZP10, Asuncion, Paraguay.

UNITED STATES

Dixon Stations	140 Montgomery St., San Francisco, Cal.
W1XAL	World Wide Broadcasting Corp., University Club, Boston, Mass.
W1XK	Hotel Statler, Boston, Mass.
W2XAD-W2XAF	General Electric Co., Schenectady, N. Y.
W2XE	485 Madison Ave., New York, N. Y.
W3XAU	1622 Chestnut St., Philadelphia, Pa.
W3XL-W3XAL	30 Rockefeller Plaza, New York, N. Y.
W4XB	Isle of Dreams Broadcasting Corp.; Radio W4XB, Herald Bld., Miami, Florida.
W8XAL	Crosley Radio Corp., Cincinati, Ohio.
W8XK	Grant Bldg., Pittsburgh, Pa burgh, Pa.
W9XAA	Navy Pier, Chicago, Ill.
W9XF-W9XBS	20 North Wacker Drive. Chicago, Ill.
WVD	Radio WVD, 517-Federal Office Bldg., Seattle, Wash

AMATEUR RADIO IN THE USSR

(Continued from page 120)

Amateur Services

The reason for this is that in the Soviet Union short-wave activities are not merely a sport, but also a socially useful function. Short-wave Amateurs take an active part in the construction of socialism in the USSR. Last year, for instance, they participated in a great number of important economic and political campaigns. Thus in lumber floating, Amateurs have rendered valuable services. In the Far North where the rivers are free of ice for a short period only, the floating of timber has to be done very quickly in order to avoid hitches in the water transport through accumulation of rafts, and it is imperative to assure constant communications between the felling and floating stations and the central management. Such communications in the virgin forests of the Soviet North can be established only by short-wave Amateurs.

Useful services are also rendered to the Soviet Government by short-wave transmission during sowing and harvesting campaigns. Only in this way is it possible for even the most distant agricultural areas of the Union to communicate results rapidly to the center, and to receive back corresponding instructions. Very important also was the collaboration of the Soviet Amateurs in the projection and the construction of roads, when parties of engineers and workers, often hundreds of miles from any inhabited regions, in the middle of the jungle, had to keep contact with the outside.

In performing these functions, Soviet Amateurs have demonstrated that they know how to turn achievements of short-wave technique to the advantage of their Soviet country.

FOREIGN NEWS

(Continued from page 128)

tape used again and again. As a matter of fact, the recording machine also demagnetizes the tape, and it can be so operated that a tape on which there is an old recording, may be run through the demagnetizing points and immediately magnetized through other recording points, all in one operation. After the tape has been magnetized, it must, of course, be rewound before it can be played through a reproducing apparatus. A feature of the recordings is that any portion may be deleted from the record and replaced with something else. The reproduction is of very high fidelity, has no noises (hiss—so common to phonographic recordings) or other detractive effects.

◆

BROADCASTING DEVELOPMENTS IN INDIA

CALCUTTA: The Government of India recently announced its decision to reorganize the country's present broadcasting system and has appropriated 20,000,000 ruples for the future expansion of radio service. As a result, stations are now being built at Delhi and Madras and service improvements are being made in the existing stations at Calcutta and Bombay. It is hoped that the new stations will be completed by 1937.

The Delhi station will embody the latest improvements in broadcasting equipment. A frequency of 882 kc (340 meters) will be used. Details regarding the Madras station have not been announced as yet.

The greatest problem confronting broadcasting in this country is the number of languages spoken in various sections. India has more than 200 recognized languages and these are subdivided into several thousand dialects. The immediate aim of the service is to meet the needs of the population using the main languages. Programs will be sent out in the most important literary tongues. The new Delhi station will use Urdu of the north; Bengali will be the medium for Calcutta; Marathi and Gujerati for Tombay and Telegu will be the languages employed at Madras.

Permission has been granted the British Broadcasting Corporation to the Indian State Broadcasting Service to relay programs to the Empire Broadcasting Service and a special receiving station near Delhi will be constructed for this service. (Consul Edward M. Groth, Calcutta).

◆

TELEVISION IN FACTORIES

AMSTERDAM: A new use has been found for television in an Amsterdam factory, according to the *Germania Review*. Fitted in the manager's office are a number of television screens linked with various departments. On pressing a switch, the manager can see and hear what is going on in any part of the building.

Details are lacking as to the system employed and the amount of definition. (W. W. No. 852-Vol. XXXVII).

◆

5 METERS TO U. S.?

SOUTHPORT, England: An amateur, Mr. W. Johnson, G2IN, of Southport, was transmitting on 5 meters from 0900 to 1600 GMT on January 26th. Tests at this time were being conducted in order to determine whether the signals reached the U. S. Has anyone heard G2IN?

◆

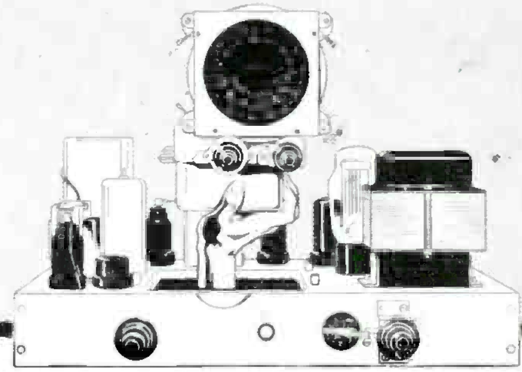
NEW ANTENNA FOR SPW

SPW, the 20-kilowatt, short-wave station at Babice, two miles from Warszawa (Warsaw), Poland, is now constructing a new antenna directed to North America, the present one being directed to South America and Japan, according to the Chicago Short-Wave Club.

So successful were the few test transmissions that about two thousand letters from all over the world have been received by Polskie Radio, according to Dr. Juljusz Szygowski, Polish Consul at Chicago.

HUGHES PRINTING CO.
EAST STROUDSBURG, PA.

NEW *and* STARTLING



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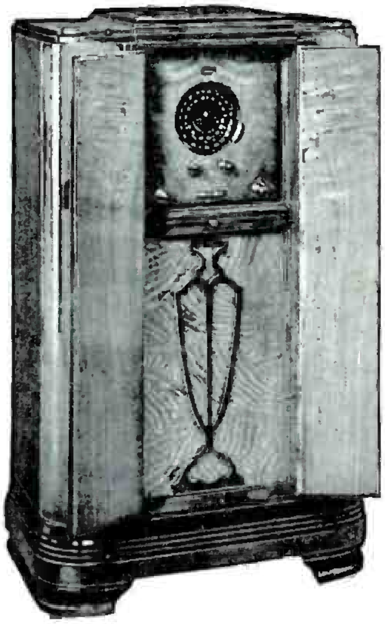
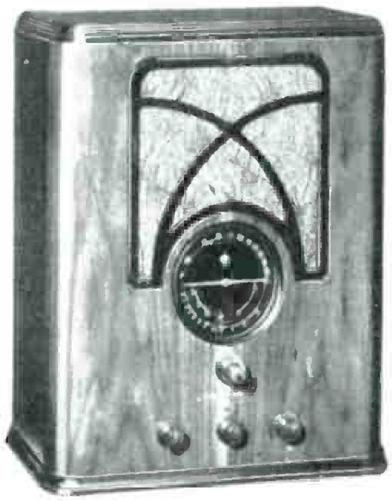
That's why CentrOmatic Radio is so free from noise. That's why you can get more long and short wave stations. That's why even short wave tuning is so accurate and easy. That's why tone is so pure and rounded out. *That's why CentrOmatic Engineering means more to your enjoyment than metal tubes alone.* In American-Bosch CentrOmatic Radio you get both.

UNITED AMERICAN BOSCH CORPORATION

Springfield Massachusetts



Model 595M — High Fidelity 10 tube, 11 tube performance, American, police and foreign, plus U. S. weather band, superheterodyne Console radio, with exclusive combination of new metal tubes and American-Bosch CentrOmatic construction. Range 540 to 18,500 Kilocycles and long wave U. S. weather band 150 to 350 Kilocycles. $169.50



Model 565W—6 tube. 9 tube performance, American, police and foreign superheterodyne Conselet with new metal tubes. Range: standard broadcast 540 to 1540 Kilocycles; police and short wave 1540 to 4200 Kilocycles; short wave 5900 to 18,200 Kilocycles. $49.95

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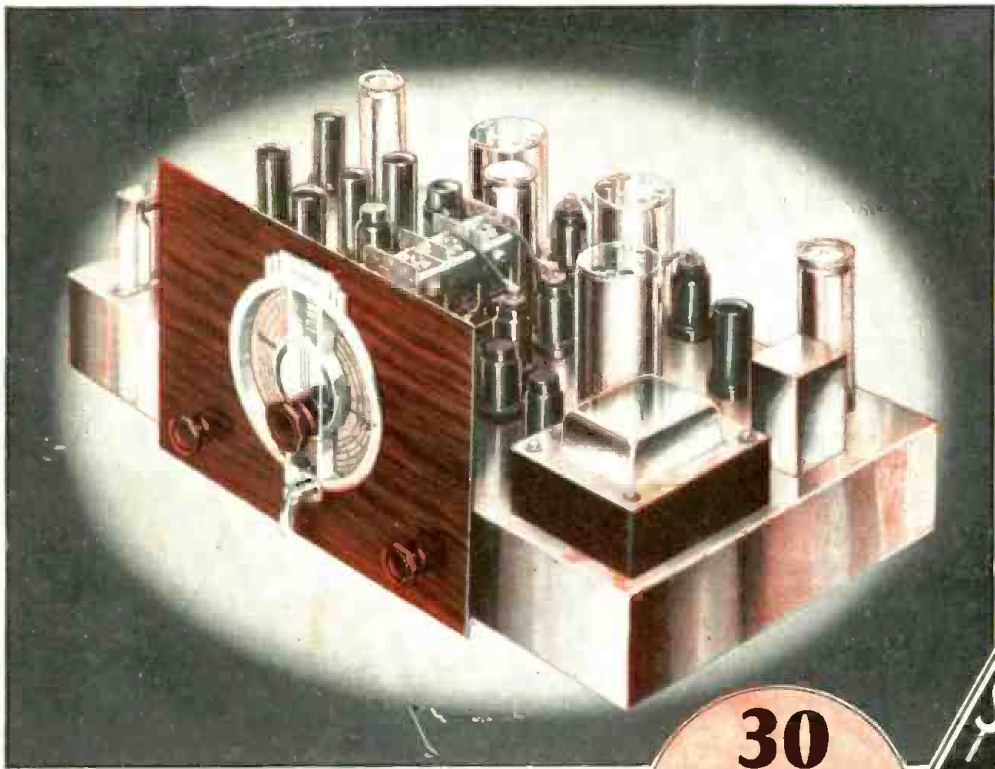

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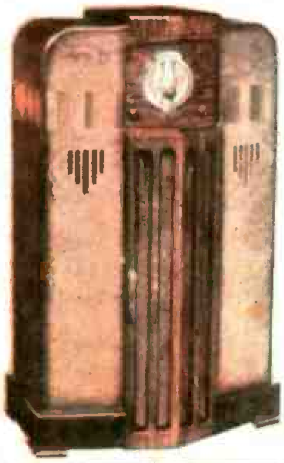

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