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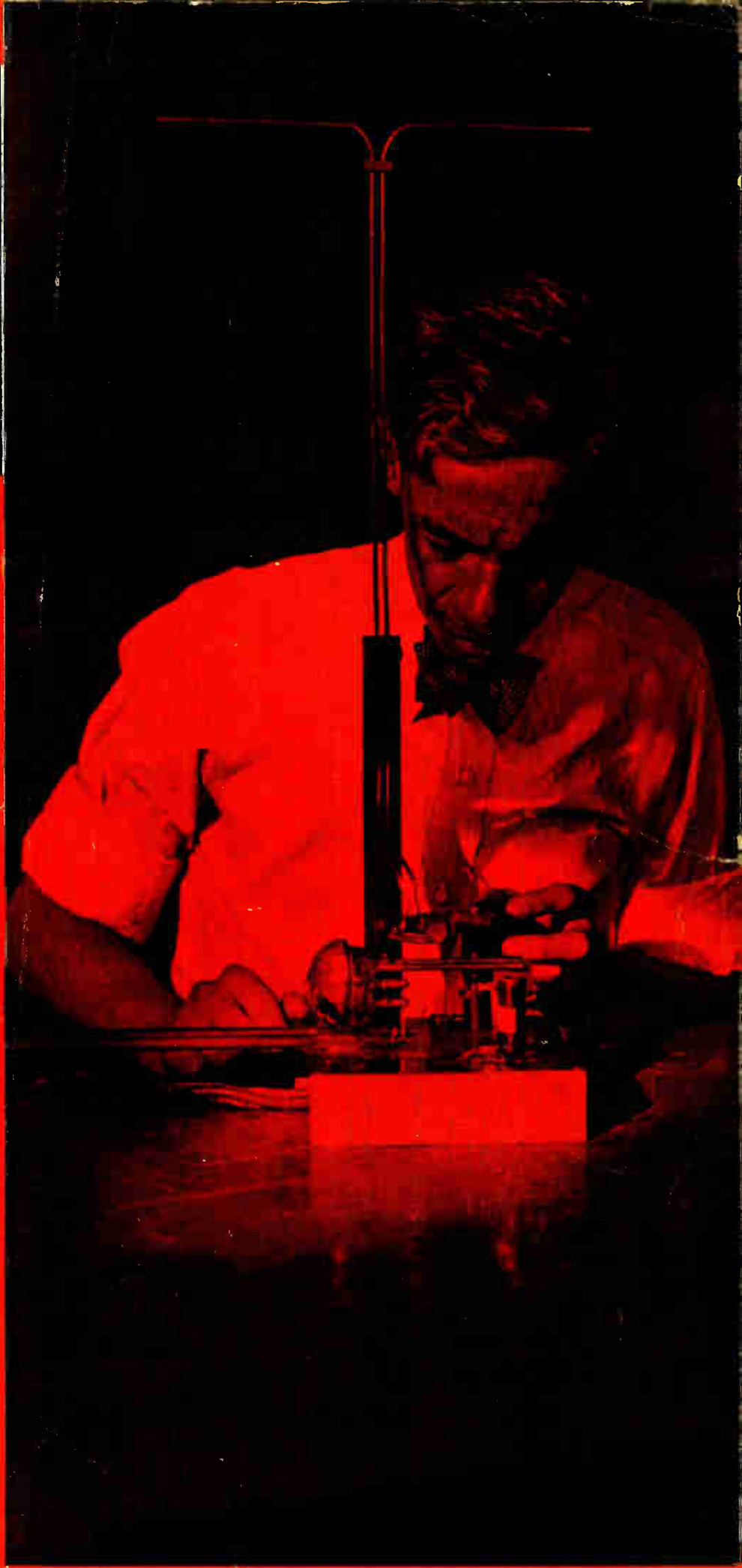

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ALL-WAVE RADIO

Reg. U. S. Pat. Off.

VOLUME 3 • NUMBER 4

GENERAL

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COVER

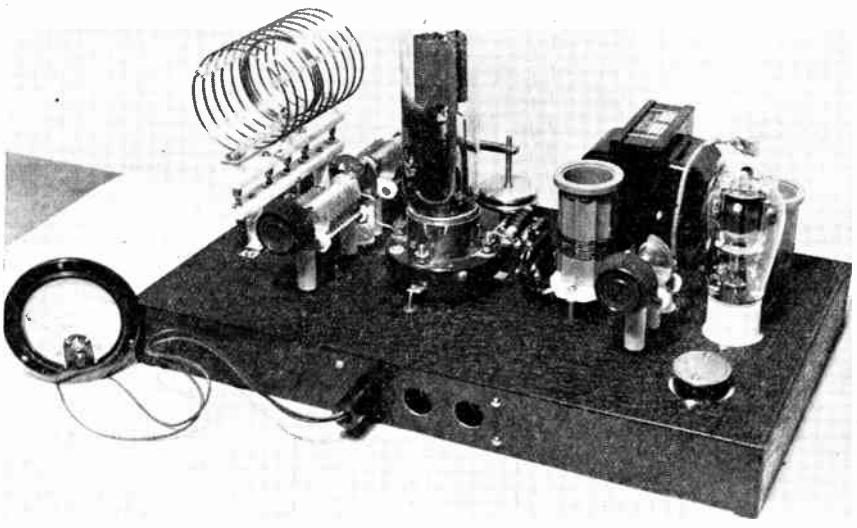
Midget ultra-short-wave transmitter, using a "doorknob" tube, and capable of radiating 6 watts at a frequency of 500 megacycles. Note miniature doublet antenna. (Photo courtesy Western Electric Co.)

FEATURES

DEPARTMENTS

THE DX4UCW XMTR

WITH XTAL ON 10-20-40-80



Two tubes, crystal controlled, high power—the c.w. transmitter for 10, 20, 40 and 80 meters, using the new ZB-120 in the final. It may be readily adapted to phone.

By Chester Watzel • W2AIF

FOR a long time one of our pet ambitions has been to build a really simple two-tube, two-stage c.w. transmitter having a reasonably high output down to, and including, 10 meters. The attainment of this objective has been fraught with difficulty up to the present. It has been done with low power rigs, but with outfits of decently high power the bugaboo of power gain has been a stumbling block.

Power Gain

The power gain of a transmitter stage is simply the ratio between input driving power and output power. As all good transmitters should use crystal control, the chief problem to be solved in our simplified c.w. transmitter is that of producing sufficient power gain to multiply the fractional-watt power of the crystal to some 100 or 200 watts in but two stages. It would seem, at first thought, that a small oscillator tube driving a large transmitting pentode in the final stage would be the answer. This does not work out in practice, as we have found to our sorrow. With a 10-meter crystal to start from it might be possible. With a 20- or 40-meter crystal it is a rather hopeless task. Neither an RK20-804 or an RK28-803 will deliver enough power output when doubling to 10 meters to be of use. In fact, we doubt if an RK28-803 will double at all to 10. An RK20-804 will deliver enough 10-meter output, doubling, to drive a final stage. These tubes are used in this manner in our own transmitters.

An RK20-804 will furnish sufficient output as a straight amplifier on 10 meters but is difficult to drive from a crystal stage using a 20-meter crystal. Even if this combination were to be worked out satisfactorily on 10 it would still fall far short of the power output goal set for 20 meters and the other bands. An RK28-803 will work out nicely in a two-tube layout on 20, 40 and 80 meters, but will not work on 10 even if a private power house is used as a driver—at least this has been our experience.

If a triode is to be used as the final stage of our two-stage transmitter, it must of necessity be used as a doubler to 10 meters because of the higher driving power requirements of this type of tube over the pentode type. Various tubes of the 203A type, including the 203A itself, make excellent doublers to 10 meters. Other tube types, such as the recently developed low-C group are also suitable for this type of operation. The driving power requirements of any of these tubes, however, is more than can be furnished by a crystal oscillator stage.

The above statements on transmitting tube layouts are meant to apply to multi-band transmitters in general and not to some particular single-band job. It is often possible, by means of prolonged and critical adjustments, to refute some of these statements and produce a high 10-meter output from some simple combination. But we are not interested in these critically adjusted transmitters. It must be possible, in our simplified transmitter, to change bands by merely plugging-in the appropriate sized coils, throwing a switch or two, and retuning. Any more difficult course is out of the question.

It is obvious that a different type of tube than previously available is necessary for either the crystal stage or the amplifier stage if we are to attain the simplicity of a high-power, two-stage, multi-band transmitter. By the term "high power" we mean the East Coast brand of high power, where the hams can put a 203A in the final stage and work the world. For the West Coast ham, this two-stage transmitter we are aiming at will make a nice driver for his brand of "high power" final amplifier.

The Answer

The tube which seems to be the answer to our prayer is the recently released ZB-120. This tube has low enough interelectrode capacitances to permit of full output on 10 meters, while the amplification factor is higher than that of any other triode at present available. High amplification factor in a tube obviates the necessity for fixed grid bias and permits the use of low driving power for full power output. This means that grid-bias power supplies may be eliminated for r.f. amplifier and Class B modulator stages and the r.f. exciter portion of the transmitter considerably simplified. In our particular case the high amplification factor of the ZB-120 means the difference between having and not having a two-stage transmitter.

The general construction and characteristics of this tube place it in the "203A" class, commonly known as the "fifty-watt" class. A standard fifty-watt type base is employed, as well as the standard filament voltage of 10 to 10.5 volts common to this type of tube. The maximum input ratings are also the same, being 1250 volts and 160 ma. The interelectrode capacitances, while not as low as in some of the recent low-C tubes, are lower than in any tube of this general construction. The plate-to-filament capacity is only 3.2 mmfd., while the grid-to-plate and grid-to-filament capacitances are, respectively, 5.2 and 5.3 mmfd. This order of interelectrode ca-

pacitances permits the ZB-120 to operate on full rated input at 30 mc.

The amplification factor of this tube (90) is about double that of the highest mu tubes of other types available at present. The combination of a very high mu, high constant input resistance and a high ratio of transconductance to interelectrode capacitance gives the ZB-120 certain advantages over other tube types, the most important of which are the following:

(a) 245 watts of audio output at 1250 plate volts and zero grid bias.

(b) 120 watts r.f. output as a Class B telegraphy amplifier with zero grid bias and a driving power of but 1.2 watts.

(c) 145 watts r.f. output as a Class C telegraphy amplifier with 135 volts grid bias from a grid leak and 5.5 watts driving power.

(d) 45 watts of phone carrier as a Class B linear amplifier with zero bias and a grid driving power (at modulation peak) of 1.5 watts.

(e) 42 watts of phone carrier as a grid modulated Class C r.f. power amplifier with 75 volts fixed bias and 1/6 watt driving power.

(f) 105 watts output as a frequency doubler for telegraphy with grid leak bias and 7 watts driving power.

(g) 45 watts of phone carrier (at 80 per cent modulation) as a grid-modulated frequency doubler with 330 volts of fixed bias and 7 watts of driving power.

(h) 95 watts output as a plate-modulator class r.f. power amplifier with 1000 volts on the plate.

With the exception of (h), all the above operating conditions are for a plate voltage of 1250 volts. Lower voltages can, of course, be used with corresponding lower outputs. We have, for instance, gotten ten watts output from the ZB-120 as a 10-meter doubler with only 380 volts on the plates of both tubes, in this transmitter.

The operating conditions that were of most value to us for this particular transmitter were (c) and (f). Condition (b) would be of interest if doubling in the final amplifier (necessary for operation of our two-stage transmitter on 10 meters) were not contemplated. With a driving power of only ½ watt required, any of the receiving type power tubes (47, 2A5, etc.) may be used in the oscillator stage at quite low plate voltages. The determining operating condition for this transmitter, however, is that of (f), which requires 7 watts of driving power. As long as this much driving power is required for 10-meter operation, it is just as well to use this available power to operate the ZB-120 under condition (c) for the other bands and get the maximum output of 145 watts on these bands.

The Oscillator Stage

As the oscillator is to operate as a tritet at times, one of the beam tube family was chosen for the oscillator. All of the beam tubes have a large second harmonic component which causes them to produce practically as high a second harmonic as fundamental output. The RK-39 was given preference over the other beam tubes because of its decidedly higher voltage and current ratings.

When using the tritet circuit, an extra tank is necessary for the cathode circuit. This is not classed as an extra tuned circuit in this transmitter, however, because it is self-tuned with a self-contained mica trimmer condenser. This condenser tunes broadly enough so that it needs but a single adjustment to cover an entire band. When once set it may be forgotten.

The use of small coil forms and a receiving-type condenser keep the cost of the oscillator parts low. The oscillator tuning condenser is mounted above the chassis with a pair of type CI-31 stand-off insulators. The socket for the plate coil is also mounted above the chassis with the metal spacers that come with the socket. This above-base mounting of both coil and condenser keeps the leads very short and permits of more turns in the plate coil.

The Amplifier Stage

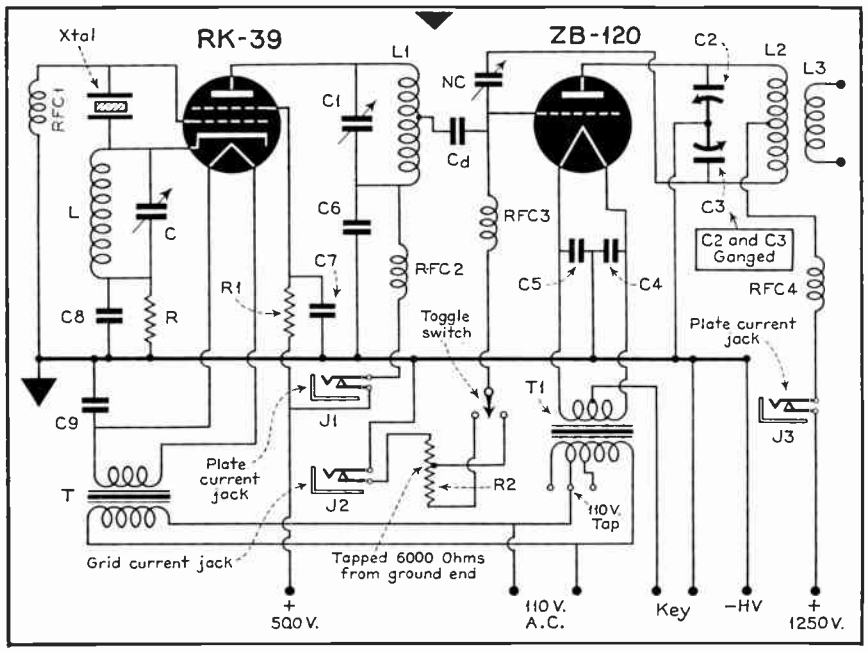
The power amplifier stage is conventional in design and construction except for the use of the ZB-120 instead of one of the more familiar class of "50-watt" tubes. In order to save both space and cost, a pair of midget transmitting condensers are ganged to form a split-stator condenser which has more convenient proportions than the usual large frame condenser. Four more of the type CI-31 insulators mount these two condensers well off the chassis. A type FC coupling is used to gang them.

The ZB-120 socket is mounted about a half-inch above the chassis to reduce its capacity to ground. It should be oriented so the grid connection faces the oscillator coil. This gives the shortest leads for the amplifier stage.

The neutralizing condenser, NC, is of a new mycalex-insulated type. It has been found that more complete neutralization can be obtained with this type than with the usual frame type, due to lower capacity to chassis. The tank coils for the amplifier have a built-in link for coupling to an antenna or larger amplifier stage. These links have been found to be the correct size for coupling directly to a 400- or 500-ohm line, such as is used with the Johnson Q type of antenna.

With the amplifier parts laid out as they are, the wiring is very short and direct. Each condenser section of the split-stator condenser assembly in the amplifier has two stator lugs projecting upward from its rear cross piece. The stator lug on each section which faces the tank coil is connected to the ends of the tank coil. The other stator lug on the front condenser goes to the plate connection on the tube socket. The remaining lug on the rear condenser runs to the top plate of the neutralizing condenser. The bottom plate of this condenser goes to the grid connection on the tube socket.

A small feed-thru insulator is mounted on the chassis between the two condenser sections. This insulator connects, on top, to the frames of the condensers and on



Circuit diagram of the two-tube, high power c.w. transmitter. Parts values are given in list of parts.

TEST OPERATION DATA CHART

Crystal Used	*Oscillator Output*	*Amplifier Output*	*Oscillator Plate Volts*	*Oscillator Plate Mils*	*Amplifier Plate Volts*	*Amplifier Plate Mils*	*Amplifier Grid Leak*	*Amplifier Grid Mils*	*Amplifier Grid Volts*	*Approx. Output*
20 M.	20 M.	10 M.	440	37	1000	125	15,000	10	150	75 W.
20 M.	20 M.	10 M.	720	50	1250	135	15,000	15	225	100 W.
40 M.	20 M.	10 M.	440	30	1000	110	15,000	10	150	60 W.
40 M.	20 M.	20 M.	500	50	1250	135	6,000	25	150	120 W.

the bottom to the common ground bus. *Don't forget to connect both of the condenser frames to this insulator*—we did, and took an evening to find the "trouble" in the amplifier.

The high mu of this tube makes grid leak bias practical for both straight-thru and doubler operation. With no excitation the plate current of the ZB-120 will drop to a safe value. With 1250 volts on the plate, for instance, the plate current will be only 50 mils with no excitation. Two different values of grid bias, and therefore two different values of grid leak resistance, are necessary, one for straight-thru and one for doubler operation. The exact values to be used depend on the plate voltage used, as well as the amount of driving power furnished by the RK-39. For c.w. operation we found that 6000 ohms for straight amplifying and 15,000 ohms for doubling were optimum. A single 15,000-ohm resistor with slider takes care of both resistance values required. An S. P.D.T. toggle switch, mounted on the back edge of the chassis, switches to either tap.

The Power Supply

While the filament of the ZB-120 may be run at 10 volts (2 amps.) under several of the operating conditions enumerated for conditions (c) and (f), under which the tube is running in this transmitter, 10.5 volts are required. Unfortunately, no 10.5-volt transformer of reasonable size and cost is at present available. The problem was solved by using a standard 10-volt, 6.5-amp. transformer. This particular filament transformer has three primary taps, for line voltages of 105, 110 and 115 volts. By using the 110-volt tap on a 115-volt line the voltage at the tube socket came out to exactly 10.5 volts.

This transformer is mounted on top of the chassis in the position shown. The filament transformer for the RK-39 is mounted under the chassis. An a.c. receptacle on the back edge of the chassis connects to a 110-volt line cord. This arrangement greatly simplifies the power connections to the transmitter. With the filament transformers self-contained, grid leak bias on the final and cathode bias on the oscillator, the only other power connections required are the plate voltages for the two tubes. A pair of posts for connection to the key complete the external connections. Small feed-thru insulators, mounted on the back edge of the chassis, take care of all connections except to the 110-volt a.c. line.

A rather novel arrangement is used in mounting the three meter jacks. These jacks are mounted on a small piece of hard rubber, which is in turn mounted a half-inch back from the front edge of the chassis. Large holes are drilled in the chassis directly in front of the three jacks. With this arrangement the jacks are away from careless fingers. With the plug all the way into any of the jacks, the metal part of the plug is safely hidden. These holes in the chassis should be large enough to clear the plug. More than one meter may be plugged in simultaneously if desired.

Operation

The transmitter was first tested with low voltage on both tubes. The power supply used for the first tests is the one shown for the 2.5-meter "Ground Hog" in this issue. Under the load drawn by this transmitter the voltage was 380. With a 40-meter crystal an output of ten watts could be secured on ten meters. One difficulty was noticed in these first tests that was at first thought could not be eliminated in this layout. The crystal current was so high that the crystals heated very rapidly and the frequency drifted a number of kilocycles in a matter of seconds as a consequence. The crystal holders were uncomfortably hot to the touch. In these tests a recommended grid leak of 15,000 ohms was used on the oscillator in addition to the cathode resistor.

Advice from a person who had experimented with beam tube oscillators to a greater extent than we had was to the effect that this crystal heating could not be eliminated except by the use of trick circuits of the "controlled oscillator" type. As a last resort the grid leak was completely shorted out, leaving only the bias resistor. The crystal current immediately dropped to a safe value while the output of the tube remained the same. A ¼-watt neon bulb which had before lighted quite brilliantly when applied to the grid went completely out when this leak was shorted. On monitoring the signal it was found to hold as steady as a rock.

The transmitter should be first tested on twenty meters and the ZB-120 neutralized for that band. The neutralizing condenser, when set at this value, provides a desirable degree of regeneration for doubling to 10. With the final correctly neutralized and the trimmers in the cathode coils set for maximum output from the oscillator as a tritet doubler, the transmitter is ready for operation with full voltage on the final. It is always a good idea to tune up the ZB-120 on low voltage. A switch to throw this final stage to either the low or high plate voltage is an addition well worth incorporating.

Specifications for an extra cathode coil are included so that 80-meter crystals may be used when desired. Although the transmitter was only tested on 10, 20 and 40 meters there is no good reason why it may not also be used on 80 meters. An oscillator plate coil of about 35 turns can be used. Whenever the oscillator plate circuit is tuned to the crystal frequency, a piece of heavy wire bent in the form of a U is used as a shorting bar in place of one of the cathode coils.

Test Operation Data

Operation on both 10 and 20 meters was tried with a variety of voltages on both tubes. The results of several of these tests are incorporated in the accompanying Test Operation Data Chart.

(Continued on page 212)

COIL DATA CHART

Nature of Coil	*Turns*	*Wire*	*Spacing*	*Exitation Tap to ZB-120 Grid*
Cathode coil for 40-meter crystal	6	No. 20 enam.	diam. of wire	
Cathode coil for 80-meter crystal	12	No. 24 d.s.c.	close wound	
Osc. plate coil for 20 meters	9	No. 20 enam.	diam. of wire	4 turns from plate end
Osc. plate coil for 40 meters	14	No. 20 enam.	diam. of wire	5 turns from plate end

All forms Hammarlund SWF4, 1½" diameter. Cathode coils have Hammarlund IBT-220 trimmer condensers mounted in coil forms with screw.

REGIONAL AMATEUR

A METHOD TO IMPROVE THE

EVERY amateur hopes that additional frequencies can be secured to decrease the interference now encountered on our 3.5-mc., 7-mc., and 14-mc. bands. All amateurs who have devoted any serious consideration to the subject know that no action can be expected along this line until the close of the International Conference at Cairo in 1938. It should be borne in mind that, among other things, we must first secure a favorable attitude from the United States' delegation to this conference, at this writing practically committed to the preservation of all present allocations. To accomplish this is child's play compared to the truly monumental task of persuading the delegations of a sufficient number of the 79 foreign nations to agree with our views. The size of this task was appreciated by the Board of Directors of the A.R.R.L. when they appointed a special committee to consider ways and means to bring about this desired result.

The writer is attempting to feel optimistic along with many others in the face of these tremendous odds against us. In the meantime, unless some other course of action is open, we must stew in an ever-increasing amount of interference for some time, with an excellent chance of coming home from Cairo without the desired frequency increases. It is also well to realize that by 1938 our numbers may have increased to such an extent that if additional frequencies *are* obtained, the increase in numbers will have been so great as to cancel the advantage of more frequency space if we continue to operate under the present set-up.

The enjoyment we amateurs secure from our hobby is directly connected with the amount of interference we encounter in our attempts to communicate with fellow amateurs. Doubtless, many of the problems that seem of such burning importance today and much of the dissension within our ranks would rapidly decrease if the old bugaboo of QRM could be lessened.

Regional Frequency Allocations

Strangely enough, a scheme to greatly decrease our interference problem can be put into effect for the asking. Best of all, it can be put into effect now, not a year from now, if the majority want it. Also the principle can still be applied if we do secure the coveted increase in frequency assignment. The system would undoubtedly be acceptable to the Federal Communications Commission for the simple reason that they have been employing it for years in this country with very satisfactory results in the broadcast band. In a word, this plan is the subdivision of our popular bands on a regional basis.

Many advantages can be obtained with such a system on our bands that cannot be secured on the broadcast band because the skip-distance effects encountered on short waves are not present on the lower frequencies. The reasons for this will be brought out as the subject is developed.

Let us take an elemental case on 7-mc. first. Imagine all the United States' 7-mc. amateurs crowded into a sub-band from 7.0-mc. to 7.2 mc., leaving the sub-band 7.2- to 7.3-mc. for the DX stations. Certainly everyone in this country would be able to hear and work DX under such conditions. Obviously, we cannot afford to waste one third of the band for such a purpose, for a number of reasons. If we go to the other extreme and assign one-ninth of the band to each of the nine districts, we evolve a cumbersome system that would also be unfair since some districts contain far more amateurs than others.

The Plan

The distribution of the amateur population and Old Man Skip Distance enter the picture at this point to aid in the development of a practical idea than can readily be put into effect. Look at Figs. 1 and 2 for a moment. We find the country divided into three sections or zones. Zone 1 and Zone 3 operate from 7000 kc. to 7150 kc. Zone 2 operates from 7150 kc. to 7300 kc. Let us now consider what will happen in various parts of the country with good DX weather in effect. Every 7-mc. brass-pounder can figure out how advantageous such a plan would be in his individual case. Take a map or in your mind's eye draw a circle with a 15-mile radius around your QRA. In this area we encounter the R9 ground waves of the local boys. If you happen to live in the country this type of interference is negligible, but if you live in a populous area the number of such ground-wave signals may be quite high. In either event, all ground-wave QRM will now be segregated, ridding one-half of the band of this type of interference for everyone. Now get a map if you didn't do so before, and draw a circle with an 800-mile radius around your QRA. This seems to be a reasonable average for 7-mc. skip distance under normal night conditions. If you live in Zone 1 or Zone 3, you will get plenty of Zone 2 signals from 7150 to 7300 kc. (You do already.) But from 7000 to 7150 kc. the only interference encountered will be from local ground-wave signals. DX stations on the opposite coast and overseas stations

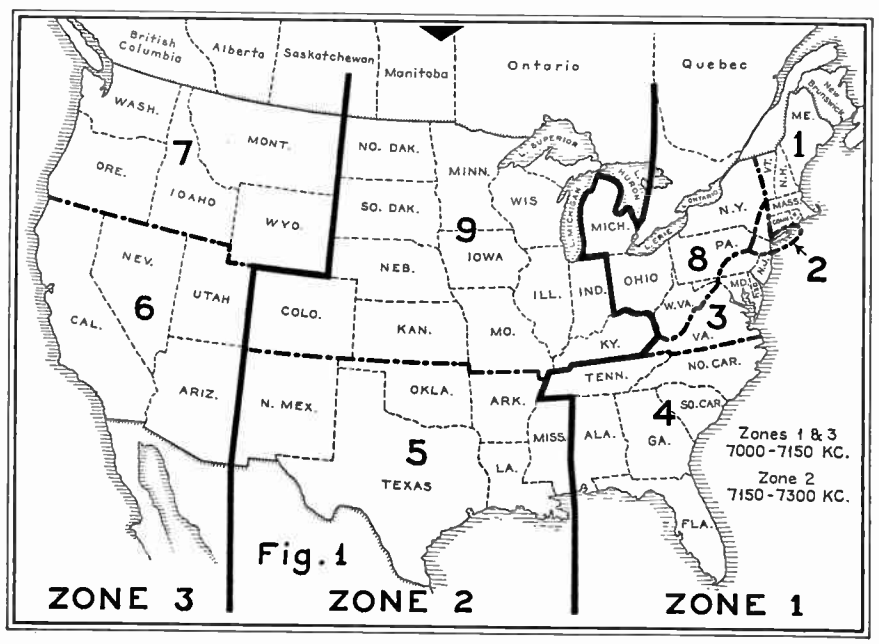


Fig. 1

Map showing the frequency zoning suggested for the 40-meter band. Zones 1 and 3 use the same frequencies; Zone 2 is allocated the frequencies from 7150 to 7300 kc. Consequently, Zone 2 neither interferes with nor experiences interference from Zones 1 and 3.

FREQUENCY ASSIGNMENTS

INTERFERENCE SITUATION

By Dana A. Griffin • W2AOE

will have an excellent opportunity to come through within the 150-kc, sub-band. Those operating in Zone 2 at present get QRM from all directions and are in a far worse position than a coastal station whose "QRM" from overseas is the thing all DX'ers yearn for. An examination of the situation in Zone 2 indicates that the operators in this area will get local ground-wave interference from 7150 to 7300 kc. and no QRM from either coast in this band, greatly increasing the opportunity for foreign contacts. QSO's with either coast will also be much easier than they are at present since Zone 2 signals will not be found from 7000 to 7150 kc.

No system can be perfect and in some cases interference other than local stuff will be encountered in the sub-bands, due to the fact that the 1600-mile circle will not always cover the zone in which the operator works. However, it should be remembered that skip distance increases in the early morning hours when DX is at its peak. At this time the fringe of 800- to 1500-mile-distant stations will not be heard, leaving only ground-wave and "overseas QRM" to be contended with within one-half of the band in every instance.

Zoning 14 MC.

A regional sub-division of the 14-mc. band is slightly more complicated due to the presence of a phone sub-band. However, as the skip distance averages around a thousand miles or more, the zone arrangement suggested for 7-mc. seems equally applicable. We have great assurance of the absence of the interference (except ground-wave signals) in the zone used by any 14-mc. operator. Surveys taken recently by League observers indicated that some of the frequencies taken away two years ago should be returned to phone use on a basis of occupancy. It is obvious that if the present band of 100 kc. is sub-divided into 50-kc. units, operation will be seriously handicapped as the phones are required to stay 3 kc. inside the sub-band edges to prevent side-band interference. In the writer's opinion, the best way out for everyone seems to be the arrangement shown in the table of Fig. 3. Such a subdivision keeps both phone and c.w. sub-bands adjacent to each other. It will not be necessary for either a phone or a c.w. operator to tune through a sub-band of the opposite type of transmission when looking for a QSO.

14-MC. ZONING

Zones 1 & 3	14,000 to 14,125	c.w.
Zone 2	14,125 to 14,250	c.w.
Zones 1 & 3	14,250 to 14,325	phone
Zone 2	14,325 to 14,400	phone

Fig. 3

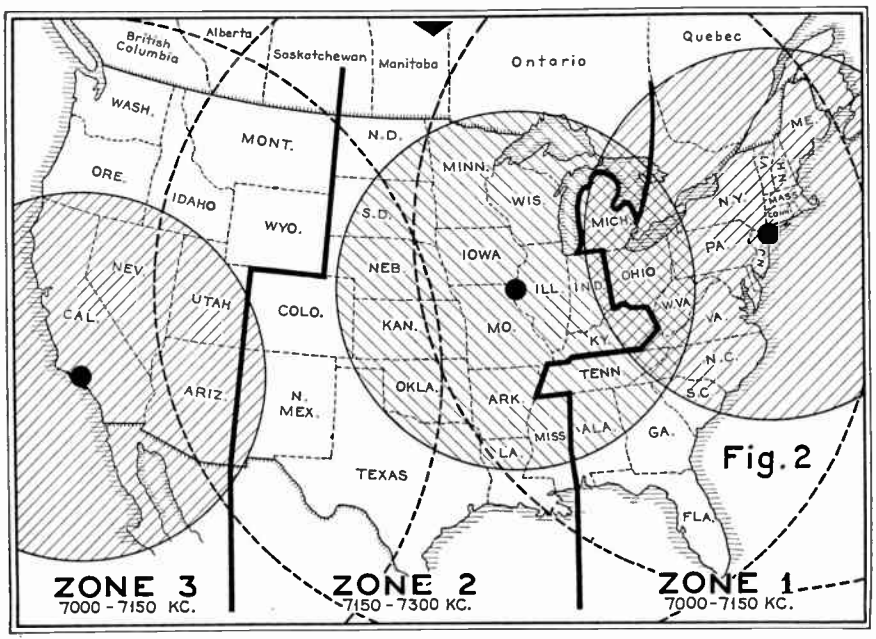
As many 14-mc. phone men operate on c.w. part of the time, it seems permissible to hazard a guess that such operation might be conducted on their normal phone frequency without causing an undue amount of phone-band interference. The c.w. man would, of course, be allowed to operate on telegraph in the phone sub-band allocated to his zone if he so desired, as he may now do in the present phone sub-band. Any 14-mc. user can turn over the advantages of such an allocation in his mind in the same manner indicated for 7-mc. However, a 1000-mile radius should be used to draw the circle on the map to determine the "zone of quiet" that will be secured in his zone by such regional allocation of frequency.

While conditions on the 3.5-mc. band insofar as QRM are concerned are equally as bad as those encountered on 7- and 14-mc., the skip effect is not as long nor is it anywhere near as consistent as it is on the other bands. Consequently any zoning on the 3.5-mc. band would necessarily have to be modified to a considerable degree if it were to be effective. No doubt the best policy would be to make haste slowly and first acquire a year's experience on the other two bands before making any attempt to "zone" 3.5 mc. The writer feels that only by collective experience obtained by actually operating under the system suggested can any worthwhile idea of the benefits and detriments be secured. A plan of this type covers such a large territory that argument can proceed indefinitely if there is no factual background upon which to base any given claims.

Advantages

It appears to the writer that the increased amount of enjoyment all those operating 7- and 14-mc. would secure with such an allocation of frequencies would be enormous. The entire picture, insofar as DX contacts without interference are concerned, would be increased to a degree never enjoyed before in this country. The suggested plan is based on a rough division of the amateur population into nearly equal parts, taking into consideration skip-distance effects

(Continued on page 218)

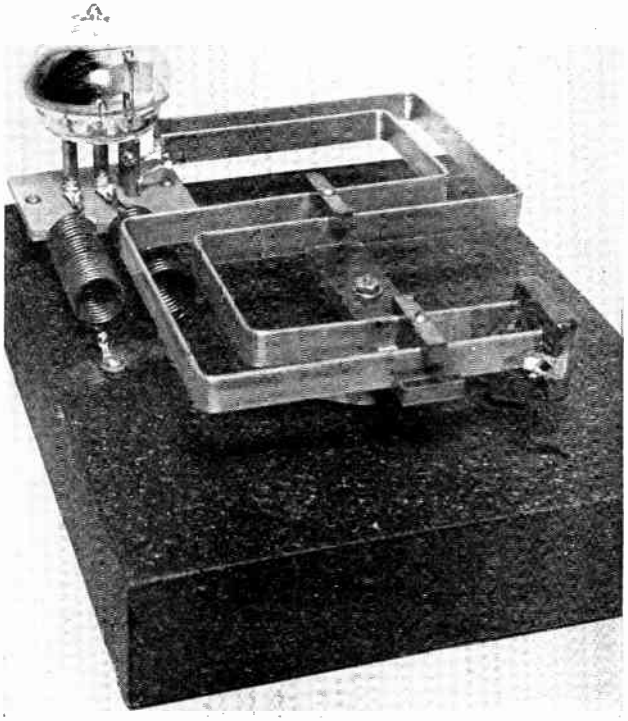


How the system would work: Black discs represent ground-wave coverage, the shaded areas "zones of quiet." The areas encompassed by the dotted circles represent skip effects, which would prevail at 40 and 20 meters during certain hours of day and night.

THE "GROUND HOG"

2.5-METER COMMUNICATION RIG

By Willard Bohlen • W2CPA



The completed r.f. unit of the transmitter, showing the "doorknob" tube and the Mayhew "S" Oscillator. Note r.f. chokes in filament leads of the 316-A tube.

THE frequencies open to the amateurs are divided into narrow bands down to, and including, the 5-meter band. All frequencies above 110 mc. are also open to the amateurs. But for convenience in locating other amateurs working in this vast frequency territory above 110 mc. it is customary for the amateur to operate on or near either 2.5, 1.25 or .75 meters. The frequencies near the low frequency end of this range, around 2.5 meters, have propagation characteristics not far different from 5 meters, but have the tremendous advantage over 5 in that there is a total lack of QRM. This is because these ultra-high frequencies have not as yet been made useful as an amateur communication band, as have the 5 to 160-meter bands, but still remain in the category of experimental frequencies. These conditions make 2.5 meters extremely desirable for communication work involving only a few nearby stations.

Ideal Station Links

One such example of special communication work for which 2.5 meters is almost ideal is a simple two-way link between two amateur stations, situated within several miles of each other, for the purpose of relaying either each other or else more distant stations through on one or more of the regular amateur communication bands. The ease with which duplex communication may be held on the 2.5 meter band, entirely free from QRM, makes possible many other interesting and useful operations between two or more stations and two or more bands.

The apparatus here described makes up a simple and modern 2.5-meter station which is entirely complete in itself. For the purpose of providing the utmost flexibility in handling a wide variety of different operations, the 2.5- meter equipment has been divided into four separate units. These are the transmitter, the receiver, the modulator and the power supply. A common plate source of 350 volts makes possible the use of a single power supply to operate the other three units. Ordinary four-prong wafer sockets are used for all power interconnections so that a receiver-type power supply may be used to operate one of the units under conditions where it is desirable to widely separate them. This would be the case if the receiver were to be operated in a different part of the house from the transmitter. It is possible, however, to operate duplex with complete satisfaction when all units are operated from the common supply and separated by only a few feet.

Standard 8½" x 10" x 2" chasses are employed. These may be bolted side-by side in pairs to form 17" long chasses which will in turn fit behind a standard 8¾" x 19" panel. This permits rack or cabinet mounting. It is better, however,

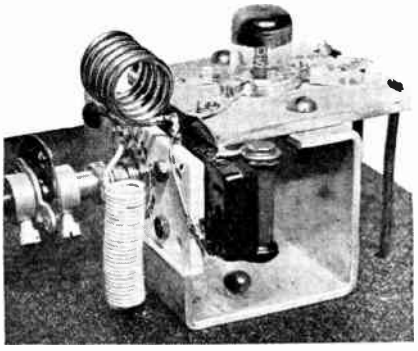
The receiving unit of the "Ground Hog." This uses a type 955 acorn tube in a super-regenerative circuit.

to keep the transmitter unit separated by a few feet from the other units to prevent any undesired feedback. There is plenty of output from this transmitter even if the plate supply is only 350 volts.

The Transmitter Unit

While the other units can, and have, followed conventional design, the construction of a 2.5-meter transmitter having a reasonable degree of frequency stability requires a bit of thought if it is to be completely contained on such a small chassis. An ordinary tank coil would go on with plenty of room to spare, but would subject the oscillator to severe frequency modulation. The usual form of long-lines oscillator built with straight lengths of copper tubing will provide a satisfactory degree of stability but occupies entirely too much space, the shortest long-lines oscillator usuable for 2.5 meters still being approximately two feet in length. Coiling or bending of copper tubing is a job better left undone.

A conference on the subject of long-lines oscillators was held with Al Mayhew, W2BYW, who was cooperating in our 2.5-meter experiments by building a duplicate layout so as to provide us with another station to work for various tests.



Closeup view of the "super" section of the receiver, showing details of the special mounting for the components.

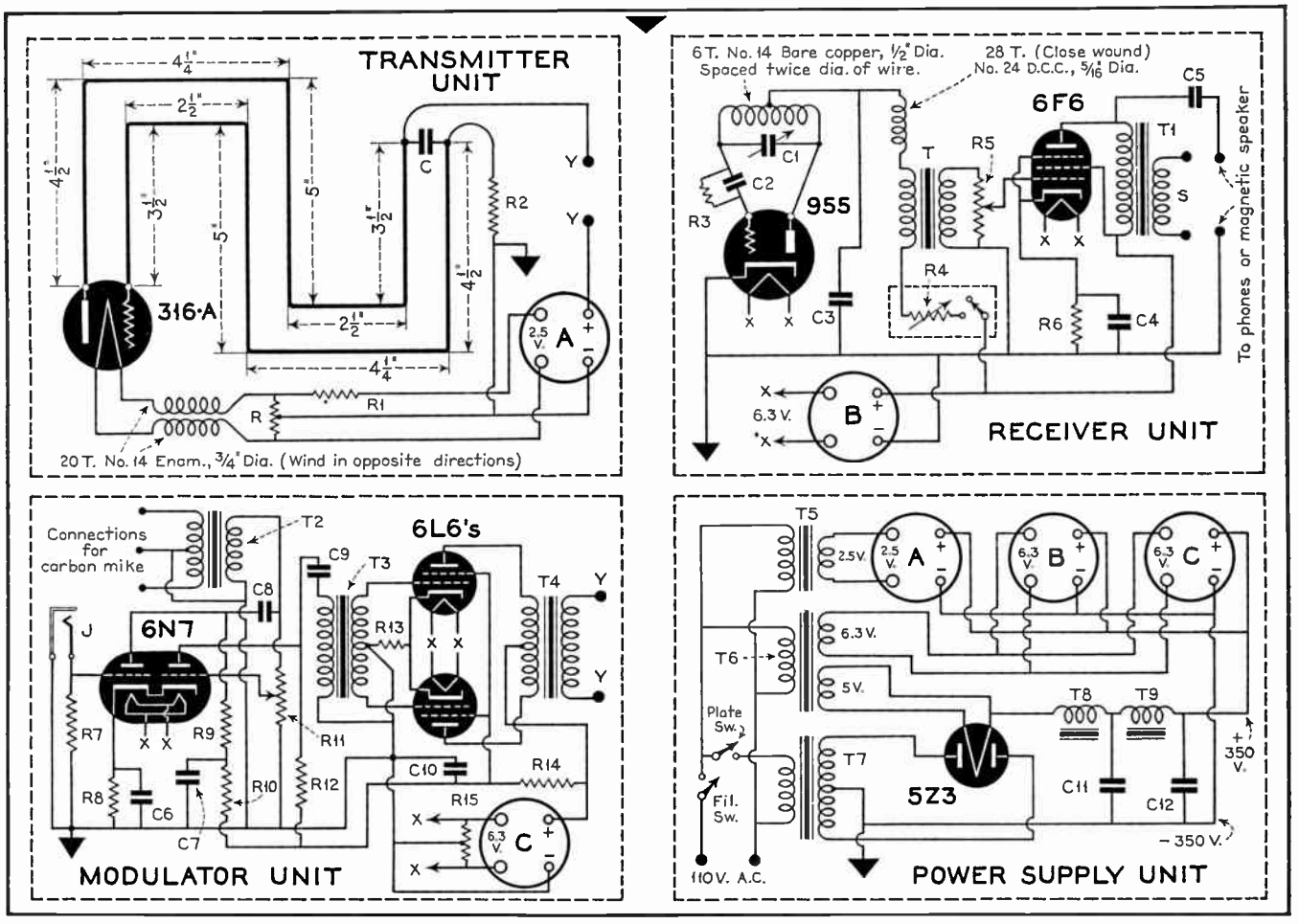
This duplication of units was also valuable in showing up any bugs that might crop up in one particular job and not in another. Fortunately, nothing of the sort occurred, both sets of units working almost identically. A further check was made by interchanging several different oscillator and detector tubes in the transmitter and receiver. This check showed that the circuits used were critical of neither tubes or part's values.

Al suggested using copper strip in place of the tubing for the long-lines oscillator. Copper strip is as effective in providing stability in the oscillator as tubing of the same circumference and is easily bent into the desired shape. The oscillator shown was built up by Al as well as a duplicate for himself. Although but two strips are necessary, a few precautions as regards spacing and bending should be observed.

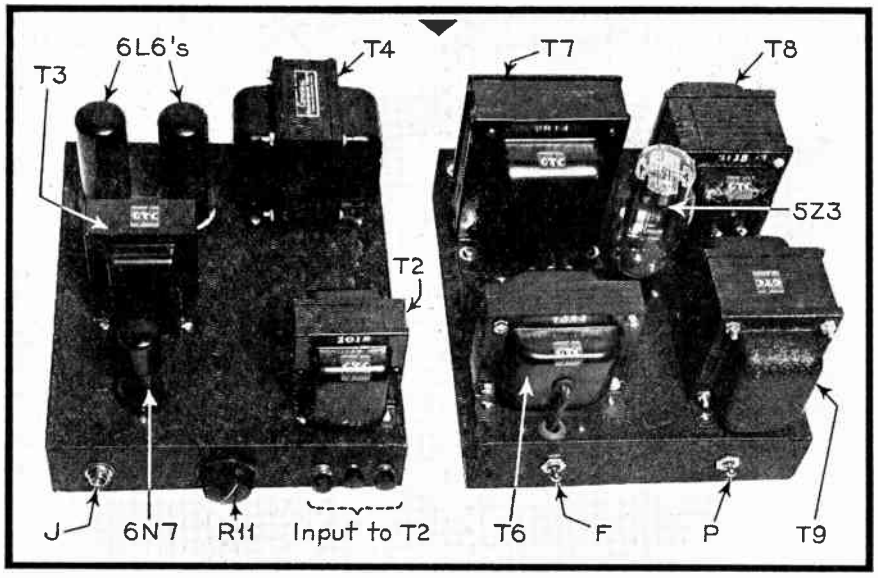
Mayhew "S" Oscillator

The spacing between strips which provided optimum results was found to be three-quarters of an inch. It is desirable to have the opposite ends of the strips from the tube at a voltage node so that the bypass condenser may be connected directly across these ends. By bending the strips into the form of an "S" it is possible to make both strips exactly the same length. The "S" figure also permits the full length of the strips to be mounted on the top of the chassis as shown in the photo. This oscillator is therefore called the Mayhew "S" Oscillator.

This long-lines oscillator is a quarter wave long at 2.5 meters. The voltage distribution is such that maximum voltage occurs at the tube terminals, while the voltage node is at the bypass condenser at the other end. This is the simplest form of long-lines oscillator



Diagrams of the four units comprising the "Ground Hog." The Transmitter, Receiver and Modulator Units plug into the Power Supply Unit, the latter supplying all plate and filament power.



At left, the "Ground Hog" modulator unit; at right, the power supply unit.

and eliminates any possibility of operation on some harmonic of the desired frequency. The actual length of strip used for 2.5-meter operation depends on the interelectrode capacitances of the tube used, as well as the length of the leads in the tube itself. A tube with low interelectrode capacitances and short leads was therefore chosen. This was, as might well be expected, the new Western Electric type 316-A "doorknob" tube. This tube is rated at 400 volts and 80 ma. input for modulation and has a plate dissipation rating of 30 watts. It is possible to get a modulated carrier output of between 5 and 10 watts on the ultra-high frequencies with this tube without exceeding any of the manufacturer's ratings.

Filament chokes of the specifications shown in the transmitter diagram are used and mounted as per the photo. One end of each choke goes to a bolt running down through the chassis and insulated therefrom by small fibre insulating washers. A pair of binding posts would also be suitable. The other ends of the chokes are soldered to lugs which are in turn soldered to the bottom of the grid and plate posts on the tube socket. The chokes should be stretched so as to space the turns slightly.

The ends of the copper strips are also soldered to lugs which are in turn soldered to the bottom of the grid and plate posts on the socket. A piece of hard rubber 5 inches long, mounted on a stand-off insulator, supports the rest of the strip. Smaller pieces of hard rubber are bolted to the large piece and clamp the copper strip tightly in place. Small grooves are filed in the rubber pieces to prevent the copper strips from shifting their position. The bypass condenser is merely soldered to the ends of the strips. The grid and plate feed wires are soldered to the same points as this bypass condenser.

It is necessary to drop the filament voltage to the tube from 2.5 to 2 volts. This is done with resistor R1. As this resistor need be but a fraction of an ohm it may be easily made up from a very short piece of resistance wire or a short length of thin copper wire, such as No. 30. A trial with a voltmeter will determine the correct length of wire to use.

The filament center-tap resistor and the grid lead are mounted under the chassis. The power connection socket (4-prong wafer) and a pair of small feed-through insulators for connection to the modulator output complete the transmitter unit.

The Receiver Unit

The receiver retains the simplicity of the transmitter. A self-quenched superregenerative detector is used, together with one stage of audio. The connection of the grid of the detector to the plate voltage through the one-megohm grid resistor is not a mistake. This positive voltage on the grid provides greater sensitivity and smoother superregeneration.

The detector unit is the heart of this receiver. A piece of aluminum of the dimensions given in the accompanying sketch is bent up into a bracket which forms the mounting for the entire detector stage. The photo shows this construction. One end of the coil is extended an extra half inch so that it can be soldered to both the plate terminal on the socket and the rotor on the tuning condenser. The other end of the coil is soldered to the stator terminal on the tuning condenser. The grid leak and the grid condenser connect between this stator terminal and the socket grid prong. The tuning condenser should mount with the connection lugs turned upward. The r.f. choke has one end soldered to the center turn of the coil while the other end runs down through a small hole in the chassis, using a length of spaghetti for insulation. The cathode and heater prongs of the socket have wires running directly down through small holes in the chassis. The cathode lead should connect directly to one of the bracket mounting screws underneath the chassis. This screw, with several soldering lugs fastened on it, should then become the "single point" ground of the receiver. The location of this detector unit on the back of the chassis with a hard rubber rod between it and the dial eliminates body capacity. The "panel" is a small piece of metal cut from an extra chassis base.

The 6F6 audio tube and the interstage audio transformer mount on top of the chassis. The output transformer is underneath the chassis and fastened to the back edge. The particular output transformer used has a secondary (S) impedance of 6 to 15 ohms and is suitable for direct connection to the voice coil of a dynamic speaker. The other pair of posts constitute a high-impedance output suitable for earphones or magnetic speaker. Where a low-impedance line is desired for remote operation of the receiver from the operating position, this 15-ohm voice coil winding may be used, providing it is suitably matched at the operating position. If a type 2338 output transformer is used instead the present type 1347 an additional 500-ohm secondary is available where a line of such an impedance is more desirable. The full primary of the type 2338 transformer should be used.

The Modulator Unit

Since the maximum input to the 316-A oscillator tube is 32 watts (at 400 plate volts) a modulator output in the neighborhood of 15 watts was necessary. Other requirements are that a gain sufficiently high for the direct use of a crystal microphone be available, as well as suitable inputs for both a single or double-button microphone, and a low-impedance line for remote operation. In keeping with the simplicity of the other units it was felt that a minimum number of stages and tubes be used.

The modulator design shown was thought to best satisfy these requirements. A 6N7 duo-triode is used for the first two stages. A pair of 6L6's are used in the output stage. These three tubes provide a total of three stages, one of them push-pull. A jack at the input to the first stage is used for the crystal mike input. The full three stages are used for this mike. Transformer T2 is connected to the input to the second stage. The primary of this transformer is 200 ohms, center-tapped. This primary can take care of either a

single-button mike, a double-button mike or a 200-ohm line. The gain of two stages is sufficient for any of these latter inputs, permitting a better setting of the gain control. This control is in the grid circuit of the second stage so as to control both input channels.

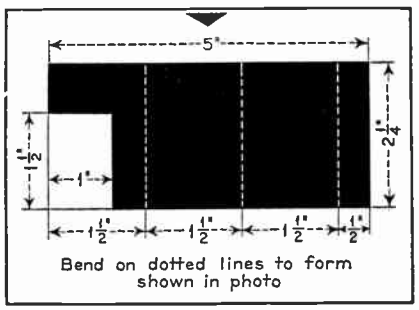
This modulator will furnish considerably more than the 15 watts output required. With the 350 volts provided by the power supply the output will be about 25 watts. This is sufficient to easily modulate an input to any transmitter of 50 to 60 watts. The unit construction makes it possible to use this modulator with other transmitting equipment.

This is actually about the simplest 25-watt modulator we have seen. It will be noticed that the output transformer used is specified by the manufacturer as a Class B 46 type. It happened to have the correct impedances for the conditions under which the 6L6's are run in this modulator. This suggests the replacement of the 46's in a Class B 46 modulator with 6L6's by the amateur desiring more gain in his present modulator. The same input and output transformers may be retained. As 6L6's operated in Class AB_1 (as in this modulator) require no grid driving power, the input transformer in a revamped Class B 46 amplifier could be replaced with a step-up interstage transformer, such as the one specified in this modulator, for additional gain.

The Power Unit

The power supply provides 350 volts at 200 ma. Choke input, with a swinging choke, is used in the filter to obtain a very good degree of regulation. Two filament transformers are used so that the plate power may be turned off without turning off the filament power. The 2.5-volt filament transformer is mounted under the chassis while all the other transformers are mounted above. Two toggle switches on the front edge are used for filament and plate. They are connected so that the filament switch also turns off the plate transformer.

Three 4-prong wafer connection sockets are mounted on the back edge, as well as an a.c. receptacle. It is well to avoid plugging the transmitter cable into one of the other sockets . . . 6 volts does not agree with the 316-A filament.



Details of the U bracket for the detector unit in receiver.

PARTS FOR GROUND HOG

AEROVOX
- 1—.002 mfd. mica condenser (C), 600 v. working
- 1—.0001 mfd. midget mica condenser (C2)
- 1—.002 mfd. midget mica condenser (C3)
- 1—5 mfd. 50-volt electrolytic condenser (C4)
- 1—½ mfd. 400-volt paper condenser (C5)
- 1—5 mfd. 50-volt electrolytic condenser (C6)
- 1—2 mfd. 250-volt paper condenser (C7)
- 2—.01 400-volt paper condenser (C8,C9)
- 3—8 mfd. 500-volt dry electrolytic condenser, cardboad case (C10,C11,C12)

AMERICAN RADIO HARDWARE
- 1—Micalex socket for acorn tube
- 1—Micalex socket for 316-A tube

BIRNBACH
- 4—small feedthru insulators
- 1—small standoff insulator

EBY
- 6—4-prong cable plugs

ELECTRAD
- 1—250,000-ohm potentiometer with switch (R4)
- 1—500,000-ohm potentiometer (R5)
- 1—500,000-ohm potentiometer (R11)

GENERAL RADIO
- 1—2-inch dial

GENERAL TRANSFORMER
- 1—type 2231 interstage transformer, 1 plate to 1 grid (T)
- 1—type 1347 output transformer from pentode (T1) (substitute type 2338 if 500-ohm output is also desired
- 1—type 1017 input transformer, d-b mike to single grid (T2)
- 1—type 2234 interstage transformer, 1 plate to 2 grids (T3)
- 1—type 2343 output transformer, Class B 46 type (T4)
- 1—type 1416 filament transformer, 2.5 v. (T5)
- 1—type 1054 dual fil. transformer, 5 v. and 6.3 v. (T6)
- 1—type 2814 power transformer, 950 v. CT at 200 ma. (T7)
- 1—type 2117 swinging filter choke, 200 ma. (T8)
- 1—type 2115 smoothing filter choke, 200 ma. (T9)

HAMMARLUND
- 2—isolantite octal sockets

IRC
- 1—1-megohm, ½ watt resistor (R3)
- 1—5-megohm, ½ watt resistor (R7)
- 1—3,000-ohm, ½ watt resistor (R8)
- 1—250,000-ohm, ½ watt resistor (R9)
- 1—15,000-ohm, ½ watt resistor (R10)
- 1—250,000-ohm, ½ watt resistor (R12)

NATIONAL
- 1—type UM15 tuning condenser (C1)
- 1—type TX shaft coupling

RCA
- 1—type 955 acorn
- 1—type 6F6
- 1—type 6N7
- 1—type 5Z3
- 2—type 6L6

WARD LEONARD
- 1—50-ohm CT filament resistor (R)
- 1—10,000-ohm, 10 watt resistor (R2)
- 1—1000-ohm, 10 watt resistor (R6)
- 1—300-ohm, 25 watt resistor (R13)
- 1—5000-ohm, 25 watt resistor (R14)
- 1—75-ohm CT filament resistor (R15)

WESTERN ELECTRIC
- 1—type 316-A u.h.f. tube

YAXLEY
- 1—single circuit jack

MISCELLANEOUS
- 2—SPST toggle switches
- 5—binding posts with insulating washers
- 5 feet of 1/16" x ½" copper strip
- 1—A.C. outlet
- 4—8½" x 10" x 2" black crackle finished chasses
- 7—4-prong wafer sockets
- 2—octal wafer sockets
- 3—small knobs
- 1—piece of resistance wire for (R1) as per text

This equipment has been thoroughly tested and has given satisfactory performance. The parts listed or their equivalent will give satisfactory results. Substitutions should be made with care.

Operation

When first testing the units, the transmitter and receiver should be plugged into the power supply but the modulator should be left disconnected. The modulator connection posts on the transmitter should be temporarily shorted to provide plate voltage to the doorknob tube. Touching either of the copper strips with a neon bulb will show the presence of oscillation. When testing be sure not to short the two copper strips with anything, even momentarily. We did just this fool thing—accidentally—with a 110-volt bulb and completely ruined a perfectly good doorknob tube in less than a second.

If the transmitter is oscillating, as it should be if all parts are good, the receiver should next be tuned to the transmitter frequency. This point will be indicated by a complete cessation of the rushing sound caused by superregeneration of the detector. If the receiver does not tune to the transmitter frequency, the detector coil should be adjusted slightly until the transmitter is received at a point not too near either end of the dial. After this adjustment is made the apparatus is ready to go on the air.

Antennas

The antennas best suited for opera-

(Continued on page 215)

R.S.S.L. NEWS

HEADQUARTERS has been literally swamped with membership applications, letters from present members, numerous station reports, and suggestions relative to League functions. We are up to our ears, but still managing to keep up with each day's work.

Some Don'ts

Some members have commenced sending in station reports and data on new stations heard to Headquarters. Though we appreciate the information, it should be pointed out that it is the main purpose of the League to provide complete signal surveys *only to such stations requesting them.* When such requests are made—and there will be many of them as soon as the service is officially made available—complete data with regard to each station will be published in this department. If, for instance, station XYZ wants to know what sort of signal coverage they are getting throughout the United States, the RSSL will provide to its members the frequency or frequencies upon which station XYZ operates, schedules of transmission and other pertinent data. Each member can then monitor XYZ's signals and submit his report—whether it be for a few hours' listening, a day or a week—to his *Sectional Manager* who in turn will collate the material and forward it to Headquarters where a field pattern, showing XYZ's signal coverage and nature of reception, will be drawn up and forwarded to the station engineers.

NATIONWIDE SIGNAL SURVEY DRILL

Other surveys, such as noise interference, will be handled in the same way for the reason that individual, unsolicited reports on any signal or noise condition are in themselves of no particular value. It is only through *group reports* on one station or one noise source that anything can be learned.

Therefore, *please do not send signal or noise survey reports either to Headquarters or your Sectional Manager unless they have been solicited.* The one exception to this rule applies to *new stations heard, the presence of severe local noise interference, discovery of peculiar phenomena such as fade-out periods, etc.* SUCH REPORTS SHOULD BE SENT TO THE DIRECTOR OF THE DIVISION TO WHICH THE REPORT WOULD APPLY, AND NOT TO YOUR SECTIONAL MANAGER. For instance, if a fade-out is noted, it should be reported to the Director, Short-Wave Broadcast Division, Radio Signal Survey League, 16 East 43rd St., New York, N. Y. If it chances that the fade-out is reported by a number of Monitoring Stations in one area, then the Director will transmit a report to the Sectional Manager for that area. Further surveys will then be conducted in an attempt to determine both the nature and the cause of the fade-out. Likewise, should it be learned that a station operating in the standard broadcast band had changed frequency, suddenly increased in signal strength in your locality, or was suddenly subject to interference from another station, the condition should be reported to the Director of the Standard Broadcast Division.

Your own good judgment will dictate the answer in most cases. Just keep in mind that *solicited reports* should be sent to your Sectional Manager *at his local address* and unsolicited reports of the nature indicated above to the proper Director *at Headquarters address.* Suggestions relative to the functioning of the League should also be addressed to the proper Director.

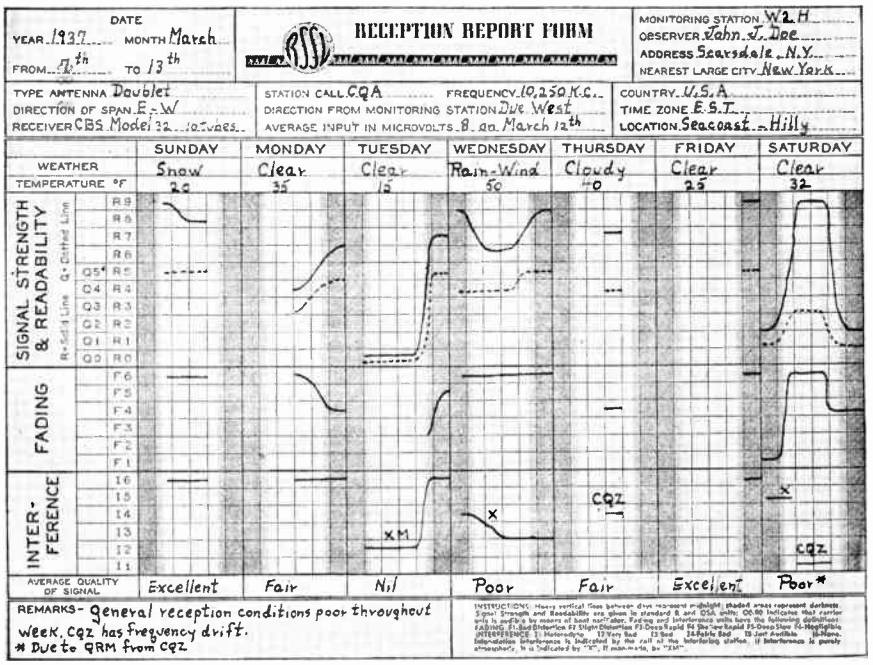
Sectional Managers

One Sectional Manager has been appointed for each State. The name and address of the Sectional Manager appointed for your State will be found in the accompanying list. Canadian and foreign Managers have not as yet been appointed, and there are a few States where a selection has not been made possible as yet. Therefore, if you reside in a State or Country with no Sectional Manager, send *solicited reports* to Headquarters until such time as a Sectional Manager is appointed to your territory.

We wish to point out to all members that since the Sectional Managers are giving freely of their time which is essentially limited, it is only fair that they should not be put to any unnecessary labor. We make the request that you refrain from any correspondence with your own Sectional Manager that does not bear on specific signal survey activities.

Initial Survey Drill

In order to determine how well our machine will work, and to seek out possible weak points in our method of collecting and compiling data on signals, a nationwide drill, in which all members are requested to participate, will be conducted on Friday, Saturday and Sunday,



Showing method of reporting the characteristics of signals on the new R.S.S.L. forms. The vertical shaded areas represent periods of darkness. Spaces are provided for weather conditions, temperature, signal strength and readability, fading, interference, and average signal quality. The report blanks may be filled in with pencil or ink.

April 2nd, 3rd and 4th. Survey data obtained during this period should be mailed to your Sectional Manager not later than Monday, April 5th.

The station selected to be monitored is HJ1ABP, Cartagena, Colombia, on a frequency of 9600 kc, or 31.25 meters. This station transmits daily from 7 to 9 A.M., 11 A.M. to 1:20 P.M. and 6 to 11 P.M. Where possible the report should also include data on any interference created during the hours of 7 to 9:15 P.M. when station RAN, in Moscow, operates on the same frequency.

A spread of three days—particularly over a weekend—should give everyone an opportunity to get in on the drill. It is by no means necessary that you listen on all three days—monitor when you can, *but be sure to state date and time on your report. Moreover, send in a report even if you are unable to hear either of the stations selected. It is just as important to know where signals cannot be heard as it is to know where and how well they can be heard.*

You can use the standard RSSL Reception Report Form if you wish, but this is certainly not necessary. However, signal strength and readibility should be given in R and QSA units. State degree of fading and interference in your own terms if you wish, but preferably follow the RSSL standard, as indicated in the accompanying illustration of one of the filled-in report forms.

So, get in on the drill and let's see what sort of a job we are able to do! Before long you're going to have some official work to handle, and all of us will want to do it up brown.

Using Report Forms

An illustration of one of the standard RSSL Reception Report Forms is shown on the opposite page. Though it may appear a complicated affair, it is really quite simple. It is so devised that spaces are allotted for each day of a week. The heavy vertical lines between days represent midnight and the shaded areas represent darkness. Without regard to actual time, a station engineer can readily determine if the signals were intercepted at dawn, early morning, midday, afternoon, evening or night. This is mor 'mportant than knowing the actual hours of reception as it is not necessary to compute time differences or account for changes such as daylight-saving time, etc. However, each square represents four hours, so that actual time can be determined. Moreover, if it is desired that the entire report represent but a single day, the other days of the week can be crossed out with pencil and each square made to represent one hour or a fraction of an hour, which may be readily indicated by writing in the hours devoted to listening.

R.S.S.L. SECTIONAL MANAGERS

ARKANSAS
John Hartshorn, W15P1
905 Beech Street, Texarkana

CALIFORNIA
R. H. Swinford, W31J2
P. O. Box 456, Napa

COLORADO
Frank J. Billiams, W21K1
511 E. Platte Ave., Colorado Springs

CONNECTICUT
Louis B. Booth, W3G1
6 Longworth Ave., Middletown

FLORIDA
L. Norman Henry, W6U1
1735 S. W. 8th St., Miami

GEORGIA
Karl D. Beckemeyer, W9Q1
Hq. & Hq. Co., 29th Infantry,
Fort Benning

IDAHO
Vick Wilson, W26C1
806 Coeur d'Alene Ave., Coeur d'Alene

INDIANA
Bernard W. Hanefeld, W10H1
1320 Jackson St., Fort Wayne

IOWA
J. W. Sullivan, W14H2
510 E. Union St., Manchester

LOUISIANA
Wilbur T. Golson, W13P1
Radio Station, WJBO, Baton Rouge

MAINE
Willis E. Blanchard, W3E1
126 Grant Street, Bangor

MARYLAND
Carroll H. Weyrich, W5J2
4310 Evans Chapel Rd., Baltimore

MASSACHUSETTS
M. C. Nichols, W3F4
36 Hillcrest Ave., Worcester

MICHIGAN
Roger Park, W10G1
1707 Maplewood Ave., Lansing

MISSOURI
Harlan E. Wykoff, W13L2
5082a Kensington Ave., St. Louis

MONTANA
Edward J. Lousen, W24E1
300 Cherry Street, Butte

NEBRASKA
Lee P. Edwards, W16J2
2313 "G" Street, Omaha

NEW HAMPSHIRE
Chester L. Wheeler, W3F1
17 Clinton Street, Milford

NEW JERSEY
Kenneth E. Vroom, W4H26
44 Glenbrook Road, Morris Plains

NEW MEXICO
Theodore F. Douglass, W22N1
315 North Third St.,
Albuquerque

NEW YORK
Arthur C. Pforzheimer, W4H23
861 Broadway, Woodmere

OHIO
J. F. Satterthwaite, W9H1
544 Colonial Ct., Toledo

OKLAHOMA
Joe E. Hester, W16M1
5318 Sand Springs Rd., Tulsa

OREGON
Harold S. Allen, W29D2
3704 S. E. Tenino St., Portland

PENNSYLVANIA
Nathan Swerdlow, W4H9
1649 N. 29th St., Philadelphia

RHODE ISLAND
George Francis Baptiste, W3G8
P. O. Box 114, Howard

TENNESSEE
James M. Alexander, Jr., W10N2
401 East Brow Road, Lookout Mt.

TEXAS
Joseph Brown Jr., W16S2
1937 Milby Street, Houston

UTAH
Bob Beadles, W25H1
634 South West Temple, Apt. 36,
Salt Lake City

VERMONT
Orrin H. Carpenter, W4E2
118 South Main Street, Waterbury

WASHINGTON
Ronald Ernest Greenwood, W29B1
3002-46th Ave., S.W., Seattle

WISCONSIN
Howard Allen Muir, W12G1
Box 296-R3, Racine

Spaces are provided for additional information, such as "Average Input in Microvolts," which may be disregarded if the data is not available. For that matter, the reporter need only fill in readability and signal strength if he so desires, and still provide a valuable report, but the more information given the more accurate will be the analysis made at Headquarters, or by a station engineer.

The specimen report shown is a very unlikely one, but serves to illustrate the manner in which the reports should be filled out. In the upper right-hand corner is space for the Monitoring Station call, name and address of the observer, and the location of nearest large city. Below this is indicated the country, the time zone in which the Monitoring Station is located, and the nature of the location.

In the upper left corner is space for the year and month, as well as the dates the report covers. Below this are spaces for information on the type of antenna used and its direction, as well as the make and model receiver employed on the survey.

In the center of the form are spaces for the call of the station which the report covers, its frequency, its direction from your own monitoring station, and the *average* signal input in microvolts in the event such data can be provided.

The Report Form includes spaces for indicating the weather and temperature for each day of the week which, though it need not be provided, is worthwhile data to include.

Note that signal strength and readability levels are indicated in the same space. Since these two factors are inter-related, this is an ideal way of presenting them. These readings usually parallel each other; therefore any great difference between the two immediately indicates the presence of a third factor, such as interference, which will show up at the bottom of the chart.

Note that on Tuesday the carrier was so weak that readability was nil, and at the same time XM (man-made static) appeared in the Interference column, due principally because the signal level was so low that the receiver was running wide open and therefore amplifying local noise. Also note that on Wednesday, during a rain and wind storm, signal strength was moderately good in the early morning, but readability was poor due to the presence of X (natural static). The Q reading did not improve until evening, when signal strength was again up and X interference down.

On Thursday there was inter-station interference from CQZ. This became worse on Saturday—amounting to an actual heterodyne—with the probability that the frequency of CQZ's carrier (or

(Continued on page 222)

THE "FLEXIBLE 400"

R. F. UNIT POWER SUPPLY

By Harry Lawson W2IER

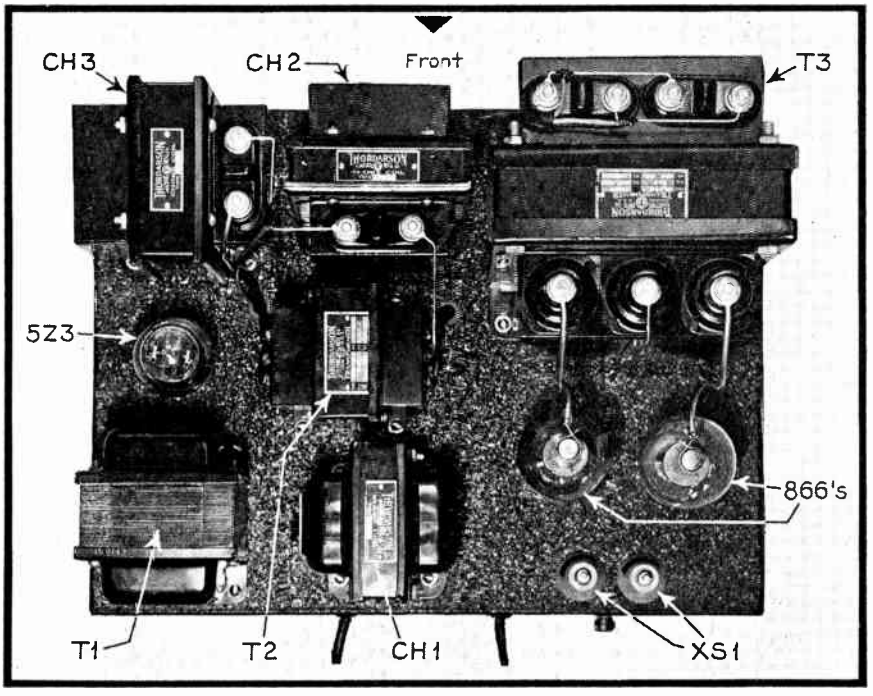


Fig. 2. Top view of the r.f. power supply—compact yet not crowded.

WHILE it is possible to take the radio frequency unit of almost any transmitter and use it in conjunction with power supplies and speech equipment that may be available, a thorough job can best be done by designing the radio frequency unit, the radio frequency power supply and the modulator at the same time. This latter procedure was followed in connection with the design of the "Flexible 400" transmitter and the results which have been obtained with it seem to bear out the soundness of the original idea.

Where Flexibility Counts

Reference has already been made to the fact that this transmitter may be set up in any number of different ways, thus lending itself to the mechanical and physical requirements of the particular amateur station in which it is to be used. Not the least important consideration in this matter is the fact that the speech amplifier and modulator equipment may be set up in the room along with the receiver, and the entire radio frequency unit, along with the radio frequency power supply, may be set up as far away as desired. This is a very desirable feature, particularly on the ultra-high-frequency bands, where a certain amount of radio frequency is sometimes picked up by the microphone and appears in the form of a disagreeable feedback.

Similarly, the speech amplifier can be separated from the remainder of the modulator equipment since it terminates in a transformer designed to have its secondary feed into a 500-ohm line. Therefore, the modulator power supply and modulator unit may be remote-controlled along with the r.f. unit, because an input transformer having a 500-ohm primary is used.

Control of the primary power supply for all of the units that go to make up the "Flexible 400" may be arranged with suitable relays to take care of any particular local requirements, and various suggestions for following this procedure will be covered in a succeeding article. For the time being we will confine our description to the radio frequency power supply, and give some idea why certain parts were chosen to fill particular functions.

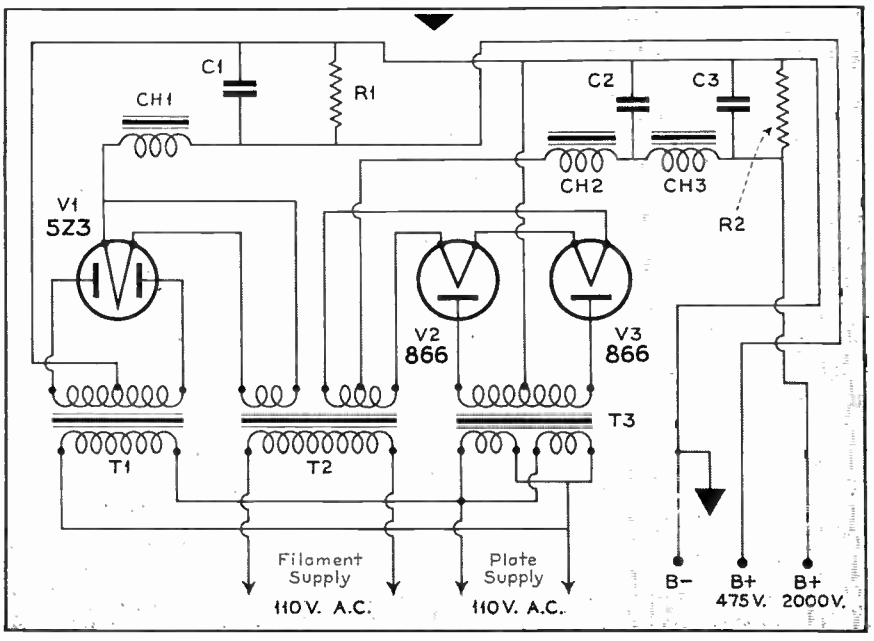


Fig. 1. Schematic diagram of the r.f. power supply with separate low-voltage unit. Values of components are given in parts list.

Power Input

The normal power on which the complete transmitter is designed to operate is 400 watts input to the final stage. A transformer was selected which would supply this power and have a reserve available for additional power if it happened to be required. Of course, the use of additional power brings about two undesirable effects. First, the power

transformer is operated beyond its normal rating and is therefore likely to overheat; secondly, the impedance match between the modulator and the radio frequency portion of the circuit was designed for 10,000 ohms, and at 400 watts this impedance match is perfect. On the other hand, when the transmitter is run at 500 watts or more, a partial mismatch is noted between the modulator and the final r.f. stage, and this mismatch is likely to bring about a certain amount of distortion.

Neither of these two defects are extremely serious, because the more reliable manufacturers rate their transformers so that they can be operated at a 25% overload, for short periods, without too great a possibility of breakdown.

If the diagram in Fig. 1 is compared with the photographic layouts shown in Figs. 2 and 3, and further reference is made to the accompanying parts list, a much more complete understanding of the problem and its solution will be had.

Dual Power Supply

It will be observed that all of the units making up the power supply for the radio frequency portion of the transmitter are mounted on a single metal deck, 13"x17"x3". In fact, there are two complete power supplies, with their respective smoothing circuits. The low-voltage power supply, incorporating the units T-1, T-2, CH-1, C-1 and R-1, is conventional, with the possible exception that the transformer, T-2, is used to supply the filament current for the 5Z3 rectifier as well as the filament current for the two 866's which are used in the the high-voltage power supply.

It will be observed from Fig. 1, and the photograph which shows the top view of the completed assembly, that the split primary of the high-voltage power transformer, T-3, used with the 866's, is connected in parallel. The output rating for this particular transformer is 2350 volts a.c. either side of the center tap which, when used with a suitable smoothing circuit, results in the production of 2000 volts d.c. at 250 mils. A satisfactory smoothing circuit for this assembly, along with a suitable bleeder for maintaining correct regulation, is found in the circuit comprising, CH-2, CH-3, C-2, C-3 and R-2.

While it is necessary to supply 1500 volts at 50 mils to the plate of the RK-37 used in the radio frequency portion of the transmitter, it was not considered advisable to include the necessary dropping resistor in the power supply for the reason that it would mean the running of another lead between the power supply and the radio frequency unit. Reference to the diagram of the r.f. unit, described last month, will indicate that this dropping resistor was mounted under the deck on which the radio frequency portion was assembled and it is indicated in the complete r.f. circuit diagram as R-8.

Thus, the r.f. power supply, when operated at 400 watts input to the RK-38's, is running at its normal full load because of the additional wattage it is supplying to the RK-37 circuit.

Convenience in wiring, as well as the elimination of long leads, dictated the use of separate filament transformers for the radio frequency portion, and it will be observed that the only leads running from the present r.f. power supply are those to the a.c. line and the two high-voltage leads for supplying the plates of the 6L6's (475 volts) and the plates of the RK-37 and RK-38's (2000 volts). The minus B connection may be made most conveniently by running a short jumper, in the form of a copper strap, between the case in which the r.f. power supply is mounted and the chassis of the radio frequency unit. For this reason, a very convenient method of running the two high-voltage wires has been found in the use of Giant-Killer Cable. This cable is insulated with Laytex and the voltage breakdown between conductors is 23,000 volts which provides a high safety factor when it is used in this manner.

A comparison of the appearance of the top and bottom views of this power supply would lead one to the belief that an attempt to maintain symmetry was made on the top but that the units on the bottom might have been disposed by dropping them into a shotgun and pulling the trigger. This conclusion would be entirely erroneous; the disposition of the units below the deck were made with complete disregard for the length of leads, but with a very thorough regard for keeping the heat developed by the resistors away from the high-voltage condensers.

For the use to which the entire assembly has been put and for which it was originally designed, the weight of the components mounted on the metal deck is sufficient to hold the entire unit in place in the two-section steel cabinet in which it is housed. If such a power supply is to be moved around a great deal

(Continued on page 218)

PARTS FOR R-F POWER SUPPLY

AEROVOX
- 1—50,000 ohms, 50 watt wire wound (R1)
- 1—100,000 ohms, 100 watt wire wound (R2)

CORNELL-DUBILIER
- 1—Dykanol 2 mfd., 1000 volt (C1)
- 2—Dykanol 2 mfd., 2000 volt (C2, C3)

NATIONAL
- 3—4-prong, isolantite sockets
- 2—XS-1 bushings for high-voltage and connections

PAR-METAL PRODUCTS
- 1—2-section steel cabinet
- 1—13" x 17" x 3" steel sub-panel (heavy duty)
- 2—8¾" steel panels

RAYTHEON
- 1—type 5Z3 full-wave rectifier (V1)
- 2—type 866 half-wave rectifiers (V2, V3)

THORDARSON
- 1—type T6878 power transformer (T1)
- 1—type T7046 filament transformer (T2)
- 1—type T6283 power transformer (T3)
- 1—type T6403 filter choke (CH1)
- 1—type T6315 filter choke (CH2)
- 1—type T6409 filter choke (CH3)

This unit has been thoroughly tested and has given satisfactory performance. The parts listed or their equivalent will give satisfactory results. Substitutions should be made with care.

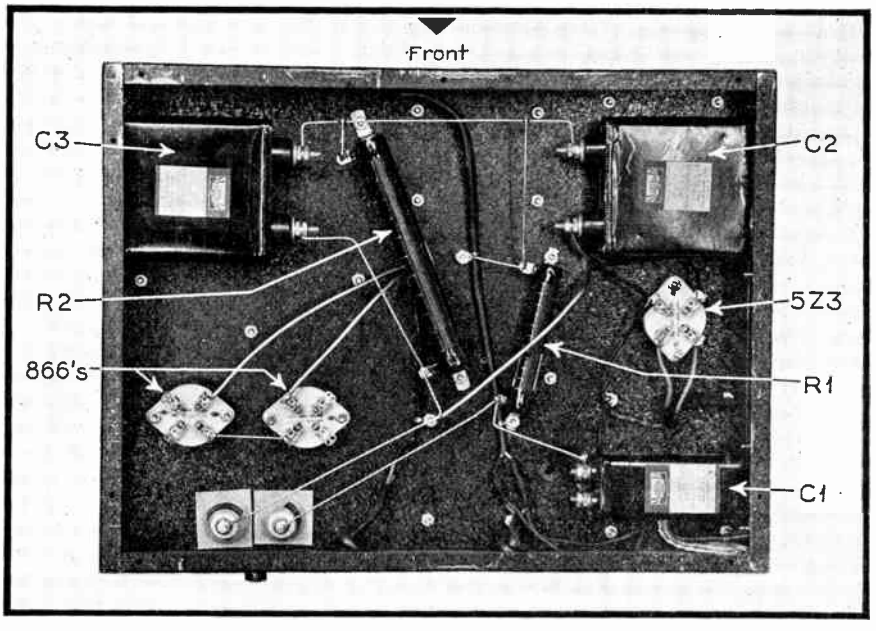


Fig. 3. Bottom view of the r.f. power deck. Note that condensers and resistors are separated so as to avoid overheating of the former.

Hamfest

By W8QMR
ex-2PI • LU4S

to the ladies . . . flood lillies . . . 'round the world plight . . . sour note

AFTER listening to a few of the YLs on the fone sub-bands one wonders where the telephone company digs up all "the voices with the smiles." There are exceptions, of course—take "Tom" down at W4DCC at Atlanta Gawjah, whose tones are quite dulcet, particularly in her QSOs with W9FLD—but most of the gals, sad to state, sound exactly like that ulcer on the broadcast band, the female announcer. But after all, that's probably what most of them are—announcers—and with hubby or the boy friend alongside it is easy enough to warble glibly about tritets which most of them do. Section 214 of the *Rules and Regulations* states that anyone may make merry with the mike as long as there is a licensed opr on the job—but only a licensed operator may touch the key. Thus we ponder on just how legitimate their sweet lingo really is. Probably very few of them are licensed operators. If there is anything a woman would rebel against it is being made to take out a license to talk.

Speaking of YLs brings up the question of when is a YL not a YL. Like many of our amateur abbreviations, its meaning has been perverted with usage. Back in the good old days when the fist was stronger than the mouth (take it any way you like) the female of the species was known as the OW—old woman being the natural feminine gender for OM. However, with the emasculating advent of fone, your amateur operator became a sissy, and under pressure coined the YL. A woman may be old enough to merit a place on Cheerio's program—but she'll never kick about being called a young lady. On the other hand, even sweet sixteen objects to old woman. But the point we're getting at is this—the moment dad parks the shotgun, the wife ceases to be a YL, even if it's a Kentucky child marriage, and she becomes an XYL.

Seriously, we feel that OG—old gal—is closer in connotation and feeling to the counterpart, OM. Wouldn't it be just ducky to hear a basso profundo on 75 meters saying "hi hi hi—oh gee!"

OUR LOG OF THE flood the early morning of January 27th is somewhat incoherent due to the fact that we ran out of paper and made notes on the marble-top table, and subsequently knocked over a mint-julep (our present QRA is Florida), and a few of the lads messed the log in the process of lapping up. So forgive a few errors that may creep into the following:

W9QZZ did a real job in getting railroad ties to the Pennsylvania railroad. W9NKD did more than his share with direct QSOs to WHAS. Palms to W9CHL in Louisville, who was forced to waste about half his valuable—even vital time—begging the jamming stations to QRT.

Someone announced that an American Legion relief party had left at 6:30 with boats, nurses and doctors. An experienced radio announcer was available to accompany the party if needed. We hope the American Legion took him up. It'll be a long while before such a good opportunity again arises for dumping one of them overboard on a dark night.

Though most of the work was done on fone, code got through very nicely when heterodynes made telephonic communication impossible. WHAS sent out an SOS for "two fast amateur operators" wanted for emergency duty at the Louisville armory.

Honorable mention goes to W4BYY, W4DSF, W4LV, W4ALO, W4BM. Same to W9JEG, Merion, Kentucky, for his indefatigable efforts to raise Fort Knox. Bouquets likewise to W9XOY of Champaign, Ill., and to W4CRE.

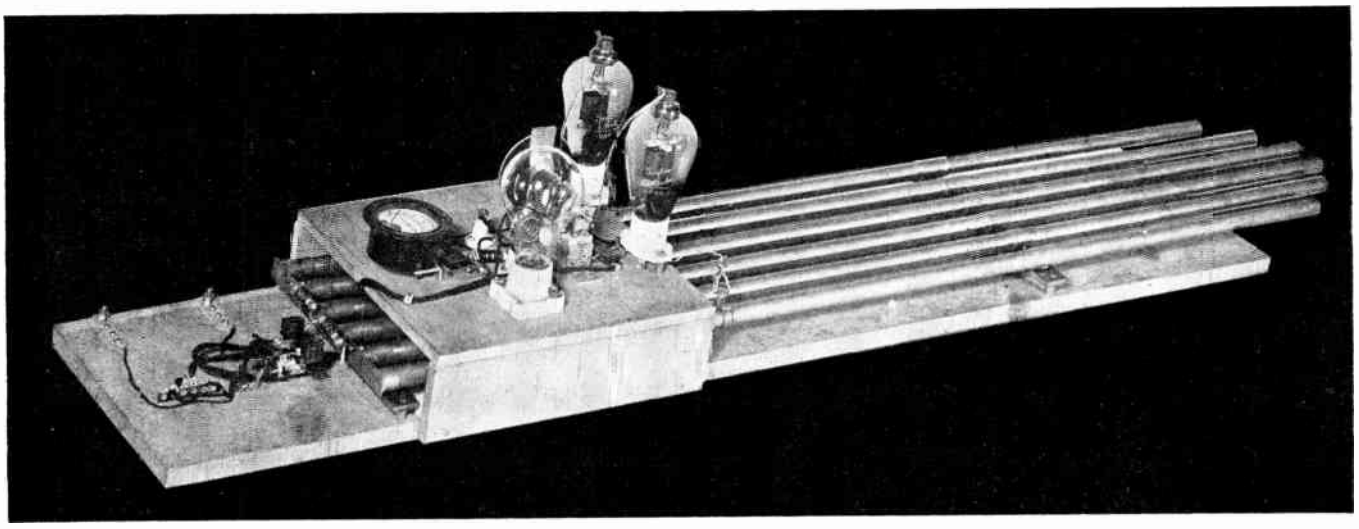
W9RSC and W9WC were given open credit for excellent emergency work over WMAQ and WENR with which stations they are associated as engineers (if not, blame it on the mint-julep-spilt). They were on the air, over the broadcasting stations, for some ten minutes—working duplex, from their own stations, to the control room—at least that's what the announcer said. However, there is still a dent in our cheek from our tongue. If that transmission was legitimate, those lads are geniuses as well as heroes. The transmissions came through without a whistle while pandemonium reigned supreme on every ham band we listened to! However, the end justifies the means—it was an excellent show—and 9RSC and 9WC beyond all doubt deserve the orchids for their flood work. And regardless of whether that little demonstration went over the air on any frequency outside of the BC band, we've done worse ourself.

While pounding brass on LU4S—an airplane rig flying around the Argentine—we cooked up a publicity scheme with the International Telephone and Telegraph Company which organization operated two commercial phone channels from Buenos Aires—one to New York and the other to Madrid. We threw together a modulating unit and suspended it in the cabin of the plane with automobile inner tubes. A W. E. carbon broadcast mike, stuffed in an Edgeworth tobacco tin, plus a wing-tip antenna supplementary to our trailing wire, and we were ready for two-way fone work, to talk all around the world while flying over the pampas. One day we

(Continued on page 221)

"The Result of Ham Radio" as pictured by Morris Harwood, ex-W3CBQ. If you want a free copy of this sketch, drop a postcard to Mr. Harwood at 3104 Edgewood Ave., Richmond, Va.

DEVELOPMENTS IN FREQUENCY STABILITY OF ULTRA-HIGH FREQUENCY OSCILLATORS



Side view of the "organ pipe" oscillator—the result of the experiments outlined in this and the former article by Mr. Elam.

PART 2

BY DAVID L. ELAM W9FPP

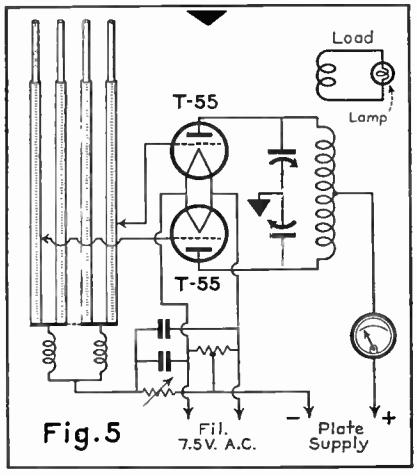
Amateur Radio Division, Montgomery Ward & Co.

WE learned, in the previous article, what factors are important in determining the frequency stability of ultra-high-frequency oscillators of the linear type. While we shall continue to talk about the linear type of oscillator, our findings will be just as applicable to oscillators of other types because the underlying principles of all oscillators are the same.

Important Factors

Let us briefly review the factors we discovered last month to be important in the stability of oscillators:

First: The value of the grid leak must be right. Too low a value causes the tubes to overheat, and too high a value causes the oscillator to quench itself, and splatter over a wide part of the radio spectrum.



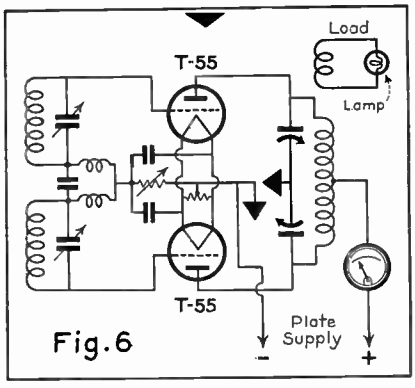
The beginning of the "organ pipe"—multiple rods in the grid circuit.

Second: The amount of grid excitation must be kept in bounds. Too little excitation, like too little resistance in the grid leak, causes the tubes to heat. And like too much grid resistance, too much excitation causes the circuit to quench. It was difficult to isolate these two factors because they are so closely interlocked, but they are both contributing factors in this particular kind of instability and must be taken into consideration.

Third: The grid-filament capacity of the oscillator tubes, when shunted across a part of the tuning circuit, has a capacitive loading effect. This causes the circuit to resonate and oscillate at a frequency considerably different from that at which the rods alone are resonant. Since the rods are not allowed to work at their resonant frequency, they have less control over the frequency of the oscillator.

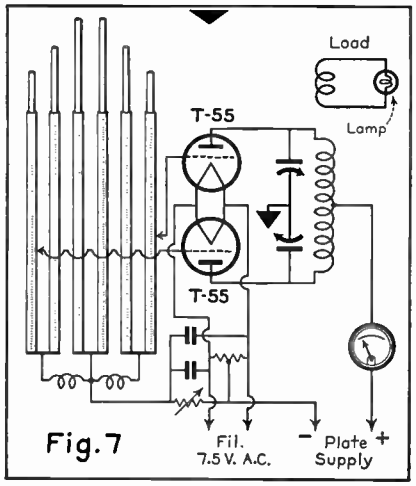
The first two factors are easy to control. We just find, by experimenting, what values permit the tubes to operate cool and give good output without causing the oscillator to quench, and that is all there is to it. The values will vary with different tubes. For the RK-34 or a pair of 10s, the proper value is about two thousand ohms. A pair of T55s work best with about one thousand ohms in the grid leak.

We have learned that the loading effect of the tube input capacities on the grid rods is the limiting factor which determines how much stability we can get out of this type of circuit. Without any loading, the wavelength of a resonant circuit made up of two rods properly spaced and connected at the base, is exactly four times the length of the rods. With a capacity loading, the wavelength will be greater than four times the rod length. Or stated another way, the rods will be less than one-quarter wavelength long. To get the greatest possible amount of stabilizing effect with this kind of circuit, it is necessary to work the rods as close to their natural wavelength as we can.



The equivalent circuit of Fig. 5.

We found, in our other experiments, that we could reduce the loading effect of the tube capacities by working the grid clips closer to the ground end of the rods. But we can go only so far in this direction before the efficiency of the



The "organ pipe" oscillator, employing three sets of two rods.

oscillator begins to fall off. The drop in efficiency, as we explained before, is caused by insufficient excitation.

Division of Load

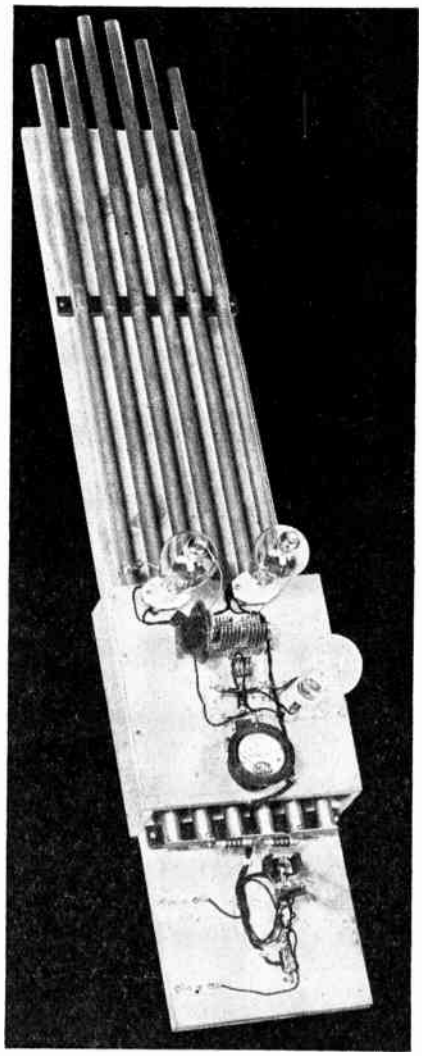
It occurred to us that we might reduce the loading effect of the tube grids by dividing the loading between two circuits. We built a duplicate set of rods and connected the grid of each tube to its own resonant circuit. To complete the grid return circuit, we connected the two sets of rods at the base. The rods were adjusted to the same length and the plate voltage applied. When we turned the plate circuit to resonance and measured the frequency we found that it had changed enormously, but in the *wrong direction*.

We had hoped that dividing the tube capacities between two circuits would permit the rods to work nearer to their natural wavelength which would mean an increase in frequency. Our measurements showed that the frequency had been lowered by several megacycles. This was very discouraging and we were about to chuck this idea overboard as useless when we accidentally moved one of the sets of grid rods. The plate current immediately jumped way up, indicating that oscillations had stopped. After we snapped the plate current off to protect the tubes, we started trying to figure what had happened. A careful check showed that no circuits had been opened or shorted so we put on the plate current again and turned the plate condenser dial. The set started to oscillate again. The frequency meter showed a different frequency. Further checking showed that the free rods in each circuit had no radio-frequency voltage on them. The two sets of rods were not acting as two individual tuned circuits, but were operating as only one circuit—the two rods on one side forming one-half the circuit and the other two, which were connected at the base, making the other half.

Circuit Isolation

We thought we might be able to isolate the two circuits and make them act individually. A radio-frequency choke was inserted between the bases of the rods and the grid leak and the power was again applied. The plate circuit was tuned to resonance and the tubes began oscillating. A check on the frequency showed that the circuit was oscillating at a frequency which was much nearer the natural wavelength of the rods than we had ever been able to approach before. This was very encouraging in itself, but the output had dropped off alarmingly and the tubes were drawing much too large an amount of current. Moving the grid clips farther up the rods helped some, but we didn't like to do that because it increased the loading effect on the rods and defeated our purpose.

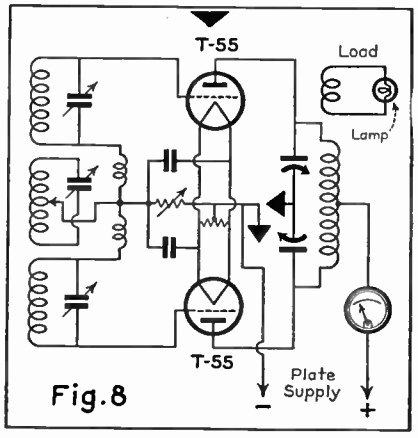
It seemed logical that the drop in efficiency was caused by a lack of excitation of the tube grids, so we looked for a way to increase the excitation. The ends of the free rods were connected together and the tubes stopped oscillating.



Top view of the completed "organ pipe" oscillator. Note load circuit, with lamp, on the tube dack.

A little thinking showed us that the two unconnected sides of the two circuits were out of phase with each other and we had, in effect, short-circuited the two circuits.

We tried again by connecting the grid side of one set of rods to the free side of the other. That worked fine. We soon found that we could move the connection down to within a few inches of the base of the rods and still get enough coupling to give a good output. Later we found



The equivalent circuit of Fig. 7.

we could get the same effect by placing the two sets of rods side by side with the spacing between the two free rods equal to the separation of the rods in each circuit. This arrangement is shown in Fig. 5. Fig. 6 shows its electrical equivalent.

Experimenting with the grid clips showed that they could be operated several inches closer to the base with the two-circuit arrangement than they could with only one set of rods. A possible reason for this is that the rods, being worked closer to their natural wavelength, develop higher voltages across themselves. Since lowering the grid clips alone gives an increase in frequency stability, we had made gains by two methods, that is by dividing the loading effect between the two circuits and by reducing the coupling to the tube grids.

Measurements showed that the rods were still about four inches shorter than one-fourth of the wavelength of the frequency produced. This indicated that, while we had made remarkable improvements in the stability of the oscillator, we had not secured all the stabilizing effect possible with the linear type of oscillator.

Additional Rods

To carry this idea to its logical conclusion, a third set of rods was constructed and inserted between the other two. The arrangement is shown in Fig. 7 and the electrical circuit equivalent is shown in Fig. 8.

The adjustments were very critical but, when they were finally made, the

(Continued on page 211)

Channel Echoes

By Zeh Bouck

first thoughts on second inaugurals . . . point-to-pointers . . . blurbles

IT is estimated that just about one-quarter the population of the world listened, via long and short-wave radio, to President Roosevelt's second inaugural—in other words one-quarter as many people as listened to King Edward's farewell address. The highlights of the inaugural were the poor English employed by NBC's ace announcers and the remarkable amnesia displayed by two offsprings of the President—son John and daughter Anna. John, speaking from Washington, and Anna into a microphone on the West Coast, both admitted that they had attended the President's first inaugural—remembered it very well indeed—and then dated it March 4th, 1932!

Shortly following the President's address, the American Club in London was put on the air—where a cocktail party had been in progress. We have the direct word of the club's president for the cocktails—as well as his reference to the "courtesy of the National Breadcasting Company." He was followed immediately by the President of the American Clubs in Paris, talking from headquarters where they had been celebrating with champagne. They hold their likker better in Paree.

◆

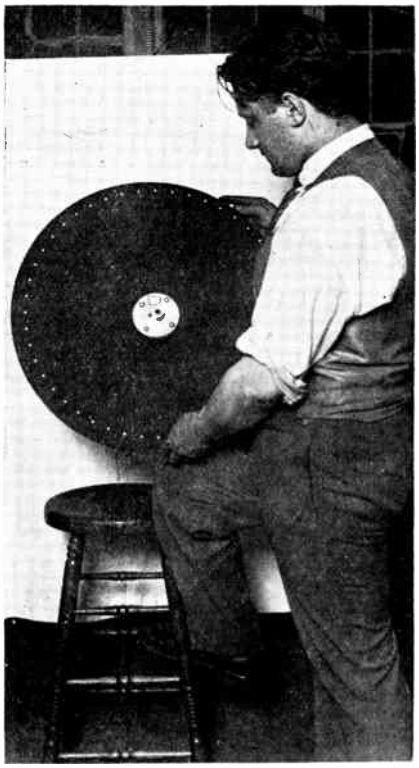
SPEAKING OF second inaugurals, we listened to Hitler's over the Zeesen Kurzwellensender. Der Feuhrer was as modest as a sun flower and addressed the Reichstag with his usual fuse-blowing, circuit-breaking pyrotechnique. It was quite a gathering—a case of *heil, heil* the gang's all here!

◆

WITH THE ETHER (or rather the warped hyperbolic space, to be modern) being strummed with go-west-to-Hawaii propaganda from the beach at Wakiki, Clipper flights and International Eucharistic Congresses at Manila, there is a lot of trans-Pacific rebroadcasting these days. Most of these programs can be received directly if the transmitting station can be located. It is an excellent idea, a half hour before the scheduled broadcast, to tune in one of the RCA stations at Bolinas, California between 10,410 and 10,390 kilocycles, which stations manage the broadcasts via trans-oceanic 'phone. During the preliminaries a cue will invariably be given as to the station on the far end, and a quick reference to Brother Hind's Short-Wave Station List will usually make it possible to tune in the distant transmitter. However, don't do this if you talk in your sleep. You might disclose something you heard—this being a point-to-point service—thus violating the FCC's "Section 605" in reference to divulging or publishing "the existence, contents, substance, purport, effect, or meaning thereof." More correctly this would constitute a violation of the Basic Communications Act, making you liable to a fine of ten thousand dollars plus two years in the can. Naughty naughty!

◆

KUOA IS DOING right by both its listeners and its sponsors by putting out a consistently high grade of programs with advertising approaching a maximum in dignity and a minimum in time. Lester Harlow, of this station, writes:



"The Discus Thrower,"—vintage of 1927. The idea was to throw this disk around the television corner.

"If you should read the fan letters written by the higher class of people to the sponsors of the really good programs, I am sure you would find them reflecting opinions from a well informed person. Many of the fan letters received by the cheap programs from their listeners (and there are many more of these received) are poorly written and almost if not entirely indecipherable. Now the broadcaster has no way of knowing what type of programs gets the greatest response except from those who write in, so naturally he concludes that the greatest number of letters indicate the best received programs, when such is not the case. Those who really appreciate good programs (and I believe they are in the majority) simply do not write in or express their opinions."

For the benefit of Phillips Lord and his half hour "Crime Busters" program, in the course of which he takes five commercial plugs—five, no less—and which program, because of its stupid and distasteful advertising can be described only in terms of a small parasitic insect, we lift another paragraph from Mr. Harlow's letter—

"We do not permit advertising in the middle of a program, demanding, instead, that all advertising announcements be confined to the beginning and end of the program; and even then the length of the announcement must not exceed a certain percentage of the program time. By doing this, we are able to give our listeners a complete program without sandwiching in a lot of advertising blurb in an interesting part of the program.

"Naturally you may wonder if such advertising gets results. Our sponsors tell us that it does. One gasoline company increased their sales in this area over fifty percent after sponsoring a program over KUOA. The announcement of their products was brief, clear and to the point."

Good programs are contaminated with mid-broadcasting plugs with malice aforethought. The sponsor and his advertising agency rightly argue that the listener must lend an ear to his message at that time, and that the majority of radio fans have developed the mean and nasty habit

(Continued on page 219)

Globe Girdling

By J. B. L. Hinds

japanese overseas schedules . . . jeloy call . . . the mexicans again . . . 11-meter globe girdler . . . "radio philco" in indo-china . . . veri slow

XOJ, 15795 kc., Shanghai, China, reported by Fred Karpen, Johnstown, Pa., as contacting JVD, Japan, on 15860 at 7 to 9 P. M.

IUG, 15450, Addis Ababa, Ethiopia, reported by LeRoy Waite, Ballston Spa, New York, phoning Rome from 9:45 to 11:15 A. M.

WCT, 13410, San Juan, P. R., heard working WOK, 10550 kc., Lawrenceville, N. J., 9:19 to 9:37 P. M. Reported by LeRoy Waite, Ballston Spa, N. Y.

OPM, 10140, Belgian Congo, 7:10 A. M. daily. Reported by E. H. Clark, Hollister, Calif.

VVS, 12870, Rangoon, India, new station heard phoning Poona 5 to 6 A. M. and also testing with music. Reported by Fred Karpen, Johnstown, Pa.

FZR, 16250, Saigon, Indo-China phones FTK, 15880, St. Assise, France daily 7 to 9 A. M. Test schedule 8:30 A. M.

KAX, 19980, Manila, P. I., phones KWU, 15355, Dixon, Calif., evenings to 10 P. M. and JVE, 15660, Nazaki, Japan after 10 P. M. Reported by Howard Wilson, Ithaca, New York.

NEW STATIONS

K.C.	Meters	Call	Location
26100	11.49	GSK	Daventry, England
25950	11.56	W6XKG	Los Angeles, Calif.
18090	16.58	TYE-1	Paris, France
17775	16.88	PHI	Huizen, Holland
15160	19.79	OLR5C	Prague, Czechoslovakia
13600	22.06	ZMBJ	Wellington, N. Z.
11900	25.21	OLR4D	Prague, Czechoslovakia
11895	25.22	HP5I	Aquadulce, Panama
11820	25.38	XEBR	Hermosillo, Mexico
11040	27.17	CSW	Lisbon, Portugal
10670	28.12	HBP	Panama City, Panama
9550	31.41	OLR3A	Prague, Czechoslovakia
9504	31.57	OLR3B	Prague, Czechoslovakia
9340	32.12	OAX4I	Lima, Peru
9120	32.89	CP-6	LaPaz, Bolivia
8840	33.94	ZMBJ	Wellington, N. Z.
6210	48.31	YV1RI	Coro, Venezuela
6130	48.94	LKJ1	Jeloy, Norway
6117	49.04	XEUZ	Mexico City, Mexico
4420	67.87	ZMBJ	Wellington, N. Z.

STATION CHANGES

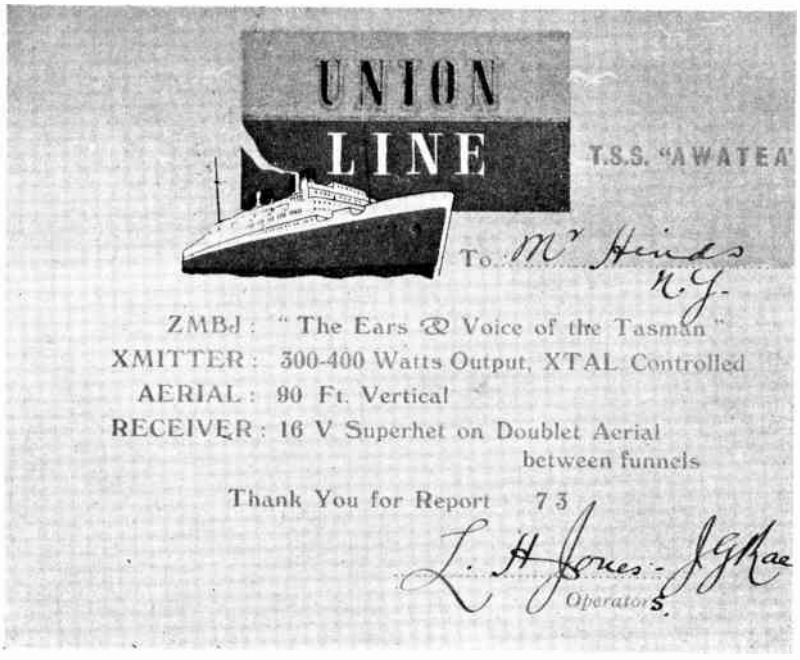
New Frequency	New Call	Old Call	Old Frequency
21450	OLR6A	OLR	21450
15320	OLR5B	OLR	15320
15300		CP-7	15305
15220	OLR5A	OLR	15230
15220		*PCJ	15220
11875	OLR4C	OLR	11870
11860		YDB	11875
11840	OLR4A	OLR	11840
11760	OLR4B	OLR	11760
11710	Philco Radio	F3ICD	11730
9610		YDB	9650
9590		PCJ	9590
9530	LKJ1	LCJ1	9530
9510		XEFT	9505
8720		VPD-2	9540
6720		PMH	6767
6400	YV5RH	YV4RH	6400
6230		YV1RG	6345
6190		HI1A	6182
6115	OLR2C	OLR	6115
6097.5		ZTJ	6090
6030	OLR2B	OLR	6030
6010	OLR2A	OLR	6010

* Location changed from Eindhoven to Hilversum.

(No stations deleted)

NON-AUTHENTICATED STATIONS

Frequency	Call	Location
15740	TFM	Reykjavik, Iceland (Dec.)
14000	PZ1AA	Paramaribo, D. G. (Dec.)
10520	GOA	Shanghai, China (Jan.)
9940	WCU	San Juan, P. R. (April)
9590	VK6ME	Perth, W. Australia (Dec.)
9540	CB954	Santiago, Chile (Dec.)
9490	XTV	Canton, China (Mar.)
9445	———	Fort de France, Martinique (April)
9440	HC2RA	Guayaquil, Ecuador (April)
9345	HBA	Geneva, Switz. (April)
6500	YV1RM	Cristo de Aranza, Venez. (Feb.)
6250	YV5RJ	Venezuela (Mar.)
6164	OAX1A	Ica, Peru (Mar.)
6120	HP5Z	Panama City, Pan. (July)
6075	HI3E	Puerto Plata, R.D. (Nov.)
5930	YV1RK	Maracaibo, Venez. (Mar.)
——	HP5A	Panama City, Pan. (April)



The T.S.S. "Awatea" blue-silver-and-green veri.

ZMBJ, TSS "Awatea," according to veri received by the writer, is operating on 13600-8840 and 4420 kc., but operates mostly on 8840. R. Simpson, Australia, advises that in addition to schedule shown in station list ZMBJ calls ZLT or VIS around 7 A. M. E. S. Time. Mr. Simpson says in closing their broadcasts, they always give call, and also state their distance from either Sydney or Auckland, New Zealand. Their Sydney address is Union Line Steam Ship Co., Ltd., 247 George Street, Sydney, N. S. W., Australia.

JVU, 5730, Japan reported by Fred Karpen, Johnstown, Pa., as heard with same program as JVT, 6750, between 3 and 5 A. M. on February 7, 1937.

WCU, 9940 kc., San Juan, P. R., is new phone station. Heard at 8 A. M. and 8 P. M. by John L. West, Lakewood, Ohio and H. Wilson Jr. Ithaca, N. Y.

HBP, 10670, Panama City, Panama, is new station. Joseph Smith, Hicksville, New York, has veri. Phone owned

by Tropical Radio Telegraph Co. station on the air 4:15 to 4:45 P. M.

Any reader receiving an official list of radiophone stations in Central and South America by individual countries would greatly oblige this department by sending in a copy. We are especially interested in receiving such a list from Argentina.

With this information and the station lists you have the Mexican situation at this writing, with the thought in mind that all may not remain on the assigned frequencies and the report that others are said to be heard. J. L. West, Lakewood, Ohio, reports hearing XEUE on 8660, although not sure of the call. Lyle Nelson, Yamhill, Oregon reports hearing XERV on 5910, Mexico City, and J. Wendell Partner, Tacoma, Wash., states he is hearing a Mexican station on 9600 called "La Voz de Victor, Alente de Bravo", between 8 and 10 P. M. While the writer has not found time to listen for these three stations, we would be grateful for further reports from listeners.

Japanese Stations

A. Yamamoto, Tokyo, sends the following time schedules from Overseas Broadcasts, E. S. Time:

Europe: JVP, 7510 kc. and JZI, 9535 kc.—Daily 2:30 to 3:30 P. M.—*East Coast U. S. A. and So. America:* JVN, 10660 kc. and JZJ, 11800 kc.—Daily 4 to 5 P. M.—*Java and Straits Settlement:* JZI, 9535 kc. and JZJ, 11800 kc.—Daily 9 to 10 A. M.—*Pacific Coast U. S. A., Canada and Hawaii:* JZJ, 11800 kc.—12 to 1 A. M.

More power is evidently being used on the broadcast between 4 and 5 P. M. as the signal is getting quite clear, strong and steady. They announce at times as "The Voice of Tokyo" and the "Land of the Rising Sun".

JYS, 9840 kc., Japan. A. B. Wood Jr., Bangor, Maine, received veri card covering reception. On one side of card is view of the imposing front side of the Temple and Holy Cistern. The Temple is located at Nikko. Card further states that JYS is used only experimentally, and verification for the particular reception is over the call of station J1AA, long-wave station.

COCD, 6130 kc., Havana, Cuba, advise Leo Herz, Chicago, Ill., that they appreciate reports and will verify. They make request, however, that listeners cooperate with them by writing their reports of reception plainly.

OAX4I, 9340, Lima, Peru, is shown in station list in this issue. If it develops that the tentative frequency setup is other than shown, subsequent changes will be made.

HI4V, 6450, San Francisco de Macoris, Dom. Rep., may have changed frequency as H. O. Nelson, Chicago, Ill., reports he has veri card showing frequency as 6550. But again the frequency shown on the card is not always the frequency used by the station.

15 - SANTA CRUZ DE TENERIFE - ISLA DE TENERIFE
Islas Canarias. Balneario en construcción. Iles Canaries. Balnéaire en construction. Canary Islands. Bathing-place under construction. Kanarische Inseln. Badeanstalt im Bau.

Brown-picture-veri from EAJ43, Canary Islands.

HI8Q, 6240, Ciudad Trujillo, Dom. Rep., still reported heard at 6190, 6198 or 6200.

HI9B, 6040, Santiago de los Caballeros, Dom. Rep. still reported heard near 5880 kc. according to several reports. No official advice yet received from stations or Dominican Republic authorities, so no changes have been made.

CT1GO, Parede, Portugal, reported to be on the air again, although the frequency on which it is to operate was not given. CT1GO was formerly operated on 6198 and 12396 by the Portuguese Radio Club of Parede.

Jeloy Call

LKJ1, 9530, Jeloy, Norway. Upon advice from the station that the call was LCJ1, we recently changed from LKJ1. Station now states that call *is* LKJ1 and another change is consequently made in this issue. J. V. Saxton, New York City, advises receipt of letter veri from LKJ1. Mr. Saxton comments that he does not like letter veries. Neither does the writer, but they are better than no veri! Let us hope that they will some day use card veries, which is becoming the general practice of stations. H. Kentzel, Averill Park, New York, also reports reception of LKJ1 on special program on February 17th between 1 and 2 A. M. In a recent letter from the Director General, Minister of Commerce, Oslo, was received information that the purported plan mentioned in January ALL-WAVE RADIO as regards new transmitters would not materialize. Jeloy has two transmitters and frequencies at present, and both are now being used; LKJ1, 6130 kc. or 48.94 meters being added this year and shown in station list this month, although it is not understood how they will be heard with good signal on 6130 kc. The Director General further advises that the power of Jeloy transmitters will be increased to 5 kw. this year but no new transmitters for short-wave broadcasts will be constructed.

HC2RA, 9440 kc., Guayaquil, Ecuador, reported in "Last-Minute Flashes" March issue, is being heard nightly but no English announcements as yet heard from reports received. Call letters reported as follows: HCOBA, HC2OBA, HC2EBA and HC2RA. Slogan of station reported as "La Vox de Alma" and "La Voz de Almos". So take your pick for record purposes until the actual facts are known. Male and female announcers. Station has fairly consistent carrier but some interference from code at times.

YNLF, 9595, Managua, Nicaragua. Department of Commerce bulletin shows this station on 9650 kc., but as no reports of this 1000-watt mystery station being heard have been received, no change will be made. The writer is unable to secure information direct from the station.

YV1RG, 6345 kc., has transferred to 6230 and announcing on this frequency, but apparently is working on about 6225 kc. so as not to conflict with OAX4G, Lima, Peru, on 6230.

YV1RK, 5930, Maracaibo, Venezuela, shown in non-authenticated block, is probably on the air as J. V. Saxton, New York, and John L. Tate, Petersburg, Va., report hearing a Venezuelean station near midnight testing on 5930, although the call was not definitely determined by either.

XEBM, 15300, Mazatlan, Mexico. E. H. Clark, Hollister, Calif., has veri card covering his reported reception. Address of station is Apartado No. 50, Ma-

zatlan, Cinaloa, Mexico. Power 50 watts. Send reports to Senor Manuel Rojo L-Argentina.

The Mexican Situation

XEWI, 11900 kc., and 6015 kc., Mexico City. Late advice from the Mexican government is that these are the assigned frequencies of this station. Also that the assigned frequencies of XEFT are 9510 and 6120. XBJQ, 11000, and XEME 8190, have suspended operation and calls are obsolete. XEBT's assigned frequency is 60000. XEDQ's assigned frequency is 9520.

XEUZ, 6117, Mexico City, is in station list, although not shown in Mexican list, or yet confirmed. It is heard by many near 6117 announcing as Radio Nacionales, Mexico City, and relaying the programs of long-wave station XEFO on 940 kc., whose address is: Estacion XEFO, Partida Nal. Revolucionario, 5 de Mayo 19, Mexico, D. F.

XEBR, 11820, Hermosillo, Mexico, is another new short-wave broadcaster now on the air and time schedule is shown complete in station list. It operates daily with 150 watts power. Address: Serdan, 45, or Apartado postal No. 68, Director, Senor J. Remigio Agraz. Station is known as "Radiodifusora de Sonora" and operated by the Herald Newspaper interests at Hermosillo, Sonora.

Here and There

YV4RH, 5910 kc., Valencia, Venezuela, whose former call was YV15RV, is being heard nightly announcing as "Radio Valencia."

YV1RI 6210, Coro, Venezuela, has been transferred from non-authenticated section to the station list, as heard by many between 7:30 and 9:30 P. M. W. D. Flagg, Holyoke, Mass., reports station announces "Radio Coro" and gives the frequency.

HP5A, Panama City, Panama, called the "Voice of the Ismo" is a new station to go on the air, according to information received from Lyle Nelson, Yamhill, Oregon. Frequency not known. It is understood that this station will have a studio to accommodate a radio theatre audience of 400 persons.

SM5SX, 11705, Stockholm, Sweden. J. W. Partner, Tacoma, Washington advises that station will soon increase its power and operate simultaneously on three frequencies with directional attennas, one for America.

HH3W, 9595, Port-au-Prince, Haiti, is apparently around 9645 or thereabouts. Station insisted in last report received that they were on 9595, their assigned frequency. Has anyone received information from station that they have been assigned a frequency other than 9595?

VPD-2, 9540, Suva, Fiji Islands, has moved to 8720 kc. and are now being heard on that frequency. Let us hope they did not "jump from the frying pan into the fire." There is considerable congestion in the 31-meter band, as well as on the other bands, and with the numerous assignments being made, and more heard of, there is a question in the mind of the writer as to just how all are going to operate without interference with each other.

PLP, 11000, and PMH, 10260, Bandoeng, Java, reported heard by Capt. R. B. Oxrieder, State College, Pa., between 6:00 and 7:30 P. M. which fits up well with the time schedule for these stations. Congratulations to you, Capt. Oxrieder.

CT1AA, 9665, Lisbon, Portugal, reported by Karl C. Whitehouse, Bound Brook, N. J., broadcasting between 12-070 and 12100 with the usual "cookoo" signature and announcing that they are on the air Tuesday, Thursday and Saturday, 9 to 12 P. M. GMT (4 to 7 P. M. EST.) Further reports welcome. Perhaps CT1AA intends not to be outdone by CSW, Lisbon.

CSW, 11040, and 9940, Lisbon, Portugal. Both frequencies are being used daily according to reports. Fred Karpen, Johnstown, Pa., reports hearing CSW on 22000 kc. Further reports of all assigned frequencies to be used and actual time schedules would be appreciated.

PHI, 17775 and 11730 kc., PCJ, 15-220 and 9590 kc., are shown in station lists, although it is not known if all are used. From late reports transmitters of PCJ were transferred from Eindhoven to Hilversum, Holland, and both stations are being heard. Fred Karpen, Johnstown, Pa., states PHI on 17775 kc. daily from 7 to 10 A. M. Station advises PHI on 11730 and on the air at Huizen as shown.

CP5, 6080 kc., CP6, 9120 kc. and CP7, 15300 kc. are the assigned frequencies of Compania Radio Boliviana, La Paz, Bolivia. This company advises, however, that for the time being these stations have not a regular schedule, but make occasional special broadcasts on a particular frequency. Further advice will be given later.

ZTJ, Johannesburg, South Africa, is now operating on 6097.56 kc. (to be exact) with 5 kw. power and transmitting the same programs as broadcast by the long-wave transmitter on 645 kc. and located at Johannesburg. Their new time schedule is shown in station list and information as to signals, calls, etc., shown in the identification section.

CR7AA, 6137, Lourenco Margues, Portuguese Africa, is operating with 250 watts. Information has been received that a new 10-kw. transmitter will be in operation by May, 1937, with assigned frequencies at 19-25-31 and 48 meters, with directional aerials to South Africa and Portugal.

OLR, Prague, Czechoslovakia, has assigned call letters to their various frequencies and all are shown in station list—13 in number. They are evidently not superstitious, and memorization of call letters will provide sport for listeners. As stated in "Last-Minute Flashes" in March ALL-WAVE RADIO they are now broadcasting on 6010, 9550 and 11840 kc. under the calls OLR2A, OLR3A and OLR4A, respectively, and testing on other assigned frequencies which may be any of those following: 6030, 6115, 9504, 11760, 11875, 11900, 15160, 15230, 15320, 21450. The time on the air is shown under 6010, 9550 and 11840 kc. The Monday and Thursday broadcasts to America is 7 to 10 P. M. instead of 1 to 3 P. M. as shown in "flashes." Programs are usually transmitted on 9550 kc. according to advice received from the sta-


ROYAL TECHNICAL UNIVERSITY, STOCKHOLM

SWEDEN

RADIO Mr. J. B. L. Hinds, Yonkers, N.Y., 11,705

WE HAVE RECEIVED YOUR REPORT CONCERNING OUR ~~N~~ MC/S

bc TRANSMISSION ON Sept. 30th 1936 AT 21.44–22.05 GMT

SM5SX

RECEIVER: 10-TUBE SUPERHET

TRANSMITTER: CRYSTAL-CONTROLLED PLATE-MODULATED 204-A IN FINAL STAGE

ANTENNA: 2 λ E–W 400 W OUTPUT

MANY THANKS AND 73

OP

Call in red, "Sweden" in blue, printing in black—a pretty from Stockholm.

tion. The original schedule was 7 to 9 P. M. but the period has been extended in accordance with the requests of listeners.

HBL, 9595, and HBP, 7797, advise that after they conclude the Swiss program at 8:30 P. M. on Saturdays, they test on 9345 and desire reports of those hearing such tests. Although we have not received information from the station as to call letters, reports can be forwarded to address as shown in address section, which section as well as the identification signal section prepared by this department, have been revised, and shown in this issue. In regard to the frequency 9345 mentioned above, one listener reports as HBA.

OER2, 11800, Vienna or Wein, Austria. While station states this frequency is the assigned one, reports would indicate it is near 11780. One report received says station is on 11780 but announcement gave 11800 kc.

U. S. 11-Meter Station

W6XKG, 25950 kc., 11.56 meters, Los Angeles, California, has been added to station list. This short-wave station is known as "The Pioneer Short-Wave Station of the West" and relays the programs of broadcast station KGFJ. It operates continuously 24 hours a day. Both stations operated by Ben S. McGlashan, Washington Boulevard at Oak Street, Los Angeles. Earl G. DeHaven, Short Wave Editor of the "California Broadcaster," conducts a thrice weekly program of short wave news and DX tips over W6XKG on Monday, Wednesday and Friday from 11:00 to 11:30 A. M. PST (2:00 to 2:30 P. M., EST.) W6XKG employs 100 watts power and is said to be receiving reports from all parts of the world.

"Radio Philco," Saigon, Indo-China, is the call at present of the station on 11710, instead of F31CD on 11730 kc. A letter received by the writer verifying reception discloses information that the transmitter in use was built up from ordinary Philco receiver parts, augmented by some copper tubing, a few high-voltage condensers and transmitting tubes. They broadcast daily according to the hours shown, but programs are not fixed in advance. However, they intend to do so when ready with their new transmitters, which would indicate transmission on more than one frequency. The station is in charge of Paul C. Brown, who is an American engineer from the Philco Company. Mr. Brown advises that at present the station is in an experimental state, has no call letters yet assigned, and as a consequence has no veri cards. It is their intention to later supply veri cards to those reporting correct reception.

Martinique, French West Indies, is being heard on the 31-meter band. First heard at 9440 or 9445 kc., but since reported at several points lower in frequency. Reported by many and from them the station appears to be located at Fort de France, Martinique, which, if your geography has failed you, lies in the West Indies, to the south and east of Haiti. Calls reported FZ1F, FZF, FP1 and mention of French West Indies, RCA Victor, etc., so you will see that nobody is yet sure of the facts. It will therefore be shown in the non-authenticated section and we will await further developments.

Robin's-egg blue card with call in red—very effective, and worth listening for!

Belgrade, Yugoslavia, 6100, is said to be heard after 1 A. M. but badly heterodyned by W9XF, Chicago, which was on that frequency before Belgrade came on. Some give the call of Belgrade as YTC. If any one hears the call, or receives information from the station direct, please communicate with the writer.

A Spanish station was heard for several evenings recently on about 9800 kc. and then vanished. Announced as Radio Nacional and signed off with the selection "Good Night Sweetheart."

Another mysterious Spanish station is heard irregularly near 6595 and signs off around 10:35 to 10:37 P. M. with the selection "Caprice Viennois." Heard by H. W. Newell, Lowell, Mass., and the writer.

India: Department of Commerce states that within the next 18 months it is expected that four short wave broadcast transmitters will be in operation.

The WWDC

The writer and staff of All-Wave Radio appreciate the kindly comments of "The World Wide Dial Club" of Chicago, and extends thanks and best wishes with the hope that they will continue to think well of us. The Club was organized in 1934 and its meetings are held in Parlor B of the Morrison Hotel, Chicago, in the evening of the second Wednesday of every month. A cordial invitation is extended to all readers of All-Wave Radio living in or near the vicinity of Chicago to attend their meetings. The purpose of this club is to develop friendships among short-wave listeners and to discuss the latest short-wave information in the way of reception and stations on the air. Mr. Howard A. Olson, 2214 N. Ballou Street, Chicago, is President of club.

Veri Slow

The following stations are still shown as being slow in forwarding verifications covering reception reports filed: HJ1-ABB, HJ4ABD, HJ4ABB, Colombia; HCETC, Ecuador; HRN, Honduras; CB960, Chili; HI2D, HI7P, HI9B, Dominican Republic; T1EP, Costa Rica.

HI4V and HI5N have been removed from this section as a number of listeners state that veries have been received. Since HI4V changed its location, cards have been forthcoming, indicating that the contemplated change was evidently the cause of the delay. T1EP has been added at the request of certain readers. Those requesting the inclusion of stations in this block will be kind enough to advise promptly when veri cards are received so that the station may be taken out of the list. And here is good news from the front—the writer knows of two parties who have received verification cards from HRN in Honduras. So let us hope that all will receive their long due cards.

Amateur Phone Stations

The following is a list of 20-meter amateur phone stations as shown in late reports which have not been listed in previous reportings in this section.

(Continued on page 223)

Night-Owl Hoots

By Ray La Rocque

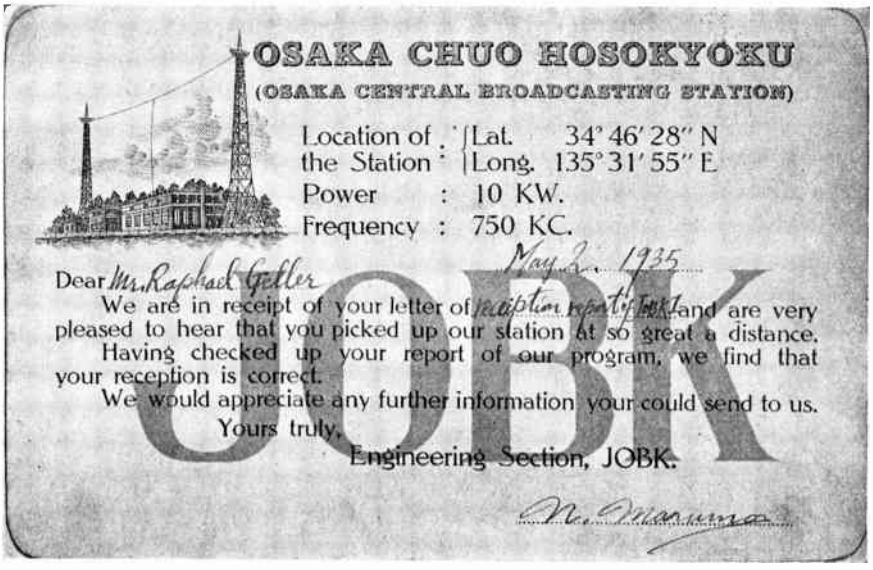
hoot birthday . . . rssl . . . dx contest gets hot . . . whas flood work "hello world" henderson back? . . . canadian freak checks . . . flash

THE Radio Signal Survey League, organized by ALL-WAVE RADIO, beckons you to join its rapidly growing ranks of recruits from all parts of the world—recruits who are banding together for a purpose far greater than any which listener organizations in the past ever have conceived. Only through a powerful international organization of listeners and radio stations can the aims of the RSSL be achieved. The Chief Night Owl, as Director of the Standard Broadcast Division, calls upon every brother Night Owl from the beginner to the super-ace, from Tokyo to Trieste, and from Aklavik to Antofagasta to enlist in our division as well as in any of the other divisions in which he may be interested.

Only too often valuable ideas and principles for the benefit of DX have been wasted because there was no powerful force or organization to carry out the plans. The RSSL is the powerful force for which DXers, stations, and clubs have been waiting during the years blessed by the most valuable institution in centuries—RADIO. Write now for your application blank. There is no fee required—no special equipment needed—just your earnest desire to help.

In April Night-Owl Hoots will be one year old. Maintaining the principle that there are already too many clubs, publications, etc., bothering the stations, especially those in this country and Canada, with requests for special courtesy DX programs we have refrained from arranging any special programs for our readers. We are flattered that, though unsolicited by us, a few stations have generously dedicated programs to ALL-WAVE RADIO and the readers of this department. These broadcasts came from CMHJ through the courtesy of the DX Director and announcer Enrique Hidalgo—the most recent program being on March 4. Station WJBO also dedicated a program to readers of Night-Owl Hoots on March 7 which was arranged by Wilbur T. Golson, Chief Engineer at the Baton Rouge, La., station. The notice of the last mentioned program reached us too late for mention in last Night-Owl Hoots, but it was included in the DX Time Table and it is hoped that many readers showed their appreciation by reporting reception. Regarding the WJBO program, Night Owl Golson (yessir, this chief engineer is a real DXer also) informs us that it is a regular feature on the first Sunday of each month from 2-4 A. M. and is dedicated to a different club each month. A special verification card has been printed for those reporting reception, and a folder of 24 photos of scenes around Baton Rouge is sent to the first listener from each state reporting on each month's broadcasts. To both these gentlemen and to the staffs of their stations many thanks for the kind dedications.

Diverting from our past policy in order to celebrate our first anniversary with AWR, the Chief Night Owl has contacted stations in foreign countries who have shown interest in DXing regarding DX programs for our readers during April. Having in mind the uselessness of a program from a station which is easily heard with regularity, we have written only to stations that will make welcome additions to any DXer's log. We do not intend to have an elaborate display of programs from a great many stations, but those programs which are arranged will be DX programs in every sense of the word—which, we have been told, means distance! Appropriately enough, the first station to signify its intentions of celebrating the first anniversary of Night-Owl Hoots is CMHJ. According to Senor Enrique Hidalgo this program, which will be from 3 to 6 A. M. on April 15, will close the DX activities of CMHJ for the season and one-half hour of the program will be entirely devoted to our anniversary celebration. For any further developments of our anniversary DX programs watch our Time Table this month and next—and for any last-minute changes or additions listen to any CMHJ DX broadcast or to Cappie Hadley's tip period over WLAC.



Veri from Osaka, Japan, received by Mr. R. Geller.

Station Changes—United States

New Stations: Granted licenses during the past month:

Location	*K.C.*	*Watts*	
College Park, Md.	1060	100	12-6 A.M. only
Superior, Wis.	1200	100	unlimited
Vasalia, Calif.	1190	250	daytime
Bridgeton, N. J.	1210	100	daytime
Richmond, Va.	1500	100	unlimited

Power Increases: WJTN (1210) 50-100, WJBO (1420) 100-500; WMBG (1210) 100-500, and WOL (1310) 100-1000.

Frequency Changes: WJBO 1420-1120, WMBG 1210-1350, and WOL 1310-1230, WPHR (880) will move into Richmond from Petersburg, and the call of KTEP (1500) will change to KROD.

Station Changes—Foreign

In the foreign station list a great number of changes have taken place, and the bulk of them have been in Mexico. The new list just received includes quite a few new stations and there are still many which have appeared since the list was printed which we will attempt to list as soon as we discover them. Meanwhile, Night Owls, don't be surprised at anything new you hear in Mexico these days and please report every change heard to us so that we can pass it along to others. New stations follow:

Call	Location	K.C.	Watts
CMJW	Camaguey, Cuba(IDA)	1340	.....
I1BO	Bologna, Italy	1222	50000
HJ1ABJ	Santa Marta, Colombia	1150	.....
LRA	Buenos Aires, Argentina (IDA)	750	10000
LT8	Rosario, Arg. (IDA)	840	.....
YV1RN	Maracaibo, Venezuela	780	.....
YV4RE	Valencia, Venezuela (NNRC)	1400	.....
YV5RI	Caracas, Venezuela (NNRC)	1370	.....
YV5RQ	Caracas, Venezuela (NNRC)	882	.....
XEAG	Cordoba, Mexico	1310	10
XEAL	Mexico City, Mexico	660	1000
XEBA	Guzman, Mexico	1080	20
XEBC	Agua Caliente, Mexico	730	5000
XEBI	Aguascalientes, Mexico	1000	25
XEBJ	Merida, Mexico	1160	20
XEBX	Saltillo, Mexico	640	250
XEBZ	Mexico City, Mexico	1160	100
XECW	Mexico City, Mexico	1310	10
XEBL	Mazatlan, Mexico	1220	50
XEDA	Anaya, Mexico	1220	200
XEDW	Minatitlan, Mexico	1150	20
XEFE	Nuevo Laredo, Mexico	850	20
XEFW	Tampico, Mexico	1310	250
XEJP	Mexico City, Mexico	1130	100
XEJW	Mexico City, Mexico	860	.....
XEMG	Atzcapotzalco, Mexico	1060	100
XENC	Mexico City, Mexico	860	50
XETB	Torreon, Mexico	1310	125
XEX	Monterrey, Mexico	1310	125
XEXO	Mexico City, Mexico	940	500
XEXH	San Luis Potosi, Mex.	1250	250
XEXS	Mexico City, Mexico	1000	100

Power Changes: XEA (1050) 500-125, XED (1150) 2500-500, XEC (1160) 30-100, XEH (720) 250-100, XES (990) 250-100, XEAF (990) 500-750, XEAM (750) 7½-25, XEAS (1160) 100-50, XEAT (1210) 50-250, XEBG (820) 500-1000, XEFB (1420) 100-200, XEMX (1280) 12-100, XENT (910) 150,000 to 50,000, XEOK (760) 250-200, XEPN (730) 100,000 to 50,000, 4IP (1440) 50-100 (IDA).

Frequency Changes: XEC 1160-1150, XED 1160-1150, XEFB 1420-870, I1TR 1222-1140, PRA-9 1110-1220, JOOG 1080-950 (IDA), JOJG 1040-1080 (IDA), JONK 950-1040 (IDA), and JBBK-2 830-820 (IDA).

Call Letters Changed: All the proposed calls listed in Venezuela last month are now in use. XEAI to XEAY, XEZZ to XECZ, XFB to XEXB, XFD to XEXD, XFA to XEXA, XFC to XEXC, and JOIG to JOLG.

Locations Changed: XEAQ (1090) to Tiajuana from Rosarito, and XEAT to Porral from Hidalgo, Mexico.

Delete: According to latest information the following are no longer in existence: XEG (1270), XEN (710), XEY (1000), XEAZ (1420), XEFL (1150), XEMZ (820), XEOX (640) XESL (1160), XEYZ (780), and XEME (1240).

During January a total of 492 reports were received on 72 different stations—a new high! This month's scoring found the leaders running into a little competition. Though both Brode and Ahman held onto first and second places, their lead is being seriously threatened by two contestants who have jumped into third and fourth places in just two months of scoring. If either Carl Forestieri or Carroll Weyrich keep up their present pace, next month may find a new name at the head of the list. The leaders now rank as follows:

George Brode, Philadelphia, Pa.	3282
Bernard Ahman, Baltimore, Md.	2762
Carl Forestieri, New York, N. Y.	2020
Carroll Weyrich, Baltimore, Md.	1460
Enrique Hidalgo, Cienfuegos, Cuba	1331
Joe Lippincott, Medford, Mass.	1302
Charles Hesterman, Saskatoon, Sask.	1050
Earl Lever, Worcester, Mass.	675
Leroy F. Nice, Souderton, Pa.	457
Kendall Walker, Yamhill, Oregon	451
John Gardner, New York, N. Y.	166
Bob Beadles, Salt Lake City, Utah	150
Harry M. Gordon, Erie, Pa.	125
Carl Sylvester, Yale, Michigan	83
Fred L. Van Voorhees, Miller Place, N. Y.	69
Bernardo A. Alcazar, Cienfuegos, Cuba	28
David Herbert, Lancaster, Calif.	4

High scorer for the month was Forestieri with 1356 and Weyrich was less than one hundred markers behind with a 1274. Other scores for January were Brode 990, Ahman 775, Hesterman 650, Nice 424, Walker 351, Hidalgo 329, Lever 147, Lippincott 134, Gordon 125, Alcazar 28, Van Voorhees 24, Herbert 4, and Beadles 2. The Bronx Owl also monopolized the Bullseye department hitting nine of them on the nose for 900 points on 9 stations! The stations were: XEFO, I1MI, Marseilles, Cologne, Lille, Strasbourg, Bordeaux, CMK, WOR. Other "bullseyes" were as fol-

(Continued on page 223)

ALL-WAVE RADIO'S

Time Table of DX Programs

(All time is given in Eastern Standard Time)

Specials

FRIDAY MORNING, MARCH 26

KTEM, Temple, Texas (NNRC) 1370 kc. 4:00-6:00

SUNDAY MORNING, MARCH 28

KWSC, Pullman, Wash. 1220 kc. 3:00-7:00

MONDAY MORNING, MARCH 29

KGFW, Kearney, Neb. 1310 kc. 6:00-6:30

WEDNESDAY MORNING, MARCH 31

KHBC, Hilo, Hawaii (NNRC) 1400 kc. 3:00-4:00

THURSDAY MORNING, APRIL 1

CMHJ, Cienfuegos, Cuba (NNRC) 1160 kc. 2:00-3:00

FRIDAY MORNING, APRIL 2

KTEM, Temple, Texas (NNRC) 1370 kc. 4:00-6:00

SUNDAY MORNING, APRIL 4

KGDY, Huron, S. D. 1340 kc. 4:00-4:30

THURSDAY MORNING, APRIL 8

WLLH, Lowell, Mass. 1370 kc. 1:45-2:15

FRIDAY MORNING, APRIL 9

WJAG, Norfolk, Neb. 1040 kc. 1:30-2:00

KFOF, Denver, Colo. 1880 kc. 2:15-2:45

SATURDAY MORNING, APRIL 10

KOTN, Pine Bluffs, Ark. 1500 kc. 3:00- ?

SUNDAY MORNING, APRIL 11

WLVA, Lynchburg, Va. 1200 kc. 1:00-1:20

XEFW, Tampico, Mexico 1310 kc. 2:00-3:00

(Night Owl Hoots 1st anniversary program)

THURSDAY MORNING, APRIL 15

CMHJ, Cienfuegos, Cuba 1160 kc. 3:00-6:00

(½ hour for N.O.H. 1st anniv. celebration)

MONDAY MORNING, APRIL 19

CJCB, Sydney, Nova Scotia 1240 kc. 1:11-1:19

CKCW, Moncton, New Brunswick 1370 kc. 1:21-1:29

CHNS, Halifax, Nova Scotia 960 kc. 1:31-1:39

CFCY, Charlottetown, P. E. I. 630 kc. 1:41-1:49

CJLS, Yarmouth, Nova Scotia 1310 kc. 1:51-1:59

CRCS, Chicoutimi, Quebec 950 kc. 2:01-2:09

CHSJ, Saint John, N. B. 1120 kc. 2:11-2:19

CFNB, Fredericton, N. B. 550 kc. 2:21-2:29

CHRC, Quebec City, Quebec 580 kc. 2:31-2:39

CFCH, North Bay, Ontario 930 kc. 2:41-2:49

CJKL, Kirkland Lake, Ontario 1310 kc. 2:51-2:59

CRCY, Toronto, Ontario 1420 kc. 3:01-3:09

CKSO, Sudbury, Ontario 780 kc. 3:11-3:19

CJIC, Sault Ste. Marie, Ont. 1500 kc. 3:21-3:29

TUESDAY MORNING, APRIL 20

C.B.C. Frequency check programs same as 19th.

WEDNESDAY MORNING, APRIL 21

WOPI, Bristol, Tenn. 1500 kc. 3:00-5:00

FRIDAY MORNING, APRIL 23

KTEM, Temple, Texas (NNRC) 1370 kc. 4:00-6:00

Regulars

EVERY SUNDAY MORNING

TGW, Guatemala City, Gua. 1210 kc. 12:00-6:00

XED, Guadalajara, Mex. 1160 kc. 12:01-2:00

WLAC, Nashville, Tenn. 1470 kc. 12:45-1:00

(Cappie Hadley's DX tips—latest data on N.O.H. anniv. program.)

CMBX, Havana, Cuba 1070 kc. 1:00-3:30

XEP, Juarez, Mexico 1160 kc. 2:00-4:00

CMCD, Havana, Cuba 950 kc. 2:00-3:00

KFBB, Great Falls, Mont. 1280 kc. 2:00-5:00

EVERY TUESDAY MORNING

KMAC, San Antonio, Texas (NNRC) 1370 kc. 5:30-6:00

EVERY FRIDAY MORNING

CFCN, Calgary, Alberta 1030 kc. 12:00-2:00

WFOY, St. Augustine, Fla. 1210 kc. 1:00-3:00

EVERY SATURDAY MORNING

WTMV, East St. Louis, Ill. 1500 kc. 12:00-3:00

CMKW, Santiago, Cuba 1330 kc. 1:00-2:00

KMAC, San Antonio, Texas (NNRC) 1370 kc. 4:30-5:00

"BARB" AND "ERNEST"—
Their Code

Get-Together

Dear Gerald:

It was swell having you out to the house last Sunday, even if we did tangle on politics. We still aren't sure if you were giving us the straight dope on the code test you gave us, but you made us feel good just the same. As for the theory, we think a bit more study is called for, and I believe you think so, too.

Now we'll tell *you* something—you drag your dots and dashes like nobody's business, so you aren't so hot yourself! Remember the tape you made? Remember how the dots and dashes looked? Oh, boy—you'd better practice a bit yourself so you can learn to "clip 'em" the way Barb and myself do. We couldn't even copy some of your stuff, but we suppose a commercial operator could if there's anything to this "tropical swing" you tried to feed us. We'll say this much—the last tape you cut on the machine was pretty good, but you got clay feet like the rest of us.

All kidding aside, you gave us confidence, and we're looking forward to getting on the air real soon. So any time you want to start "planning" our equipment, we're ready to put our heads together with yours.

Barb and Ernest.

◆

"Best By Test"

Dear Barb and Ernest:

You get me half lit with cocktails and then expect me to give you the perfect example of what a "fist" should be . . . pfhooey on you. But the dinner was excellent, and tell Marj I enjoyed her homemade chili sauce.

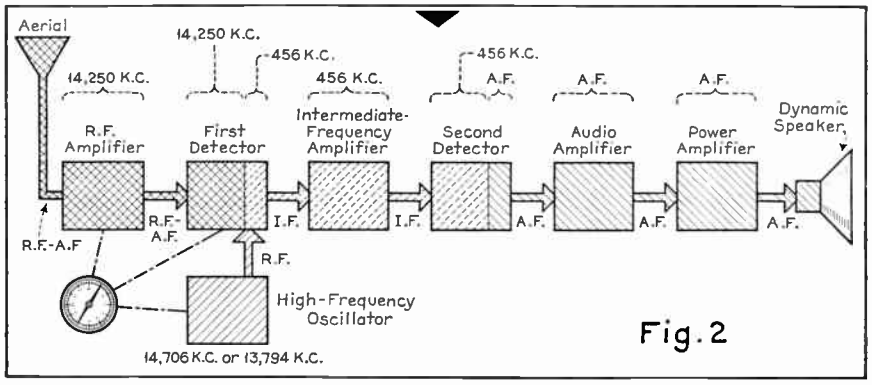
You two can just get off your high horse—I'll grant that you're both good for a solid 15 per on both transmission and reception, but don't go around underrating an old commercial operator who is used to pounding brass in the tropics where the static busts eardrums. And don't under-rate my "sleepy-time" sending because it has a perfectly beautiful off-measure beat like the so-called "swing music" one hears nowadays. Just live and learn, and don't be so bright all at once or you'll trip up on a continental comma.

I hate telling you that you're doing better than I had expected—*on code.* You get ideas. All right—you're good on code, but you'd better start brushing up on theory. You're fairly good as it is, but not good enough. So keep at it. In the meantime, I'll get along with these animated circuits of mine with the hopes that they'll teach you something. We're off.

What Makes a Super Soup?

If you can remember as far back as my last letter, you may recall that I explained the general operation of a tuned-radio-frequency type of receiver, to say nothing of a simple transmitter. Now we come to the superheterodyne type of receiver, which is lovingly referred to as a "super" by the "boys". Since this type of receiver is practically standard, you'll want to know just what makes it "soup". Here's the lowdown:

Look at Fig. 2. This is a block diagram of a superheterodyne minus its power supply; I dealt with the power supply in my last letter so there's little sense bringing that up again. The diagram shows the aerial feeding a modulated signal carrier (remember?) to an r.f. amplifier. The output of this amplifier is fed into the detector, and both of these circuits are simultaneously tuned, and to the same frequency. So far this is just like the tuned-radio-frequency receiver I covered last month, except that in this case the "detector" is referred to as the "first detector", simply because there are *two* detectors in a super. Furthermore, this part of the super is the same as a t-r-f receiver in that the r.f. amplifier and first detector are both tuned to the actual frequency or wavelength of the desired signal, *but the other circuits or stages of the super are not.*



Animated block diagram of superheterodyne receiver, illustrating method of its operation.

We will assume that the super represented by the block diagram of Fig. 2 is tuned to a phone signal on 14,250 kilocycles, as indicated. The signal voltage is represented the same way as it was last month—lines slanting to the left for the a.f. and lines slanting to the right for the r.f. Since the signal is composed of r.f. and a.f., the lines are shown superimposed.

Now note that a high-frequency oscillator is shown directly below the first detector stage. This oscillator generates a radio-frequency voltage which is fed into the first detector stage where it combines with the signal voltage. But, as indicated, the oscillator is not tuned to the signal frequency of 14,250 kc, but rather to a frequency of 14,706 kc or 13,794 kc—just 456 kc above or below the actual signal frequency.

Before explaining the reason for this, note that the first detector is followed by an "intermediate-frequency amplifier" and a "second detector", both of which are *fixed-tuned* to a frequency of 456 kc, that is, these two stages are never varied in frequency.

Now let us return to the high-frequency oscillator and first detector; we will assume that the r.f. amplifier and first detector are tuned to a 14,250-kc signal and that the high-frequency oscillator is tuned to 14,706 kc, or just 456 kc *above* the signal frequency. The r.f. voltage fed into the first detector is therefore oscillating at a frequency of 14,706 kc. There are therefore two distinct voltages present in the first detector stage—the 14,250-kc modulated signal voltage and the 14,706 unmodulated r.f. oscillator voltage. These two voltages are mixed in the first detector stage and produce a *third* voltage which bears the modulation characteristics of the original carrier but differs in frequency by an amount equal to the difference between the oscillator frequency and the carrier frequency, or 456 kc. in our example—a simple case of subtraction.

EMBRYO RADIO HAMS

Speed Upped

It is evident, therefore, that by the process of *heterodyning,* a *beat frequency* is produced which has the original signal characteristics. This beat frequency is amplified by an *intermediate-frequency amplifier* of one or more stages the tuning of which is never altered. It is only necessary that the frequency of the oscillator be at all times 456 kc above the frequency of the received signal. Therefore the r.f. amplifier, first detector and oscillator tuning condensers can be ganged together on the same shaft, as indicated in the diagram, and the capacity of the oscillator condenser so adjusted that, irrespective of what frequency the r.f. amplifier and first detector are tuned to, the oscillator will always be just 456 kc higher in frequency. As a consequence, any signal tuned in will automatically be converted to a frequency of 456 kc, in the manner explained.

It should be pointed out that the same results can be obtained by tuning the oscillator to a frequency just 456 kc *below* the signal frequency, or 13,794 kc, as indicated in the diagram, but it is customary to tune the oscillator to the higher frequency.

The remainder of the operation of the super is quite matter-of-fact; the 456-kc signal frequency is passed through the intermediate-frequency amplifier, as indicated by the dotted slanting lines, and finally into the second detector where the audio component of the signal is separated from the carrier through the process of rectification. The detector output is therefore an audio-frequency voltage similar in all respects to the audio frequencies built up by the speech amplifier in the transmitter. These audio voltages are increased in amplitude in passing through the audio amplifier and finally converted into audio power in the power amplifier stage which feeds the loudspeaker.

The question now left is simply this—why bother to convert an incoming signal to another frequency when it would appear just as simple to amplify it at its original frequency, as it is done in a tuned-radio-frequency receiver. The answer is that the lower the frequency of the signal the greater its amplification, for we have already learned that high radio frequencies have the habit of skipping from one tube element to another instead of waiting patiently to be amplified. Moreover, the selectivity of an intermediate-frequency amplifier, tuned to say 456 kc, is far greater than the selectivity of a radio-frequency amplifier tuned to a high radio frequency. As a matter of fact, the intermediate-frequency amplifier in a superheterodyne contributes most of the selectivity and signal gain—far more than a number of r.f. amplifier stages could possibly provide.

It is understood, of course, that the frequency of the i.f. amplifier need not be 456 kc. This merely happens to be a value commonly used.

C.W. Reception in Super

Now let us take the case of a superheterodyne receiver equipped for the reception of continuous-wave (c.w.) code signals. In this case we are dealing with an unmodulated carrier; that is, a pure radio-frequency voltage no part of which would be audible under the usual conditions. Let's see how it is done.

In Fig. 3 is shown a super which, in its general form, is no different than the one shown in Fig. 2. It is tuned to a frequency of 14,000 kc and we will assume that a c.w. signal on this frequency is being intercepted. In this case, then, the voltage in the aerial and in the r.f. amplifier and first detector stages is pure r.f., there being no a.f. component whatsoever (an ideal condition.) Since the r.f. circuit is tuned to 14,000 kc, it stands that the high-frequency oscillator is tuned to 14,456 kc (or 13,544 kc) in order to produce the required 456-kc signal, the frequency to which the i.f. amplifier is tuned. This signal is indicated by the dotted slanting lines in Fig. 3.

Obviously the c.w. signal cannot be heard unless it is modified in some manner. Since it is an unmodulated signal, with no audio component, the action of the second detector cannot make it audible; as much as this detector can do is to rectify the r.f. and thereby produce a d.c. voltage which in itself cannot be heard as there is no fluctuation at an audible rate.

It is necessary, therefore, that an audio component be introduced, and this is accomplished by means of a *beat-frequency oscillator,* which, as shown in the diagram, feeds an r.f. voltage into the second detector. The oscillator is tuned so that the frequency of the r.f. voltage is slightly above or below the 456-kc signal frequency. As a consequence, there are two r.f. voltages present in the second detector (just as there are in the first detector). These voltages mix and produce a third voltage the frequency of which is equal to the difference between the frequency of the beat oscillator and the i.f. signal frequency. Since the beat oscillator shown is adjusted to 455 kc (of 457 kc), the beat or difference frequency is 1 kc or 1000 cycles. If a 500-cycle note were desired, then the beat oscillator would be adjusted to 455.5 kc. Or it could be adjusted to 456.5 kc and the results would be the same.

Since the i.f. amplifier and second detector are always tuned to 456 kc, the beat oscillator may also be adjusted to a fixed frequency and never again changed. However, it is common practice to place a control on the beat oscillator so that its frequency may be varied over narrow limits. This control is nothing more than a low-capacity variable condenser connected across the grid coil, and by means of which the pitch of the c.w. signal may be varied from a few cycles up to thousands of cycles to suit the ear. This control is also valuable when two c.w. signals of practically the same frequency are received simultane-

(Continued on page 218)

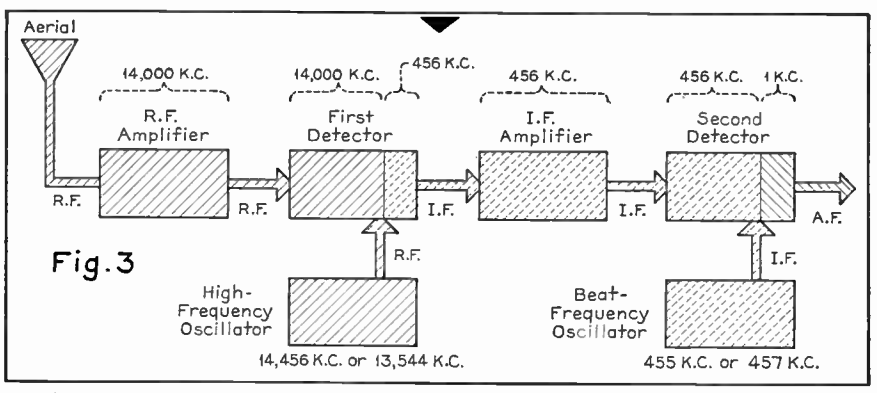


Fig. 3

Block diagram illustrating the manner in which a beat-frequency oscillator makes audible a c.w. code signal.

Queries

Code-practice oscillator . . changing the "G" type tubes . . television

CODE PRACTICE OSCILLATOR

Question No. 27:

I have constructed the buzzer code practice unit described in the May issue of ALL-WAVE RADIO. While it works fairly well, the pitch isn't constant, and the note is often raspy. Is there any cheap and simple way of imitating the clear whistle of the code stations I hear with my short-wave receiver?—*J. R. B., Brooklyn, N. Y.*

Answer:

The circuit diagram of such an arrangement is shown in Fig. 1. In addition to the key and telephone receivers which you already have, you will need an audio-frequency amplifying transformer, a type 30 tube and socket, two dry cells (such as you used with the buzzer) a 22.5-volt B battery and a 20-ohm rheostat. You can buy the cheapest sort of an amplifying transformer. The ratio is not important—anything between two-to-one and five-to-one will be satisfactory. Usually it should be connected as shown—one winding in accordance with the lettering (such as G to grid and F to filament, or P to plate and B to B battery through the 'phones) and the other winding reversed. In any event, if the oscillator does not work, reverse *one* of the windings. The pitch can be controlled somewhat with the rheostat.

Two sets of headphones can be used, connected in series, if desired for mutual practice. This is desirable, for a beginner, when transmitting to a friend, will find it very difficult to form perfect characters without hearing them. If you possess a broadcast receiver having provisions for a phonograph pick-up, these posts or pin jacks can be connected in place of the telephone receivers and the code listened to by all interested on the loudspeaker.

If two-way operation is desired, between two operators for instance located in different rooms, one oscillator is all that is required. The telephone receivers are connected in series as already described, and each key connected in series with one headset. When receiving, the party on the receiving end must keep his key depressed, or shorted with a simple switch. Many keys, especially those designed for landline telegraphy, have shorting switches mounted on the bases.

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.

METAL vs. G-TYPE TUBES

Question No. 28:

I have had trouble with metal tubes, particularly with the 6H6, 6C5 and 6L6. I was advised to replace these tubes with the octal base glass or G-type, which I did with perfectly satisfactory results. As other metal tubes "went west," I also replaced these with the octal base glass, one by one, until, at the present time, I have more than half glass tubes in my set. While I have had no glass tube failures, the receiver is not operating as satisfactorily as it did originally with the metal tubes—especially on the short waves. Are the glass tubes fundamentally less efficient than the metal types?—*A. C. D., Plattsburg, N. Y.*

Answer:

No—the glass tubes are as good as the metal type. However, the inter-electrode capacities are not quite the same as those of the corresponding metal types and compensation must be made for this difference if the highest efficiency is to be obtained. It appears likely that A. C. D.'s early replacements of the 6H6, 6C5 and 6L6 were all in audio-frequency circuits where the very minor capacity discrepancies would have absolutely no effect, or would any difference in operation be noticeable when substitutions are made in the relatively low radio-frequency circuits associated with the intermediate-frequency amplifier. However, in the pre-selector r-f, mixer and oscillator circuits, small variations in capacity will throw the receiver out of alignment, the degree of error introduced increasing with the frequency. The set may still operate fairly well on the standard U. S. broadcast band, but the efficiency on the short waves will be definitely impaired.

This can be demonstrated mathematically if you are interested. The expression for frequency is—

$$f = \frac{1}{2\pi\sqrt{LC}}$$

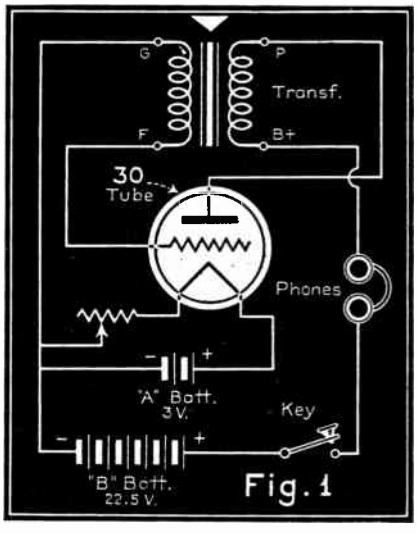
—where f is the frequency in cycles per second, L the inductance in henries and C the capacity in farads. It is obvious that the product LC and the square root of LC are constants for any given frequency.

Differentiating f in respect to C,

$$\frac{df}{dC} = -\frac{1}{4\pi C\sqrt{LC}}$$

—df/dC being an expression giving the rate at which frequency shifts with capacity changes. The product LC is much smaller at high frequencies. For instance, at 500 meters it is .0704—while at ten meters it is only .0000282. Obvi-

(Continued on page 220)



Circuit diagram of simple code-practice oscillator using a dry-cell type tube.

RADIO PROVING POST

LAFAYETTE MODELS B-97, B-98

THE Lafayette Model B-98 All-Wave Superheterodyne Receiver, illustrated in Fig. 1, is the product of Wholesale Radio Service Co., Inc. The chassis alone, with speakers, is Model B-97. The latter model, shown in Fig. 2, was submitted for test in our laboratory.

Both models are equipped with two 12-inch (cone-housing diameter) dynamic loudspeakers. In our tests, the speakers were used with and without baffles, for reasons that will be explained later.

The Series 2DL Chassis employed in the Models B-97 and B-98 receivers employs 13 tubes, all but one of which are of the metal type. The tuning range is continuous from 528 kc. to 18.3 mc in the following steps: Range 1-528 to 1730 kc; Range 2-1710 to 5800 kc; Range 3-5.75 to 18.3 mc. Provisions are made for high-fidelity reception from any station when signal and noise conditions are favorable.

The 9-inch tuning dial is actually a mirror with the three frequency range scales etched into the glass. These scales are illuminated by lights placed at the left and right edges of the mirror, the light being transmitted *into* the glass and diffused by the scale etching. This produces an interesting effect—much as it the dial scales were painted on the mirror with radium salts.

The tuning indicator proper is a traveling spotlight, located behind the scale mirror and controlled by the tuning knob. There are three such lights, one for each tuning scale, and these are controlled by the waverange switch. The indicator projects a brilliant narrow pencil of light onto the frequency scale in use, and this slit of light travels across the scale as the tuning knob is rotated.

The dual-ratio tuning mechanism is automatic in operation. It contains a traveling planetary drive which alters the ratio when the tuning knob rotation is reversed. Thus, turning the knob in one direction provides a normal (fast) ratio of 8-to-1. which may be increased to a (slow) ratio of 40-to-1 at any point on the scale by merely reversing the direction of the knob rotation. By this means slow-motion tuning may be had at any desired frequency, or over any frequency band, without the slightest inconvenience. The slow action continues for approximately an inch of travel of the tuning indicator light, and so long as tuning is done within this limit, the slow action is had irrespective of which way the tuning knob is rotated. Fast action is restored only after the indicator is made to travel beyond the inch limit, one way or the other.

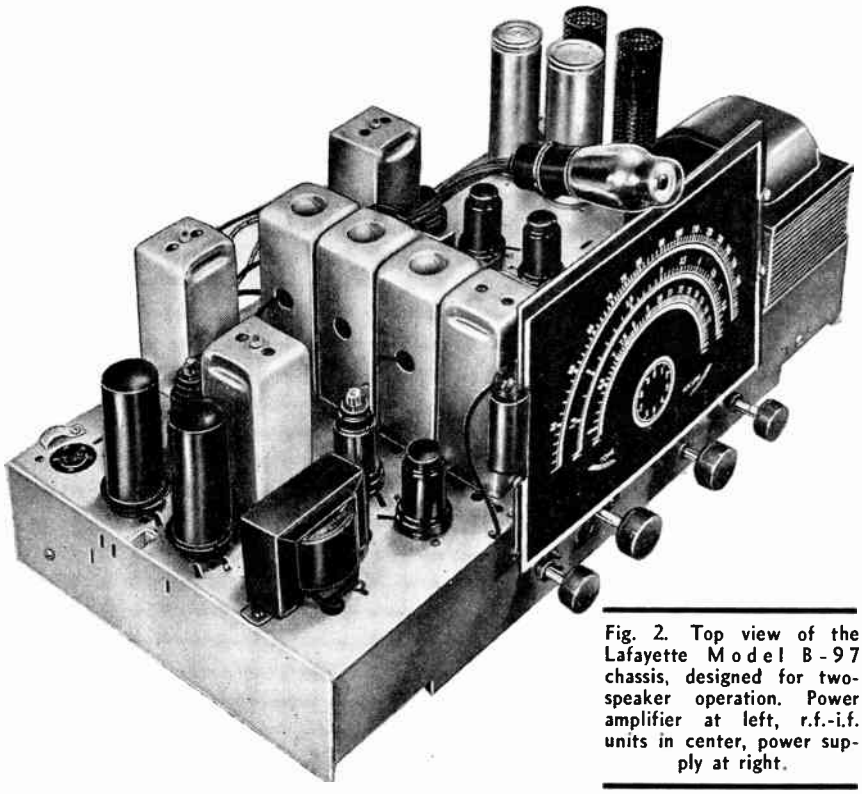


Fig. 2. Top view of the Lafayette Model B-97 chassis, designed for two-speaker operation. Power amplifier at left, r.f.-i.f. units in center, power supply at right.

A supplementary vernier dial, shown at the center of the mirror scale in Fig. 2, provides mechanical band-spread. This dial has a 16-to-1 ratio to the main spotlight indicator and permits accurate station logging. A pencil of red light travels around a 360-degree scale which has a total of 50 divisions. The frequency spread on this scale is equal to approximately 40 kc in Range 1, 225 kc in Range 2, and 900 kc in Range 3. This amounts to approximately 5.5 kc per division at 6 mc, and 6 kc per division at 10 mc. At 12, 15 and 18 mc the spread per division is approximately 2.5 kc. The spread at the low end of the broadcast band is approximately 10 kc, and at the high end 20 kc.

All receiver functions are controlled by four knobs. The knob at the extreme left is the tone and selectivity control. This knob not only alters the tone from bass to sharp to treble, but when turned full to the right provides high-fidelity reception by broadening the tuning of the intermediate-frequency amplifier so that the higher audio frequencies may pass through. In all other positions of this knob, the i. f. amplifier is sharply tuned. A shadow traversing a small scale etched into the lower left corner of the mirror scale indicates the relative degree of tone shading and selectivity.

The second knob controls the waveband switch which not only selects the desired wave range but also switches on the proper tuning indicator spotlight. The third knob is the tuning control, which has already been explained. The knob to the extreme right is the on-off switch and volume control. The de-

gree of volume is indicated by a shadow which travels over a small scale at the lower right corner of the mirror scale. When this knob is turned full to the left, the receiver is turned off.

Mechanical Details

All four controls are smooth and sure in operation, although the tuning control on the chassis under test required a bit of "working-in" before it functioned satisfactorily.

The major components are well distributed on the chassis—the power supply units at the extreme right, the power amplifier at the extreme left, and the r.f.-i.f. parts locat d centrally with adequate space between them and the heat-generating units at the outer edges of the chassis. Moreover, there is ample space between the metal tubes and the r.f. and i.f. transformers, with the result that coil and condenser values are not altered by the effects of heat. All r.f. trimmer condensers are in a single line, under the chassis, and also well removed from sources of heat.

The steel chassis has welded corners and is well braced. Rubber floats eliminate acoustically-induced speaker hum. The power transformer is a husky affair and does not run hot, as many do.

An interesting feature is the manner in which the ground (chassis) connections are made. Where such connections are required, the chassis has been

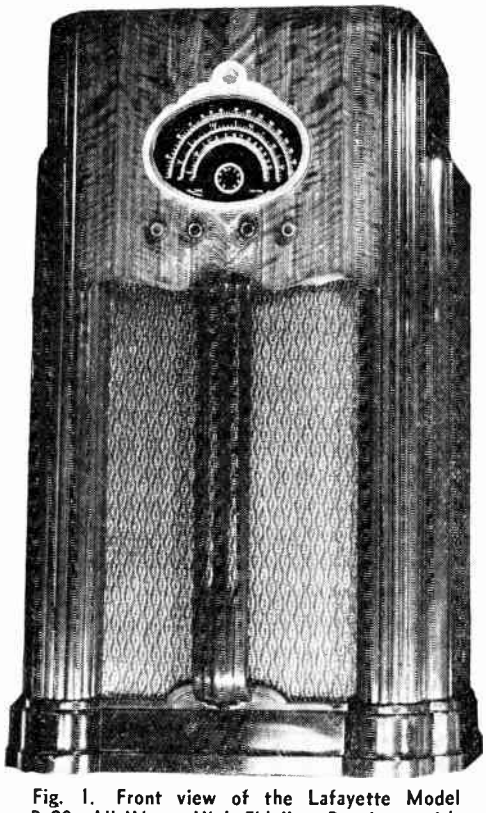


Fig. 1. Front view of the Lafayette Model B-98 All-Wave High-Fidelity Receiver with Magic Mirror Dial. Set has two speakers.

Fig. 3. The schematic diagram of Lafayette Models B-97 and B-98 receivers. Note the band-pass filter in r.f. stage. Audio output, 20 watts.

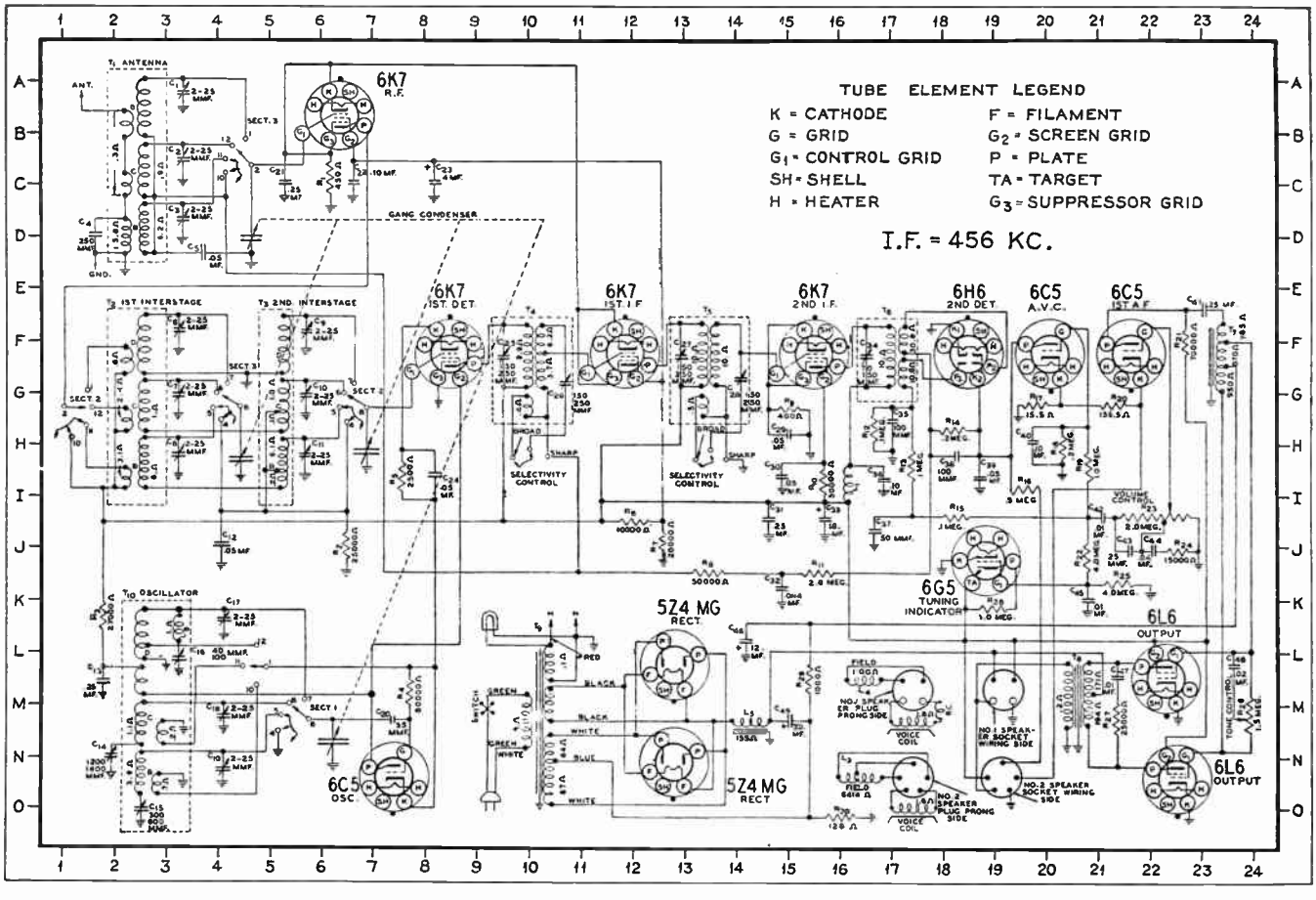
punched so that a small tab is formed. Connections are soldered directly to these raised tabs, rather than to screws or bolts that can in time become loose and cause trouble.

The Circuit

The schematic diagram of the receiver, drawn up in road-map fashion, is shown in Fig. 3. There are four 6K7 tubes, used in the r.f. stage, the first detector, and the two i.f. amplifier stages. A 6C5 is used in the circuit of the high-frequency oscillator. The second detector is a 6H6. One section of this tube is used in conjunction with a 6C5 for automatic volume control. The section of the 6H6 used for detection feeds a 6C5 audio amplifier which in turn is coupled to a pair of 6L6 beam-power tubes in push-pull. Since the current drain of this receiver is high (power consumption is 170 watts) the power-supply unit employs two type 5Z4-MG full-wave rectifiers. The tuning indicator tube is a 6C5.

Separate coils for each wave range are used in all of the r.f. circuits. It should be noted that, for the sake of high-fidelity reception, a band-pass tuner is employed to couple the r.f. tube to the first detector. This is located at G-5 in the diagram. By this means, a high degree of selectivity is obtained without side-band cutting, or, in other words, without

(Continued on page 216)



Backwash

A Fine Tribute to the RSSL

Editor, ALL-WAVE-RADIO:

I have read with anticipation the news of the Radio Signal Survey League, and would like to add my voice as a DXer and member of the staff of a broadcasting station.

I am of the opinion that the formation of such an organization has more import than just a compilation of signal reports. DXers are of more varieties and types than a genus of plant. Having conducted DX programs on this and other stations, I have found that reports can be either good or bad, containing valuable information or just a mere request for a veri. Sometimes, the number of valueless reports is so large that we hesitate to even send a card of verification, and often makes us think of whether there is any end in presenting an hour or two in the early morning just so that some DXer can complete his Massachusetts log or hang up another card to show for five or ten minutes of listening. To my mind, that is not in the spirit of DX. If a DX club states, in its request for a program, that we shall receive enough reports to compile some information on our signal, we naturally expect it. However, as many DX announcers and engineers agree, that is very often not the case.

The Radio Signal Survey League can do much toward bringing about a change in the attitude of many DXers. First, the signal survey is designed to supply information of *technical* nature; what takes place on the program is of no importance, except in obtaining a verification of the station received. In order to supply the desired information for publication, it will be necessary for each listening post of the signal-survey to pay critical attention to the signal as it is received, even going so far as to indicate the duration and degree of each and every fade. If every DXer did that, I think more stations would broadcast more programs, and letters of criticism would not be forthcoming from disgusted and harassed engineers.

I am heartily in accord with the gentleman who wrote in your December issue that field managers would greatly facilitate the handling of information compiled by the various listening posts and observers in each of several districts.

While the Radio Signal Survey League has been formed in the nature of a club, I am sure it will not be an ordinary club. So far, nothing has been said of any charge to DXers for anything in connection with the Signal Survey activities. If ALL-WAVE RADIO is going to print a standard report form and, no doubt, certificates of membership, I am of the opinion that we, as DXers, should make some contribution in assisting the publication of such material. In years to come, the Radio Signal Survey League may become an organization of tremendous proportions, with dozens of different forms, yearly handbooks, etc. No reason why it shouldn't. So, in anticipation of such developments, we may reasonably expect to assist the founders of this noble undertaking.

In conclusion, may I offer my services at any time for the project? I have a Hallicrafters 1937 Super Skyrider and my specialty is in antenna experimentation. I am about to erect a rhombic of rather large proportions and from some reports of amateur transmitting use, this set-up should pull them in way above expectations of other types of antennae.

As this is the first letter I have ever written to AWR, may I say that it is just the finest publication for the DXer and radio fan I've ever seen. Night Owl Hoots are tops; Zeh Bouck is certainly distinctive in his crusade for more sensible broadcasting; and Barb and Ernest surely are carrying a grand job right to the embryo ham. Roses to all of you and let's make way for the biggest and finest radio club in the world—The Radio Signal Survey League!

MORTON W. BLENDER.
Chief Announcer, WCOP,
In Charge of DX Activities.

(Thank you for your very fine and valuable letter. It is our sincere hope that the Radio Signal Survey League will turn out to be an organization capable of providing a worthwhile service to station engineers, and capable of lending inspiration to the efforts of its members.—Editor)

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AWR Regenerative Preselector

Editor, ALL-WAVE-RADIO:

No use going into a lot of details about me being a constant reader of your magazine. To my way of thinking every honest to goodness short-wave fan must be that. I find your magazine very instructive, interesting and essential.

I have a 1936 model 610B Philco 5-tube receiver, which has proved very satisfactory indeed. So when I read about your DX Pre-Selector in the September, 1936 issue, I went right to work and built it as per instructions. It sure works splendid. It outplays any set in town, regardless of the number of tubes.

No more trouble with image frequency and also the avc seems to operate now on short waves; anyway there is very little fading on foreign stations. It certainly pulls them in with good volume and clearness. So I sure got something worthwhile out of reading your magazine.

CHARLES SCHAFER,
DINUBA, CALIF.

(Thanks for the report on the Regenerative Preselector. It certainly makes a heap of difference, as many listeners have learned.—Editor)

Space For Hinds

Editor, ALL-WAVE RADIO:

For some time I have been intending to write and congratulate you on the very fine magazine you are publishing. Your first issue came through the mail as a sample copy and I liked it so well that I have continued to buy it at the local newsstand since that time. Several rough edges have been polished off and I think the present (December) issue is the best one yet.

I always read the magazine from cover to cover but my first port of call is always "Globe Girdling" for Mr. Hinds department is right down my alley. He is doing a great job and I am glad to see that you are allowing him more space, for his articles are always of interest and many times of help in locating new stations.

My hobby is short-wave listening and has been since 1928 and I find your magazine is a great help in furthering my hobby.

Next in importance to me after "Globe Girdling" are: "Short-Wave Station List" and "In Writing for Veries." All three taken together supply information of value which I am unable to find in other magazines devoted to radio.

Ray La Rocque's "Night-Owl Hoots" is very good and I am thinking seriously of giving the BCB a whirl after reading his articles on the subject.

The "Barb and Ernest" series is very interesting and I am saving them on the chance that I may some day be interested in becoming an amateur.

Zeh Bouck's "Channel Echoes" always makes interesting reading for he has a style all his own and he sure does dish out some hot stuff at times.

I believe that pretty well covers the points of primary interest to me for, while I read everything in the magazine, the above are the ones that hold the most interest for me.

To sum it all up I think you are putting out a pretty swell magazine and hope you will continue to give as much space as possible to Mr. Hinds' department.

Wishing you and the magazine the best of luck in the future,

ROY WAITE,
BALLSTON SPA, NEW YORK

(Mr. Hinds does a fine job of including all *the the valuable data in compact form. It is easier to read that way, too. But should he need more space, he'll get it.—Editor.)*

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Wants S. W. List Continued

Editor, ALL-WAVE-RADIO:

I have for some years been a reader and subscriber to a certain radio publication. Their short-wave timetable finally became

(Continued on page 219)

In Writing For Veries...

ADDRESSES OF PRINCIPAL SHORT-WAVE STATIONS BY COUNTRY

AFRICA

FVA	Service Algerien des Postes, Telegraphes, Telephones, 137 Rue de Constantine, Alger, Algeria. Africa.
CNR	Director General des Postes, Rabat, Morocco.
CT2AJ	Radio Station CT2AJ, Ponta Delgada, Island of St. Michael, Azores.
CR6AA	Estacao Radio Difusora, Caixa Postal 103, Lobito, Angola, Portuguese West Africa.
CR7AA	Radio Station CR7AA, P. O. Box 594, Lourenco Marques, Africa.
EA9AH	Government Station EA9AH, El Coronel Jefe de Estado de las Mayor de las Fuezas Militares de Marruecos Tetuan, Spanish Morocco, Africa.
IUA-IUB et al	Minister of Marine, Addis Ababa, Ethiopia, Africa.
OPL-OPM	Radio Leopoldville, Congo Belge, Africa.
SUV-SUX	P. O. Box 795, Cairo, Egypt.
VQ7LO	Cable and Wireless Ltd., 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.
ZEC	Radio Station ZEC, Salisbury, Rhodesia, So. Africa.
ZEB	Radio Station ZEB, Bulawayo, Rhodesia, So. Africa. Address both c/o Postmaster, Salisbury.
FIQA	Radio Station FIQA, Tananarive, Madagascar.

ASIA, OCEANIA AND FAR EAST

CQN	Government Broadcasting Station CQN, Chief of Radio Station, Post Office Bldg., Macoa (Portuguese), China.
XGOX	The Ceneral Broadcasting Administration — Central Broadcasting Committee of Kuomintang, Nanking, China.
FO8AA	Radio Club Oceanien, Alfred T. Poria, Pres., Papeete, Tahiti.
"Radio Philco"	Establishment Boy-Landy 211-213 D. Rue Catinat, Saigon, Indo-China.
FZS	Postale Boite 238, Saigon, Indo-China.
HSJ-HSP	Superintending Engineer, Post and
HS8PJ	Telegraph Dept., Radio Technical Section, Bangkok, Siam.
Java Stations	I. Sanders, Chief Engineer, Java Wireless Stations, Bandoeng, Java.
"JV" Stations	International Wireless Telephone Company of Japan, Osaka Bldg., Kojimachiku, Tokyo, Japan.
JZJ-JZI et al	Broadcasting Corporation of Japan, Overseas Section, Atagoyama, Shiba-Ken, Tokyo, Japan.
KAY et al	Philippine Long Distance Telephone Co., Manila, P. I.
PMY	Radio Station PMY, Nillmy Bldg., Bandoeng, Java, Netherland Indies.
RV15	Radio Committee, Radio Station RV15, Khabarovsk, USSR.
VK2ME	Amalgamated Wireless, Ltd., Wireless House, 47 York St., Sydney, N.S.W., Australia.
VK3LR	Australian Broadcasting Commission, G.P.O. Box 1686, Melbourne C. I., Australia.
VK3ME	Amalgamated Wireless Ltd., 167-9 Queen St., Melbourne, Australia.
VK9MI	SS. "Kanimbla," McIlwraith and McEacharn, Bridge St., Sydney, Australia
VPB	Radio Club of Ceylon and South India, P. O. Box 282, Colombo, Ceylon.
VPD-2	Amalgamated Wireless, Ltd., Suva, Fiji Islands.
VUC	Indian State Broadcasting Service, 1 Garstin Place, Calcutta, India.
VUY-VUB	C. B. Sethna, Esq., OBE., JP., Director, All India Radio, Irwin House, Ballard Estate, Bombay, India.
XGW	Radio Administration, Sassoon House, Shanghai, China.
YBG	Radio Service, Serdangweg 2, Sumatra, Dutch East Indies.
YDA-YDB YDE2	Mr. A. H. K. Mulder, Genl. Mgr., The Netherlands Indies Broadcasting Co., Ltd., (N.I.R.O.M.), Batavia, 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 ZHJ, Radio Society of Penang, Penang, Malay Straits.
ZLT-ZLW ZLR	Supt. Post & Telegraph, G.P.O., Wellington, New Zealand.
ZMBJ	TSS "Awatea." Union Line, S.S., Coy Head Office, Wellington, New Zealand.

CANADA

CGA-CJA, et al	Marconi Station, Drummondville, Quebec, Canada.
CJRX-CJRO	Royal Alexander Hotel, Winnipeg, Manitoba, Canada.
VE9BK	Radio Sales Service, Ltd, 780 Beatty St., A. M. Jagoe, Mng'r, Vancouver, B. C., Canada.
VE9CS	743 Davie St., Vancouver, B. C., Canada.
VE9DN-CFCX	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	P. O. Box 998, Halifax, N. S., Canada.
CFU	Radio Station CFU, Rossland, B. C., Canada.

CUBA, MEXICO, CENTRAL AMERICA AND WEST INDIES

CMA-3	Cuba Transatlantic Radio Corp.,
CMB-2	Apartado No. 65, Havana, Cuba.
COKG	Emisora Grau, Estacion Coke, Apartado 137, Santiago, Cuba.
CO9JQ	Estacion Experimental de Onda Corta-CO9JQ, Calle del General Gomez, No. 4, Camaguey, Cuba.
COHB	P. O. Box 85, Sancti-Spiritus, Santa Clara, Cuba.
COCO	P. O. Box 98, Havana, Cuba.
COCD	Radio Estacion COCD, P. O. Box 2294, Havana, Cuba.
COCH	Estacion COCH, General Elect. Co. of Cuba, P. O. Box 41, Havana, Cuba.
COCQ	Sr. Miguel Gabriel, Administrador Gerente, Calle 25, No. 445, Havana, Cuba.
COCX	Radiodifusora COCX, P. O. Box 32, Havana, Cuba.
HI1A	Radiodifusora HI1A, P. O. Box 423, Santiago de los Caballeros. R. D.
HI1S	Radiodifusora HI1S, Santiago de los Caballeros, R. D.
HI2D	Radiodifusora HI2D, Ciudad Trujillo, R. D.
HI3C	Radiodifusora HI3C, Sr. Roberto Palli B. Prop., La Ramona, R. D.
HI3U	Radiodifusora HI3U, Apartado 23, Santiago de los Caballeros, R. D.
HI4D	Radiodifusora HI4D, Ciudad Trujillo, R. D.
HI4V	Radio HI4V, San Francisco de Macoris, Prov. Duarte, R. D.
HI5G	Radiodifusora HI5G, Las Vega, R. D.
HI5N	Radio HI5N, Santiago de los Caballeros, R. D.
HI7P	Sr. J. M. Roques, R. Director, Ciudad Trujillo, R. D.
HI8A	Radiodifusora HI8A, Apartado 1312, Ciudad Trujillo, R. D.
HI8Q	Abbes and Garcia, Owners, Ciudad Trujillo, R. D.
HI9B	Sr. J. L. Sanchez, Director, Apartado 95, Santiago de los Caballeros, R. D.
HH2T	Societe Haitienne de Radiodiffusion, P. O. Box 103, Port-au-Prince, Haiti.
HH2R	
HH2S	
HH3W	Radiodifusora HH3W, P. O. Box
HH3NW	A117, Port-au-Prince, Haiti.
HIG	Sr. A. Cordero, P. Director, Radio difusora HIG, Av. Jose Trujillo, No. 20, Ciudad Trujillo, R. D.
HIH	Radiodifusora HIH, Calle Arzobispo Merino No. 97, Ciudad Trujillo, R. D.
	San Pedro de Macoris, R. D.
HIL	Radio HIL, Apartado 623, Ciudad Trujillo, R. D.
HIN	Radiodifusora HIN.
HIX	Radio HIX, J. R. Saladin, Director of Radio Communication, Ciudad Trujillo, R. D.
HIJ	Radiodifusora HIJ, Apartado 204, San Pedro de Macoris, R. D.
HIT	Radiodifusora HIT, Apartado 1105, Ciudad Trujillo, R. D.
HIZ	Radiodifusora HIZ, Calle Duarte No. 68, Ciudad Trujillo, R. D.
HP5B	Radio HP5B, P. O. Box 910, Panama City, Panama.
HP5F	Radio HP5F, Hotel Carlton, Colon, Panama.
HP5J	Radio HP5J, Apartado 867, Panama City, Panama.
HP5K	Radio HP5K, P. O. Box 33, Colon, Panama.
HP5L	Radiodifusora HP5L, Apartado 129, David, Chirigui, Panama.
TGS	Radio TGS, Casa de Presidencial, Guatemala City, Guatemala.
TGW-TGWA	Radiodifusora Nacional TGW, Republic de Guatemala.
TG2X	Direccion general de la Polica Nacional, Guatemala City, Guatemala.
TIMS	Radio TIMS, Puntarenas, Costa Rica, C. A.
TIOP	Radio TIOP, P. O. Box 45, Port Limon, Costa Rica, C. A.
TIPG	Radio TIPG, Perry Girton, Prop., Apartado 225, San Jose, Costa Rica, C. A.
TI4NRH	Estacion TI4NRH, Apartado 40, Costa Rico, C. A.
TI8WS	Radio TI8WS, Sr. Abel Salazar F, Apartado 75, Puntarenas, Costa Rica.
TIEP	Radio TIEP, Apartado 257, San Jose, Costa Rica, C. A.
TIGPH	Radiodifusora TIGPH, Apartado 800, San Jose, Costa Rica.
TIRCC	Radioemisora Catolica Costaricense, Apartado 1064, San Jose, Costa Rica, C. A.
TI5HH	Sr. R. Herrera, Manager, Radiodifusora, TI5HH, San Ramon, Costa Rica, C. A.
HRD	Radiodifusora HRD, La Ceiba, Honduras, C. A.
HRN	Radio HRN, Tegucigalpa, Honduras.
HRPI	Manuel Escota, Director y Gerente, San Pedro Sula, Honduras.
VPN	Station VPN, Nassau, Bahama Islands.
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.
ZFB-ZFD	Engineer-in-Charge, Wireless Receiving Station, Devonshire, Bermuda.
XAM	Director General de Correos, Merida, Yucatan, Mexico.
XEBR	Estacion XEBR, Apartado 68, Hermosillo, Son, Mexico.
XEXR	Estacion XEXR, Secretaria Educacion Publica. Argentina L. G. Obregon, Mexico D. F.
XECU	Estacion XECU, Sr. Ramon Loreto, Hildago 599, Guadalajara, Jalisco, Mexico.

In Writing For Veries

XDA-XDC	Secretaria de Communicaciones, Mexico, D. F.
XEBT	El Buen Tono, S. A., Apartado 79-44, Mexico, D. F.
XECR	Estacion XECR, Departamento de Publicidad de la Secretaria de Relaciones Exteriores, Mexico, D. F.
XEFT	Radio XEFT, Av. Independencia 28, Vera Cruz, Mexico.
XEXS	Estacion XEXS, Depto. Salubridad, Mexico, D. F.
XEBQ	Estacion XEBQ, Sr. Roberto G. Mata, Prop. Astillero 35, Mazatlan, Son. Mexico.
XEBM	Estacion XEBM, Sr. Ignacio L. Sais, Prop., Angel Flores 390, Mazatlan, Son. Mexico.
XEDQ	Estacion XEDQ, Apartado 197, Guadalajara, Jalisco, Mexico.
XEXF	El Jefe del Departmento Secretaria de la Economia Nacional, Mexico, D. F.
XEPW	Estacion XEPW, Sr. Jose G. Garza Fox, Mina 140, Mexico, D. F.
XEUW	Radiodifusora XEUW, Av. Independencia 98, Vera Cruz, Mexico.
XEWI	Estacion Difusora XEWI, P. O. Box 2874, Mexico, D. F.
XEXA	Secretaria de Educacion Publica, Mexico, D. F.
YNA	Tropical Radio Telegraph, Managua, Nicaragua, C. A.
YNAM	Radiodifusora YNAM, A. Majewsky, Gerante, Managua, Nicaragua.
YNGU	Radiodifusora YNGU, Apartado 295, Managua, Nicaragua, C. A.
YNLF	Radiodifusora YNLF, c/o Ing. Moises Le Franc Calle, 15 de Set No. 206, Managua, Nicaragua.
YNLG	Radiodifusora YNLG, Managua, Nicaragua.
YN1GG	Radiodifusora YN1GG, Managua, Nicaragua, C. A.
YNOP	Radiodifusora YNOP, Edmundo Tefel, Owner, Managua, Nicaragua, C. A.

EUROPE

Belgrade	Director, Bureau Central de Presse, Belgrade, Short-Wave Station, Belgrade, Yugoslavia.
2RO	5 Via Montello, Rome, Italy.
CSW	Radio Nacional, Lisbon, Portugal.
CT1AA	Antonio Augusto de Aguair, 144, Lisbon, Portugal.
SPW	Polskie Radio, 5, Mazowiecka St., Warsaw, Poland.
DAN	Hauptfunkstelle Nordeich, Norden-Land, Germany.
DJA, et al.	German Short Wave Station, Broadcasting House, Berlin, Ger.
Dutch Phones	Parkstaat 29, S'Gravenhage, Holland.
EAQ	Transradio Espanola, P. O. Box 951, Madrid, Spain.
EA8AB	Radio Club Tenerife, Alvarez de
EA-J43	Lugo 1, Apartado 225, 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, E. C. 1.
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.
HBL-HBP et al.	Radio-Suisse S. A., 12, Quai de la Poste, Geneva, Switzerland.
HVJ	Stazione Radio HVJ, Citta del Vaticano, Vatican City.
IAC	Director, Centro di Coltano Radio, Pisa, Italy.
IRM-IRW	Italo Radio, Via Calabria N. 46/
IRG-IQA	48, Rome, Italy.
LZA	Radio Station LZA, Director General, Telegraphs and Telephones, Sofia, Bulgaria.
LKJ1	Ministere Du Commerce, Administrator des Telegraphes, Oslo, Norway.
OER2	Radio OER2 Osterr. Radioverkehrs A. G., Wien, 1, Johannesgasse 4 b, 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.
OLR	Radiojournal, Praha XII, Fochova Tr. 16, Prague (Praha), Czechoslovakia.
SM5SX	Royal Technical University, Stockholm, Sweden.
TPA2-3-4	Minister des Postes, Boulevard Haussman, 98 Bis., Paris, France.
RNE-RKI RAN-RV96	Radio Centre, Solianka 12, Moscow, USSR.

SOUTH AMERICA

CEB	Radio CEB, Casilla 761, Santiago, Chile.
CEC-CED	Cia Internacional de Radio, Casilla 16-D, Santiago, Chile.
CB615	Radiodifusora CB615, Santiago, Chile.
CB960	Radiodifusora CB960, Casilla 1342, Santiago, Chile.
CP5	Radio CP5, Casilla 637, La Paz, Bolivia.
CXA4	Radio Electrico de Montevideo, Director Hector M. Labordo, Mercedes, 823, Montevideo, Uruguay.
El Prado	Apartado 98, Riobamba, Ecuador.
HC1PM	Estacion HC1PM, P. O. Box 664, Quito, Ecuador.
HC2ET	Estacion Radiodifusora HC2ET, P. O. Box 824, Guayaquil, Ecuador.
HCETC	Director, Manuel Mantilla, Apartado 134, Quito, Ecuador.
HC2CW	Radiodifusora HC2CW, Casilla 1166, Guayaquil, Ecuador.
HC2JSB	Ecuador Radio Station HC2JSB, Juan S. Behr, Prop., Guayaquil, Ecuador.
HC2RL	Estacion HC2RL, P. O. Box 759, Guayaquil, Ecuador.
HCJB	Director, Clarence W. Jones, Casilla 691, Quito, Ecuador.
HCK	Radiodifusora HCK, Quito, Ecuador.
HJ1ABB	Radio HJ1ABB, Apartado 715, Barranquilla, Colombia.
HJ1ABC	Radiodifusora HJ1ABC, Quibdo, Colombia.
HJ1ABE	Radio HJ1ABE, Apartado 31, Cartegena, Colombia.
HJ1ABG	Radio HJ1ABG, Apartado 674, Barranquilla, Colombia.
HJ1ABJ	Radio HJ1ABJ, Santa Marta, Colombia.
HJ1ABP	Radiodifusora Cartagena, P. O. Box 37, Cartagena, Colombia.
HJ2ABC	Pompilio Sanchez, Cucuta, Colombia.
HJ2ABD	Hector McCormick, Prop., Radiodifusora HJ2ABD, Calle 2A, No. 1205, Bucaramanga, Colombia.
HJ3ABD	Colombia Broadcasting, Apartado 509, Bogota, Colombia.
HJ3ABF	Radio HJ3ABF, Apartado 317, Bogota, Colombia.
HJ3ABH	Radio HJ3ABH, Apartado 565, Bogota, Colombia.
HJ3ABX	Radiodifusora HJ3ABX, Bogota, Colombia.
HJ4ABB	Radio HJ4ABB, Apartado 175, Manizales, Colombia.
HJ4ABC	Radiodifusora HJ4ABC, Lamus Rivera and Company, Ibague, Colombia.
HJ4ABD	Radiodifusora HJ4ABD, Medellin, Colombia.
HJ4ABE	Radiodifusora HJ4ABE Medellin, Colombia.
HJ4ABH	Emisora HJ4ABH, Armenia, Colombia.
HJ4ABP	Radiodifusora HJ4ABP, Medellin, Colombia.
HJ4ABU	Radiodifusora Pereira, Caldas, Colombia.
HJ5ABD	Radiodifusora HJ5ABD, Cali, Colombia.
HJB	Marconi Telegraph Co., Apartado 1591, Bogota, Colombia.
HJN	Estacion Radiodifusora HJN, Ministerio de Educacion Nacional, Teatro de Colon No. 5-28, Bogota, Colombia.
HJU	Radio HJU, Buenaventura, Colombia.
HJY	All-American Cables, Inc., Bogota, Colombia.
HKV	Radiodifusora HKV, Ministerio de Guerra, Military Service, Bogota, Colombia.
LSN-LSL, et al.	Compania Internacional, 143 Defensa, Buenos Aires, Argentina.
LSX	Transradio Internacional, San Martin 329, Buenos Aires, Argentina.
LRU-LRX	Radio El Mundo, Calle Maipu 555, 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.
OAX5A	Radio Ica, (Universal) c/o Macchiavello & Umbert, S. C., Tacna 112, Ica, Peru.
OCI-OCJ	All-American Cables, Inc., Lima, Peru.
PPU-PPQ, et al.	Companhia Radiotelegraphica Brasileira, Caixa Postal 500, Rio de Janeiro, Brazil.
PZH	Radio Station PZH, Paramaribo, Surinam, Dutch Guiana.
PRA8	Radio Station PRA8, Radio Club of Pernambuco, Pernambuco, Brazil.
PRF5-PSK	Comp. Radio Internacional Do Brazil, P. O. Box 709, Rio de Janeiro, Brazil.
VP3BG	Radio Station VP3BG, Georgetown, British Guiana.
VP3MR	The British Guiana Broadcasting Co., No. 1 Wellington St., Georgetown, British Guiana.
YV1RH	Radiodifusora YV1RH, P. O. Box 261, Maracaibo, Venezuela.
YV5RH	Radiodifusora YV5RH, Valencia, Venezuela.
YV5RP	Radiodifusora YV5RP, P. O. Box 508, Caracas, Venezuela.
YV1RG	Radiodifusora YV1RG, Valera, Venezuela.
YV5RC	Radio YV5RC, P. O. Box 2009, Caracas, Venezuela.
YV5RD	Radiodifusora YV5RD, Caracas, Venezuela.
YV5RF	Estacion S.A.R., YV5RF, Apartado 983, Caracas, Venezuela.
YV1RB	Radio YV1RB, P. O. Box 37, Maracaibo, Venezuela.
YV4RB	Radio YV4RB, Valencia, Venezuela.
YV1RD	Radiodifusora YV1RD, P. O. Box 100, Maracaibo, Venezuela.
YV3RA	Radiodifusora YV3RA, Barquisimeto, Venezuela.
YV5RH	Radiodifusora YV5RH, Apartado 1931, Caracas, Venezuela.
YV2RA	Radiodifusora YV2RA, San Cristobal, Venezuela.
YV6RB	Radiodifusora YV6RB, Apartado 34, Ciudad Bolivar, Venezuela.
YV4RD	Radiodifusora YV4RD, 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	Westinghouse Electric & Mfg.
W1XKA	Co., Springfield, Mass.
W2XAD-	General Electric Co., 1 River Rd.,
W2XAF	Schenectady, N. Y.
W2XE	485 Madison Ave., New York, N. Y.
W3XAU	1622 Chestnut St., Philadelphia,
W3XKA	Pa.
W3XAL	30 Rockefeller Plaza, New York, N. Y.
W4XB	Isle of Dreams Broadcasting Corp., Radio W4XB, Herald Bldg., Miami, Florida.
W8XWJ	4465 Penobscot Building, Detroit, Mich.
W8XAL	Crosley Radio Corp., Cincinnati, Ohio.
W8XK	Grant Bldg., Pittsburgh, Pa.
W8XKA	
W9XAA	666 Lake Shore Drive, Chicago, Ill.
W9XF	20 N. Wacker Drive, Chicago, Ill.
WVD	Radio WVD, 517 Federal Office Bldg., Seattle, Wash.

Station Signatures...

IDENTIFICATION SIGNALS OF SHORT-WAVE BROADCAST STATIONS

17775 16.88 PHI
Call: In seven languages. *Interval:* Metronome with 80 beats per minute. *Closing:* Netherlands National Anthem.

15370 19.52 HAS3
(See 9125 kc.)

15330 19.56 W2XAD
Signs on for the day with the "Voice of Electricity" three flashes of 10-million volt artificial lightning (recorded). *Closing selection:* "Star Spangled Banner" after regular or special announcements have been made. Spanish programs include call in that language.

15280 19.63 LRU
Station known as "Radio El Mundo." Announcements in English only at opening and closing. Selection played at opening and closing composed by Maestro Castellanos, a local musician of note, especially for the station and bears no title.

15243 19.68 TPA2
(See 11720 kc.)

15230 19.69 OLR5A
Opening and closing: Melody from the "New World Symphony", by Anton Dvorak.

15220 19.71 PCJ
Interval: Metronome, 80 beats per minute. *Closing:* Netherlands National Anthem.

15121 19.84 HVJ
Call: "Stazione Radio HVJ, Citto del Vaticano." *Signals:* (1) Tick-tock of the clock (5 mins. before the B.C.) (2) Bells of St. Peters—opening. (3) Beginning and ending words: "Laudetur Jesus Christus." *Programs:* Mon., Italian; Tues., English; Wed., Spanish; Thurs., French; Fri., German; Sat., Netherlands; Sun., Latin-French.

14970 20.04 LZA
Call: Radio Sofia, Radio Stara Zagora and the S.W. Station LZA. Bulgarian, French, German and English. *Opening:* The opening notes of the Racherutza (Bulgarian Folk Dance). *Closing:* "National Anthem" and the "Hymn of His Majesty the King." Male and female announcers.

12830 23.38 CNR
(See 8035 kc.)

12000 25.00 RNE
Call: "This is Moscow Calling", followed by call letters and meters. Plays "Internationale" at opening and closing.

11900 25.21 XEWI
Call: Akees-a-doble u-ee. Mee - voz - ahl - moon-dohdehsdeh-Mahee-coh. In English: XEWI, "My Voice to the World from Mexico" and which is the station slogan. *Signals:* 2 strokes gong, closely following at announcements. *Opening and closing selection:* "May Angels Guard Thee" (From Forza del Destino).

11880 25.24 TPA3
(See 11720 kc.)

11810 25.40 2RO4
(See 9636 kc.)

11800 25.42 JZJ
Overseas programs. Opens and closes with the "Kimigayo," the National Anthem of Japan. Musical chimes follow the National Anthem in closing.

11800 25.42 OER2
Call: "Hier Radio Wein." *Interval:* Metronome, 60 beats per minute.

11790 25.43 W1XAL
Call: "Station W1XAL, Boston." News B. C. preceded by selection "Blaze Away." *Closing Selection:* "The Star Spangled Banner."

11720 25.60 CJRX
Call: "CJRX 11720 kc., owned and operated by James Richardson and Sons, Ltd., Winnipeg, Canada." No opening and closing selection.

11720 25.60 TPA4
Call: "Allo, ici Paree, station d'etat Radio Coloniale." *Interval:* Three tones ("F" in Morse). Opens and closes with anthem "La Marseillaise." Studio chimes strike ¼-½-¾ and hour. News broadcasts in English, Italian, Arabic, Portuguese, Spanish and German.

11435 26.24 COCX
Station known as "La Voz del Radio Philco." Opens and closes with selection "Pajarillo Barrangueno." *Call:* Stations of house "Lavin" CMX-COCX, the "Voice of the Radio Philco." Five bells, followed by announcement each ¼ hour. English announcements each ½ hour.

10740 27.93 JVM
(See 10660 kc.)

10660 28.14 JVN
Interval: Chimes and gongs, irregular. *Closing Selection:* "Kimigayo."

10350 28.98 LSX
Call: "Ellie-Essay-Aixey B-way-nos-eyeries." *Closing:* "San Lorenzo" march.

10330 29.04 ORK
Call: Ici Bruxelles Institut Nationaal de Radiodiffusion. *Opening selection:* "Vers l'Avenir" ("Towards the Future"). *Interval:* Uses a carrillon. *Closing Selection:* "Brabanconne."

9860 30.43 EAQ
Opening: Few bars of "La Verbena de la Paloma." *Calls:* La Voz de Espanola "E-A-Cu" Madrid. English: "Listen to the Voice of Spain radiating on a wave-length of 30.43 meters 9.86 m.c. and 20 k.w. EAQ is owned and operated by Transradio Espanola." *Closing:* Good night greeting in Spanish and English, followed hy "Himno de Riego" with their own programs. Closing with International Broadcast Club, London: Ted Lewis' "Good Night Melody."

9665 31.04 CT1AA
Call: "Aqui Estacoa Radio Coloniale Lisboa." Announcements in Portuguese, French, English; sometimes in Spanish and German. In English: Radio CT1AA (short a) Lisboa. *Interval:* "Cookoo" Signal (2 notes G, E, repeated three times). Station known as "Radio Coloniale Lisboa." Closes with National Anthem "A Portuguesa."

9660 31.06 CR6AA
English announcement: Short Wave Broadcasting Station CR6AA Angola, Portuguese West Africa. *Identification signal:* Three notes on piano.

9635 31.13 2RO3
Call: Ente Italiano Audizioni Radiofonice EIAR. *Opening Selection:* "Campane di Roma" or "Bells of Rome." *Interval:* Bird call, electrical device, Capinera or blackcap bird. *Closing:* Italian "Royal March" and the Fascist anthem, "Giovinezza" (meaning "Youth.")

9600 31.25 CQN
Portuguese and English announcements every other number. No interval signals. Music—Portuguese, Chinese and foreign. *Opening hymn:* "Maria da Fonte." *Closing:* National Anthem, "A Portuguesa."

9600 31.25 CB960
Opening selection: "Babes in Toyland" (Victor Herbert). *Call:* CB960, "Radiodifusora Pilot." Occasional announcements in English. *Closing Selection:* "Rhapsody in Blue"—organ. (By Gershwin.)

9600 31.25 HJ1ABP
Opening and closing selection: Sousa's "Under the Double Eagle." *Station slogan:* "Radio-difusora Cartagena."

9595 31.27 IIBL
(See 7797 kc.)

9590 31.28 VK2ME
Call: "You are listening to VK2ME, Sydney, the short-wave experimental station of the Amalgamated Wireless, Australasia." Gives time of day often; clock chimes each quarter hour. Clock strikes at hour. *Interval:* Call of Kookaburra bird. *Closing:* "God Save the King." Known as "The Voice of Australia."

9590 31.28 W3XAU
No opening or closing selection. English announcements only.

9590 31.28 HP5J
Station call: "La Voz de Panama," HP5J Panama. Spanish and English. News period (English) 6:30 p.m. opened by Sousa's "The Black Horse Troop March." *Closing:* "Discipline Honor" and "Ahregacion" (Prof. Alberto Galimony) *Station slogan:* "La Voz de Panama."

9580 31.32 VK3LR
Opening signal: Recording of the "Song of the Australian Lyre bird." *Closing:* "God Save the King."

9570 31.33 W1XK
Opening and closing: "Stars and Stripes Forever" (Sousa).

9565 31.36 VUY VUB
Call: "This is the Bombay-All India Radio calling, broadcasting on 9565 kc.," followed by indication of Indian Standard Time. *Interval:* "Bombay calling." No chimes or bells. *Closing:* "God Save the King."

9560 31.40 DJA
Call: "Hier der Deutscher Kurzwellensender"; English; "Hello dear friends in North America." *Interval:* Notes from a music box. *Closing:* The two German national anthems, "Deutschland" - - "Horst Wessellied."

9530 31.48 LKJ1
Call: "Hallo, Hallo—Oslo." *Interval:* Six piano notes. *Closing:* Short piano selection.

9525 31.49 ZBW3
Call: "This is station ZBW, at Hong Kong."

9520 31.51 HJ4ABH
Call: Radio Difusora Colombiana La Voz de Armenia Estaciones HJ4ABH onda corta and HJ4ABN orda larga in the city of Armenia, Republic of Colombia, South America. Announcements in Spanish and English each 15 minutes. *Opens and closes* with musical selection "The Spanish Soldiers"—one step. *Signals:* 5 blows on Marimba from opening to 6 P.M. and at closing. After 6 P.M., 1 blow. 2 blows when broadcasting from one country to another. 3 blows when broadcasting from the New to the Old World. News period, 7:00 to 10:00 P.M. Station known as "Emisora La Voz de Armenia."

9520 31.51 XEDQ
Call: This is long wave XED and short wave XEDQ broadcasting from Guadalajara. English used only on DX programs. *Opening and closing selection:* Mexican dance called "Jarabe Tapatio."

9510 31.55 VK3ME
Call: "You are listening to VK3ME Melbourne. the short wave experimental station of the Amalgamated Wireless, Australasia." *Closing:* Chimes; clock strikes hour of 10. "God Save the King."

9500 31.55 HJU
Call: Estacion Radiodifusora La Voz de el Pacifico HJU situada en Buenaventura, Colombia Sur America que trabaja en una frequencia 9510 kc. o sean 31 metros 55 centimetros. English and Spanish announcements each 5 minutes. *Opening and closing:* "Palmira," which is the official march of the station.

9500 31.55 PRF5
Call: "Pay-air-effie sinko, La Voz do Brazil." English: "PRF5 short-wave station of the Government of Brazil." Broadcasts called "The Brazilian Hour." *Interval:* Three-note gong. *Closing:* Brazilian national anthem.

9500 31.58 HJ1ABE
Station slogan: "The Voice of Fuentes Laboratories." *Opening:* Organ, "Song of the Islands." Call and frequency in English each hour. Every hour "Big Ben" strikes the hour. *Closing:* "Aloha Oe." Special DX Clubs program 9:30-10:30 P.M. each Monday.

9428 31.81 COCH
Call: Estacion de Onda corta COC Ahchie Habana Cuba. English: Station COCH, General Electric Company of Cuba, Havana. Announcements each 15 minutes in Spanish and English. *Signals:* Chimes each 15 minutes. Two blows on gong at other announcements, hut not fixed practice. *Opening and closing:* "Maria My Own," organ selection.

9350 32.09 HS8PJ
Opening: Three chimes are sounded beginning from the lowest note. Announcements are made first in Siamese, then English, German (not always) and French. Titles of recordings announced.

9125 32.88 HAT4
Call: "Hallo Itt Radio Budapest." *Interval:* Musical box melody. Comes on the air with bells ringing. Also announces in English; gives meters and kilocycles. Station known as "Radio Budapest." *Slogan:* Justice for Hungary. *Closing:* National Anthem "Isten ald meg a Magyart" (Lord Bless the Hungarian).

8948 33.53 HCJB
Opening selection: (record) March "Patria." *Call:* "HCJB 'La Voz de los Andes'." English; HCJB; H as in Harry, C as in Chicago, J as in Jones, and B as in Broadcast. *Interval:* Four notes on gongs. *Closing:* Ecuadorian National Anthem. Mentions "Westinghouse" quite often in Spanish program. Staff completely Ecuadorian, except Director, C. W. Jones, who hails from Chicago.

8720 34.40 VPD2
Call: Radio Suva calling. *Station slogan:* Radio Suva. *Closing selection:* "God Save the King."

8404 35.70 HC2CW
Station slogan: "Ondas del Pacifico." *Opening and closing:* Selection "Sangre Ecuatoriana."

8035 37.33 CNR
Call: "Ici Radio Moroc en Rabat." *Interval:* Metronome, 60 beats per minute.

7797 38.47 HBP
Station slogan: "Radio Nations." *Call:* Call letters, wave lengths, followed by: "Geneva, Switzerland," or "League of Nations Wireless Stations, Geneva, Switzerland." No special selection at opening or closing.

7010 42.80 EA8AB
Opening and closing: "Lady of Spain." Announcements in English only on Saturdays. All other Spanish.

6820 43.99 XGOX
Announcements in Chinese, except English at 8:15 A.M. E.S. Time. Bells at certain hours. No regular opening and closing selections.

6730 44.58 HI3C
Call: Esta es la Emisora III3C, La Voz de la Feria, La Romana, Republica Dominicano, en su fracuencia de 6730 kc. equivalente a 44.58 meters. *Station slogan:* "La Voz de la Feria." Announcements in English, Spanish and Italian.

6690 44.84 TIEP
Call: "La Voz del Tropico."

6635 45.21 HC2RL
Opens and closes with Ecuadorian National Anthem. Station known as "Quinta Piedad." *Call:* "Hello, America, this is station HC2RL, Guayaguil, Ecuador." Announcements every 15 minutes in English and Spanish.

6630 45.25 HIT
Call: Hache-i-te. Also English. *Opening and closing:* "Anchors Aweigh." *Station slogan:* La Voz de la RCA Victor.

6618 45.33 Prado
Opening: Station chimes. *Announces:* "Estacion el Prado en Rio-bamba Ecuador."

6520 46.01 YV4RB
Station known as "La Voz de Carabobo." *Interval:* Bugle calls near closing. Taps and off.

6479 46.30 HI8A
Announcements each 15 minutes in Spanish and English. *Station slogan:* "La Voz de la Fa-Doc En el Aire." *Opens and closes:* Mexican March "General Alvaro Obregon." *Signals:* Two strokes of bell preceding announcements.

6410 46.80 TIPG
Closing: Selection "Parade of the Wooden Soldiers." Station known as "La Voz de la Victor."
"TI" assignment for Costa Rica.
"PG" for Perry Girton, owner of the station.

6375 47.10 YV5RF
Closing: Record, "Blue Danube March" (Jesse Crawford). Station known as "Ecos del Avila."

6351 47.24 HRP1
Call: "El Eco de Honduras en San Pedro Sula Centro Americano."

6340 47.32 HIX
Call: "Hache-I-Ekis en Santo Domingo." *Interval:* Bells. Known as Radiodifusora HIX.

6243 48.05 HIN
Call: Esta es la estacion HIN en Ciudad Trujillo, Republica Dominicano. Announcements in English at stated intervals.

5235 48.11 HRD
Call: Radiodifusora HRD La Voz de Atlantida. La Ceiba Honduras. Centro America. English at 8, 9, 10 and 11 P.M. *Opening:* Marimba selection, "Solo Tuyo" (Yours Only.) *Closing:* Intermezzo No. 1 by Luis Calvo. Pianist Senor Tito del Moral—Piano —Ted Lewis' "Good Night Melody" at 10:58 P.M. No bells or chimes.

6230 48.15 OA4XG
Closing: Selection "Good Night Sweetheart."

6190 48.47 HI1A
Call: "Aqui la Voz del Yaque." *Interval:* gong. *Closing:* Selection "Anchors Aweigh." *Slogan:* "La Voz del Yague."

6170 48.62 HJ3ABF
Call: "Estacion de Radiodifusora 'Hache-Jota-tresbe-efe'." *Closing:* Selection "Good Night Sweetheart." Station known as "La Voz de Bogota."

6156 48.73 YV5RD
Call: "Aqui Radiodifusora Venezuela en Caracas." *Interval:* 5 strokes of bell. Station known as "Radiodifusora Venezuela." *Opening and closing:* Selection, "Triunfo Aereo."

5150 48.78 HJ4ABU
Call: In Spanish on the hour. No English spoken. Official station march "El Hombre Payaso." Porgram closed with overture with chorus of voices. *Slogan:* "La Voz de Pereira." No signals at announcements.

6150 48.78 CJRO
Call: "Station CJRO, Winnipeg, Manitoba."

6140 48.86 W8XK
Opening and closing: Selection "Stars and Stripes Forever."

6138 48.88 HJ4ABD
Call: Hache, jota, can'tro, a-be-de. *Slogan:* La Voz Catia. *Opening and closing:* "Guillermo Tell, Parte 4a" (William Tell).

6137 48.88 CR7AA
Call: Portuguese and English — CR7AA Lourenco Marques operating on 6137 kc. or 48.88 meters. *Opening:* "A Maria da Fonte." *Closing:* National Anthem, "A Portuguesa."

6133 48.91 XEXA
Opening and closing: Selection "March of the Tovs" (by Victor Herbert).

6132 48.92 VP3BG
Closing: (Band) "God Save the King."

6130 48.92 COCD
Call (English): "You are listening to CO-CD, Habana, Cuba, on 6130 kc." *Slogan:* "La Voz del Aire, S. A." *Closing:* Selections "Smoke Gets in Your Eyes" and Ted Lewis' "Good Night Melody."

6130 48.94 VE9HX
Opens with selection, "O Canada." *Closes* with the national anthem. Chimes as identification at stated periods.

6128 48.96 HJ1ABB
Announces: "La Voz de Barranquilla en Columbia Sur America." Three chimes identification like NBC. One chime between advertisements. *Closing:* Selection "La Golondrina."

6120 49.02 W2XE
Announces in five languages: English, French, Spanish, Italian and German. *Closing:* "Star Spangled Banner."

6110 49.10 HJ4ABB
Call: "Hegui radiodifusora HJ4ABB en Manizales." Uses bells.

6100 49.18 W9XF
Announces in Russian, Spanish, French, Swedish, Italian, German and English. *Opening and closing:* "Star Spangled Banner."

6100 49.18 W3XAL
Call: This is station W3XAL, owned and operated by the National Broadcasting Company, located at Bound Brook, New Jersey, U.S.A.

6098 49.27 ZTJ
Call: This is Johanneshurg calling. Good morning everybody. *Signals:* Chimes at certain hours. Bugle call at opening and closing. *Closing record:* "God Save the King." Physical jerks sessions opens with bugle call "Reveille." Closes with "Cook House." Time signals: stated hours 6 "pips"—last being on the hour.

5930 50.60 HJ4ABE
Call: "Compania Radiodifusora de Medellin," Ahchie-jay-quatro-ah-bay ee. *Slogan:* "La Voz de Antioquia." *Interval:* Morse letter "M" (—.). Four chimes like NBC, last note higher.

6080 49.34 W9XAA
Call: This is W9XAA, the short-wave transmitter of the Chicago Federation of Labor, transmitting on 6080 kc. (or 11830 kc.) by authority of the Federal Communications Commission. We relay the programs of WCFL, "The Voice of Labor." Our transmitter is located at Downer's Grove, Ill. *Opening:* National Anthem. Announcement and three chimes each 15 minutes in English, German and Spanish.

6080 49.34 CP5
Opening: Gong, one stroke and then chimes. Station known as Radio Illimani. Relays long-wave station CP4 (1040 kc.).

6080 49.34 VE9CS
Call: This is Standard Broadcasting System, Vancouver. *Signals:* 3 strokes of gong, similar to N.B.C. *Opening:* Selection "O Canada." *Signs off* with "God Save the King."

6060 49.50 VQ7LO
Call: This is VQ7LO, Nairobi station of the East Africa Broadcasting Company calling." *Closing:* Good night greeting and "God Save the King."

6060 49.50 OXY
Call: "Danmarks Radio, Kobenhavn, Kalundborg." *Opens:* One gong stroke. *Closing:* Selection "Derer et Yndigt Land" ("There Is a Winsome Land").

6050 49.59 GSA, etc.
Call: "London, calling you." *Interval:* Bow bells. Big Ben strikes at hour according to arrangement of program. *Closing:* "God Save the King."

6050 49.59 HJ3ABD
Call: HJ3ABD operades por la Colombia Broadcasting S. A. que transmite en una frequencia de 6050 kc. onda corta y 1110 kc. en onda larga. *Slogan:* "Emisora Neuva Granada." *Opening and closing:* Selection "Para Ti Rio Rita"—Colombian National Anthem at close.

6040 49.67 PRA8
Call: "Radio Club de Pernambuco, La Voz de Norte." *Interval:* Siren (fades in and out).

6040 49.67 W1XAL
Call: "Station W1XAL, Boston. News BC preceded by selection, "Blaze Away." *Closing:* Selection "The Star Spangled Banner."

6030 49.75 HP5B
Call: "Estacion Marimar de la Radio Panama." In English, "This is station HP5B in Panama City in the Republic of Panama." One of several slogans used—"Where the land is divided so the world could be united." *Closing:* Spanish and English selection "A Happy Good Night"; also "Good Night Sweetheart."

6030 49.75 VE9CA
Call: "Your station is Calgary, the Voice of the Prairie, in the Province of Alberta."

6020 49.83 XEUW
Closing: Selection "Las Mananitas." Station known as El Eco de Sotavento de de Veracruz."

6015 49.88 HI3U
Call: Estacion Perifonica "La Voz del Comercio." *Opening and closing:* "Maria My Own" (Jesse Crawford).

6012 49.85 HJ3ABH
Station called "La Voz de la Victor." *Interval:* Three chime notes.

6010 49.92 COCO
Call (English and Spanish): English, "This is station COCO, Habana, Cuba; P. O. Box 98."

6005 49.96 CFCX
Call: Station CFCF and short wave CFCX, Montreal, Quebec, Canada. Owned and operated by Canadian Marconi Co.

6000 50.00 HJ1ABC
Opening and closing: March, "Relator." English announcement at times, but not always. *Signals:* 2 blows on Chinese gong before station announcements. *Slogan:* "La Voz del Choco."

6000 50.00 XEBT
Interval: Three blasts on horn. Sounds like the old time rubber bulb auto horn. Also rooster crowing at times. Siren whistle heard occasionally, is used before announcement of persons missing. Station known as "De El Buen Tono." *Opening:* Selection "Las Mananitas." *Closing:* Selection "Liebestraum."

5910 50.76 HH2S
Opening and closing: "The Swan," by Camille Saint-Saens. *Signals:* Each quarter hour, 4 tones on standard gong 1-3-2-4. French and English announcements.

5875 51.11 HRN
English announcement at times. "This is station HRN. Tegucigalpa, capital city of Honduras; H for Honduras, R for Radio and N for Navy." *Closing:* Selection Ted Lewis' "Good Night Melody." Station known as "La Voz de Honduras."

5850 51.28 YV1RB
Call: YV1RB Ecos del Zulia en Maracaibo, Venezuela, America del Sur. *Opening and closing:* "Strike Up the Band." Call, frequency and address given at various times in English. *Slogan:* Ecos del Zulia.

5830 51.46 TIGPH
Closing: Selection "Good Night Melody." Station known as "Estacion Alma Tica."

5800 51.72 YV5RC
Call: "Aqui Cia Anomonia Venezuela"; also "Radio Caracas." *Interval:* Four chimes. *Opens and closes* with station's official "1BB March." It is not the Venezuelan anthem as many believe. Bugle calls and whistles just before closing. Station known as "Radio Caracas."

5780 51.90 OAX4D
Identifying announcement: "La Voz del Peru." No bells, chimes or opening or closing selections. At regular intervals announcements are made for identification in English. At end of program good night greetings in both English and Spanish. Signs on and off by Morse code.

5725 52.40 HC1PM
Call: La Estacion es "El Palomar." *Opens and closes* with "La Marcha de Aida."

5710 52.54 YV2RA
Call: Estacion YV2RA en San Cristobal, Venezuela, America del Sur 5710 kc. Spanish and English announcements every 15 minutes. *Opens and closes* with "El Capitan" March (Sousa). Philadelphia Symphony Orchestra record. *Signals:* 6 strokes on gong preceding announcements.

5140 58.37 PMY
Opening: March, "Le Rene Passe." *Closing:* On chimes—"Good Night" and National Anthem.

4600 65.22 HC2ET
Station known as "Radiodifusora de El Telegrafo." *Interval signal:* 12 chimes.

4273 70.21 RV15
Russian announcement: "Vremya saychass sem chasser tree minuti Khabaroskava (The time is now three minutes after 7 A.M. Khabarovsk time). "Vnimaniye. Gavorit Khabarovsk" (Attention, Khabarovsk speaking). "Cherez peredatchik Er Veh Pyatnattzet na volne sendyesat i dve desatih metrah" (Broadcasting from RV15 on a wave length of 70.2 meters). Broadcast closes with the "Internationale." English begins at 2 A.M., E. S. Time. "Hello. Everybody, Station RV15 on the air, broadcasting from Khabarovsk in the Far Eastern Region of the USSR." And concludes. "Our next English B.C. is on ..... (date). Until then, good bye everybody."

5885 50.98 HCK
Call: "Radiodifusora del Estado."

SHORT-WAVE STATION LIST

BROADCAST STATIONS INDICATED BY DOTS • PHONE (P) • EXPERIMENTAL (E) • HOURS IN E.S.T.

KC	Meters	Call	Location	Time
31600	9.4	W1XKA	• Boston, Mass.	Daily 9 A.M.-12 A.M.
31600	9.4	W8XKA	• Pittsburgh, Pa.	3-11 P.M. daily
31600	9.4	W3XKA	• Philadelphia, Pa.	Daily 12-10 P.M.
31600	9.4	W8XWJ	• Detroit, Mich.	Sunday 2:30-7:30 P.M. Daily 6:15 A.M.-12:30 P.M., 2-5 P.M., 7-10 P.M.
26100	11.49	GSK	• Daventry, England	Not in use
25950	11.56	W6XKG	• Los Angeles, Calif.	Continuously 24 hours each day
24380	12.3	CRCX	• Bowmanville, Ont.	Experimental
21540	13.92	W8XK	• Pittsburgh, Pa.	6:30 A.M.-9 A.M. daily
21530	13.93	GSJ	• Daventry, England	Not in use
21520	13.94	W2XE	• Wayne, N. J.	7:30 A.M.-12 noon; 6-7 P.M. daily
21520	13.94	JZM	• Nazaki, Japan	Irregular
21500	13.95	NAA	Washington, D. C.	(E) Time signals
21470	13.97	GSH	• Daventry, England	6-8:45 A.M., 9 A.M.-12 noon daily
21450	13.99	OLR6A	• Prague, Czechoslovakia	Irregular (see 6010-9550-11840 kc.)
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 irreg.
21140	14.19	KBI	Manila, P. I.	(P) Tests and relays P. M. irregular
21080	14.23	PSA	Rio de Janeiro, 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
20910	14.35	PSB	Rio de Janeiro, Brazil	(P) Phones N. Y. and Madrid irreg.
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 A.M.
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 A.M.
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 A.M.
19720	15.21	EAQ	Madrid, Spain	(P) Relays & tests A.M.
19680	15.24	CEC	Santiago, Chile	(P) Phones OCI - HJY afternoons
19620	15.29	VQG	Nairobi, Kenya, Africa	(P) Phones GAD 7-8 A.M.
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 Janeiro, 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	Brussels, Belgium	(P) Phones OPL A.M.
19160	15.66	GAP	Rugby, England	(P) Phones Australia A.M.
19140	15.68	LSM	Buenos Aires, Arg.	(P) Phones DFB-FTM-GAA-GAB A.M.
19020	15.77	HS8PJ	• Bangkok, Siam	Mondays 8-10 A.M.
18970	15.81	GAQ	Rugby, England	(P) Phones ZSS A.M.
18960	15.82	WQD	Rocky Point, N. Y.	(E) Tests LSY irreg.
18920	15.85	WQE	Rocky Point, N. Y.	(E) Programs, irreg.
18910	15.86	JVA	Nazaki, Japan	(P) Phones Europe days to 8:30 P.M.
18890	15.88	ZSS	Klipheuvel, So. Africa	(P) Phones GAQ-GAU mornings
18830	15.93	PLE	Bandoeng, Java	(P) Phones PCV mornings early; KWU evenings
18680	16.06	OCI	Lima, Peru	(P) Phones CEC - HJY days; WKK-WOP noon
18640	16.09	PSC	Rio de Janeiro, Brazil	(P) Phones N. Y. and B. A. irreg.
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.
18450	16.26	HBF	Geneva, Switzerland	(E) Commercial; irreg.
18440	16.25	HJY	Bogota, Colombia	(P) Phones CEC - OCI noon; music irreg.
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.
18388	16.31	FZS	Saigon, Indo-China	(P) Phones FTK early mornings
18340	16.36	WLA	Lawrenceville, N. J.	(P) Phones GAS A.M.
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	IUD	• Addis Ababa, Ethiopia	Irregular
18250	16.43	FTO	St. Assise, France	(P) LSM-LSY A.M.
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, U. S. evenings
18180	16.51	CGA	Drummondville, Que.	(P) Phones GBB A.M.
18135	16.54	PMC	Bandoeng, Java	(P) Phones PCK - PCV early A.M.
18115	16.56	LSY3	Buenos Aires, Arg.	(E) Phones DFB-FTM-GAA-PPU A.M.; evening broadcasts occasionally
18090	16.58	TYE-1	Paris, France	(P) Phones New York evenings
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 A.M.
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, A.M.
17850	16.81	LSN	Buenos Aires, Arg.	(P) Phones S. A. irreg.
17790	16.86	GSG	• Daventry, England	2-4 A.M., 6-8:45 A.M. daily
17785	16.87	IZL	• Nazaki, Japan	Irregular
17780	16.87	W3XAL	• Bound Brook, N. J.	9 A.M.-5 P.M. daily
17780	16.87	W9XAA	• Chicago, Ill.	Not in use at present
17775	16.88	PHI	• Huizen, Holland	7-10 A.M. daily
17760	16.89	W2XE	• Wayne, N. J.	12 noon-1 P.M. daily
17760	16.89	DJE	• Zeesen, Germany	12:05-5:15 A.M., 5:55-11 A.M. daily
17755	16.90	ZBW5	• Hong Kong, China	Daily 11:30 P.M.-1:30 A.M. ex. Sat. Mon. & Thurs. 4-10 A.M. Tues., Wed., Fri., Sun., 3-10 A.M. Sat. 3-11 A.M., 9 P.M.-1:30 A.M.
17750	16.91	IAC	Pisa, Italy	(P) Phones and tests to ships A.M.
17740	16.91	HSP	Bangkok, Siam	(P) Phones DFB early A.M.
17710	16.94	CJA-3	Drummondville, Que.	(P) Phones Australia and Far East early A.M.
17699	16.95	IAC	Pisa, Italy	(P) Phones and tests to ships A.M.
17620	17.03	IBC	San Paolo, Italy	(P) Irregular
17545	17.10	VWY	Poona, India	(P) Phones GAU-GBC-GBU mornings

Short-Wave Station List

KC	Meters	Call	Location	Time
17520	17.12	DFB	Nauen, Germany	(P) Phones PPU-YVR-KAY mornings
17480	17.16	VWY	Poona, India	(P) Phones GAU-GBC-GBU daytime
17280	17.36	FZE8	Djibouti, French Somaliland, Africa	(P) Irregular
17260	17.37	CMA5	Havana, Cuba	(P) Phones and tests evenings
17260	17.37	DAN	Nordenland, Germany	(P) Phones ships A.M.
17120	17.52	WOO	Ocean Gate, N. J.	(P) Phones ships daytime
17120	17.52	WOY	Lawrenceville, N. J.	(P) Phones England irregularly
17080	17.56	GBC	Rugby, England	(P) Phones ships daytime
16910	17.74	JZD	Nazaki, Japan	(P) Phones ships irreg.
16385	18.31	ITK	Mogdishu, Somaliland, Africa	(P) Irregular
16305	18.39	PCL	Kootwijk, Holland	(P) Special relays and phones irreg.
16300	18.44	WLK	Lawrenceville, N. J.	(P) Phones England irreg.
16250	18.46	FZR	Saigon, Indo-China	(P) Phones FTA-FTK early A.M.
16240	18.47	KTO	Manila, P. I.	(P) Phones JVE-KWU evenings
16140	18.59	GBA	Rugby, England	(P) Phones Argentina & Brazil irreg.
16117	18.62	IRY	Rome, Italy	(P) Phones IDU-ITK A.M.
16050	18.69	JVC	Nazaki, Japan	(P) Phones Hong Kong early A.M.
16030	18.71	KKP	Kahuku, Hawaii	(P) KWU A.M. & P.M. 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.; to KWU 4 P.M. and 4 A.M. daily
15860	18.90	CEC	Santiago, Chile	(P) Phones OCJ A.M.
15810	18.97	LSL	Buenos Aires, Arg.	(P) GAA, A.M.; GCA, PSE, PSF, P.M.
15795	18.99	XOJ	Shanghai, China	(E) Phones GBA 6-7 A.M., JVD 8 P.M. and later
15760	19.04	JYT	Kemikawa-Cho, Japan	(E) Tests KKW-KWE-KWU evenings
15740	19.06	JIA	Chureki, Japan	(P) 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 eves.
15625	19.20	OCJ	Lima, Peru	(P) Phones CEC days
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.
15530	19.32	HSC-2	Bangkok, Siam	(P) Phones JVE late P. M. and early A.M.
15530	19.32	HS8PJ	● Bangkok, Siam	Mondays 8-10 A.M. occasionally
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
15450	19.42	IUG	Addis Ababa, Ethiopia	(P) Phones irregular
15430	19.44	KWE	Bolinas, Calif.	(P) Tests JYK-JYT-PLE evenings
15415	19.46	KWO	Dixon, Calif.	(P) Phones JVF evenings
15370	19.52	HAS3	● Budapest, Hungary	Sunday 9-10 A.M.
15360	19.53	DJT	● Zeesen, Germany	Irregular
15355	19.54	KWU	Dixon, Calif.	(P) Phones Japan, Manila and Java evenings
15340	19.56	DJR	● Zeesen, Germany	8-9 A.M. daily
15330	19.56	W2XAD	● Schenectady, N. Y.	10 A.M.-3:45 P.M. daily
15320	19.58	OLR5B	● Prague, Czechoslovakia	Irregular (see 6010-9550-11840 kc.)
15310	19.60	GSP	● Daventry, England	Not in use
15300	19.61	CP7	● La Paz, Bolivia	No regular schedule
15300	19.61	XEBM	● Mazatlan, Mexico	Daily 9-10 A.M., 1-2 P. M., 8-10 P.M.
15280	19.63	LRU	● Buenos Aires, Arg.	7 A.M.-7 P.M. daily
15280	19.63	DJQ	● Zeesen, Germany	6-8 A.M., 8:15-11 A.M. daily 4:50-10:45 P.M. Sun., 11:10 A.M.-12:25 P.M.
15270	19.64	W2XE	● Wayne, N. J.	1-6 P.M. daily
15260	19.66	GSI	● Daventry, England	12:15-4 P.M. daily
15252	19.67	RIM	Tashkent, USSR.	(P) Phones RKI early mornings
15243	19.68	TPA2	● Pontoise, France	6-11:05 A.M. daily
15220	19.71	OLR5A	● Prague, Czechoslovakia	Irregular (see 6010-9550-11840 kc.)
15220	19.71	PCJ	● Hilversum, Holland	Sun. 7:30-8:30 A.M.; Tues. 4:30-6:30 A.M.; Wed. 8-11 A.M.
15210	19.72	W8XK	● Pittsburgh, Pa.	9 A.M.-7 P.M. daily
15200	19.74	DJB	● Zeesen, Germany	12:05 A.M.-5:15 A.M., 5:55-11 A.M., 11:10 A.M.-12:25 P.M., 4:50-10:45 P.M. daily, 8-9 A.M. Sun. only
15190	19.75	ZBW-4	● Hong Kong, China	Daily ex. Sat. 11:30 P.M.-1:30 A.M. Mon. & Thurs. 4-10 A.M. Tues., Wed., Fri., Sun., 3-10 A.M. Sat., 3-11 A.M., 9 P.M.-1:30 A.M.
15183	19.76	RV96	● Moscow, USSR.	Not in use
15180	19.76	GSO	● Daventry, England	2-4 A.M. daily
15160	19.79	OLR5C	● Prague, Czechoslovakia	Irregular (see 6010-9550-11840 kc.)
15160	19.79	JZK	● Nazaki, Japan	Irregular
15150	19.80	YDC	● Soerabaja, Java	Sundays 5:30-10:30 A.M., 7:30 P.M.-2 A.M. Weekdays 5:30-10:30 or 11 A.M. (Sat. 11:30 A.M.), 6-7:30 P.M., 10:30 P.M.-2 A.M.
15145	19.81	RKI	● Moscow, USSR.	Broadcasts irreg. Sun. Phones RIM A.M.
15140	19.82	GSF	● Daventry, England	9 A.M.-12 noon, 4-5:45 P.M. daily
15121	19.84	HVJ	● Vatican City, Vatican	10:30-10:45 A.M. weekdays
15110	19.85	DJL	● Zeesen, Germany	12-2 A.M., 8-9 A.M., 11:35 A.M.-4:30 P.M. daily. Sunday 6-8 A.M.
15070	19.91	PSD	Rio de Janeiro, Brazil	(P) Phones B. A. irreg.
15055	19.92	WNC	Hialeah, Fla.	(P) Phones daytime
15040	19.95	HIR	Ciudad Trujillo, R. D.	(P) Phones WNC days
14985	20.02	YSL	San Salvador, Salvador	(P) Phones days irreg.
14980	20.03	KAY	Manila, P. I.	(P) Phones DFC-DFD-GCJ early A.M.; KWU evenings
14970	20.04	LZA	● Sofia, Bulgaria	Weekdays 5-6:30 A.M., 12-2:45 P.M. Sundays 12 A.M.-4:30 P.M.
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. Broadcasts irreg.
14920	20.11	KQH	Kahuku, Hawaii	(P) Tests irregularly
14910	20.12	JVG	Nazaki, Japan	(P) Phones Formosa and broadcasts 1-2:30 A.M. irreg.
14845	20.19	OCJ2	Lima, Peru	(P) Phones HJY and others daytime
14800	20.27	WOV	Rocky Point, N. Y.	(E) Tests Europe irreg.
14790	20.28	RIZ	Irkutsk, USSR.	(P) Calls RKI 9:30 A.M.
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
14690	20.42	PSF	Rio de Janeiro, 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. Broadcasts irreg.
14590	20.56	WMN	Lawrenceville, N. J.	(P) Phones England days
14535	20.64	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 days
14485	20.71	TIU	Cartago, Costa Rica	(P) Phones WNC days
14485	20.71	YNA	Managua, Nicaragua	(P) Phones WNC days
14485	20.71	HPF	Panama City, Panama	(P) Phones daytime
14485	20.71	HRM	Tela, Honduras	(P) Phones WNC days
14485	20.71	TGF	Guatemala City, Guat.	(P) Phones WNC days
14485	20.71	HRL5	La Ceiba, Honduras	(P) Phones WNC 5:45 P.M.
14480	20.72	PLX	Bandoeng, Java	(P) Phones Europe and B.C. irregular to 3 P.M.
14470	20.73	WMF	Lawrenceville, N. J.	(P) Phones England day time
14460	20.75	DZH	● Zeesen, Germany	Irregular
14440	20.78	GBW	Rugby, England	(P) Phones Lawrenceville daytime
14410	20.82	IBC	San Paolo, Italy	(P) Irregular
14410	20.80	DIP	Zeesen, Germany	(E) Experimental; irreg.
14250	21.00	W10XDA	Schooner Morrissey	(P) Irregular
13990	21.44	GBA2	Rugby, England	(P) Phones Argentina & Brazil irreg.
13900	21.58	WQP	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
13760	21.80	TYE-2	Paris, France	(P) Phones U. S. days
13745	21.83	CGA-2	Drummondville, Que.	(P) Phones Europe irreg.
13738	21.82	RIS	Tiflis, USSR.	(P) Tests with Moscow irregular
13720	21.87	KLL	Bolinas, Calif.	(P) Special relays; tests afternoon and evening
13690	21.91	KKZ	Bolinas, Calif.	(P) Tests Japan and Java early A.M.; days Honolulu

Short-Wave Station List

KC	Meters	Call	Location	Time
13667	21.98	HJY	Bogota, Colombia	(P) Phones CEC afternoons
13635	22.00	SPW	● Warsaw, Poland	11:30 A.M.-12:30 P.M., Mon., Wed., Fri.
13610	22.04	JYK	Kemikawa-Cho, Japan	(E) Tests irregular A.M.
13600	22.06	ZMBJ	● "TSS Awatea," Wellington, N. Z.	See 8840 kc.
13595	22.07	GBB2	Rugby, England	(P) Phones Canada days
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
13410	22.37	WCT	San Juan, P. R.	(P) Phones WNC 5:45 P.M.
13410	22.37	YSJ	San Salvador, Salvador	(P) Phones WNC days
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
13020	23.04	JZE	Nazaki, Japan	(P) Phones ships irreg.
13000	23.08	FYC	Paris, France	(P) Phones CNR A.M.
12985	23.11	DFC	Nauen, Germany	(P) Phones KAY-SUV-SUZ early A.M.
12865	23.32	IAC	Pisa, Italy	(P) Phones ships irreg.
12860	23.33	RKR	Novosibirsk, USSR	(P) Daily. 7 A.M.
12840	23.36	WQO	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	(P) Phones FYB-TYB-FTA near 4 P.M.
12830	23.38	CNR	● Rabat, Morocco	Special broadcasts irreg.
12795	23.45	IAC	Pisa, Italy	(P) Phones ships and tests Tripoli, irreg.
12780	23.47	GBC	Rugby, England	(P) Phones VWY early A.M.
12394	24.21	DAN	Nordenland, Germany	(P) Phones ships irreg. mornings
12300	24.39	CEB	● Santiago, Chile	11 A.M.-1 P.M., 4-8 P.M., 10-11 P.M. daily
12300	24.39	PLM	Bandoeng, Java	(P) Phones 2ME near 6:30 A.M.
12295	24.40	ZLU	Wellington, 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 Sun., 1:40-2:30 P.M.
12220	24.55	FLJ	Paris, France	(P) Phones ships irreg.
12215	24.56	TYA	Paris, France	(P) Algeria days
12150	24.69	GBS	Rugby, England	(P) Phones Lawrenceville days
12130	24.73	DZE	● Zeesen, Germany	Irregular
12100	24.79	CJA	Drummondville, Que.	(P) Tests VIY early A. M. and evenings
12060	24.88	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings
12055	24.89	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings
12050	24.90	PDV	Kootwijk, Holland	(P) PLE - PLV - PMC early mornings
12020	24.95	VIY	Rockbank, Australia	(P) Tests CJA6 early A.M. and evenings
12000	25.00	RNE	● Moscow, USSR.	Sun. 6-7 A.M., 10-11 A. M., Wed. 6-7 A.M.
11991	25.02	FZS	Saigon, Indo-China	(P) Phones FTA - FTK early A.M.
11955	25.09	IBC	San Paolo, Italy	(P) Irregular
11955	25.09	IUC	● Addis Ababa, Ethiopia	12-1 A.M.; music at times
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
11900	25.21	XEWI	● Mexico City, Mexico	Sun. 12:30-2 P.M. Mon., Wed., Fri., 3-4 P.M., 9 P.M.-12 A.M. Tues., Thurs.,, 7:30 P.M.-12 A.M. Sat., 9 P.M.-12 A.M. (see 6015 kc.)
11900	25.21	OLR4D	● Prague, Czechoslovakia	Irregular (see 6010-9550-11840 kc.)
11895	25.22	XEXR	● Mexico City, Mexico	6-11:30 P.M.
11895	25.22	HP5I	● Aguadulce, Panama	7-9:30 P.M. daily
11885	25.24	TPA3	● Pontoise, France	4-5 A.M., 11:15 A.M.-6 P.M. daily
11880	25.25	XEXA	● Mexico City, Mexico	8-11:30 A.M., 3-5 P.M., 7-11 P.M. ex. Sunday
11875	25.26	OLR4C	● Prague, Czechoslovakia	Irregular (see 6010-9550-11840 kc.)
11870	25.26	W8XK	● Pittsburgh, Pa.	7-9 P.M. daily
11860	25.29	YDB	● Soerabaja, Java	10:30 P.M.-2 A.M. daily
11860	25.29	GSE	● Daventry, England	Not in use
11855	25.31	DJP	● Zeesen, Germany	Irregular
11830	25.36	W2XE	● Wayne, N. J.	7-10 P.M. daily
11840	25.34	OLR4A	● Prague, Czechoslovakia	Sunday 2-7:30 A.M. Daily ex. Sun. 8:55 A.M.-12 noon, 2:25-4:30 P.M. Thurs. & Sat., 5-7:30 A.M. Mon. & Thurs., 7-10 P.M. (America)
11830	25.36	W9XAA	● Chicago, Ill.	Weekdays 9 A.M.-6 P. M. Sun. 9-11 A.M., 1-5:30 P.M.
11820	25.38	XEBR	● Hermosillo, Mexico	1-4 P.M., 9 P.M.-12 A. M. daily
11820	25.38	GSN	● Daventry, England	Not in use
11810	25.40	2RO4	● Rome, Italy	6:43 A.M.-12:30 P.M. (See 9635 kc.)
11800	25.42	OER-2	● Vienna, Austria	Weekdays 9 A.M.-5 P. M. Saturdays to 5:30 P.M.
11800	25.42	OAX5A	● Ica, Peru	Daily 1 A.M.-12 noon, 4-11 P.M.
11800	25.42	JZJ	● Nazaki, Japan	9-10 A.M., 4-5 P.M., 12-1 A.M. daily
11795	25.43	DJO	● Zeesen, Germany	Irregular
11790	25.43	W1XAL	● Boston, Mass.	Daily 4:30-6:30 P.M.
11770	25.49	DJD	● Zeesen, Germany	11:35 A.M.-4:30 P.M., 4:50-10:45 P.M.
11760	25.51	OLR4B	● Prague, Czechoslovakia	Irregular (see 6010-9550-11840 kc.)
11750	25.53	GSD	● Daventry, England	12:15-4 P.M., 6-8 P.M., 9-11 P.M. daily
11740	25.55	HP5L	● David, Panama	4-7 P.M. daily
11730	25.57	PHI	● Huizen, Holland	8:30-10:30 A.M. except Tues. and Wed.
11720	25.60	CJRX	● Winnipeg, Manitoba	Week Days 6 P.M.-12 A.M. Sundays 5-10 P.M.
11720	25.60	TPA4	● Pontoise, France	6:15-8 P.M., 10 P.M.-1 A.M. daily
11710	25.62	Philco Radio	● Saigon, Indo-China	Daily 6:30-9:30 A.M. News: French 9-9:10 A.M.
11710	25.62	VK9MI	● Sydney, Australia; "S.S. Kanimbla"	11 P.M.-7 A.M. Irregular
11705	25.63	SM5SX	● Stockholm, Sweden	Weekdays 6:25-7 A.M., 11 A.M.-5 P.M. Sun., 3 A.M.-5 P.M.
11680	25.68	KIO	Kahuku, Hawaii	(P) Phones Far East early A.M.
11670	25.62	PPQ	Rio de Janeiro, Brazil	(P) Phones WCG-WET-LSX evenings
11660	25.73	JVL	Nazaki, Japan	(P) Phones Taiwan eve. Broadcasts irreg. 1-2:30 A.M.
11595	25.87	VRR4	Stony Hill, Jamaica	(P) Phones WNC 5:45 P.M.
11570	25.93	HH2T	● Port-au-Price, Haiti	Sp'l programs irreg.
11560	25.95	CMB	Havana, Cuba	(P) Phones New York irreg.
11538	26.00	XGR	Shanghai, China	(P) Tests irregularly
11500	26.09	XAM	Merida, Mexico	(P) Phones XDF-XDM-XDR irreg.
11495	26.10	V1Z3	Rockbank, Australia	(P) Tests CJA4 early A.M.
11435	26.24	COCX	● Havana, Cuba	8 A.M.-1 A.M. daily
11413	26.28	CJA4	Drummondville, Que.	(P) Phones VIZ3 early A.M.
11402	26.31	HBO	Geneva, Switzerland	(E) Broadcasts Sundays 11:30 P.M.; commercial, irreg.
11260	26.64	HIN	● Ciudad Trujillo, R. D.	Daily 11:40 A.M.-1:40 P.M., 4:30-6 P.M., 7:10-9:10 P.M.
11275	26.61	XAM	Merida, Mexico	(P) Phones XDR-XDM irregular
11050	27.15	ZLT	Wellington, N. Z.	(P) Phones VLZ early mornings
11040	27.17	CSW	● Lisbon, Portugal	3-6 P.M. daily
11000	27.27	PLP	Bandoeng, Java	(P) Phones early A.M.; Broadcasts Sun. 5:30-10:30 A.M., 7:30 P.M.-2 A.M. Weekdays 5:30-10:30 or 11 A.M. (Sat. 11:30 A.M.), 6-7:30 P. M., 10:30 P.M.-2 A.M.
10975	27.35	OCI	Lima, Peru	(P) Phones CEC-HJY days
10975	27.35	OCP	Lima, Peru	(P) Phones HKB early evenings
10960	27.37	JZB	● Nazaki, Japan	Irregular
10955	27.38	HSG	Bangkok, Siam	(P) Phones irregularly
10940	27.43	FTH	St. Assise, France	(P) Phones So. America irreg.
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, A.M.
10795	27.79	GCL	Rugby, England	(P) Phones Japan days
10790	27.80	YNA	Managua, Nicaragua	(P) Phones So. America days, irreg.

KC	Meters	Call	Location	Time
10770	27.86	GBP	Rugby, England	(P) JYS and XGR irreg.; Phones VLK early A.M. & P.M.
10740	27.93	JVM	● Nazaki, Japan	4-7:30 A.M., irregular
10675	28.10	WNB	Lawrenceville, N. J.	(P) Phones ZFB daytime
10670	28.12	CEC	Santiago, Chile	(P) Phones HJY - OCT daytime
10670	28.12	HBP	Panama City, Panama	(P) Phones 4:15-4:15 P. M.
10670	28.12	CEC	● Santiago, Chile	Daily ex. Sat. and Sun., 7-7:20 P.M. (see CED, 10230 KC.)
10660	28.14	PSG	Rio de Janeiro, Brazil	(P) Phones N. Y., B. A., Madrid
10660	28.14	JVN	Nazaki, Japan	(P) Phones JIB early A.M.; Relays JOAK irreg.
10660	28.14	JVN	● Nazaki, Japan	4-7:40 A.M. irreg.; 4-5 P.M. daily
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
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 nights
10530	28.49	JIB	Tawian, Japan	(P) Phones JVL - JVN early mornings to 8 A.M.; sp'l he's 3-4 A.M. Sun.
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 N. Am. days
10480	28.63	ITK	Mogdishu, Somaliland, Africa	(P) Irregular
10440	28.74	DGH	Nauen, Germany	(P) Phones HSG - HSI - HSP early A.M.
10430	28.76	YBG	Medan, Sumatra	(P) Phones PLV - PLP early A.M.
10420	28.79	XGW	Shanghai, China	(P) Tests GBP - KAY early A.M. Musical tests 10:45 A.M.-3 P.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 A.M., and special programs irreg.
10410	28.82	PDK	Kootwijk, Holland	(P) Phones PLV A.M. and special programs 3:30-4 P.M.
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	EAJ43	● Santa Cruz de Tenerife, C. I.	2:15-3:50 P.M., 6-7 P. M., 7:10-8 P.M. daily
10380	28.90	WCG	Rocky Point, N. Y.	(E) Programs, irreg.
10375	28.92	JVO	Nazaki, Japan	(P) Manchuria and Dairen early A.M.
10370	28.93	EHZ	● Tenerife, Canary Islands	(P) Phones EDN 3:30-6 A.M.; B.C. 3-4 P.M., 6-8:15 P.M.
10350	28.98	LSX	● Buenos Aires, Arg.	Mon., Tues., Fri., 5-6 P.M.
10335	29.03	ZFD	Hamilton, Bermuda	(P) Phones afternoons
10330	29.04	ORK	● Brussels, Belgium	1:30-3 P.M. daily
10310	29.10	PPM	Rio de Janeiro, Brazil	(P) Tests New York and B.A. 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 irreg.
10290	29.15	DZC	● 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 Sundays 5:30-10:30 A.M., 7:30 P.M.-2 A.M. Weekdays 5:30-10:30 or 11 A.M. (Sat. 11:30 A.M.), 6-7:30 P.M., 10:30 P.M.-2 A.M.
10250	29.27	LSK3	Buenos Aires, Arg.	(P) Afternoons
10230	29.33	CED	● Antofagasta, Chile	Retransmits programs of CEC, 10670 KC., daily ex. Sat. and Sun., 7-7.20 P.M.
10220	29.35	PSH	Rio de Janeiro, Brazil	(P) Phones LSL-WOK evenings; broadcasts irreg.
10160	29.53	RIO	Bakou, USSR.	(P) Phones RIR-RNE irreg. A.M.; News irreg. 11 P.M.-3 A.M.
10140	29.59	OPM	Leopoldville, Belg.-Congo	(P) Calls 7-11 A.M. daily. Phones ORK afternoons
10120	29.64	PSI	Rio de Janeiro, Brazil	(P) Phones LSL irreg.
10080	29.76	RIR	Tiflis, USSR.	(P) Phones RIM-RKI 7-11 A.M.
10070	29.79	EDN	Madrid, Spain	(P) Phones YVR afternoons
10055	29.84	ZFB	Hamilton, Bermuda	(P) Phones WNB days
10055	29.84	SUV	Cairo, Egypt	(P) Phones DFC-DGU-GCA-GCB days
10042	29.87	DZB	● Zeesen, Germany	Irregular
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
9940	30.18	CSW	● Lisbon, Portugal	6:30-8 P.M. daily
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.	(P) Phones and tests; England irreg.
9860	30.43	EAQ	● Madrid, Spain	Saturday 1-3:30 P.M.; daily 5:15-9:30 P.M.
9840	30.47	JYS	Kemikawa-Cho, Japan	(E) Tests irregular
9830	30.50	IRM	Rome, Italy	(P) Phones JVP - JZT - LSX-WEL A.M.
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	COCQ	● Havana, Cuba	8 A.M.-12 mid. daily
9750	30.77	WOF	Lawrenceville, N. J.	(P) Phones GCU irreg.
9710	30.88	GCA	Rugby, England	(P) Phones LSL afternoons
9700	30.93	LQA	Buenos Aires, Arg.	(P) Tests and relays early evenings
9675	31.00	DZA	● Zeesen, Germany	Irregular
9670	31.02	TI4NRH	● Heredia, Costa Rica	Daily 9-10 P.M., 11:30 P.M.-12 A.M.; Sat. night to 2 A.M. Sun.
9665	31.04	CT1AA	● Lisbon, Portugal	Tues., Thurs., Sat., 3-6 P.M.
9660	31.06	CR6AA	● Lobito, West Africa	3:45-5:30 P.M. Wed. & Sat.
9660	31.06	LRX	● Buenos Aires, Arg.	7-11:30 P.M. daily
9660	31.06	PSJ	Rio de Janeiro, Brazil	(P) Irreg., Argentina
9635	31.13	2RO3	● Rome, Italy	12:30-6 P.M. Mon., Wed., Fri. Amer. Hour, 6-7:30 P.M., Tues., Thurs., Sat. Lat. Amer., 6-7:30 P. M. Sunday, off at 5:30 P.M. and later
9630	31.15	CFA5	Drummondville, Que.	(P) Phones No. America days
9620	31.17	DGU	Nauen, Germany	(P) Phones SUV A.M. Relays irreg.
9620	31.17	FZR	Saigon, Indo-China	(P) Phones Paris early A.M.
9610	31.22	YDB	● Soerabaja, Java	Sunday 5:30-10:30 A.M., 7:30 P.M.-2 A.M. Weekdays 5:30-10:30 or 11 A.M. (Sat. 11:30 A.M.), 6-7:30 P.M., 10:30 P.M.-2 A.M.
9600	31.25	CQN	● Macao, China	Mon. & Fri. 7-8:30 A.M.
9600	31.25	RAN	● Moscow, USSR.	7-9:15 P.M. daily
9600	31.25	HJ1ABP	● Cartagena, Colombia	7-9 A.M., 11 A.M.-1:20 P.M., 6-11 P.M. daily
9600	31.25	CB960	● Santiago, Chile	Daily ex. Sun. 11:30 A.M.-2 P.M., 6-8:30 P.M.; Sun. 3-5 P.M., 6-8:30 P.M.
9595	31.27	HBL	● Geneva, Switzerland	5:30-6 P.M., 7-8:30 P.M. Saturdays, First Mon. each month 6-7 P.M.
9595	31.27	HH3W	● Port-au-Price, Haiti	1-2 P.M., 7-8:30 P.M.; ex. Sunday
9595	31.27	YNLF	● Managua, Nicaragua	8-9 A.M., 1-3 P.M., 6:30-10:30 P.M. daily
9590	31.28	W3XAU	● Philadelphia, Pa.	Daily ex. Sun. & Wed. 12-8 P.M. Sun. & Wed. 12-7 P.M. Also Thurs. 10-11 P.M.
9590	31.28	VK2ME	● Sydney, Australia	Sunday 1-3 A.M., 5-9 A.M., 9:30-11:30 A.M.
9590	31.28	HP5J	● Panama City, Panama	Week days 12-1:30 P.M., 6-10 P.M. Sun. 10:30 A.M.-1:30 P.M., 7-10 P.M.
9590	31.28	PCJ	● Hilversum, Holland	Sun. 2-3 P.M., 7-8 P.M. Wed. 7-10 P.M.
9580	31.32	GSC	● Daventry, England	4-5:45 P.M., 6-8 P.M., 9-11 P.M. daily
9580	31.32	VK3LR	● Melbourne, Australia	Week days 3:30-8:30 A.M., 8:45-9:45 A.M. Sun. 3-7:30 A.M., 8:45-9:45 A.M.
9575	31.33	HJ2ABC	● Cucuta, Colombia	11 A.M.-12 noon; 6:30-9 P.M. daily
9570	31.33	W1XK	● Boston, Mass.	Weekdays 6:30 A.M.-1 A.M. Sundays, 8 A.M.-1 A.M.
9565	31.36	VUY VUB	● Bombay, India	Thurs. and Fri., 11 P.M.-12:30 A.M.; Sun., 1:30-3:30 A.M.

Short-Wave Station List

KC	Meters	Call	Location	Time
9560	31.38	DJA	●Zeesen, Germany	12:05-5:15 A.M., 4:50-10:45 P.M. daily
9560	31.38	HJ1ABB	●Barranquilla, Colombia	7 A.M.-12:30 P.M. daily
9550	31.41	OLR3A	●Prague, Czechoslovakia	Sunday 2-7:30 A.M. Daily ex. Sun. 8:55 A.M.-12 noon, 2:25-4:30 P.M. Thurs. & Sat., 5-7:30 A.M. Mon. & Thurs. 7-10 P.M. (America)
9545	31.44	HH2R	●Port-au-Prince, Haiti	Special programs irreg.
9540	31.45	DJN	●Zeesen, Germany	12:05-5:15 A.M., 5:55-11 A.M., 4:50-10:45 P.M. daily
9535	31.46	JZI	●Nazaki, Japan	9-10 A.M., 2:30-3:30 P.M. daily
9530	31.48	W2XAF	●Schenectady, N. Y.	4 P.M.-12 A.M. daily
9530	31.48	LKJ1	●Jeloy, Norway	5-8 A.M., 11 A.M.-5 P.M. daily
9525	31.49	ZBW-3	●Hong Kong, China	Daily ex. Sat. 11:30 P.M.-1:30 A.M.; Mon. & Thurs. 4-10 A.M.; Tues., Wed., Fri., Sun. 3-10 A.M.; Sat., 3-11 A.M., 9 P.M.-1:30 A.M.
9520	31.51	HJ4ABH	●Armenia, Colombia	Weekdays 8-11 A.M., 6-10 P.M. Sundays 7-10 P.M.
9520	31.51	XEDQ	●Guadalajara, Mexico	Daily 12-4 P.M., 8 P.M.-12 A.M. Occasional Sunday DX 2-4 A.M.
9510	31.55	GSB	●Daventry, England	2-4 A.M., 6-8:45 A.M., 9 A.M.-12 noon, 12:15-5:45 P.M., 6-8 P.M., 9-11 P.M. daily
9510	31.55	VK3ME	●Melbourne, Australia	Mon., Sat. 4-7 A.M.
9510	31.55	HJU	●Buenaventura, Colombia	12-2 P.M., 8-11 P.M., Mon., Wed., Fri.
9510	31.55	XEFT	●Vera Cruz, Mexico	(See 6120 kc.)
9504	31.57	OLR3B	●Prague, Czechoslovakia	Irregular (see 6010-9550-11840 kc.)
9500	31.58	PRF5	●Rio de Janeiro, Brazil	4:45-5:45 P.M. ex. Sun.
9500	31.58	HI5G	●La Vega, R. D.	6:40-8:40 A.M., 10:40 A.M.-2:40 P.M., 4:40-8:40 P.M.
9500	31.58	HJ1ABE	●Cartagena, Colombia	11 A.M.-1 P.M., 5-10:30 P.M. Sun. 9 A.M.-3 P.M.
9490	31.61	KEI	Bolinas, Calif.	(P) Phones Indo-China and China A.M.
9480	31.65	PLW	Bandoeng, Java	(P) Phones Australia early A.M.
9480	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 A.M.
9450	31.75	TGWA	●Guatemala City, Guate.	Daily ex. Sun. 12-2 P.M., 8-9 P.M., 10 P.M.-12 A.M.; Sun., 12 noon-2 P.M., 12 A.M.-6 A.M.
9430	31.80	YVR	Maracay, Venezuela	(P) Tests mornings
9428	31.81	COCH	●Havana, Cuba	Daily 8 A.M.-12 A.M.
9415	31.86	PLV	Bandoeng, Java	(P) Phones PCV-PCK-PDK-VLZ-KWX-KWV early A.M.
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
9350	32.09	HS8PJ	●Bangkok, Siam	Thurs., 8-10 A.M.
9340	32.12	OAX4I	●Lima, Peru	6-11:30 P.M. daily
9330	32.15	CGA4	Drummondville, Que.	(P) Phones GCB-GDB-GBB afternoons
9300	32.27	YNGU	●Managua, Nicaragua	1-3 P.M., 6-7 P.M. Sundays 12-1:30 P.M.
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
9125	32.88	HAT4	●Budapest, Hungary	6:00-7:00 P.M. Sundays
9120	32.89	CP6	●La Paz, Bolivia	No regular schedule
9110	32.93	KUW	Manila, P. I.	(P) Tests and phones early A.M.
9091	33.00	CGA-5	Drummondville, Que.	(P) Phones Europe days
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, early A.M.
8975	33.43	VWY	Poona, India	(P) Phones GBC-GBU mornings
8960	33.48	FVA	"Radio Algiers," Alger, Algeria, Africa	(P) Phones Paris 12-1 A.M. daily
8950	33.52	WEL	Rocky Point, N. Y.	(E) Tests with Europe, irreg.
8950	33.52	W2XBJ	Rocky Point, N. Y.	(E) Tests irregularly
8948	33.53	HCJB	●Quito, Ecuador	7:30-8:30 A.M., 11:30 A.M.-2:30 P.M., 5:30-10 P.M. daily ex. Mon. (8948 kc.) (7-10 P.M. only on 8948 and 4107 kc.)
8930	33.59	WEC	Rocky Point, N. Y.	(P) Phones Ethiopia irregular
8900	33.71	ZLS	Wellington, N. Z.	(P) Phones VLZ early mornings
8840	33.94	ZMBJ	●TSS "Awatea," Wellington, N. Z.	B.C. Sundays 6:40 P.M. Daily 1-3 A.M.
8830	33.98	LSD	Buenos Aires, Arg.	(P) Relays to New York early evenings
8795	34.13	HKV	●Bogota, Colombia	(E) Tests early evenings and nights; broadcasts news Mon. and Thurs. 7-7:30 P.M.
8790	34.13	TIR	Cartago, Costa Rica	(P) Phones Cent. America daytime
8775	34.19	PNI	Makasser, D. E. I.	(P) Phones PLV early mornings
8760	34.35	GCQ	Rugby, England	(P) Phones ZSR afternoons
8740	34.35	WXV	Fairbanks, Alaska	(P) Phones WXH nights
8730	34.36	GCI	Rugby, England	(P) Phones VWY afternoons
8720	34.40	VPD-2	●Suva, Fiji Islands	5:30-7 A.M. daily
8710	34.44	KBB	Manila, P. I.	(E) 6-8 A.M. special broadcast
8680	34.56	GBC	Rugby, England	(P) Phones ships and New York daily
8665	34.62	CO9JQ	●Camaguey, Cuba	7:45-9:00 P.M. weekdays. Sundays irreg.
8650	34.68	WVD	Seattle, Wash.	(P) Tests irregularly
8630	34.76	CMA	Havana, Cuba	(P) Phones N. Y. irreg.
8560	35.05	WOO	Ocean Gate, N. J.	(P) Phones ships days
8515	35.23	JAC	Pisa, Italy	(P) Phones irreg.
8505	35.27	YNLG	●Managua, Nicaragua	Daily 1-2:30 P.M., 7:30-9:45 P.M.
8500	35.29	JZF	Nazaki, Japan	(P) Phones ships irreg.
8470	35.39	DAN	Nordenland, Germany	(P) Phones ships irreg.
8404	35.70	HC2CW	●Guayaquil, Ecuador	Weekdays 11:30 A.M.-12:30 P.M., 7-11 P.M. Sundays 3-5 P.M.
8185	36.65	PSK	Rio de Janeiro, Brazil	(P) Phones LSL-WOK evenings. Broadcasts irreg.
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 A.M.
8110	37.00	ZP10	●Asuncion, Paraguay	8-10 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
7960	37.69	VLZ	Sydney, Australia	(P) Phones ZLT early A.M.
7955	37.71	HSJ	Bangkok, Siam	(P) Phones Berlin, Manila, Java irregular
7935	37.81	PSL	Rio de Janeiro, Brazil	(P) Phones N. Y. and Madrid irreg.
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	IDU	Asmara, Eritrea, Africa	(P) Irregular
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	HC2JSB	●Guayaquil, Ecuador	9 A.M.-2 P.M., 4-11 P.M. daily
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 P.M., 7-8:30 P.M. Saturdays. First Mon. each month, 6-7 P.M.
7790	38.49	YNA	Managua, Nicaragua	(P) Phones Cent. & So. America daytime
7770	38.61	PDM	Kootwijk, Holland	(P) Special relays to E. Indies
7765	38.63	PDM	Kootwijk, Holland	(P) Special relays to Dutch Indies
7760	38.66	PDM	Kootwijk, Holland	(P) Special relays to E. Indies
7740	38.76	CEC	Santiago, Chile	(P) 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
7715	38.89	KEE	Bolinas, Calif.	(P) Relays programs to Hawaii seasonally
7669	39.11	TGF	Guatemala City, Guate.	(P) Phones TIU-HPF daytime
7626	39.31	RIM	Tashkent, USSR.	(P) Phones RKI early mornings
7620	39.37	IUB	●Addis Ababa, Ethiopia	Irregular
7610	39.42	KWX	Dixon, Calif.	(P) Phones KKH nights; KAZ-KTP-PLV-JVT-JVM A.M.
7565	39.66	KWY	Dixon, Calif.	(P) Phones Shanghai early mornings

KC	Meters	Call	Location	Time
7550	39.74	TI8WS	● Puntarenas, Costa Rica	Sun., 4-5 P.M. Weekdays, 5-7 P.M., 8:30-10 P.M.
7520	39.89	KKH	Kahuku, Hawaii	(P) KEE-KEJ evenings, KWX-KWV nights
7518	39.90	RKI	Moscow, USSR.	(P) Phones RIM early mornings
7510	39.95	JVP	● Nazaki, Japan	(P) Tests Point Reyes early A.M.; broadcasts 2:30-3:30 P.M. daily
7500	40.00	CFA-6	Drummondville, Que.	(P) Phones N. America days
7470	40.16	JVQ	Nazaki, Japan	(P) Relays and phones early A.M.; broadcasts Mon., Thurs., 2-3, 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
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 6-8 P.M.
7370	40.71	KEQ	Kahuku, Hawaii	(P) Relays programs evenings
7345	40.84	GDL	Rugby, England	(P) Phones Japan irreg. A.M.
7200	41.67	YNAM	● Managua, Nicaragua	Daily 7-10 P.M.
7100	42.25	FO8AA	● Papeete, Tahiti	Tues. & Fri. 11 P.M.-1 A.M.
7080	42.37	PI1J	● Dordrecht, Holland	Sat., 10:10-11:10 A.M.
7030	42.67	EA9AH	● Tetuan, Spanish Morocco, Africa	4-4:25 P.M. daily; 12-2:30 A.M. irregular
7010	42.80	EA8AB	● Santa Cruz de Tenerife, Canary Islands	Mon., Wed., Fri., Sat., 3:15-4:15 P.M.
7000	42.86	PZH	● Paramaribo, D. Guiana	S. A. Sun., 9:45-11:45 A.M.; Mon. and Fri., 5:45-9:45 P.M.; Tues. 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
6977	43.00	XBA	Tacubaya, D. F., Mex.	(E) 6-8 P.M. daily
6950	43.17	WKP	Rocky Point, N. Y.	(E) Relays programs evenings
6950	43.17	GBY	Rugby, England	(P) Phones U.S.A. irreg.
6922	43.34	IUF	Addis Ababa, Ethiopia	(E) Irregular
6905	43.45	GDS	Rugby, England	(P) Phones WOA-WNA-WCN evenings
6900	43.48	HI2D	● Ciudad Trujillo, R. D.	Daily 6:40-8:40 A.M., 10:40 A.M.-2:40 P.M., 4:40-8:40 P.M.
6895	43.51	HCETC	● Quito, Ecuador	8:15-10:30 P.M. ex. Sun.
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.
6850	43.80	TIOW	● Port Limon, Costa Rica	Weekdays 10-11:30 P.M. Sun. 2-3 P.M.
6845	43.83	KEN	Bolinas, Calif.	(P) Used irregularly
6830	43.92	CFA	Drummondville, Que.	(P) Phones N. America nights
6820	43.99	XGOX	● Nanking, China	Weekdays 5:30-8:30 A.M., Sun. 7-9 A.M.
6800	44.12	HI7P	● Ciudad Trujillo, R. D.	Daily 6:40-8:40 A.M., 10:40 A.M.-2:40 P.M., 4:40-8:40 P.M.
6795	44.15	GAB	Rugby, England	(P) Phones Canada irreg.
6780	44.25	HIH	● San Pedro de Macoris, R. D.	Daily 12:10-1:40 P.M., 7:40-9 P.M. Sunday 5:10-6:40 P.M. DX 2:40-3:40 A.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 and Pt. Reyes irreg.
6750	44.44	JVT	● Nazaki, Japan	4:40-7:40 A.M. daily
6730	44.58	HI3C	● La Romana, R. D.	Weekdays 12:10-2:10 P.M., 6:10-7:40 P.M. Sun., 12:10-2:40 P.M.
6725	44.60	WOQ	Rocky Point, N. Y.	(E) Tests evenings irreg.
6720	44.64	PMH	● Bandoeng, Java	Phones early A.M. B.C. Sunday 5:30-10:30 A.M., 7:30 P.M.-2 A.M. Weekdays 5:30-10:30 or 11 A.M. (Sat. 11:30 A.M.), 6-7:30 P.M., 10:30 P.M.-2 A.M.
6718	44.66	KBK	Manila, P. I.	(P) Phones A.M. seasonally
6690	44.84	TIEP	● San Jose, Costa Rica	7-11 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.
6672	44.96	YVQ	● Maracay, Venezuela	8-9 P.M. Saturdays
6672	44.96	YVQ	Maracay, Venezuela	(P) Phones LSL irreg.
6650	45.11	GBY	Rugby, England	(P) Phones U.S.A. irreg.
6650	45.11	IAC	Pisa, Italy	(P) Phones ships irreg.
6635	45.21	HC2RL	● Guayaquil, Ecuador	Sun. 5:30-7:30 A.M. Tues. 9-11 P.M.
6630	45.25	HIT	● Ciudad Trujillo, R. D.	12:10-1:40 P.M., 6:10-8:40 P.M. ex. Sun. 1st Sat., DX 11:10 P.M.-1:10 A.M.
6618	45.33	Prado	● Riobamba, Ecuador	Thursday 9-11 P.M.
6550	45.81	TIRCC	● San Jose, Costa Rica	Daily 12-2 P.M., 6-9:30 P.M.
6548	45.82	XBC	Vera Cruz, Mexico	(E) 7-8 P.M. irreg.
6545	45.84	YV6RB	● Ciudad Bolivar, Venez.	7-10 P.M. daily; 3-6 P.M. Sun.
6535	45.91	YN1GG	● Managua, Nicaragua	6-10 P.M. daily
6520	46.01	YV4RB	● Valencia, Venezuela	11 A.M.-1:30 P.M., 5:30-9:30 P.M. daily
6500	46.15	HIL	● Ciudad Trujillo, R. D.	12-2 P.M., 6-8 P.M.
6482	46.28	HI4D	● Ciudad Trujillo, R. D.	Mon. & Sat., 11:55 A.M.-1:40 P.M., 4:40-7:40 P.M.
6479	46.30	HI8A	● Ciudad Trujillo, R. D.	Daily 8:40-10:40 A.M., 2:40-4:40 P.M. Sat., 9:10-10:40 P.M.
6450	46.51	HI4V	● San Francisco de Macoris, R. D.	11:40 A.M.-1:40 P.M., 5:10-6:40 P.M. daily
6420	46.72	HI1S	● Santiago de los Caballeros, R. D.	11:40 A.M.-1:40 P.M., 5:40-7:40 P.M.
6415	46.77	HJA3	Barranquilla, Colombia	(P) Phones HJA2 evenings
6410	46.80	TIPG	● San Jose, Costa Rica	7:30-9:30 A.M., 12-2 P.M., 6-11:30 P.M. daily
6400	46.88	YV5RH	● Caracas, Venezuela	7-11 P.M. irreg.
6375	47.10	YV5RF	● Caracas, Venezuela	5:30-9:30 P.M. ex. Sun.
6360	47.17	YV1RH	● Maracaibo, Venezuela	6-11 P.M. daily
6351	47.24	HRP1	● San Pedro de Sula, Honduras	12-2 P.M., 7:45-10 P.M. daily ex. Sunday
6340	47.32	HIX	● Ciudad Trujillo, R. D.	Sun. 7:40-10:40 A.M. Daily 12:10-1:10 P.M. Tues. & Fri. 8:10-10:10 P.M.
6330	47.39	JZG	● Nazaki, Japan	5-7 A.M. irregular
6325	47.43	HH3NW	● Port-au-Prince, Haiti	1-2 P.M., 7-8:30 P.M. ex. Sunday
6316	47.50	HIZ	● Ciudad Trujillo, R. D.	Daily 11:30 A.M.-2:45 P.M., 5:30 P.M.-9 P.M. Sat. to 10 & 11 P.M.
6300	47.62	YV4RD	● Maracay, Venezuela	6:30-9:30 P.M. ex. Sun.
6280	47.69	COHB	● Sancti-Spiritus, Cuba	9-10 A.M., 12-1 P.M., 4-6 P.M., 9-11 P.M. daily
6280	47.77	HIG	● Ciudad Trujillo, R. D.	7:10-8:40 A.M., 12:40-2:10 P.M., 8:10-9:40 P.M.
6270	47.85	YV5RP	● Caracas, Venezuela	6-11:45 P.M. daily
6243	48.05	HIN	● Ciudad Trujillo, R. D.	(See 11260 kc.) Weekdays 11:40 A.M.-2:40 P.M., 7:10-9:10 P.M. Sun. 11:10 A.M.-3:40 P.M.
6240	48.08	HI8Q	● Ciudad Trujillo, R. D.	Daily 10:40 A.M.-1:40 P.M., 4:40-8:40 PM
6235	48.11	OCM	Lima, Peru	(P) Phones afternoons
6235	48.11	HRD	● La Ceiba, Honduras	8-10:30 PM., Sundays 4-6 P.M.
6230	48.15	OAX4G	● Lima, Peru	7-11 P.M. daily
6230	48.15	YV1RG	● Calera, Venezuela	6-9:30 P.M. daily
6210	48.31	YV1RI	● Coro, Venezuela	7:30-9:30 P.M. daily
6200	48.39	COKG	● Santiago, Cuba	Sundays 12:01-1 A.M., 5-6 P.M., 9:30-10:30 P.M. daily
6200	48.39	XEXS	● Mexico City, Mexico	7-11 P.M.
6190	48.47	HI1A	● Santiago de Caballeros, R. D.	Daily 11:40 A.M.-1:40 P.M., 7:40-9:40 P.M.
6170	48.62	HJ3ABF	● Bogota, Colombia	11 A.M.-2 P.M. 6-11 P.M.
6160	48.70	VPB	● Colombo, Ceylon	Daily 6:30-9 and 10 A.M.
6156	48.73	YV5RD	● Caracas, Venezuela	Weekdays 10:30 A.M.-1:30 P.M., 4:30-10 P.M.; Sundays 8:30 A.M.-12:30 P.M., 2:30-10:30 P.M.
6150	48.78	HJ4ABU	● Pereira, Colombia	Daily 9:30 A.M.-12 Noon, 6:30-10 P.M.
6150	48.78	CJRO	● Winnipeg, Manitoba	Weekdays 6 P.M.-12 A.M., Sundays 5-10 P.M.
6150	48.78	GBT	Rugby, England	(P) Phones U.S.A. days
6150	48.78	HI5N	● Santiago de los Caballeros, R. D.	Daily 6:40-8:40 A.M., 10:40 A.M.-2:40 P.M., 4:40-8:40 P.M.
6150	48.78	CB615	● Santiago, Chile	4-7 P.M. daily
6140	48.86	W8XK	● Pittsburgh, Pa.	9 P.M.-1 A.M. daily
6140	48.86	ZEB	● Bulawayo, Rhodesia, Africa	Sun. 3-5 A.M.; Tues. & Thurs. 1:15-3:15 P.M.
6138	48.88	HJ4ABD	● Medellin, Colombia	Weekdays 10 A.M.-2 P.M., 4-11 P.M. Sun., 11 A.M.-3 P.M., 7-11 P.M. (see 5900 and 5780 kc.)
6137	48.88	CR7AA	● Lourenco Marques, Africa	Weekdays 4:45-6:15 A.M., 12:45-3:15 P.M.; Sundays 5:30-7 A.M., 10 A.M.-12:30 P.M.
6133	48.91	XENA	● Mexico City, Mexico	8-11:30 A.M., 3-5 P.M., 7-11 P.M. ex. Sunday
6132	48.92	VP3BG	● Georgetown, Br. Guiana	6-8:45 P.M. daily
6130	48.94	ZGE	● Kuala Lumpur, S.S.	Sun., Tues., Fri., 6:40-8:40 A.M.
6130	48.94	LKJ1	● Jeloy, Norway	11 A.M.-5 P.M. daily
6130	48.94	COCD	● Havana, Cuba	Daily 11 A.M.-1 A.M.
6130	48.94	VE9HX	● Halifax, Nova Scotia	Sun. 3-10:45 P.M., Mon. to Fri. 6:30 A.M.-10:45 P.M., Sat. 11 A.M.-10:45 P.M.

KC	Meters	Call	Location	Time
6128	48.96	HJ1ABB	● Barranquilla, Colombia	11:45 A.M.-1 P.M., 5:30-10 P.M. daily
6125	48.98	CXA4	● Montevideo, Uruguay	8 A.M.-12 noon, 2-10 P. M. daily
6122	49.00	HJ3ABX	● Bogota, Colombia	Weekdays 10:30 A.M.-2 P.M., 5:30-11:30 P. M.; Sundays 12-1:30 P.M., 6-11 P.M.
6120	49.02	XEFT	● Vera Cruz, Mexico	Daily 11 A.M.-4 P.M., 7:30 P.M.-12 A.M.
6120	49.02	W2XE	● Wayne, N. J.	10-11 P.M. daily
6117	49.04	XEUZ	● Mexico City, Mexico	8 P.M.-2 A.M. daily
6115	49.06	OLR2C	● Prague, Czechoslovakia	Irregular (see 6010-9550-11840 kc.)
6110	49.10	HJ4ABB	● Manizales, Colombia	11 A.M.-1 P.M., 5-8 P.M.
6110	49.10	GSL	● Daventry, England	Not in use
6110	49.10	VUC	● Calcutta, India	Mon., 8-9 A.M. Wed., 10:30-11:30 A.M.
6110	49.10	XEPW	● Mexico City, Mexico	10 A.M.-12 noon, 2-4 P. M., 8 P.M.-12 A.M.
6100	49.18	Belgrade	● Belgrade, Yugoslavia	1 A.M.-5:15 P.M. daily
6100	49.18	W9XF	● Chicago, Illinois	Daily ex. Sat. 11:05 P. M.-2 A.M.
6100	49.18	W3XAL	● Bound Brook, N. J.	Mon., Wed., Sat., 5 P. M.-1 A.M.
6097.5	49.20	ZTJ	● Johannesburg, S. Africa	Sunday 4-5 A.M., 12:15-3:15 P.M. Weekdays 12-12:45 A.M., 3:15-5 A.M., 9 A.M.-4 P.M.
6097	49.20	HJ4ABE	● Medellin, Colombia	11 A.M.-12 noon, 6-10:30 P.M. daily
6095	49.22	JZH	● Nazaki, Japan	Irregular
6090	49.26	CRCX	● Bowmansville, Ont.	Weekdays 12 noon-8 P. M. Sunday 11 A.M.-8 P.M. Sat. "Northern Messenger," 11 P.M.-12 A.M.
6090	49.26	ZBW-2	● Hong Kong, China	Daily ex. Sat. 11:30 P. M.-1:30 A.M.; Mon. & Thurs., 4-10 A.M.; Tues., Wed., Fri., Sun., 3-10 A.M.; Sat., 3-11 A.M., 9 P.M.-1:30 A. M.
6090	49.26	HJ4ABC	● Ibague, Colombia	6-11 P.M.
6085	49.30	HJ5ABD	● Cali, Colombia	11 A.M.-2 P.M., 6-11 P. M. daily
6080	49.34	W9XAA	● Chicago, Ill.	Weekdays 7:30-9 A.M., 6 P.M.-1 A.M. Sun. 11 A.M.-1 P.M., 6 P. M.-1 A.M.
6080	49.34	ZHJ	● Penang, S. S.	6:40-8:40 A.M.
6080	49.34	CP5	● LaPaz, Bolivia	No regular schedule
6080	49.34	VE9CS	● Vancouver, B. C.	Sun. 12 noon-1:30 A.M.; Mon., Thurs., Sat., 9:30 A.M.-8:30 P.M.; Tues., Wed., Fri., 9:30 A.M.-2:30 A.M.
6080	49.34	HP5F	● Colon, Panama	Daily ex. Sunday, 11 A. M.-1 P.M., 7-10 P.M.; Sun. 10:45-11:30 A.M., 7-10 P.M.
6079	49.35	DJM	● Zeesen, Germany	Irregular
6075	49.38	XECU	● Guadalajara, Mexico	8:15-11 P.M. daily
6070	49.42	YV1RD	● Maracaibo, Venezuela	Daily 8 P.M.-12 A.M.
6065	49.46	XEXR	● Mexico City, Mexico	6-11:30 P.M.
6060	49.50	W8XAL	● Cincinnati, Ohio	6:30 A.M.-8 P.M., 11 P. M.-2 A.M. daily
6060	49.50	W3XAU	● Philadelphia, Pa.	8-11 P.M. daily ex. Thurs. (8-10 P.M.)
6060	49.50	VQ7LO	● Nairobi, Kenya Colony, Africa	Mon. to Fri. 5:45-6:15 A.M., 11:30 A.M.-2:30 P.M. Tues. and Thurs., 8:30-9:30 A.M. Sat., 11 A.M.-3 P.M. Sun., 11:30 A.M.-2:30 P.M.
6060	49.50	OXY	● Skamleback, Denmark	1-6:30 P.M. Sunday 11 A.M.-6:30 P.M.
6050	49.59	GSA	● Daventry, England	Not in use
6050	49.59	HJ3ABD	● Bogota, Colombia	Weekdays 9 A.M.-2 P. M., 6 P.M.-12 A.M. Tues. & Thurs. to 3 P. M. Wed. & Fri. begin 5:30 P.M.
6050	49.59	XEXF	● Mexico City, Mexico	8 P.M.-12 A.M.
6043	49.62	HJ1ABG	● Barranquilla, Colombia	Daily 11 A.M.-11 P.M. Sun., 11 A.M.-8 P.M.
6040	49.67	HI9B	● Santiago de los Caballeros, R. D.	Daily 6:10-9:40 P.M.; Sat. 11:40 P.M.-12:40 A.M.
6040	49.67	PRA8	● Pernambuco, Brazil	9:30-11:30 A.M., 2:30-8:30 P.M.
6040	49.67	YDA	● Tandjong Priok, Java	10:30 P.M.-2 A.M. daily
6040	49.67	W4XB	● Miami, Florida	Temporarily off the air. Undergoing repairs.
6040	49.67	W1XAL	● Boston, Mass.	Mon., Tues., Fri., 7:30-9:30 P.M. Sundays 5-7 P.M.
6030	49.75	OLR2B	● Prague, Czechoslovakia	Irregular (see 6010-9550-11840 kc.)
6030	49.75	HP5B	● Panama City, Panama	12 noon-1 P.M., 6-10 P. M.
6030	49.75	HJ4ABP	● Medellin, Colombia	6-10:30 P.M. daily
6030	49.75	PGD	Kootwijk, Holland	(P) Phones Java and E. Indies irreg.
6030	49.75	VE9CA	● Calgary, Alberta, Can.	Weekdays 9 A.M.-1 A. M.; Thursdays to 2 A. M.; Sundays 12 noon-12:30 A.M.
6030	49.75	XEBQ	● Mazatlan, Mexico	8-11:30 P.M.
6025	49.79	PGD	Kootwijk, Holland	(P) Phones Java and E. Indies irreg.
6025	49.79	HJ1ABJ	● Santa Marta, Colombia	11:30 A.M.-2 P.M., 5:30-10:30 P.M. daily
6020	49.83	PGD	Kootwijk, Holland	(P) Phones Java and E. Indies irreg.
6020	49.83	DJC	● Zeesen, Germany	11:35 A.M.-4:30 P.M.
6020	49.83	XEUW	● Vera Cruz, Mexico	7 A.M.-11 P.M. daily
6018	49.85	ZHI	● Singapore, S. S.	Mon., Wed., Thurs. 5:40-8:10 A.M.; Sat. 10:40 P.M.-1:10 A.M.; 2nd & 4th Sundays. 5:10-6:40 A.M.—organ
6015	49.88	HI3U	● Santiago de los Caballeros, R. D.	Weekdays 7:10-8:40 A. M., 10:40 A.M.-1:40 P.M., 4:40-9:40 P.M. Sundays, 10:40 A.M.-1:40 P.M. only
6015	49.88	XEWI	● Mexico City, Mexico	Irregular (see 11900 kc.)
6012	49.90	HJ3ABH	● Bogota, Colombia	11:30 A.M.-2 P.M., 6-11 P.M.; Sun. 12-2 P.M., 4-11 P.M.
6010	49.92	VP3MR	● Georgetown, Br. Guiana	Sunday, 7:45-10:15 A.M. Weekdays, 4:45-8:45 P.M.
6010	49.92	VK9MI	● Sydney, Australia "S.S. Kanimbla"	11 P.M.-7 A.M. Irregular
6010	49.92	COCO	● Havana, Cuba	8 A.M.-10 P.M. daily
6010	49.92	OLR2A	● Prague, Czechoslovakia	Sunday 2-7:30 A.M. Daily ex. Sun. 8:55 A. M.-12 noon, 2:25-4:30 P.M. Thurs. & Sat., 5-7:30 A.M. Mon. & Thurs., 7-10 P.M. (America)
6005	49.96	HP5K	● Colon, Panama	7:30-9 A.M., 12-1 P.M., 6-9 P.M.
6005	49.96	CFCX	● Montreal, Que.	Weekdays 7:45 A.M.-1 A.M. Sundays, 9 A. M.-11:15 P.M.
6005	49.96	VE9DN	● Montreal, Que.	Sat., 11:30 P.M.-1 A.M., Fall, Winter & Spring
6000	50.00	HJ1ABC	● Quibdo, Colombia	Sun., 3-5 P.M.; Wed., Sat., 5-6 P.M.; daily 6-9 P.M.
6000	50.00	XEBT	● Mexico City, Mexico	10 A.M.-1 A.M. daily
6000	50.00	FIQA	● Tananarive, Madagascar	3:30-4:45 A.M., 7 A.M.-1 P.M. daily
6000	50.00	RV59	● Moscow, USSR.	4-5 P.M., Mon., Wed., Fri.
5980	50.17	HJ2ABD	● Bucaramanga, Colombia	Daily 11:30 A.M.-12:30 P.M., 6-10 P.M.
5969	50.26	HVJ	● Vatican City, Vatican	2-2:15 P.M., Sunday 5-5:30 A.M.
5955	50.35	HJN	● Bogota, Colombia	Daily 11 A.M.-2 P.M., 5-10:30 P.M.
5940	50.51	TG2X	● Guatemala City, Guat.	Daily 4-6 P.M.; Mon., Thurs., Sat., 10 P.M.-1 A.M.; Sundays, 1-2 P.M.
5910	50.76	YV4RH	● Valencia, Venezuela	8-11:30 P.M. daily
5910	50.76	HH2S	● Port-au-Prince, Haiti	7-10 P.M.
5905	50.80	TIMS	● Puntarenas, Costa Rica	6-11 P.M. daily
5900	50.85	HJ4ABD	● Medellin, Colombia	Weekdays 10 A.M.-2 P. M., 4-11 P.M. Sundays 11 A.M.-3 P.M., 7-11 P.M. (see 6138 & 5780 kc.)
5880	51.02	YV3RA	● Barquisimeto, Venezuela	Daily 11:30 A.M.-12:30 P.M., 5:30-9:30 P.M.
5880	51.02	IUA	● Addis Ababa, Ethiopia	Used irregularly
5875	51.11	HRN	● Tegucigalpa, Honduras	6:30-8 P.M., 8:30-10 P. M. daily
5865	51.15	HI1J	● San Pedro de Macoris, R. D.	11:40 A.M.-1:40 P.M., 5:40-9:40 P.M. daily
5853	51.20	WOB	Lawrenceville, N. J.	(P) Phones ZFA P.M.
5850	51.28	YV1RB	● Maracaibo, Venezuela	Weekdays 8:45-9:45 A. M., 11:15 A.M.-12:45 P.M., 4:45-9:45 P.M. Sundays 10:45 A.M.-12:45 P.M.
5830	51.28	GBT	Rugby, England	(P) Phones U.S.A. irreg.
5843	31.33	KRO	Kahuku, Hawaii	(P) Tests early mornings
5830	51.46	TIGPH	● San Jose, Costa Rica	8-11 P.M. daily ex. Sun.
5825	51.50	HJA2	Bogota, Colombia	(P) Phones HJA3 afternoons irreg.
5800	51.72	KZGF	Manila, P. I.	(P) Tests A.M. irreg.
5800	51.72	YV5RC	● Caracas, Venezuela	Sunday 8:30-11:30 A.M., 1:30-10 P.M. Weekdays 10:45 A.M.-1:30 P.M., 4-10:30 P.M.
5800	51.72	ZEC	● Salisbury, Rhodesia, Africa	Sun. 3-5 A.M.; Tues. & Fri. 1:15-3:15 P.M.
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.
5780	51.90	HJ4ABD	● Medellin, Colombia	Weekdays 10 A.M.-2 P. M., 4-11 P.M. Sunday 11 A.M.-3 P.M., 7-11 P.M. (see 6138 & 5900 kc.)
5758	52.10	YNOP	● Managua, Nicaragua	8:30-10:30 P.M. daily
5750	52.17	XAM	Merida, Mexico	(P) Phones XDR-XDF early evenings
5730	52.36	JVV	Nazaki, Japan	(P) Phones JZC early A.M.
5725	52.40	HC1PM	● Quito, Ecuador	Tuesdays 9-11 P.M.
5713	52.51	TGS	● Guatemala City, Guat.	Sun., Wed., Fri., 6-8 P.M.

Short-Wave Station List

KC	Meters	Call	Location	Time
5710	52.54	YV2RA	● San Cristobal, Venez.	Sundays 5:30-10 P.M. Weekdays 11:30 A.M.-12:30 P.M., 5:30-9 P.M.
5705	52.59	CFU	Rossland, Canada	(P) Phones CFO and CFN eves.; news, 8:30-8:45 P.M.
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
5395	55.61	CFA7	Drummondville, Que.	(P) Phones No. America irregular
5260	57.03	WQN	Rocky Point, N. Y.	(E) Program service; irregular
5140	58.37	PMY	● Bandoeng, Java	Daily 4:45-10:45 A.M., 5:45 P.M.-2:15 A.M.
5110	58.71	KRG	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, USSR.	(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.	5:30-11 A.M., 5:45-6:45 P.M., 10:30 P.M.-2 A.M. daily
4795	62.56	VE9BK	● Vancouver, Canada	Weekdays 11:30-11:45 A.M., 2:30-3 P.M., 7:30-8 P.M. Sat. (same ex. last), 7-7:30 P.M.
4752	63.13	WOY	Lawrenceville, N. J.	(P) Tests irregularly
4752	63.13	WOO	Ocean Gate, N. J.	(P) Phones ships irreg.
4752	63.13	WOG	Lawrenceville, N. J.	(P) Phones Rugby irreg.
4600	65.22	HC2ET	● Guayaquil, Ecuador	9:15-10:45 P.M., Wed. & Sat.
4555	65.95	WDN	Rocky Point, N. Y.	(P) Tests Rome and Berlin evenings
4550	65.93	KEH	Bolinas, Calif.	(P) Phone; irreg.
4510	66.52	ZFS	Nassau, Bahamas	(P) Phones WND daily; tests GYD - ZSV irregular
4465	67.19	CFA2	Drummondville, Que.	(P) Phones No. America; irregular days
4420	67.87	ZMBJ	● TSS "Awatea." Wellington, N. Z.	(See 8840 kc.)
4355	68.88	IAC	Pisa, Italy	(P) Phones and tests irreg.
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.
4273	70.21	RV15	● Khabarovsk, USSR.	Daily ex. 6, 12, 18, 24, 30th, 3 P.M.-8 A.M. On 6, 12, 18, 24, 30th, 7:10 P.M.-8 A.M. English programs start at 2 A.M.
4272	70.22	WOO	Ocean Gate, N. J.	(P) Phones ships afternoons and eve.
4272	70.22	WOY	Lawrenceville, N. J.	(P) Tests evenings
4107	73.05	HCJB	● Quito, Ecuador	(See 8948 kc.)
4002	75.00	CT2AJ	● Ponta Delgada, Azores	Wed. and Sat., 5-7 P.M.
3750	80.00	HCK	● Quito, Ecuador	Mondays 8:30-10:30 P.M. and occasional specials
3310	90.63	CJA8	Drummondville, Que.	(P) Phones Australia A.M.
3040	98.68	YDA	● Batavia, Java	Sunday 5:30-10:30 A.M., 7:30 P.M.-2 A.M. Weekdays 5:30-10:30 or 11 A.M. (Sat. 11:30 A.M.), 6-7:30 P.M., 10:30 P.M.-2 A.M.

ULTRA-HIGH FREQUENCY OSCILLATORS

(Continued from page 186)

center pair of rods were exactly one-quarter of a wavelength long. The radio-frequency voltage distribution on the four inside rods was very nearly the same and the grid clips could be moved down a little farther on the rods. In order to adjust the voltage distribution so as to keep it uniform on the various rods, we had to make the outside rods shorter than the inside ones.

The two photographs show the mechanical layout of the final oscillator. The top view illustrates the actual rod length adjustment. They weren't really rods at all, but brass tubes with the end sections telescoping into the others for easy adjustment of length.

The side view shows how the tubes, plate circuit, milliammeter, and the lamp used as a dummy load were mounted on a bridge which could be moved up and down when we adjusted the grid clips. After the adjustments were made, the bridge was fastened in place by the screws shown at the side.

Tuning

The tuning of the plate circuit was very critical. When it was tuned slightly off resonance the output would drop off rapidly and the tubes would heat up. If the plate circuit was tuned very far off resonance, the tubes would stop oscillating. Tuning the plate circuit of this oscillator is very much like tuning the plate circuit of a crystal oscillator. When resonance is approached from one side, the output will steadily increase until resonance is passed and then oscillations will suddenly stop. If the condenser is rotated in the opposite direction, the circuit will start oscillating suddenly at resonance and gradually subside as it is tuned away from resonance.

While we could change the frequency of the oscillator several kilocycles by tuning the plate circuit, the output dropped off fast on one side of resonance and stopped entirely on the other. The stability was excellent and the output with the T55 tubes was about 100 watts when 1000 volts was used on the plates. The second harmonic of a battery-operated shielded autodyne detector was brought to zero beat with the signal of the oscillator and they stayed together for five minutes before one of them drifted out.

Summary

The use of too high a value of grid leak or too much grid excitation in an oscillator can cause the oscillator to quench itself and become very unstable. The full stabilizing effect of the grid rods in a linear type of oscillator cannot be utilized because of the loading effect of the grid-filament capacity of the tubes. Working with the grid clips near the base of the rods reduces the loading effect of the tube capacities and improves the stability. Using two sets of grid rods closely coupled greatly increases the stability of the circuit. When three sets of rods were used the stability was increased again but there was not as much improvement as when the rods were increased from one set to two.

Application

An oscillator using two or three sets of rods in the grid circuit will give a good account of itself when used as a modulated oscillator, but would show up to much better advantage if it were used to drive a modulated amplifier. Any oscillator will give poor results when it is heavily modulated. If it is coupled closely to a load, it will stop oscillating on the negative modulation peaks. If the grid leak resistance is too high, or if there is too much grid excitation, it will quench itself on the positive peaks. Such an oscillator, even at five meters, will cause bad interference with broadcast receivers located nearby.

DX4UCW XMTR

(Continued from page 173)

In one of these tests the oscillator was run with a plate voltage of 720, using a 20-meter crystal. Both the tube and the crystal ran cool. Tritet operation of the RK-39 was tried with this plate voltage of 720 but the tube ran a bit red under these conditions. About 500 volts is a safe maximum for the RK-39 as a tritet. Under no conditions should either the ZB-120 or RK-39 plates show any trace of color.

Using a 40-meter crystal and plate voltages of 440 and 1000, respectively, on the two tubes an output of approximately 60 watts was obtained on 10 meters. We doubt if the increase in output to 100 watts or so would be noticeable in most cases at the receiving end on this band.

The operating conditions listed in the chart do not represent the conditions for maximum output, but rather the particular conditions under which the transmitter was tested. Somewhat higher outputs may be obtained with optimum voltages and currents on the tubes. While plate voltages of 1000 and 1250 are given in this chart it must not be thought that the transmitter cannot be used effectively on lower voltages. Some tests were run with 600 volts on both tubes. The ZB-120 ran quite efficiently at this voltage, in fact even at the low voltage of 380 with which the transmitter was first tested. For the chap who has at present only a 500- or 600-volt power supply this transmitter is still an effective and low-cost rig. The voltage on the final may be increased at any time with no change in the transmitter. This rig is, in fact, extremely tolerant of plate voltages. This makes for an easily-operated job which may be changed to various bands when desired without applying advanced engineering tactics.

PARTS FOR C.W. TRANSMITTER

AEROVOX
- 3—.002 mfd., mica bypass condensers, 600 v. working (C4, C5, C6)
- 1—.00025 mfd., mica bypass condenser, 2500 v. working (Cd)
- 3—.01 mfd. midget mica condensers (C7, C8, C9)

AMERICAN RADIO HARDWARE
- 1—type 1303 neutralizing condenser (NC)

AMPEREX
- 1—type ZB-120 tube

BIRNBACH
- 8—type 458 feedthru insulators
- 7—type 478 feedthru insulators

BLILEY ELECTRIC
- 1—type LD-2 40-meter crystal
- 1—type HF-2 20-meter crystal

COTO COIL CO.
- 1—type 10BTL coil (L2, L3)
- 1—type 20BTL coil (L2, L3)
- 1—type 40BTL coil (L2, L3)
- 1—type CI-6BTLM mounting base
- 6—type C131 standoff insulators

HAMMARLUND
- 2—type S4, 4-prong isolantite sockets
- 2—type S5, 5-prong isolantite sockets
- 4—type SWF4 coil forms (L, L1)
- 3—type CHX r.f. chokes (RFC1-2-3)
- 1—type CH500 r.f. choke (RFC4)
- 1—type FC shaft coupling
- 1—type MC-50-S tuning condenser (C1)
- 2—type MC-50-SX tuning condensers (C2, C3)
- 2—type IBT220 trimmer condensers (C)

JOHNSON
- 1—type 211 socket

LEEDS
- 1—17" x 10" x 2" crackle finish chassis

OHMITE
- 1—500 ohm, 10 watt resistor (R)
- 1—15,000 ohm, 25 watt resistor with slider (R2)
- 1—50,000 ohm, 10 watt resistor (R1)

THORDARSON
- 1—type T6414 filament transformer, 10 v. (T1)
- 1—type T6185 filament transformer, 6.3 v. (T)

TRIPLETT
- 1—0-300 ma. bakelite case 3-inch milliammeter

YAXLEY
- 1—bakelite case fone plug
- 3—closed circuit infant jacks

This transmitter has been thoroughly tested and has given satisfactory performance. The parts listed or their equivalent will give satisfactory results. Substitutions should be made with care.

Low-Cost Power Supplies

One type of power supply for this transmitter which is both adequate and cheap is the now popular bridge rectifier circuit. A power transformer having 500 to 750 volts each side of center should be used. The best rectifier tubes for this circuit are the 5Z3 type. The 5Z3s have been used by us on voltages up to 1700 volts, believe it or not. At voltages of around 1000 or 1250 these tubes seem to last indefinitely. We have yet to see one of our 5Z3s give up the ghost. Type 83s have a short life when used on high voltages and have a habit of shorting the power supply when they blow.

Other low-cost supplies may be constructed with either the new dual winding or multiple winding power transformers, which require only two 5Z3s.

Nothing has been said about fone operation. For the ham who wants a cheap 10-meter fone, the ZB-120 may be operated under condition (g). A simple grid modulator using a receiving power tube for the output tube should be sufficient. Adjustments for operation under these conditions are somewhat critical, as in all grid-modulated transmitters. Probably the best arrangement for 10-meter fone is to use a small amplifier for plate modulation. The 6L6 modulator described in the 2.5-meter "Ground Hog" article is sufficient to modulate a 10-meter carrier of the order of 40 or 50 watts. As has been mentioned in previous transmitting articles, this amount of power is quite ample for 10-meter work.

V.W.O.A. ANNUAL DINNER-CRUISE

Gathering of officers of the Veteran Wireless Operators Association at the recent Dinner-Cruise held simultaneously in New York, Boston, Chicago, Miami, New Orleans, San Francisco and Honolulu, and linked by radio. Top row, left to right: V. P. Villandre, Wm. C. Simon, Harvey Butt, W. S. Fitzpatrick, H. H. Parker, A. A. Isbell, and Fred McDermott. Second row, left to right: Arthur H. Lynch, R. H. Frey, H. T. Hayden, Arthur Wallis, Josef Israels, and Paul K. Trautwein. Bottom row, left to right: A. J. Costigan, George H. Clark, William J. McGonigle, new V.W.O.A. President, C. D. Guthrie, H. F. Coulter, Fred Muller, and C. S. Anderson.

RCA ALL THE WAY

RCA Radio News

RCA Manufacturing Company, Inc. • Camden, New Jersey
A Service of the Radio Corporation of America

EVERYTHING IN RADIO—MICROPHONE TO LOUDSPEAKER

To the consumer, RCA means high quality performance at low cost . . . To the radio man, RCA means easier selling, higher profits

NEW STREAMLINED "MIKE"!

RCA "Aerodynamic" Microphone combines small size with fine performance!

SPECIFICATIONS:

Type . . . Pressure Operated.
Frequency Range . . . 100 to 6000 cycles.
Impedance . . . 250 ohms.
Average Operating Level −68 db (10 bar signal across open circuit).
Dimensions . . . 2⅝" wide, 3" high, 3⅜" deep.
Net weight . . . 1¼ pounds.
Finish . . . polished chromium.
Cable . . . 6 feet shielded cable.
Stand Fitting Size . . . ⅜" pipe thread.

RCA's new Aerodynamic Microphone, MI-6226—the pressure operated dynamic type—is small enough to fit the hand, light enough to carry easily, and offers outstanding performance! It is ideal for normal public address work and particularly suited for close talking.

This new "mike", handsomely streamlined, gives excellent frequency response, insuring truly natural tone reproduction and clarity of speech. Its new Alnico permanent metal magnet provides maximum sensitivity and extra long magnet life. In addition, it makes the use of external excitation or power unnecessary.

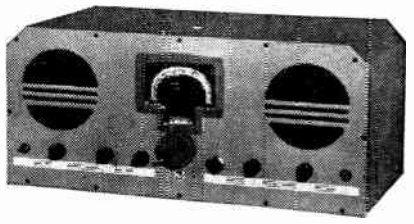
Besides these features, the RCA Aerodynamic Microphone also offers many others, listed below for your convenience. Look them over. They'll convince you that there's plenty of microphone quality packed beneath the attractive chrome covering!

NOTE THESE FEATURES!

• Small size • Light Weight • High Sensitivity • No external excitation of power supply required • Rugged construction—insensitive to mechanical vibration.

• Unaffected by changes in temperature, humidity or barometric pressure • May be operated at distances up to 1000 feet from amplifier • Excellent for close talking • Practically non-directional when faced vertically • Minimum response to wind • New Alnico metal magnet—retains magnetism indefinitely.

List Price, $26.50



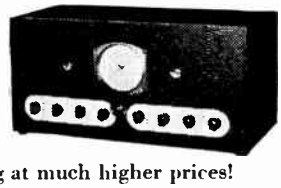
ACR-155 . . . New, Low-Cost General Purpose Communications Receiver
Amateur's Net $74.50 f.o.b. factory

2 RCA Amateur Receivers Answer Price and Performance Problems!

This receiver brings superior performance under modern operating conditions—yet sells at exceptionally modest cost! A number of its features are not to be found in other receivers costing so little. The outstanding features include continuous frequency coverage from 520 to 22,000 kcs . . . 9 Metal RCA Radiotrons for improved high-frequency performance . . . improved, large tuning knob with crank handle for easy tuning . . . 100 to 1 band spread tuning drive . . . improved, adjustable, air-dielectric trimming capacitors . . . magnetite-core i-f transformers . . . calibration-spread dial for accurate logging . . . electrically stabilized oscillators.

ACR-175 . . . New, Multi-Feature Communications Receiver . . . An Outstanding Value!

Amateur's Net $119.50 f.o.b. factory



This excellent instrument presents a combination of advanced features not even found in receivers selling at much higher prices!

Its keen selectivity, plus a specially designed crystal filter, makes separation of interfering stations easy—even in the most crowded amateur bands.

Among its 32 performance features is an unusual tuning range—500 to 60,000 kcs.—giving coverage of many services unreached by other communications receivers. Has 11 tubes, two stages of high-gain i-f amplification and a smooth-handling, single control band spread system for easy tuning and accurate logging without use of reference points.

Convert Your Radio Into Phonograph-Radio at Low Cost!

You can do it with the smart RCA Victor Record Player illustrated here! This fine instrument easily and quickly attaches to any electrically operated radio and in a jiffy turns it into an electric phonograph-radio combination! With it, you can hear all your favorite radio programs PLUS recorded music!

Its small size means you can conveniently place it in any small place. And it's yours for less than $20, in a fine walnut finish. Or you can get it in red, black or ivory for just a few dollars more.

RCA Victor also offers great values in new, 1937 radios! There are many new models and prices, plus a fine array of performance features including Magic Voice, Magic Brain, Magic Eye, Metal Tubes. And in addition—with an RCA Victor set you enjoy the extras of radio that's RCA ALL THE WAY—instruments created by the same men who build big broadcasting studios! Hear these new radios today. Their beautiful cabinets will more than please you. Easy C. I. T. time payments.

LATE NEWS FLASH!

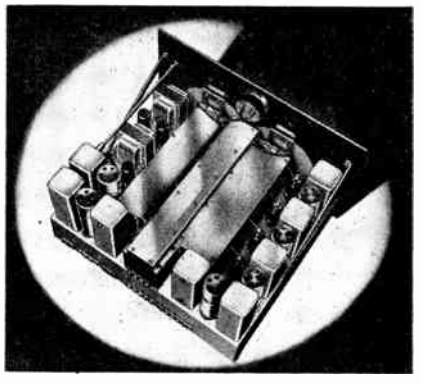
1936 RCA Metal Tubes Sales Double Those of 1935!

Extra quality of RCA Tubes boosted 1936 sales to double the millions sold in 1935.

On the Market

New "Super-Pro" Covering 20 to 40 MC

AFTER AN INTENSIVE period of experimenting. the engineers of Hammarlund have just produced an additional new model of the 16 tube "Super-Pro" with a 20- to 40-megacycle band, that is unusually efficient.



This model like the other "Super-Pro" types has been carefully engineered, with the additional frequency range incorporated only after considerable thought, laboratory work and modeling.

In this new model, two steps of radio-frequency amplification have been included for all the five ranges. This affords very high gain and a high image rejection ratio. To be more specific, on a test on 28 megacycles, it is said the image rejection ratio was found to be 150 to 1, while the sensitivity on the same frequency with a 6-to-1 signal-to-noise ratio was .8 microvolt. Such a high image rejection ratio definitely eliminates all fear of the "two-three spot tuning."

Another interesting characteristic of this new receiver is the tremendous band spread possible on the 28- to 30-mc band. This 2000 kilocycle region is covered by 90 degrees of the band spread dial. Thus it becomes quite a simple matter to really pick apart even the most crowded sections easily. Due to the design of this receiver, all the amateur bands fall in the center of the tuning range of each band. Thus it is possible to simply set the tuning dial at any particular amateur band and turn the band switch.

As in the standard "Super-Pro," there are five tuning ranges. Here, of course, the tuning begins at 40 mc, as follows: 20 to 40 mc., 10 to 20 mc, 5 to 10 mc., 2.5 to 5 mc., and 1250 to 2500 kc. This tuning coverage arrangement provides complete control of the ultra-high-frequency and high-frequency channels most popular today.

Of course all of the many unusual features that contribute to the success of the standard "Super-Pro" have been retained. That is, the accurately calibrated 3- to 16-kilocycle continuously variable band-width panel control is still used to not only afford selectivity control, but also fidelity and tone control. The graduated audio and sensitivity controls permit, as before, accurate adjustment and simplified logging. With the 0 to 2500-cycle beat note panel control, it is possible to select a frequency within this range on either side of zero beat.

For those who require additional hair-breadth selectivity for c.w. a crystal model is also made. By properly adjusting this crystal control additional selectivity for phone or other modulated signals can also be obtained. ALL-WAVE RADIO.

✦

New Meissner Dual-Universal Wave Trap

NEW AND UNIQUE in the way of wave traps is the latest contribution of the Meissner Manufacturing Co., of Mt. Carmel, Ill. Ordinarily wave traps are capable of eliminating interference at one frequency only. The Meissner Dual-Universal Wave Trap, however, is so designed that it will simultaneously eliminate both i.f. and broadcast-band interference.

The unit is shown in the accompanying illustration. The use of a Ferrocart iron core in the inductance provides an unusually high "Q" circuit. The frequency may be adjusted over a range of 400 to 1720 kc. The range of the broadcast section of the trap is from 1720 to 700 kc. and the range of the i.f. section is from 400 to 700 kc. The latter section may therefore be used to attenuate a signal in the lower broadcast band if not required at the intermediate frequency.

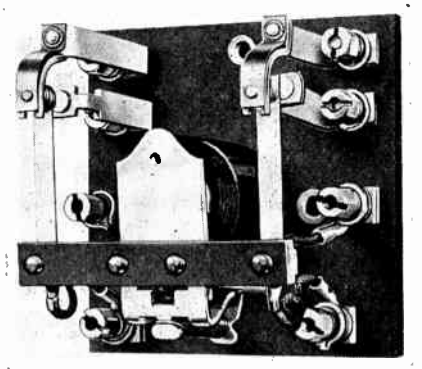
According to the manufacturer, tests show that using an average size antenna the strength of an interfering signal either at 456 kc. or in the broadcast band and low-frequency police band is reduced approximately 175 per cent of the normal value, or 40 db.

The wave trap is easily installed in the antenna-ground circuit of any radio, and is easily adjusted to eliminate interferences from long-wave code signals or powerful, nearby broadcasting stations. ALL-WAVE RADIO.

Ward Leonard R. F. Relays

WARD LEONARD Radio-Frequency Relays are now available in two sizes, 15-ampere capacity and 4-ampere capacity.

The new midget type with 4-ampere contacts arranged for double pole, double throw is available for operation on 6 to 8-volt d.c. and 110-volt a.c. circuits.



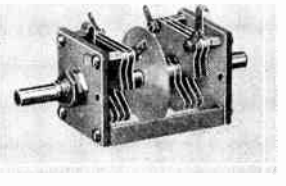
A micalex insulating base and cross arm and 2-inch spacing of contact arms insures against leakage of radio-frequency currents.

These Radio-Frequency Relays are specially designed for antenna change-over and for switching directional antennae. The midget size, 3-inch square base, is particularly adapted for mobile installations such as police or aircraft transmitters. They are also suitable for other high-frequency applications. ALL-WAVE RADIO.

✦

Cardwell Dual Trim-Air Condensers

THE ALLEN D. CARDWELL Mfg. Corp., 81 Prospect Street, Brooklyn, N. Y., have made available a new complete line of 10 standard double-section equivalents of stock Trim-Air Condensers. These condensers are constructed with sturdy, over-size double bearings, and are selling for less than the cost of two individual units. They can be furnished either with a circular shield, as illustrated in this ER-25-AD, or with a square shield that is removable from the nickled brass tie rods. A ¼-inch shaft extends at the rear for additional ganging.



This midget is so constructed as to allow for any of four convenient methods of mounting. Isolantite insulation. ALL-WAVE RADIO.

THE "GROUND HOG"

(Continued from page 179)

tion can be determined by experimentation. For our tests between W2CPA and W2BYW—a distance of about four miles—we used a simple set of antennas. For the receiver an antenna a half wave long at 2.5 meters (about 4 feet) was coupled by bending one end of the coil into a small one-turn loop and placing it between the turns of the detector coil. For the transmitter another half-wave antenna was used but was coupled with a single wire feeder (which was tapped 14 per cent of the antenna length from its center) to the plate strip at a point 3 inches from the bypass condenser.

R9 signals were put through in both directions with these simple antennas. The transmitted signal became a bit rough when the feeder from the antenna was clipped too far from the bypass condenser on the copper strip. When clipped at a point 3 inches from this condenser the roughness disappeared. Duplex was worked while using the common power supply. A small difference in the lengths of the strips in the two transmitters placed them ten degrees apart on the receiver dial. This was sufficient for duplex work.

Much more efficient antennas than those used for this test can be used. When coupling other antennas to the transmitter, it should be remembered that the ends of the strips terminating at the bypass condenser correspond to the "dead" center point of the usual tank inductance. The nearer the feeder or feeders are connected to the tube the higher the impedance will be and the higher the plate current. If a two-wire feeder line is employed, the feeders should be clipped on both strips at points equidistant from the bypass condenser.

An excellent precaution to take is to place blocking condensers (.0001 mfd. mica will do) in the feeder lines. This will prevent the possible shorting of the grid and plate strips, with the resulting death knell to the tube.

The frequency response of this modulator is excellent, in fact better than had been expected considering the simple layout used. It was put through the usual testing procedure with a good phono. pickup and a pair of large dynamic speakers. The high audio output showed up to advantage when the volume was turned up to the higher levels. The undistorted output was, to the ear, considerably higher than with the amplifier unit described previously with the AWR 2-3 transmitter. This amplifier used a pair of 2A3's in push-pull in the

output. It was necessary, of course, to match the high impedance output to the voice coils of the speakers. An output transformer designed to couple push-pull 2A3's to voice coil did the job.

Conclusion

The various ways in which this 2.5-meter equipment may be used by one or more amateur phone stations will be left to the ingenuity of the ham. With the inputs of various impedances provided for the different units, a goodly number of combinations may be tried. Various rebroadcasting operations involving other amateur stations, as well as remote control of other equipment, are possible. With the lack of QRM that is at present prevalent on these ultra-high frequencies, two sets of these units will provide what is virtually a private phone system.

LAFAYETTE B-97, B-98

(Continued from page 198)

attenuating the higher audio frequencies.

It should also be noted that the first and second i.f. transformers, at G-10 and G-14, each have a separate winding which may be cut in and out of circuit by means of the selectivity control switch. When these windings are out of the circuit, the two i.f. transformers are sharply tuned. When the coils are switched into the circuit, the coupling between the primary and secondary windings of the two transformers is considerably increased. This "over coupling" broadens the selectivity curve of the i.f. amplifier, and under these conditions the higher audio frequencies are passed through to the detector. The fidelity of reception is therefore improved.

Also note that the third i.f. transformer, at G-17, has a split secondary winding. The lower secondary feeds the detector diode of the 6H6 which has in its load circuit the bass-compensated volume control (at I-22). The upper secondary feeds the avc diode of the 6H6 which functions in conjunction with the 6C5 avc amplifier (at F-20). The avc action is therefore isolated from the detector action and both are able to function under the best operating conditions and without interaction.

The automatic volume control system works on the r.f. stage and the first i.f. stage. It is so arranged that the full sensitivity of the receiver is available for weak-signal reception, the actual control not taking effect unless the received signal is above a certain level. The avc amplifier plays its major role on very strong signals which, if not kept within reasonable limits, would cause overloading and blasting. The avc amplifier is capable of supplying very high values of negative bias under conditions of exces-

sive signal level, and thereby reduce amplification in the controlled stages to a minimum.

The coupling between the 6C5 first audio tube and the 6L6 tubes in push-pull is novel. Direct plate current does not flow through the auto-transformer, T7 (at F-23). Voltage to the 6C5 plate is supplied through resistor R21. The amplified audio voltage is fed to the auto-transformer through the coupling condenser C41. The upper portion of the transformer functions the same as the usual primary, and that portion from the first tap down as the secondary. Grid bias for the 6L6 tubes is supplied through the center tap which connects to a resistor (at O-16) in the return leg of the power supply.

The tone control is in the grid circuit of the 6L6 push-pull amplifier (M-24) where no high voltage is present. It consists of the potentiometer R26 and the condenser C46.

Results of Tests

The receiver was found to have moderated good sensitivity and selectivity—about what may be expected from a set having one stage of r.f. and two stages of i.f. The same holds for image interference, which was encountered on excessively strong signals in the short-wave bands, but was no greater than one usually runs into.

The frequency drift, as measured from a cold start at 14 megacycles, was found to be 20 kc.—not at all bad for a receiver of this type. No doubt the sensible distribution of the components on the chassis has something to do with this.

Calibration was good in both the short-wave ranges, but was about 10 kc off in the standard broadcast band—a minor fault with no relation to fundamental design.

Though reception conditions were decidedly poor during the period this receiver was tested, good results were had in all bands from 16 meters and up. The standard broadcast band produced one station per scale division, while JZJ, RAN and OAX5A were received satisfactorily. The foreign locals, including London, Berlin, Rome and Paris, were received remarkably well and in three instances it was found practical to switch to the high-fidelity position and derive the benefits of an extended audio range.

The high mark of the Lafayette Model B-97, B-98 Receiver is its output power and audio range. The 6L6 push-pull amplifier can pump in the neighborhood of 20 watts into the two speakers—far more volume than one would ever care to use outside an auditorium. In our own tests it was interesting to observe that our ears were overloaded (verging on physical pain and aural distortion) before either the amplifier or speakers gave any indication of blasting or distortion.

The acoustical range was found to be excellent—in the neighborhood of 80 to 6000 cycles in the high-fidelity position, and with speaker baffling. The lower organ tones were reproduced with remarkable faithfulness, and the high-pitched tones of the triangle and orchestral bells, so often lost, were clearly transmitted by the speakers.

As surprising as it may seem, excellent reproduction of both low and high frequencies was obtained with the speakers unmounted. This was tried to determine if the very high audio frequencies got off the cones at moderate volume levels and also to see if binaural effects could be achieved. The speakers were set up approximately three feet apart and facing into the room. Under these conditions the source of the sound appeared to be a point two feet in front of the speakers and midway between them—which chanced to be the mirror dial on the receiver chassis.

The least that can be said is that the audio response, coupled with the output power, is very impressive, and this is so whether the receiver is operated in "normal" or "high-fidelity" position.

THE "FLEXIBLE 400"

(Continued from page 183)

it might be desirable to put a few heavy bolts through the bottom of the cabinet and attach the deck to it in a firm manner.

Further Reports

As an indication of the reliability of the "Flexible 400", and the soundness of its original design, it may be well to mention that this transmitter has been on the air for comparatively long periods since its completion on January 7th. No less than 100 cards have been received, indicating remarkably good reception throughout the United States as well as Europe. Eighteen such reports were received from England in a single mail and the average signal strength reported by the foreign listeners was R8 to R9. No less than eight of these reports said that signals received from the "Flexible 400" were the strongest of any American station on the 10-meter band.

EMBRYO HAMS

(Continued from page 195)

ously; in this instance it is usually possible to set the pitch of the desired signal at a frequency to which the ear is particularly susceptible. There is usually enough difference in frequency between the two signals that the undesired one is either of very low pitch, and therefore more difficult to distinguish, or of such high pitch that it is almost beyond the range of hearing.

Image Reception

The superheterodyne receiver has one disadvantage not common to the tuned-radio-frequency set—its negative ability to produce the same signal at two different places on the tuning dial, or two signals of different frequency at the same place on the dial. These forms of potential interference are the result of the function of heterodyning in the first detector circuit, and the off-tune signals are known as "images."

If you will consider the fact that in the case of Fig. 3 as an example, a signal of a frequency of 14,912 will also beat with the oscillator frequency of 14,456 and produce a 456-kc signal, it is evident that a signal of this frequency as well as one on 14,000 kc will appear as a 456-kc. signal in the intermediate amplifier. Assuming that there are stations operating on these two frequencies, the only factor that will prevent the 14,912-kc signal from getting into the first detector circuit when the receiver is tuned to the 14,000-kc signal is the r.f. selectivity. Even with one stage of r.f. amplification it is often the case that the other signal gets through, particularly if it is a strong one.

Conversely, if the receiver is tuned off the 14,000-kc signal, and the input selectivity is poor, this same signal will produce a 456-kc beat with the oscillator frequency when it reaches 13,544 kc—just 912 kc removed from the point where the signal would normally be received. In other words, a signal of given frequency will beat with the oscillator at two different points where it will produce a difference frequency of 456 kc to which the intermediate amplifier is tuned.

The safeguard in either case is sufficient selectivity preceding the first detector to prevent any signal from getting through when the receiver is tuned away from it by as much as 912 kc. Two stages of r.f. amplification afford enough selectivity to accomplish this, except possibly on very strong local signals.

Despite this disadvantage, the superheterodyne circuit is far superior to that of the tuned-radio-frequency type in both sensitivity and gain or amplification. It has displaced the t-r-f set for this reason.

Next month we'll deal with a few more transmitter circuits, and then we'll be ready to get down to the business of planning your equipment.

Gerald.

FREQUENCY ZONING

(Continued from page 175)

and the time element. There are several minor disadvantages, such as the necessity for a considerable amount of "horse trading" with crystals, but the fact remains that everyone without exception would have less interference than he does at present, the amount depending

on the individual's geographical location. Those that would benefit the least, due to their geographical location, have at present far less interference difficulties than those who would benefit the most. There seems to be little doubt that those who would benefit most would be in the majority.

To sum up the situation, do the majority of amateurs operating on the bands under consideration wish to try regional frequency assignment in an attempt to utilize our present frequency allocations to much better advantage? To make such a plan effective, it would be necessary to provide sub-band allocations for c.w. and phone alike under F.C.C. regulations. The plan has tremendous possibilities which are quite obvious, but no individual or group can possibly take into account all the factors that may arise.

Proposal

Let us then consider the value of putting such a scheme into effect for twelve months with the necessary regulations automatically terminating at the end of the year. Then if the plan proved unsatisfactory the frequency assignments would automatically return to their present status. If the majority found conditions improved two or three times over those now in effect, which seems reasonable to assume, the Board of Directors can readily ask for an extension and any modifications that might prove advisable.

The proposal then is to try a nation-wide experiment with two of our horribly overcrowded bands in an endeavor to make the use of them more enjoyable to us all. Your Director will be greatly interested in securing comments of any kind in regard to this outlined proposal. If the majority want to try a plan of this type, we will secure much valuable knowledge on this frequency-allocation business. Furthermore, we would have a new and interesting type of fun in trying it while we are waiting for the crumbs to fall from the Conference Table at Cairo—if they fall!

BACKWASH

(Continued from page 199)

so confusing to follow, and their habit of starting an article on one page and continuing it in microscopic print somewhere near the back cover so very bewildering that I gave up this year and began shopping about for my idea of a good publication. Hence my subscription.

The reason behind this letter is a letter in Backwash by one Walker, VE4B. He actually suggests deleting the station list in favor of more technical data. Having operated a station in the heart of South America, been a ham since '24 and worked with N. B. C., I too enjoy technical magazines. But suggest Mr. Walker turn to *QST* and similar publications for his learning! And leave us peacefully with our AWR, our radio and our pipe.

JOHN W. NEWELL,
KALAMAZOO, MICH.

(Thanks for your opinion, as well as the many others who requested the continuance of the Short-Wave Station List. It is of more service than even we expected—and it is kept right up-to-date.—Editor)

CHANNEL ECHOES

(Continued from page 187)

of turning down the volume control on terminal blurbs, which, we'll admit, is our own technique. However, listeners refuse to tolerate beginning and ending announcements purely through self defense. If they were short and dignified, most of us would be glad to oblige and consider listening to such a sales message as a reasonable price for the accompanying entertainment. As for the blurb in the middle of the program, it never accomplishes its purpose. Rather it is the other way around. In breaking up an interesting program, antagonism for the sponsor invariably is created. The message is about as welcome as is a vacuum cleaner salesman's foot jammed in so that you cannot close the front door. After it is all over, the only way to get even is to buy someone else's shaving soap, cigarettes, gasoline, cough medicine, cosmetics, hair tonics, breakfast food, etc., etc.—which we, and probably a million others do. We definitely know of many boycotts due to excess and misplaced radio advertising.

✦

THE HUNGARIAN Broadcasting System recently released a statement showing the percentages in which the various types of program material was split up over their stations. Classical music gets 14.5%, light music 35.1% and dance music 4.5%. Humanities—whatever they may be—are accorded .55%, the lowest percentage of all. Women's programs and "Farce", both receive .7%—doubtless a duplication of the same thing under two headings.

✦

THE PICTURE this month, dug from our "immediate attention" file of ten years ago, shows "The Discus Thrower" vintage 1927. The idea was to throw this disk around the television corner.

✦

WE CAN'T PASS up the month without some reference to the Flood. WMAQ and WENR let themselves in for a barrage of personal messages the night of January 27th—mostly, it seemed, from a roster of in-laws stating that seeing the flood was so bad, all was temporarily forgiven, and the son-in-laws, daughter-

in-laws, etc., etc., could come (with families) to Chicago and live until things dried up a bit. The number of these messages mounted up until the announcer was forced to admit that he was flooded with them. Some day Chicago is going to have a blizzard, with a few hundred thousand marooned, and conditions will be duplicated. This time the announcer will be snowed under.

QUERIES

(Continued from page 196)

ously, as LC becomes smaller the rate change of frequency with capacity becomes larger.

A variation in capacity of a few micromicrofarads in an oscillating tube may change the frequency by only a few hundred cycles or so on the standard broadcast band—a difference that would not be noticed in tuning. However, on the short waves this same capacity difference might throw the oscillator off by as much as or more than the intermediate frequency, (456 kc or so) severely affecting the operation of the receiver.

Thus when changing from metal to glass tubes—or visa versa—in all but low- frequency circuits it is necessary to realign the receiver—a job that should be given to an expert serviceman unless you yourself are competent and have on hand the essential equipment.

The above applies, though perhaps not to the same extent, also when replacing a tube or tubes with the same type but of different manufacture. Minor interelectrode capacity differences exist in different brands of the same type tube.

When replacing metal tubes with the octal base glass variety, in all but low-frequency circuits, it will usually be necessary to shield the tubes. Also, the glass tubes are larger than the metal type. So, before purchasing, make certain that there is sufficient room on your chassis to accommodate both the glass tubes and the necessary shields. Shields shaped to conform with the shape of the tubes requires the least room.

◆

TELEVISION

Question No. 29:

I would like to obtain one or two addresses of companies that sell Television sets. A young man in a nearby town bought the parts and made one himself. From what I hear it worked fairly well, but he has moved and I did not get to see it.—*R. S., West Chester, Iowa.*

Answer:

To the best of our knowledge it is a lot easier to buy television stock than it is to buy a television receiver. To the

layman, television has immediate possibilities—to the engineer it is still something for the future. Closer, undoubtedly, than a few years ago, but still not out of the laboratory. There are no television receivers being made in this country on a commercial scale. We advise R. S. to wait another year—perhaps two, and maybe even more. As soon as television turns the crucial corner, ALL-WAVE RADIO will be among the first to supply its readers with full details—theoretical, constructional, trade notes and program data. Aside from the technical difficulties which are still far from solved, there remain esthetic, economic, legal and production problems that recommend a period of watchful waiting on the part of the ultimate television fan. Or, better yet—you do the waiting, and ALL-WAVE RADIO will do the watching.

HAMFEST

(Continued from page 184)

held confab with the managing editor of the San Francisco *Examiner*—he sitting comfortably behind his mahogany desk in California, while we froze at ten thousand feet in the South American winter. Our signal was picked up at the I. T. & T. receiving central at Platinous, piped to the control station at Cuyo and from there to the transmitter at Hurlingham. It jumped to the U. S. on the New York beam and then by landline to San Francisco. The return voice was wired to Lawrenceville, back to Platinous on the beam, through Cuyo to Hurlingham to modulate the Madrid beam, which we picked up on the plane (direct reception of the New York beam was not satisfactory). Thus we used to tie up the entire works—New York to Spain—for a couple of hours every morning. Once the arrangements were made, we had to stick to schedule.

While talking to the editor of the *Examiner,* it was decided to put Ramon Navarro on the phone the next A. M. So we reeled in the antenna, chipped the ice off the microphone, crawled up forward over five hundred pounds of storage battery, and hunched shivering until we landed. All the *ron calientes* in the Grande Hotel Jousten that night couldn't keep away the flu. The following morn-

ing found us intimately concerned with our temperature of 104 degrees F, and not the least bit interested in Ramon Navarro—and we said as much.

There was no one else who could operate the rig, and about five thousand dollars worth of time had been tied up—not to mention the possible inconvenience to Ramon. So we told them how to run the stunt—and it went off very well. Navarro got quite a kick out of it—not to mention publicity. As we recall it now, the *Examiner* carried the story, telling how excellent the speech was despite the roar of the motor in the background, and even mentioned a momentary motor failure. So what? You can't expect a piece of cardboard to hold up for ever against a twelve-inch fan turning over 1800 r.p.m.

◆

IT IS UNFORTUNATE that we must conclude our comments on the flood with a sour note. We of course refer to the QRM caused by stations not handling vital traffic—even after being ruled off the air by the FCC. Many amateurs apparently do not even know how QRR should be used. It definitely is not a form of CQ to be employed by anyone who wants to handle flood traffic—or one who even has important emergency traffic to get off the hook. QRR is a land SOS, and should be used only by the station asking for help—not as a general prefix to emergency traffic.

However—these are all matters for the FCC, the ARRL—and the consciences of the violators.

— — 73 . . . . CU next month.

R.S.S.L. NEWS

(Continued from page 181)

CQA) was none too stable. Note that in this case the Q reading was low when the actual R reading during the period of the heterodyning was high. If the heterodyne had not been present, the Q reading would have more closely followed the R reading.

A space is provided at the bottom of the chart for a summary of average signal quality or merit. There is also a space for additional remarks which can also be used for requesting verification in such cases where the report is sent directly to the station. However, "Re-

marks" is particularly advantageous in supplying information on poor modulation, noise on the carrier, etc. Sometimes transmitters can go haywire in minor respects unknown to the station engineers. Therefore, any such information is valuable.

M. L. MUHLEMAN
Acting Director

GLOBE GIRDLING

(Continued from page 191)

Country	*Frequency*	*Calls*	*Time*
Australia	LF	VK2IQ	5.50 A.M.
	HF	VK2HF, VK2FV	3:30 A.M. to 11:50 P.M.
	LF	VK3LA, VK3AC, VK4LO, VK4AB, VK5AW, VK7JB	1:10 to 6:00 A.M.
	HF	VK3ZL, VK3KR	12:00 to 12:30 A.M.
Argentina	LF	LU4BL, LU1DA	8:45 to 9:27 P.M.
	HF	LU9BD	8:30 P.M.
Baffin Land	LF	VE5TV	8:30 A.M.
Brazil	LF	PY8AC, PYROO1, PYRZZ1	6:10 P.M. to 1:00 A.M.
Barbados	LF	YP6FO, YP6TR	12:30 and 6:30 A.M.
Belgian Congo	LF	ON4CSL	11:30 P.M.
Bahamas	HF	VP7NC	7:35 A.M.
Chile	HF	CE3DG, CE4DU	10:30 and 7:15 P.M.
Colombia	LF	HK5OBC	12:00 A.M.
China	HF	XU6LN	7:00 A.M.
Cuba	LF	CO2MT, CO2WK, CO2KC	4:30 P.M. to 9:00 P.M.
	HF	CO2IJ	7:00 P.M.
England	LF	G6ML	2:52 P.M.
	HF	G5WH, G2XR	6:35 P.M. and 1:20 A.M.
Ecuador	LF	HC2CG	8:45 A.M.
Egypt	LF	SU1KG, SU1GP	7:00 P.M. and 3:39 P.M.
Fanning Is.	HF	VQ1AB (25 watts)	10:00 P.M.
France	LF	F8KW, F3JD	5:00 P.M. and 3:48 P.M.
Holland	LF	PAOEO	3:33 P.M.
Hawaii	Am.	K6AIU	8:00 P.M.
Haiti	LF	HH5PA	8:38 A.M.
Irish Free State	LF	EI9J, EI8L	1:45 and 4:11 P.M.
India	HF	VU2CG	7:25 A.M.
Jamaica	HF	VP5AF	8:15 A.M.
Liberia	HF	EL1A	1:15 A.M.
Labrador	HF	VO3Z	2:00 P.M.
Newfoundland	LF	VO4A	9:00 A.M.
No. Rhodesia	HF	VQ2EWA	1:15 A.M.
Portugal	LF	CT1AK	5:08 P.M.
Porto Rico	HF	K4GU	7:00 P.M.
Peru	LF	OA4C	2:15 A.M.
	HF	OA4N, OA4R	2:20 and 6:50 A.M.
So. Africa	LF	ZS6AA, ZT6N, ZU5P	3:54 to 11:00 P.M.
	HF	ZS2N	11:28 P.M.
So. Rhodesia	HF	ZE1JN	12:15 A.M.
Venezuela	LF	YV5AK, YV1AA	7:25 A.M. and 7:10 P.M.
	HF	YV1AC	7:31 A.M.

NIGHT-OWL HOOTS

(Continued from page 193)

lows: Hesterman 6, JOIK, JOHK, JOGK, KGMB, 7ZL, 5CL; Weyrich 4, XEFC, I1RO, Bologna, HJ1ABJ; Walker 3, XEB, XEOK, XED; Brode 3, XET, CMGH, XEBK; Ahman 2, CMBD, YV5RA; Gordon 1, XEMX; Nice 1, CMCO; and Hidalgo 1, TGW.

The stations reported during January with the number of times are as follows: XERA 59, XENT 58, XEAW 56, XEPN 46, XELO 31, CMQ 21, LR1 18, CMBC 9, WNEL 9, XEW 8, WKAQ 8, CMX 8, CMBZ 7, CMHJ 7, Rennes 7, WJAX 6. Belfast 6, Radio Normandie 6, CMCB 6, CMOX 6, WLAC 6, CMCF 5, PRF3 4, CMCY 4, KHBC 4, WLVA 4, CMCG 4, XEP 3, CFCN 3, Paris PTT 3, XEK 3, CMGH 2, Poste Parisien 2, CMBS 2, CMCJ 2, XEL 2, WTRC 2, and all those listed as Bullseyes one each. Credit for the best catch of the month goes to Weyrich on HJ1ABJ. A few reports were returned to us because of either insufficient or wrong program data. The penalties have been deducted from this month's scores without mention of names. Avoid penalties—send in good reports!

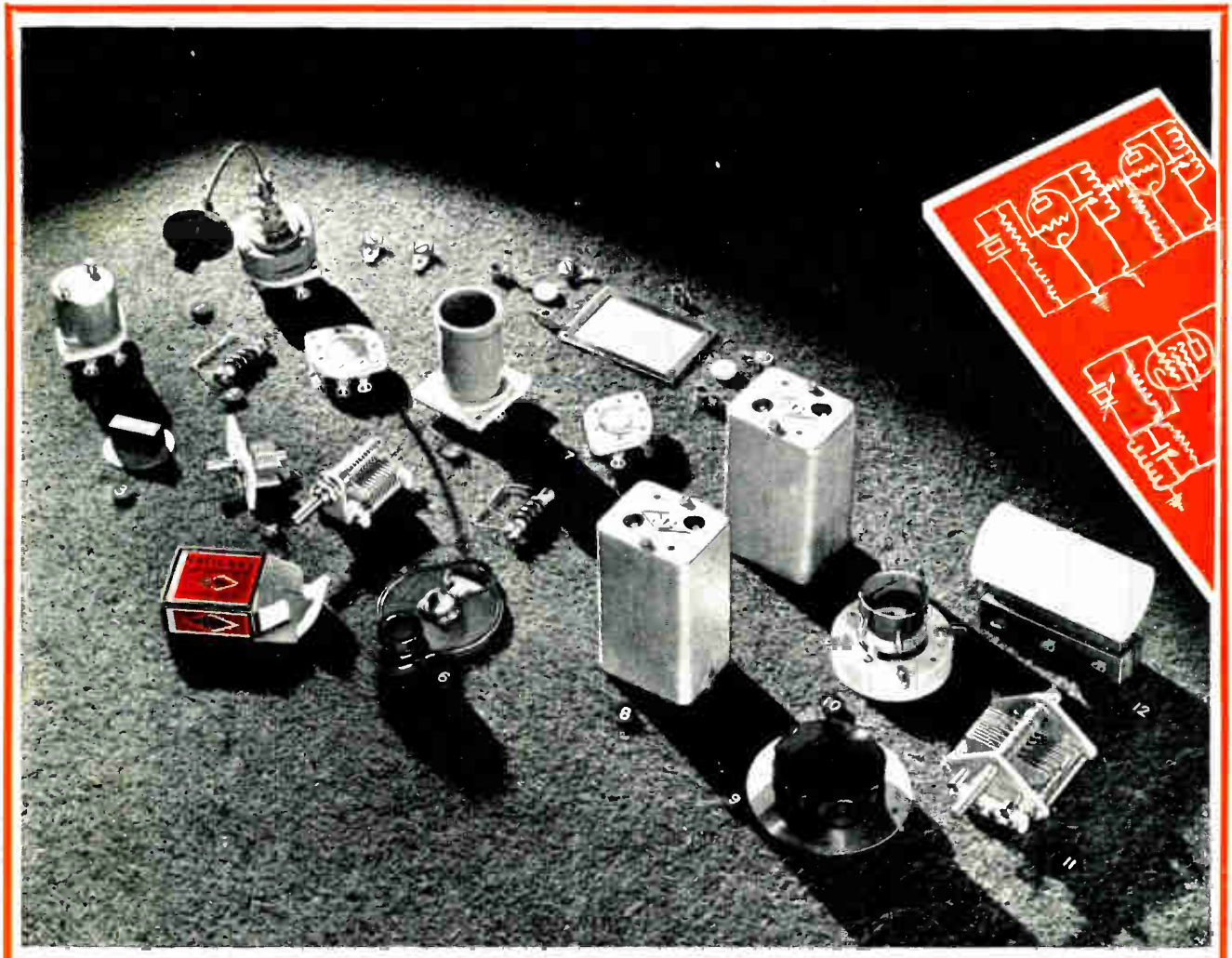
Cheers and Jeers

We have so many cheers to hand out this month that we will entirely dispense with any jeers. It's impossible to enumerate the many hundreds of radio stations in this country who deserve many times three cheers for their courageous work during the recent Mississippi-Ohio River flood disaster. Nevertheless, let us dump out a couple of carloads of them all over the United States and let each and every station help themselves. Special mention is in order for one station which, through the outstanding work of its staff and owners, stood out like a beacon to all other stations and made itself the key station of all relief work. We refer to Louisville's one and only WHAS who are rightfully deserving of more praises than we can heap upon them in this small amount of space. DXer's should be doubly proud to have WHAS's famous five verification stamps in their collection!

Stop Press News

New stations for Helena, Mont., on 1210 kc (100 w.), Saginaw, Mich., on 950 kc (500 w.), and Santa Barbara, Calif., on 1220 kc (500 w.) WTCN's and WLB's CP to increase power and hours of operation have been set for hearing because of protest of WMIN. The new station in Superior, Wisconsin, will bear the call WDSN.

"The Voice of Tampico," Mexico's principal seaport will help celebrate the first anniversary of Night-Owl Hoots by favoring our readers and other DXers with a special DX program on the morning of April 11, from 2 to 3 A.M. XEFW, a little 250-watter seldom heard in this country because DX programs are few during the year, on this morning will be broadcasting on its frequency of 1310 kc. We have promised the owners that we'll do our utmost to keep that channel free of interference on that morning. We ask the co-operation of all clubs.



EXCITERS, for example

National makes the parts it takes to build transmitters, and builds them well. Take exciters, for example. From adjustable-frequency crystal holder to fixed-tuned tank, National parts show specialized fitness for this work. The group of parts shown above have become standard equipment for fine exciters. All are described in the National Catalogue and Catalogue supplement, both free for the asking at your dealers.

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3. HRO Dial, Type 10-0
4. UM and ST Condensers
5. XR-6 Coil Form with Square Socket
6. BM Dial
7. 6-prong Socket
8. FXT Fixed-tuned Exciter Tank
9. O Dial, Type 0-100
10. XM-10 Transmitting Socket
11. TMSA-50 Condenser
12. UR-13 Buffer Coil Form Assembly

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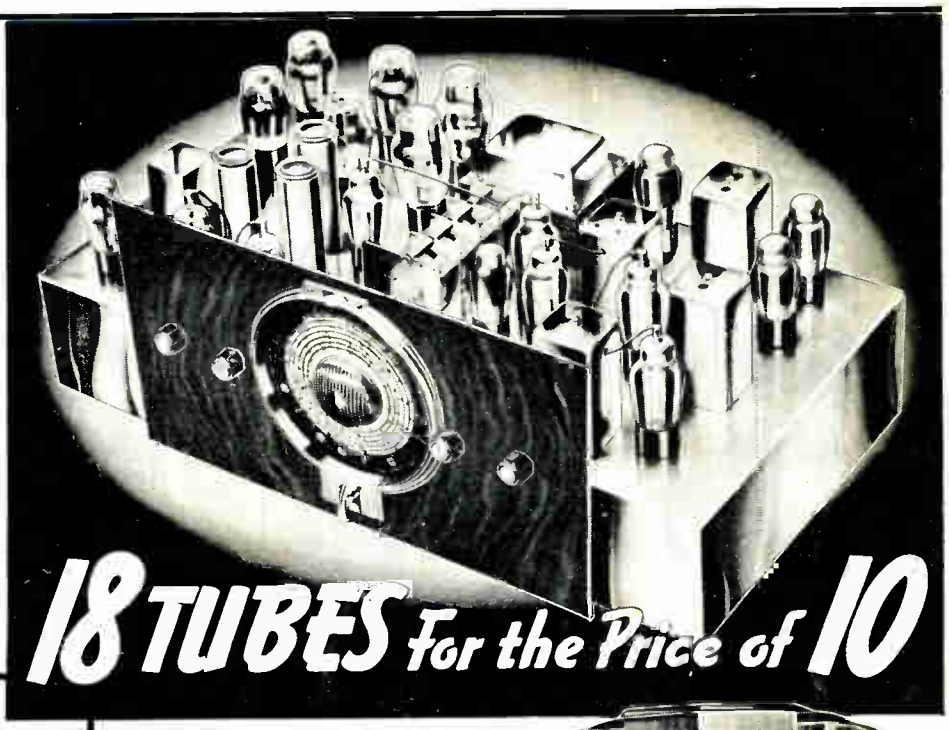
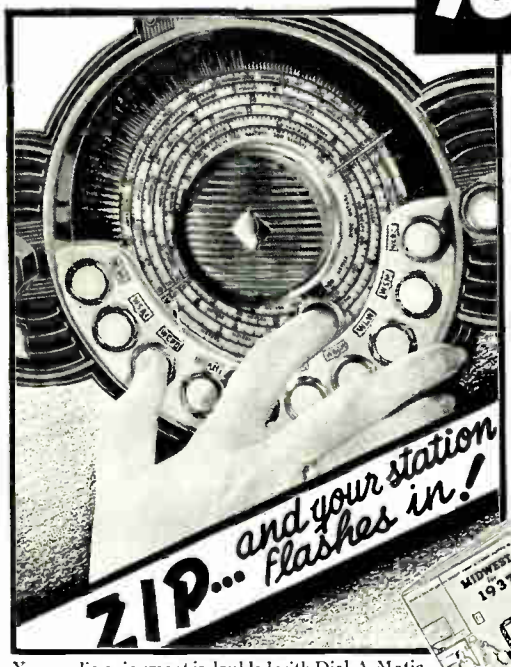


18 TUBES For the Price of 10



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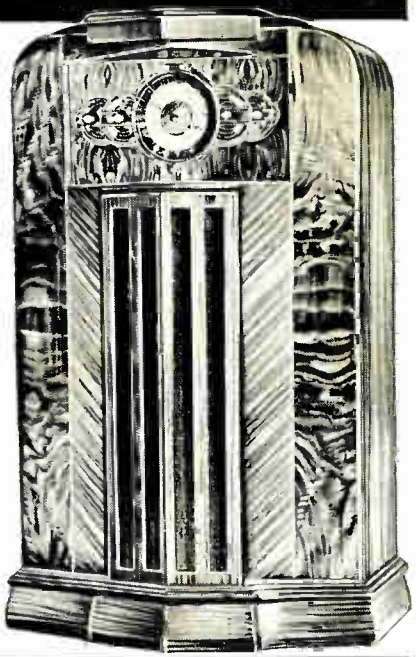

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